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Governments tighten grip on power sector

Presidential control: Russia's Vladimir Putin



Although politically motivated, moves by Russia, Bolivia and Argentina to take control of strategic assets could mark the start of a wider trend by governments to exercise greater control of their electricity sectors, says Junior Isles

Moves by Bolivia, Argentina and most recently Russia to re-take or maintain control of their electricity markets may be the start of a trend of governments taking greater control of what is seen as a key strategic sector.

Late last month, Russia's President Vladimir Putin decreed that planned privatisations in the Russian energy sector would be cancelled.

The decree designated power grids FSK and MRSK, and hydroelectric company Rushydro as strategic companies, where majority stakes could not be sold into private hands.

The decree removes them from a

\$32 billion privatisation programme drawn up by Prime Minister Dmitry Medvedev.

Mr Putin's decree included Rosneft in the list of strategic companies, a move that ring-fences the company. However, it did not exclude a sale of the state's stake in Rosneftgaz, the vehicle through which the government owns a 75 per cent stake in Rosneft.

One senior banker told the *Financial Times* that the decree did not take the assets completely off the agenda; it merely set out that the President – and not the government – would determine if, how and when they would be

privatised.

The announcement followed news earlier in the month that the Bolivian government was completing the nationalisation of its electricity sector by seizing control of its main power grid from Spanish-owned Red Eléctrica Corporación SA. The company owned 74 per cent of Bolivia's electrical transmission network.

President Evo Morales has long said he wants state ownership of "strategic assets" and took advantage of the symbolism of May Day, the international day of the worker, to order troops to occupy installations owned by Red

Eléctrica. Two years ago, also on May Day, Morales' government took control of most of Bolivia's power generation assets, nationalising its main hydro-power plants.

Spain's ambassador to Bolivia, Ramon Santos, told reporters the electric grid takeover "is sending a negative message that generates distrust".

Morales did not say how much Red Eléctrica would be compensated, but the nationalisation decree says the state would negotiate an indemnity fee.

Continued on Page 2

Hollande election may put UK nuclear under further pressure

The UK's nuclear programme, already threatened by the withdrawal of German utilities E.ON and RWE, may be further jeopardised with the election of François Hollande as the new French President.

With EDF expected to make a final decision on whether to go ahead with the UK projects by the end of the year, some argue that France's change of government could not have come at a worse time for the UK.

During his election campaign, Hollande pledged to close 24 of France's 58 reactors – reducing the reliance on nuclear power from three quarters to half by 2025 – and may not be in favour of state-owned EDF building new nuclear plants in the UK. He may also not be enthusiastic about tying up state resources in the UK in the

tough economic climate.

EDF, however, does not see any reason why the change of government should affect its plans for the UK. "As far as I know Britain is not part of France," EDF Energy CEO Vincent de Rivaz told a conference last month. "I don't see any reason why there will be any change," he said.

Nevertheless EDF, which is planning to build two reactors at Hinkley Point in the UK in consortium with Centrica, last month threatened that it would not build the plants unless it received long term guarantees on the price it would receive for electricity from the plants.

The company sees the right government incentives as crucial, especially in light of rising costs for new nuclear build post-Fukushima. EDF recently increased the estimated cost of new nuclear plants

in the UK by 40 per cent. The consortium is expected to make a final decision on whether to go ahead with the UK projects by the end of the year.

Prior to the French elections Tim Yeo, UK member of parliament and head of a parliamentary committee on energy and climate change, said the French elections had added an extra element of uncertainty for investment in new nuclear in the UK.

While giving evidence to the parliamentary committee last month, Energy Minister Charles Hendry expressed optimism that the projects were still on-track. However, he appeared to be unable to guarantee with certainty that any of the five agreed new nuclear power plants would go ahead.

Last month Nomura was appointed to find a buyer for Horizon, the joint

venture formed by E.ON and RWE to build two nuclear plants in the UK. Npower, RWE's UK arm remains confident that it will sell Horizon. According to the *Financial Times*, the UK government and Horizon are talking to two consortiums.

One potential bidder is GDF, which is considering a joint bid with its Nugen partner, Iberdrola. The other potential consortium involves Westinghouse (owned by Japan's Toshiba) with a western utility, a Chinese group, either China Guangdong Nuclear Power or China's State Nuclear Power Technology Corporations, and potentially a sovereign wealth fund.

Russia's Nuclear Energy State Corporation, or Rosatom is also said to be interested, as is US power company, Exelon.

Continued from Page 1

UK company Rurelec is still seeking compensation for its four Bolivian plants which were seized in 2010. In March, Rurelec submitted a \$142.2 million claim to the Permanent Court of Arbitration in The Hague. The Bolivian government is disputing the claim.

President Morales' order to re-take the transmission assets followed shortly after neighbouring Argentina moved to take control of the country's oil company, YPF, from the Spanish energy company Repsol SA, which had held a majority interest.

Russia, Bolivia and Argentina's moves all appear to be driven by domestic politics but may mark the start of a wider trend by governments to exercise greater control over their electricity sectors.

Although it is unlikely that European markets, liberalised since the 1990s, will see wholesale re-nationalisation of their electricity markets, some experts believe there is likely to be increasing government intervention as countries attempt to promote a balanced generating portfolio while reducing carbon emissions.

As the only country with a legally binding carbon reduction target, the UK may provide an indicator of how other governments might approach the challenge if legally binding CO₂ targets are introduced.

The UK recently published a draft of its Energy Bill, outlining how the market will be reformed to attract the investment needed to build new low carbon generating capacity.

Commenting on the proposed Bill, Duncan Sinclair Director of Redpoint Energy, a UK-based energy consulting group that has been involved in the EMR consultation said: "There are still some key decisions to be made, particularly around the length of capacity contracts. If the mechanism is predominantly based around annual or shorter term contracts it will resemble the capacity markets deployed in the North Eastern US, but if long term contracts are to be offered to new capacity, then coupled with the long term contracts for difference) for low carbon generators,



Smith: UK Bill "kills off" idea of a truly open market

the market will increasingly resemble the central buyer model – like they have in Brazil, for example."

Alistair Smith, Chairman of the Power Division of the Institution of Mechanical Engineers, noted: "Although this Bill effectively kills off the idea of a truly open UK electricity market, this legislation is necessary in order to encourage companies to build a balanced electricity generating mix, with the correct proportion of baseload nuclear power along with the right balance of intermittent forms of renewable energy such as offshore wind power backed-up by reliable gas-fired generation."



■ Germany coal fired generation up 15 per cent ■ Commission wants higher carbon price

The combined effect of the economic crisis in Europe and low carbon prices is resulting in greater coal use for power generation in the bloc.

According to recent research by Reuters, Europe's economic slump is allowing utilities in some countries to burn increasing amounts of cheap coal for electricity generation and still meet legally binding targets to cut carbon dioxide emissions.

The EU's emissions trading system (ETS) caps CO₂ emissions on around 12 000 industrial and power plants in 30 countries and requires them to purchase permits to exceed those caps.

The supply of permits has increased, however, to the equivalent of several hundred million tons of emissions, due largely to slowing industrial output. Preliminary EU data suggests emissions in the capped market fell just over 2 per cent last year.

Prices have slumped accordingly to just over €6 (\$7.62) per tonne of CO₂ emitted, down more than 60 per cent from this time last year, giving utilities leeway to burn more coal.

Utilities in Germany, Europe's biggest power market and economy, have

constantly increased their use of coal-fired plants since the beginning of the year.

Between January and May, German midday hard coal and lignite power generation rose from 53 per cent to 68 per cent of the nuclear and fossil power generation share, according to data from Leipzig-based European Energy Exchange (EEX).

"If you have anything that's coal-fired in your generation park at the moment – be it lignite or hard coal – you will take advantage of the high margins and burn the stuff," a trader with a major German utility said.

The UK is also running coal plants at capacity while carbon permits are cheap and gas is expensive, but how long this lasts will depend on the weather, according to the UK Coal Importers Association.

The UK Department of Energy and Climate Change said "demand for coal in 2010 was 51 million tons, a 5 per cent increase on 2009, which was the lowest on record". It also said that coal's share in power generation had risen from 27 to 28 per cent between 2009 and 2010.

However, Matteo Mazzoni, an energy and carbon analyst at Nomisma Energia said that despite the increase, the overall impact on emissions would not be too big, given Europe's lagging economy.

"You need to take into account the overall level of power generated, and for 2012 we see a 1.8 per cent drop in German power generation.

That means something like 10 TWh less than 2011," he said, adding that the resulting net increase of 5 million tons was "not such a big deal at current conditions".

Mazzoni said the same was likely for other European countries, notably Spain and Portugal, whose economies have been hit hard by the sovereign debt crisis.

Portugal's coal burn is likely to be 1.5-1.6 million tons this year, a slight rise from 2011, according to Carbopego.

Spain is likely to burn around 10 million tons this year, unchanged from last year, while Italy is likely to consume 17 million tons, also unchanged.

Continued low carbon prices have called into question the effectiveness

of the EU ETS as Europe's main tool for reducing carbon emissions.

Speaking at Reuters' Global Energy and Environment Summit last month, Günther Oettinger, the EU's energy commissioner, said he would like to see a minimum carbon price of €12 (\$15.21). The commissioner said current EU allowance (EUA) prices, of around €6, "is not a price signal for anything, not for investors and not for consumers".

In the past the Commission has been careful not to comment on emissions prices but recently has publicly acknowledged that prices are too low to spur investments in clean technology such as renewables and carbon capture and storage.

Last month Oettinger said he was supportive of actions that could push EUA prices to €10 per tonne.

EUA prices have been suppressed in recent months due to an oversupply of allowances – which the European Commission said had doubled in 2011, to 900 million allowances – as a consequence of the economic slowdown and the growing penetration of renewable energy generation.

CCS still in the doldrums

Global funding for carbon capture and storage (CCS) technology remained unchanged at \$23.5 billion in 2011 in comparison to the previous year, according to a new report from the Worldwatch Institute.

The United States is the leading funder of large-scale CCS projects, followed by the European Union and Canada.

Of the 75 large-scale, fully integrated CCS projects in 17 countries at various stages of development, only eight are operational – a figure that has not changed since 2009.

"Although CCS technology has the potential to significantly reduce carbon dioxide emissions – particularly when used in greenhouse gas-intensive coal plants – developing the CCS sector to the point that it can make a serious contribution to emissions reduction will

require large-scale investment," said report author and Worldwatch Sustainable Energy Fellow, Matthew Lucky. "Capacity will have to be increased several times over before CCS can begin to make a dent in global emissions."

According to the report, the storage capacity of all active and planned large-scale CCS projects is equivalent to only about 0.5 per cent of the emissions from energy production in 2010.

The International Energy Agency (IEA) claimed in a new report that CCS was making halting progress at best. "Carbon capture and storage is not seeing the necessary rates of investment to develop full-scale demonstration projects," it said and added that governments "must urgently scale-up financial and policy support".

The report noted that given that CCS

technologies are not being developed or deployed quickly, high efficiency, low-emission coal generation technologies – supercritical pulverised coal combustion, ultra-supercritical pulverised coal combustion and integrated gasification combined-cycle (IGCC) – are more important.

The IEA said IGCC technology in the long term, offers greater efficiency and greater reductions in CO₂ emissions, but very few IGCC plants are under construction or currently planned because costs remain high.

Recent research by the US Department of Energy (DOE) found that changes in operating conditions coupled with changes in commercially manufactured catalysts can produce both power generation increases and significant cost savings for IGCC plants.

Results from the project at DOE's National Carbon Capture Center (NCCC) could ultimately lead to lower-cost carbon-capture technologies.

■ The world's largest CO₂ capture test facility – partially based on Alstom's Chilled Ammonia technology – at the Technology Centre Mongstad was inaugurated in Norway last month.



The US is the leading funder of large-scale CCS projects

China continues Europe focus

China's Three Gorges Corp. and China State Grid Corp. would be interested in making acquisitions in Poland's energy sector to increase their European presence after buying into Portuguese utilities, according to Banco Espirito Santo Investimento (BES).

BES, which advised on Portugal's sale of stakes in EDP-Energias de Portugal SA. (EDP.LB) and REN-Redes Energeticas Nacionais SGPS SA (RENE), said that it now expects to

advise the Chinese companies in their efforts to enter the Polish market.

"We are talking to Chinese companies that invested in Portugal to come to Poland," said BES' chief executive Jose Maria Espirito Santo Ricciardi.

The purchase of minority stakes in Portuguese utilities in December 2011 and in early 2012 marked a growing interest of Chinese companies in Europe.

During a visit to Europe at the start of May, Chinese Vice Premier Li Keqiang

called for more energy cooperation between his country and the European Union (EU).

Li told the first China-EU high-level energy meeting in Brussels that the immense potential of China-EU energy cooperation lies in the marriage of China's urbanisation with new energy and energy conservation.

He said the EU should be more flexible in high-tech transfers to China and the two sides should open their

respective energy markets, expand technology exchanges and protect intellectual property rights.

European Commission President Jose Manuel Barroso told the same meeting that energy cooperation between the EU and China has global significance.

"The European Union and China are two of the global economy's main actors... Our actions therefore matter for the world as a whole," said Barroso.



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USA sets stiff solar tariffs

■ Final ruling expected in October ■ Move angers Beijing

Siân Crampsie

Chinese solar module manufacturers could have to pay tariffs of at least 31 per cent to import their products into the USA.

The US Department of Commerce has issued a preliminary ruling in a case against Chinese solar cell manufacturers that says that the Chinese firms have been dumping solar cells on the US market at margins ranging from 31 to 250 per cent.

The import tariff will be imposed if the preliminary ruling is upheld and could be in addition to countervailing fees of 2.9-4.73 per cent that the Department of Commerce said in March that it might impose as the result of a second case against the Chinese firms.

The rulings could increase trade tensions between the US and China, while the German company that made the

initial complaint in the USA – SolarWorld – is now preparing to launch a similar case in Europe, according to *Euractiv*.

SolarWorld, which manufactures solar panels, operates in Oregon and California in the US, and believes that heavily subsidised Chinese firms have been flooding the US market with cheap cells and panels.

It called the preliminary ruling a “very positive first step” that would be critically important for thousands of US workers in the solar sector.

SolarWorld is backed by six other solar manufacturers, including Helios Solar Works and MX Solar.

However, other US solar manufacturers have criticised the ruling. The Coalition for Affordable Solar Energy (CASE), a group set up to voice opposition to SolarWorld’s complaint, says that the decision would “increase solar electricity prices in the US

precisely at the moment solar power is becoming competitive with fossil fuel generated electricity”.

CASE said it would continue to fight SolarWorld’s efforts in order to try and get the proposed anti-dumping tariff reduced when the Department of Commerce issues a final ruling in October.

Members of the coalition include California-based SunEdison, Recurrent Energy, SolarCity and Westinghouse Solar, as well as China-based Suntech Power Holdings Co.

CASE says that the vast majority of the 100 000 jobs in the US solar industry are in sales, marketing, design and engineering of solar projects and depend on affordably priced solar panels.

“The US solar industry has been growing, adding new solar electric systems, creating jobs and investing billions of dollars in the US energy

infrastructure,” said Kevin Lapidus, Senior Vice President Legal and Government Affairs for SunEdison.

“By increasing the price of modules and therefore the price of solar energy, these tariffs will undermine the success of the US solar industry and reduce the ability of solar energy to compete with electricity generated from fossil fuel,” he also noted.

SolarWorld’s President, Gordon Brinser, said the Commerce Department had merely confirmed that Chinese manufacturers have illegally dumped solar cells and panels in the US market, giving their products an unfair advantage.

The ruling “will re-establish a natural balance in pricing that does need to occur in the global marketplace”, Brinser said, adding that the US solar market has been distorted by cheap Chinese imports.

Eosol supports Chilean solar sector

Chile’s bid to improve the sustainability of its energy sector has received a boost from plans by Eosol New Energy to build a 192 MW photovoltaic (PV) solar plant.

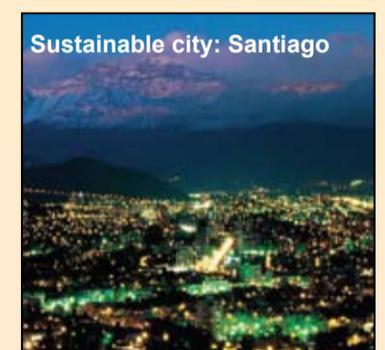
The Chilean renewable energy developer has also inaugurated the country’s first solar PV laboratory.

Eosol has submitted an environmental impact declaration for its proposed \$619 million solar energy project in Tocopilla, northern Chile. The plant would be connected to the northern SING network and will help Chile to diversify its energy sources in line with government energy policy.

Eosol has also invested \$300 000 in a new PV research unit at the Adolfo Ibáñez University in Chile. The facility features four 12 kW grid-connected PV systems and will serve as a testing laboratory for both students and private companies.

According to the Chilean ministry of energy’s Renewable Energy Centre, solar developers have applied to build over 2500 MW of PV and solar thermal projects in Chile.

Eosol has developed solar energy projects in Spain, France and Mexico.



US sets new shale gas drilling rules

■ Chemical disclosure required
■ Gas replacing coal in the generating mix

The US government says that new rules for oil companies drilling for oil and natural gas on public lands will help to protect the environment while allowing for the continued expansion of the industry.

The proposed new rules require oil companies to publicly disclose the chemicals used in hydraulic fracturing – the technique used to extract shale gas – and also set standards for the construction of wells and wastewater disposal.

The impact of hydraulic fracturing has been a major concern among environmentalists since the start of the shale gas boom in the USA. While the disclosure of chemicals is a positive step forward, environmental groups have criticised the proposed legislation because companies would only have to make that disclosure after drilling.

The US Environmental Protection Agency (EPA) is currently conducting a study on the impact of hydraulic

fracturing on water supplies and is expected to release preliminary results later this year.

“The EPA has also moved to regulate emissions from hydraulic fracturing practices, and of the disposal of contaminated fluids once they are retrieved from the well after the hydraulic fracturing is completed,” said Peter Kiernan, energy analyst at the Economist Intelligence Unit. “The growth in the shale gas industry has been explosive in the US and it is only now that we see regulations catching up to its development.”

The boom in shale gas development has caused a sharp drop in natural gas prices in the USA. This, coupled with stricter environmental regulations, is resulting in a rise in gas-fired generation and a drop in the number of coal-fired power plants.

The shale gas boom has also led to a big drop in the country’s carbon emissions as power generators switch



from coal to cheap gas.

According to the International Energy Agency, US energy-related emissions of carbon dioxide fell by 450 million t over the last five years – the largest among all countries surveyed. Fatih Birol, the IEA’s chief economist partly attributed the fall to a “major shift” from coal to gas in the power sector.

AEP Chief Executive Nick Atkins said in April that only half of the company’s power generation fleet would be using coal by 2020, compared to 65 per cent today, while Southern Co also said that coal fired plant now accounts for 35 per cent of its output, compared with 70 per cent five years ago.

However, if demand for natural gas from the power generation sector continues to rise, natural gas prices may recover. Shell said in May in an interview with the *Financial Times* that it expects US natural gas prices to double by 2015.

Mexico passes climate change law

Mexico’s Senate has passed a climate change bill that paves the way for the creation of an emissions trading market in the country.

The measure gives the energy ministry authority to establish policies and incentives to promote low-carbon technologies, including a non-binding national emissions trading scheme in which companies can voluntarily take part.

The legislation sets out that participants in the future emissions market can trade CO₂ permits with partner countries. It is a landmark piece of legislation and comes at a time when the country has also just approved a law that will set a benchmark for best practice on tackling deforestation and forest degradation.

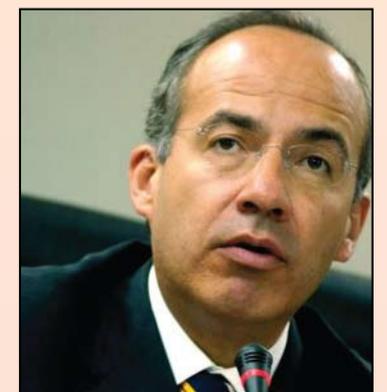
It also highlights a shift in the current political debate on climate change, according to John Gummer, a former UK environment minister and president of Globe International, a group that pushes for environmental legislation.

“Until now, [climate change law] has been largely framed by the narrative of sharing a global burden – with governments, naturally, trying to minimise their share,” said Gummer in a written statement. “Now, legislators increasingly view the issue as one of national self-interest, with each

country trying to maximise the benefits of climate-change legislation.”

China is developing comprehensive climate change legislation, while South Korea recently passed legislation for an emissions trading scheme.

Mexican President Felipe Calderon is an advocate for action to curb greenhouse gas emissions. The climate change law passed the Mexican Senate last year but underwent changes in the lower house, which passed it in April.



President Felipe Calderon: taking action to curb greenhouse gas emissions

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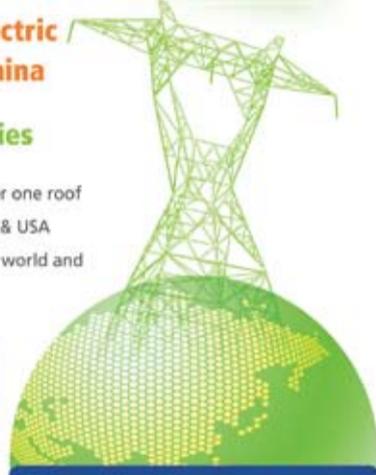
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Nuclear shutdowns will slow economic growth

Japan has been advised that the continued shutdown of nuclear plants jeopardises its energy security and puts economic growth at risk. **Syed Ali**

Japan's real gross domestic product is predicted to contract by 2030 without nuclear power. According to the government, increased power charges stemming from higher fuel costs will curb industrial activity.

The Ministry of Economy, Trade and Industry says the country's GDP would shrink by 0.8 to 4.1 per cent in 2030 if nuclear energy accounts for 15 per cent of the nation's total power output, compared with 24 per cent in 2010, and by 0.7 to 3.6 per cent if nuclear power accounts for 20 per cent; by 0.7 to 3.5 per cent if it accounts for 25 per cent, and by 0.7 to 2.5 per cent if it accounts for 35 per cent.

In June 2010, the government adopted a basic energy plan envisioning nuclear power accounting for 50 per cent of the nation's total power generation by 2030, up from around 30 per

cent at that time.

That target is now under review following the Fukushima Daiichi nuclear power plant crisis triggered by the March 11, 2011, earthquake and tsunami disaster.

The World Economic Forum has warned that if Japan turns away from nuclear power rapidly, the country would put its energy security at risk. Instead, it says the country should focus its efforts on strengthening the safety of its nuclear power plants over the long term.

In a report issued at the end of April, it called for transparency in relevant information by ensuring the independence of nuclear regulators in Japan, while advocating the need for greater involvement by the International Atomic Energy Agency.

The report said any rapid change from

the current energy policy "would jeopardise Japan's energy security and increase its dependence on fossil fuel imports," adding that a major shift toward renewable energy would require large-scale investment.

The Organisation for Economic Co-operation and Development (OECD), meanwhile, urged Japan to resume the operation of nuclear power plants after their safety has been confirmed.

While showing understanding of the public reaction, OECD Secretary General Angel Gurría expressed concern that a power supply shortage would restrict production, saying: "As a condition of growth policy, you have to have sufficient sources of energy to fuel the economy, households, companies, and infrastructure."

Tokyo Electric Power Company (Tepco), the owner of the crippled

Fukushima Daiichi plant, has already had to raise electricity bills for corporate customers in an effort to counteract some of the massive losses it has suffered and plans to do the same for households.

Last month the government approved a Yen1 trillion (\$12.5 billion) public bailout for the utility and put it under temporary state control.

In exchange, Tepco has appointed new management and pledged to cut costs while raising utility rates as it works to stabilise the crippled nuclear plant and compensate tens of thousands of victims displaced by the nuclear disaster. The plan calls for Yen3.3

trillion (\$41.3 billion) of cost cuts over 10 years by Tepco.

The disaster has forced thousands of people to leave no-go zones near the plant, and the livelihoods of farmers and ranchers have suffered as a result of radiation contamination.

As a result, the anti-nuclear movement has grown with frequent protests demanding an end to nuclear power.

"I hope Tokyo Electric will work to win back public trust," Economy and Trade Minister Yukio Edano said. He stressed the need for Tepco to become more transparent amid criticism that it did not release complete and timely information about the disaster.

Korea's low carbon electricity sector takes shape

- Emissions trading law passed
- European wind ties

South Korea's plan to tackle greenhouse gas emissions and increase the use of green technology is taking shape.

After more than a year of delays, the country last month passed a law mandating the launch of an emissions trading system (ETS) in 2015, making the country the third in the Asia-Pacific region, and the first in Asia, to pass such legislation.

Korea has pledged to reduce emissions by 30 per cent below business-as-usual by 2020. "Our government's thought was that we had to keep our promise by introducing the best policy choice - which is the ETS," said Nam Kwang-hee, director general of the Presidential Committee on Green Growth (PCGG), which led the bill.

To prepare industry for the ETS, the environment ministry launched the voluntary "cap without trade" Target Management System (TMS) this year. But from 2015, participation in the ETS will be mandatory for installations emitting 25 000 tonnes of carbon dioxide equivalent and firms emitting 125 000 tonnes, with smaller entities continuing with the TMS. Three 3-year phases are planned, with at least 95 per cent of allowances given

for free in the first two.

Some industries will receive 100 per cent of their allowances for free during these phases, said Nam. Determining which sectors will receive free allocations, as well as third-phase rules, are among the scheme details now being deliberated by the PCGG and were due to be announced via presidential decree at the end of May.

The country also recently made significant steps in its efforts to develop its wind sector and increase green technology export. At the end of April the Korean Wind Energy Association signed a Memorandum of Understanding (MoU) with RenewableUK, the UK trade and professional body representing the wind, wave and tidal energy industries.

The two associations committed to an agreement to work together to increase trade by "pursuing mutually beneficial business opportunities". RenewableUK and the Korean Wind Energy Association will "facilitate opportunities for business engagement among individual companies active in the wind sectors of the two countries".

The UK and South Korea are already



engaging commercially in the offshore wind sector with a significant investment announced by Samsung earlier this year. In January, Samsung announced a £100 million (\$155 million) project in Scotland to develop its new 7 MW offshore turbine at Fife Energy Park.

South Korea's Ministry of Education, Science and Technology also recently signed a MoU on research, innovation and higher education with Denmark.

The development of innovative solutions in green technology will be a prime goal of the MoU. Denmark has a long history in wind power generation, which South Korea hopes to benefit from.

South Korea plans to develop a 2.5 GW offshore wind project in the South China Sea. South Korea currently generates 2 per cent of its energy from renewable sources. It plans to increase this to 10 per cent by 2022.

Ratchaburi targets Australia

Ratchaburi Electricity Generating Holding plc, Thailand's largest private power producer by capacity, is looking to expand internationally, particularly in Australia, on the back of improving financial performance.

The company said that its financial performance this year is likely to surpass both the Baht4.84 billion (\$154.7 million) in net profit and Baht43.46 billion (\$1.4 billion) in revenue recorded last year.

The company will use the bulk of its investment budget to fund the acquisition of a coal mine in Australia, and the possible construction of two or three new power projects in Laos as well as 2000 MW of power projects in Cambodia.

Chief Operating Officer Peerawat Pumthong said Ratchaburi Electricity is conducting a feasibility study on the acquisition of the coal mine in Australia, adding the study is expected to be completed within the current quarter and a deal should be concluded by the year-end.

The company will also be adding 200 MW of wind turbine capacity in Australia to its existing 100 MW over the next few years. The planned expansion, which will cost about \$600 million, will be handled by its subsidiary Ratch-Australia Corporation (RAC) in order to comply with local renewable energy policies, according to chief executive Noppol Milinhangoon. He

said Australia has strong winds on its coasts and the government fully supports renewable energy development, offering several investment incentives. According to Mr Noppol, Ratchaburi will spend Baht1 billion in July to raise its investment in RAC to 80 per cent from its current 68 per cent stake.

Ratchaburi acquired RAC from Australia-based Transfield Services Infrastructure Fund. RAC has a total generating capacity of 1200 MW.

Ratchaburi believes its worldwide generating capacity may outstrip its original 2016 target of 7800 MW and be closer to 10 000 MW in that year, said Mr Noppol.

New capacity in Thailand will come mainly from renewable energy sources, such as biomass, solar power and algae.

Internationally, Ratchaburi is planning to acquire several fossil fuel and renewable energy projects. The company has earmarked Baht30 billion for acquisitions and new projects.



Digging deep: Ratchaburi is looking to expand in Australian coal mining

GE and Shenhua open IGCC JV

GE and Shenhua Group have formed a 50-50 joint venture (JV) to advance the development and deployment of "cleaner coal" technology solutions in China.

The new company combines GE's expertise in industrial gasification technology with Shenhua's expertise in

coal gasification and coal-fired power generation. The JV will sell industrial gasification technology licenses in China, conduct research and development to improve cost and performance of commercial-scale gasification and integrated gasification combined cycle

(IGCC) solutions and work to advance to distribution of commercial-scale IGCC.

"Both GE and Shenhua have worked together for years in China on important projects, including the Shenhua Baotou coal-to-olefins facility, which uses

GE's gasification technology. The collaboration will create a leading gasification technology business in China with significant local presence, focus, resources and expertise," said Wang Xiaolin, deputy general manager of Shenhua Group.

Paul Browning, president and CEO of Thermal Products, GE Energy, said: "Coal plays an important role in the economies of both the US and China, and gasification technology allows us to use this abundant and low-cost resource in a much cleaner way."



Looking overseas: NTPC has put import plans in place for fuel security

India's biggest power producer by capacity, National Thermal Power Company (NTPC) Ltd, plans to increase coal imports amid falling income.

A senior company executive who did not wish to be named told *Dow Jones Newswires* that the state-run utility plans to increase this fiscal year's coal imports by a third due to a local shortage.

Last month the company reported a second consecutive drop in quarterly net profit during the January-March period, caused partly by lower power generation due to a shortage of coal.

NTPC has already more than halved

its capacity addition target for the five years through March 31, 2017 to 14 GW from 29 GW. The cut surprised many analysts and made the company focus on its coal import plans for fuel security.

Local coal shortages are estimated at around 100 million tons. NTPC, which had contracted Adani Enterprises Ltd. in March to supply 4 million tons of imported coal, is seeking bids for another 5 million tons, the tender for which was scheduled to open at the end of May.

"We will do another 7 million tons during the second half of the year," the executive said. "With import plans in

place, we are quite comfortable fuel-wise."

Most of NTPC's projects totalling 37.5 GW are coal-based. The shortages hurt the electricity sector the most as more than half of the 200 GW capacity is coal-based and many upcoming projects depend on coal.

If Coal India, which supplies more than 80 per cent of India's coal, continues to fall short in supplying fuel to power plants, the electricity generation capacity addition target for the current plan period (2012-17) would have to be curtailed to 45 GW from the proposed 75.78 GW, says a report by the Working Group on Power.

Indonesia to strengthen grid following blackout

- Nearly \$100 million for grid development
- Grid will support new capacity

Indonesia's state power company, PT Perusahaan Listrik Negara (PLN), says it will set aside Rupiah881.34 billion (\$95.84 million) this year to improve the reliability of the Java and Bali grid system and reduce blackouts.

The announcement came days after a rolling blackout hit the capital city of Jakarta, disrupting services for around two hours, due to a disturbance at the Gandul power station.

PLN operation director for Java and Bali, I Gusti Ngurah Adnyana, said: "A lot of existing equipment in our grid system has aged, and we need to replace it or there will be power supply interruptions, as recently happened in Jakarta." He noted that investments in electricity transmission and distribution were also needed to cope with growing demand.

He said that in 2012, PLN would add thirty-two 500 kV transformers in Java and Bali and more than one hundred 150 kV transformers. Next year, the firm would not add more 500 kV transformers, but would install thirty-nine 150 kV transformers. A 1007 km transmission line will also be installed this year.

An improved transmission and distribution system will be needed to support PLN's plans to construct 28

power stations in Java and Bali this year with a capacity of 2200 MW. Two stations will be built in Bali, nine in East Java, seven in Central Java, five in West Java and five in Jakarta and Banten.

Many of the power stations will help Indonesia meet its renewable energy goals. PLN recently said it aims to raise the use of renewable energy for electricity generation to 20 per cent within the next eight years, from the current level of 11 per cent.

The company said it would persistently encourage and support development of renewable sources such as hydropower, geothermal, solar energy and biomass, for electricity generation.



Avoiding blackouts: grid improvements are under way



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Germany debates energy transition

- Concerns voiced over wind and transmission plans
- Austria to end nuclear power imports

German Chancellor Angela Merkel has met with electricity industry representatives amid concerns that the country's transition to a non-nuclear nation has stalled.

Utilities, trade unions and electricity industry associations held talks with the Chancellor last month to discuss how a plan to construct new generating and transmission capacity will be financed and implemented.

The industry is concerned about the level of investment that is required in the next decade to build enough capacity to replace Germany's nuclear power plants, and whether new onshore and offshore transmission lines can be built quickly enough.

Germany's decision to exit nuclear power – taken after the Fukushima disaster in 2011 – has already resulted in a sharp fall in revenues for utilities, who will have to invest €60 billion in the next few years, says German

energy group BDEW.

Merkel is planning to publish a plan for the power grid network in early June and has called on energy utilities to “dig deeper and maybe put in extra work” to realise the energy transition, according to newspaper *Hamburger Abendblatt*.

The government's target to install 10 GW of offshore wind energy capacity by 2020 was criticised by RWE chief Peter Terium, who said that a target of 6000 MW was more realistic.

The development of Germany's offshore wind energy sector has been held up by delays in connecting wind farms to the grid, which system operator TenneT says is largely due to the technical challenges of constructing offshore converter stations.

TenneT needs to attract equity for its offshore grid connection projects and may struggle to do so because of the technical risks.

Another issue facing Germany is the construction of new onshore transmission lines to carry the power generated from offshore wind farms to demand centres in southern Germany. Economics Minister Philipp Roesler has said that the current approval procedures for grid expansion must be streamlined because it currently takes too long to build new lines – up to ten years in some cases.

The government has indicated that the construction of new generating capacity will be incentivised by subsidies, but only for small utilities and not for the large players such as E.ON and RWE.

The large utilities have objected to this plan and have also voiced concerns that power prices are currently too low to incentivise investment in new generating plant.

In early May, Germany signed an agreement with Austria and

Switzerland to cooperate in the use of hydropower.

The three countries want to create a centre that would coordinate the operation of pumped storage hydropower plants, which are highly flexible and an ideal back-up for intermittent renewable energy sources.

Austrian federal Minister of Economy Reinhold Mitterlehner said that the plan would strengthen Austria's position as the ‘green battery’ at the heart of Europe.

Austrian energy companies recently agreed to stop imports of nuclear energy from neighbouring countries to make it a truly nuclear energy-free state.

In a summit held at the end of April between government, energy companies and environmental organisations, the country's utilities voluntarily committed to stop imports of nuclear energy by the end of 2015.

End in sight for EED

European ministers in Brussels have agreed to adopt the proposed energy efficiency directive (EED) by the end of June.

The EED aims to improve energy efficiency in the 27-nation bloc by 20 per cent by 2020 and has been the subject of fierce debate in Brussels. At a meeting in Denmark EU energy and climate ministers agreed that negotiations should be completed by the end of June and the Danish Presidency of the EU is now negotiating an agreement with the European Parliament on behalf of the Council.

“Future growth in Europe hinges on increased resource efficiency and to a very large extent increased energy efficiency,” said Danish Minister for Climate, Energy and Building Martin Lidegaard. “The Energy Efficiency Directive can form a valuable part of the foundation for growth and job creation in years to come – and will limit Europe's import of expensive fossil fuels.”

While the European Parliament is pushing to maintain the EED's proposed 20 per cent goal, several members of the European Council are opposed. Environmentalists have criticised ‘watered down’ versions of the directive proposed by the Council that would only result in small reductions in energy consumption.



Lidegaard: future growth hinges on increased energy efficiency

UK outlines energy plan

The UK has set out a range of proposals to help it fill a looming energy gap.

Siân Crampsie

The UK government is planning to reward low carbon generators with a fixed price for the energy they produce in order to incentivise investment in ‘clean’ power generating capacity.

The proposals are part of a new energy bill that sets out the biggest reforms to the UK energy sector in two decades.

The Electricity Market Reform bill will help to keep the lights on, tackle climate change and keep consumers' energy bills low, says the government. It includes a feed-in tariff contract for difference (CFD) scheme, capacity payments and a carbon price floor.

“These reforms will ensure we can keep the lights on, bills down and the air clean,” said Energy and Climate Change Minister Ed Davey. “Leaving the electricity market as it is would not be in the national interest. If we don't secure investment in our energy infrastructure, we could see the lights going out, consumers hit by spiralling energy prices and dangerous climate change.”

Around one-fifth of the UK's energy capacity is due to be retired in the next decade leaving an energy gap that the government wants to fill with nuclear energy and renewables, as well as other low carbon forms of generation such as coal plant equipped with carbon capture and gas fired power plants.

Industry groups have largely welcomed the legislation as it will bring more certainty for investors, but some green groups have criticised it. Greenpeace said in a statement that the proposed reforms would encourage “a big increase in [the UK's] dependence on burning expensive natural gas”. It called on the government to increase investment in energy efficiency.

Included in the energy reform bill is a plan to introduce CFD for low carbon forms of generation, including nuclear energy, to give generators a ‘strike price’ for their energy that is likely to be above market rates.

This, says the government, makes investment in clean energy more attractive as it removes exposure to electricity price volatility.

Tempered demand: Jorge Calvet, Chairman and CEO of Gamesa

US offshore market too slow for Gamesa

Gamesa says it is poised to play a leading role in the offshore wind energy sector as it prepares to deploy its first offshore turbine prototype.

The Spanish wind energy company has selected a site in the Canary Islands, Spain, to test the 5 MW turbine, which will be the first of its kind installed in Spain.

Gamesa selected the site, in Arinaga Quay, Gran Canaria, over a site in Cape Charles in the US state of Virginia. It expects to begin installation of the G128-5.0 MW turbine in the second quarter of 2013 and achieve certification in the following months.

The decision to test the prototype in

Gran Canaria was driven by wind conditions in the region as well as customer investment plans, said Gamesa, which is to close its offshore wind technology centre in Chesapeake, Virginia, USA, at the end of the year.

“The authorities are firmly committed to the development of offshore wind power in major markets such as the UK, Germany, France and China. Based upon the current situation, the US market appears to be set to develop later than others,” said Jorge Calvet, Chairman and CEO of Gamesa. “Regional and country specific market conditions warrant an even more rational decision making process than

ever, from both the technology and financial standpoints.”

Calvet said that demand for offshore wind turbines was strong but is being tempered by “economic and financial factors and the difficulties being encountered by developers in accessing credit”.

Gamesa has also opened an offshore technology centre in Scotland and is currently in discussions with Forth Ports at Leith in Scotland over the creation of a manufacturing base.

This manufacturing base would produce nacelles and blades as well as take care of port logistics and operation and maintenance service platforms.



Chevron, Shell win shale gas rights



The award of rights to explore gas fields is a major step forward for Ukraine's energy strategy.

Siân Crampsie

Ukraine has paved the way for a new wave of foreign investment in its energy sector by awarding two international oil majors the right to develop shale gas fields.

Royal Dutch Shell and Chevron Corp will explore the Yuzivske and Oleske unconventional gas fields. The move could put Ukraine at the forefront of Europe's emerging shale gas industry and free the ex-Soviet nation from the stranglehold held over it by Moscow.

The Ukrainian government has also reiterated its commitment to nuclear energy as a means of improving energy security. The country is highly reliant on Russia for energy imports.

Shell and Chevron will each invest between \$300 million and \$400 million initially, it is estimated. If the reserves held in the two fields prove to be commercially viable, they could provide

Ukraine with up to ten per cent of its natural gas needs by 2020.

The investments could prove to be controversial, however, with pressure mounting on Ukrainian president Viktor Yanukovich over his alleged political persecution of jailed opposition leader Yulia Tymoshenko.

Extraction of natural gas at the sites will begin in 2018-2019. The Oleske field is thought to contain 3 trillion m³ of conventional and unconventional gas, and the Yuzivske field 4 trillion m³, according to the Ukrainian state geological service.

Ukraine's shale gas reserves are thought to be the fourth largest in Europe, after Poland, France and Norway. Large quantities of commercially viable reserves would transform the country's energy landscape and potentially make the country an exporter of the fuel.

Shale gas exploration in the USA has

had a major impact on the oil and gas industry there, but concerns over the environmental impact of extraction techniques such as horizontal drilling and fracking mean that exploration of Europe's reserves has been slow.

France has banned fracking, while in the UK a project to explore for shale gas was temporarily put on hold because of two minor earthquakes linked with drilling.

Shell has been awarded the rights to explore the Yuzivska field in eastern Ukraine, while Chevron will explore the Oleske field in the west of the country. The two companies beat rival bids from TNK-BP, Exxon Mobil and Eni.

According to the *Financial Times*, Chevron and Shell pledged to invest double the minimum investment required under the terms of the Ukrainian tender and could end up investing billions of dollars if the reserves are commercially viable.

Shoaiba boosts Saudi capacity

Energy companies and equipment suppliers in Saudi Arabia are expanding operations in the country in order to help it keep up with growing demand.

GDF Suez-owned International Power said recently that it will extend three power plants for Saudi Aramco, while Siemens in May broke ground on a new gas turbine manufacturing facility in the city of Dammam.

In addition, Alstom announced last month that it had successfully completed and handed over the Shoaiba III power station ahead of schedule.

The 1.2 GW power plant is an important part of the Kingdom's plans to expand its power generating capacity.

International Power and Saudi Oger are to expand three power plants owned by Tihama Power, their joint venture company.

The three plants are located at Saudi Aramco-owned gas and oil refineries and the expansion project is backed by long-term energy conversion agreements.

Engineering, procurement and construction will be carried out by Hyundai Heavy Industries of South Korea and GE will supply the gas tur-

bines. The project will add a total of 532 MW to Tihama's portfolio.

Siemens says that its new factory will be completed in late 2014 and will have an initial production capacity of 20 turbines per year. It will supply the Saudi market and is the first of its kind for Siemens in the Middle East.

Saudi Arabia is aiming to add between 3000 and 4000 MW of new generating capacity per year to keep up with growing electricity demand. Current installed capacity stands at 52 000 MW and this could reach 102 GW by 2032, according to some estimates.

The completion of Shoaiba III by Alstom brings the total output of the Shoaiba power plant site to 5600 MW. Shoaiba III consists of three oil-fired, 400 MW blocks equipped with Alstom STF40 steam turbines and a seawater flue gas desulphurisation system.

Ali Saleh Al-Barrak, President and CEO of the Saudi Electricity Company (SEC), which owns the Shoaiba site, said that Shoaiba III is "crucial for the development of the Saudi economy".

Electricity demand in Saudi Arabia is growing at a rate of eight per cent per year, according to estimates.



Saudi Arabia is aiming to add between 3000 and 4000 MW of new generating capacity per year

PV price drop is here to stay

- Policymakers are behind the curve
- Global Solar Council launched

The dramatic fall in the prices of solar photovoltaic (PV) modules in recent years is a reflection of the reduction in manufacturing costs rather than overcapacity in global supply, according to a new report.

Research company Bloomberg New Energy Finance (BNEF) says that recent price reductions in PV modules are therefore likely to be sustainable, and that power generated by PV panels is much closer to competitiveness with conventional electricity generation than many policymakers realise.

According to BNEF, average PV module prices have fallen by nearly 75 per cent in the last three years, to a point where solar power is now competitive with daytime retail power prices in a number of countries. It believes that many industry observers and decision-makers – including those that set government policy – have yet

to catch up with the improvements in the economics of solar power.

The fall in prices and global oversupply of PV modules has hurt many manufacturers, particularly those in North America and Europe. Several big names in the solar industry have gone out of business in recent months, in spite of continued investment in the sector.

Recent data from GlobalData shows that in 2011 solar power investments accounted for 49 per cent of global renewable power investments.

It also shows that global investment in renewable energy in 2011 surpassed previous years at \$209 billion.

Representatives of leading international companies in the solar PV industry have announced the founding of the Global Solar Council, a CEO-level industry coalition whose aim is to expand the global deployment of



Robert Hansen, CEO of Dow Corning, is a member of the newly launched Global Solar Council

solar energy. Global Solar Council members will engage with policymakers worldwide to emphasise the importance of a supportive policy and trade environment, which will enable the ongoing development of competitively priced solar energy, driving job creation and economic growth.

Atmea1 and AES-92 are best fit for Jordan

Jordan has moved a step closer to its goal of building its first nuclear power plant by narrowing its technology choice to two suppliers.

The Jordan Atomic Energy Commission (JAEC) has said that the Atmea consortium and Russia's AtomStroyExport are the two suppliers that are best qualified to meet Jordan's needs.

Its decision means that Candu Energy and its Enhanced Candu 6 reactor design are no longer in the running for the Jordanian project.

JAEC is to continue discussions with Atmea – a joint venture between Areva and Mitsubishi Heavy Industries – and AtomStroyExport, with the next phase of its evaluation focused on resolving outstanding technical issues and bringing site selection and operating company information into consideration.

Both the Atmea1 reactor design and AtomStroy's AES-92 reactor are advanced pressurised water reactors with enhanced active and passive safety systems. The 1150 MW Atmea1 design

received preliminary approval from French nuclear regulators earlier this year.

Jordan wants to commission its first nuclear reactor in 2020 with a second plant coming on line five years later. Its nuclear power programme is designed to reduce the country's dependence on energy imports.

The country is also planning to upgrade its power network with smart grid technologies in order to improve energy efficiency.

Jordan's Electricity Regulatory Commission (ERC) has signed an agreement with the US Trade and Development Agency (USTDA) under which the US will extend \$1.15 million to Jordan to help finance a study into smart grid implementation.

The studies will examine ways smart grids can increase safety, reliability and load management capacity for the Electricity Distribution Company, the Irbid Electric Power Company and the Jordanian Electric Power Company.



EDF finalises Edison deal

France's EDF is to take control of Edison after a two-year battle for the Italian utility.

The Italian regulator Consob has given its approval to an improved offer made by EDF to Edison's Italian shareholders and has also agreed a deal with Delmi to buy its 50 per cent stake in Transalpina d'Energia, which owns 61.3 per cent of Edison.

EDF will pay €0.89 per Edison share, or around €780 million to increase its stake in Edison from 50 per cent to 80.7 per cent. It will use the company, which produces and sells power, natural gas and crude oil, as a platform to develop its gas business in Italy.

EDF has been trying to conclude a deal for Edison for two years but had met with opposition from the utility's Italian shareholders. As part of the deal, Delmi, which is controlled by Italian utility A2A, will buy Edison's 50 per cent stake in Edipower, which owns nine power plants in Italy.

The deal is one of a number of key mergers and acquisition (M&A) deals in the European utilities sector in the first quarter of 2012, according to Ernst & Young.

Other key M&A deals in the region include the takeover of International Power of the UK by GDF Suez and the purchase of a 50 per cent stake in Borkum Riffgrund 1 by two Danish investment firms.

According to Ernst & Young, domestic privatisation and asset disposal programmes in Europe meant that the region accounted for 48 per cent of utility M&A deals globally in the first quarter of 2012 and 71 per cent of deal value. Central to M&A decisions is the Eurozone crisis, with dealmakers attempting to balance financial discipline with consolidation in core markets and the need to gain traction in high growth markets.

"While fiscal tightening by European banks might restrict future M&A

activity, the growing number of asset disposal programmes by European utilities and government privatisation programmes is expected to drive deal flow in the short term," said Joseph Fontana, Ernst & Young Global Transaction Advisory Power and Utilities Leader.

Overall, M&A activity in the global

utilities sector fell by 16 per cent year-on-year in the first quarter of 2012. Continued economic uncertainty, tightening financial markets and disparity in global gas pricing are among the reasons for the drop. Deals in the generation and renewable energy sector dominated transactions as utilities try and align themselves with tightening

environmental regulations.

■ US industrial component manufacturer Eaton Corp. is moving into the global power industry by acquiring Cooper Industries, one of the USA's largest makers of electrical equipment, for \$12.6 billion. The takeover is the third largest announced worldwide this year.



GE has set up a new transmission and distribution partnership that is designed to rival the market presence of ABB, Siemens and Alstom.

Sian Crampsie

GE says it has reached a milestone in its long-term strategy to become a major player in the global transmission and distribution (T&D) market by forming a partnership with Chinese firm XD Electric.

The partnership will create a global player in the T&D segment using XD Electric's broad range of high voltage equipment with GE's automation equipment and international reach.

GE will purchase a 15 per cent equity stake in XD Electric and appoint a representative to the Chinese firm's board of directors.

"This is a significant milestone in GE's long-term strategy to become a highly competitive, global player in transmission and distribution technologies," said Dan Janki, president and CEO of GE Energy Management.

The partnership will not only target China but also other markets where transmission grids are growing rapidly in response to economic growth and development.

It also sees potential in more established markets such as Europe and North America, where growth in the T&D sector is being driven by the need to modernise infrastructure.

"This is the beginning of an important

relationship between two companies with complementary product lines and commitments to technology.

"It will enhance GE's ability to provide end-to-end transmission and distribution solutions and expand our presence in the fastest growing regions of the world," said Bob Gilligan, president and CEO of GE's Digital Energy business.

The global T&D sector is a \$100 billion industry, according to GE. China represents one-quarter of the global T&D industry's projected expansion and plans to invest \$600 billion in its electrical infrastructure over the next decade.

AES sells Chinese assets

AES has announced plans to sell a number of its business interests in China in order to narrow its geographic focus and concentrate on core markets.

The USA-based power company has signed two agreements to sell equity interests in coal, hydropower and wind

power assets for \$134 million. It says that it is making the sales because it no longer has a competitive advantage in these markets.

AES has agreed to sell its 25 per cent equity interest in the 2100 MW coal-fired Yangcheng plant and its 49 per cent equity interest in the 248 MW

China Wind joint venture to Sincor Utilities for a total of \$86 million.

It has also agreed to sell its 49 per cent equity interest in Jianghe Rural Electrification Development Company Limited to its joint venture partner, China Three Gorges New Energy Corporation, for \$48 million.

Gamesa teams up with Toyota

Gamesa is continuing its assessment of the potential for mass-market electric vehicle (EV) technology through a new collaboration agreement with Toyota.

The Spanish wind turbine manufacturer is to make use of a Toyota plug-in hybrid vehicle for a six-month period to assess its performance as well as the infrastructure that would be needed to facilitate near-term mass-market rollout of EVs in Spain.

Gamesa will operate the vehicle in urban environments as well as at its wind farm locations and will share data from the test drives with Toyota Spain.

EVs are one of six key advanced energy technologies that Gamesa has identified for research, development and investment and for the future diversification of its product offerings. It is also developing charging technology for EVs.

"These energy efficient cars with their reduced carbon footprints can and must contribute short and medium term to the energy saving and environmental protection imperative and to verifying the enormous synergies between wind energy and green mobility," said David Mesonero, Gamesa's Director of Corporate Development.

Gamesa started manufacturing EV charging stations in Spain earlier this year and has already signed a charging station supply and marketing agreement with Iberdrola.

■ Gamesa said in May that the complex economic environment, volatility in many of the main wind energy markets and new product launches had a temporary impact on its net debt and profitability in the first quarter of 2012. The company reported a 33 per cent rise in sales to €777 million but posted a loss for 1Q2012 of €21 million, down from a profit of €13 million in the same period a year ago. Latin America was its main growth driver.

EVs are one of six key energy technologies identified for research



Offshore wind issues hit Siemens

Siemens has reduced its financial outlook for 2012 after its second quarter earnings were hit by charges in its power transmission business.

The German engineering firm said that profits in the first three months of 2012 – its fiscal second quarter – fell to €1.02 billion, down from €2.84 billion in the same period for 2011. Revenues for the period were up over 2011 by nine per cent.

CEO Peter Loescher said the second quarter was difficult and remained below the firm's own expectations as incoming orders slowed down.

Profits fell because of a €278 million charge to its transmission business related to projects connecting off-

shore wind farms in Germany to the onshore electricity grid. It also booked a €640 million write-down on its NSN communications division.

Siemens is constructing five major offshore wind connection projects in the German North Sea, two of which are experiencing delays in part due to the technical challenges of building offshore structures. The company has acknowledged that it had underestimated the complexity of the projects.

German transmission system operator TenneT has called a moratorium on the development of new offshore wind connection projects until lessons learned from current connection projects can be learned.

Tenders, Bids & Contracts

Americas

Light expands Rio smart meter project

Elster has announced that Light S.A., the second largest utility in Brazil, has chosen Elster's Garnet and Dracon solutions to expand its Advanced Metering Infrastructure (AMI) system in the city of Rio de Janeiro.

Since the initial deployment of Elster solutions for 20 000 metering endpoints in the communities of Tabajaras, Cabritos and Borel in the first half of 2011, Light has placed subsequent orders for an additional 80 000 endpoints to be installed by the end of 2012.

The deployment of AMI solutions has helped Light to reduce non-technical losses as well as modernise its infrastructure.

SPX wins ACC order

SPX Corporation has announced that its Thermal Equipment and Services division has won an order to supply one of the world's largest air-cooled condensers (ACCs) for a new 1.3 GW natural gas fired combined cycle plant in the USA.

Dominion Virginia Power, a subsidiary of Dominion, plans to build the new power station facility in Warren County, Virginia.

The contract was awarded to SPX by Warren County Energy Partners, a joint venture of Burns & McDonnell and Zachry Industrial, Inc., and calls for SPX to supply the ACC for what is expected to be one of the largest combined cycle power plants ever installed in the Americas.

The new plant will consist of three gas turbines and a steam turbine. SPX Cooling Technologies' 60 Module (10x6) SRC A-frame ACC is scheduled to be installed in the plant during 2013.

Gamesa debuts in Uruguay

Gamesa is to venture into a new market by signing its first deal to supply wind turbines in Uruguay.

The Spanish company is to deliver 25 of its G90-2.0 MW turbines to a 50 MW wind farm that Abengoa, via companies Teyma and Inabensa, is developing in Peralta, in the department of Tacuarembó.

Gamesa will produce the turbines this year at its manufacturing plants in the United States, with transport, assembly and start-up scheduled for 2013. Gamesa will perform operation and maintenance (O&M) services on the machines for 20 years.

URS consortium wins waste contract

A consortium led by URS Corporation has been awarded a \$1.3 billion contract to handle nuclear waste in New Mexico, USA.

The Nuclear Waste Partnership consortium, which also includes France's Areva, will characterise waste from US Department of Energy sites around the country, manage transportation and receipt at the Waste Isolation Pilot Plant (WIPP) in New Mexico, then execute final burial in the 7052 m-deep geologic repository.

The \$1.3 billion management and operations contract obtained by the consortium runs for five years, with an option for an additional five years.

Maui smart grid selects Alstom

Alstom Grid has been selected to provide its e-terradistribution Integrated Distribution Management System (IDMS) for Maui Electric Company's (MECO) Smart Grid demonstration

project in Hawaii.

The demonstration project will evaluate how smart grid technologies can help MECO reduce peak demand, improve service quality, inform consumer energy use decisions, and integrate renewable energy.

Some of the technologies tested in the project include advanced metering infrastructure, home area networks, and battery energy storage. Alstom's IDMS suite of smart distribution applications will integrate information from the smart grid network to improve monitoring and control of MECO's distribution system and distributed energy resources (DER).

Ormat negotiating project agreement

Ormat Technologies has announced that it has been named as the preferred bidder for a \$61.2 million engineering, procurement and construction (EPC) contract for a geothermal power project in North America.

Under the expected EPC contract, which is currently under negotiation, Ormat would provide two air-cooled Ormat Energy Converters for the proposed power project. The project is expected to be completed by the end of 2013.

Asia-Pacific

Wuhan to supply cogen boilers

Wuhan Boiler Company (WBC), Alstom's largest utility boiler manufacturing site, has signed a contract with Shandong Weiqiao Pioneering Group Co. Ltd., to supply four 350 MW sub-critical pulverised coal-fired boilers for a cogeneration power plant located in Shandong Province, China.

Alstom WBC will design, manufacture and supply the units, delivery of which will be completed by 2013.

Toshiba wins India order

Toshiba has won an order to supply two steam turbines for a new thermal power plant in India.

The Japanese firm has signed an agreement with a joint venture company led by India's National Thermal Power Corp to engineer, procure, manufacture and install the equipment. The new plant will be situated in Uttar Pradesh state and will start operating in May 2016.

Siemens awarded Australia LTSA

Santos GLNG, a joint venture between Santos, Petronas, Total and Kogas, has awarded Siemens a contract to provide long term maintenance services for a pioneering energy project in Queensland, Australia.

The six-year contract includes preventative maintenance, remote monitoring, parts supply, and field service for 16 SGT-400 industrial gas turbines (nine generator sets and seven compressor sets) spread across three Santos GLNG sites in Australia. The multi-million dollar service order is Siemens' largest ever for its small gas turbine (SGT) product line.

The agreement will help to ensure predictable reliability and maintenance costs for the SGT-400 gas turbines at the Santos GLNG project, which will convert coal seam gas to liquefied natural gas.

UGL consortium wins Australia order

UGL Limited has announced that in a 50:50 joint venture with CH2M Hill it has been awarded a \$550 million

contract by JKC Australia LNG Pty Ltd for the construction of a combined cycle power plant for the Ichthys liquefied natural gas (LNG) project in Northern Territory, Australia.

As part of the agreement, GE will engineer and supply gas turbines, steam turbines and heat recovery steam generators for the \$34 billion Ichthys project. The CH2M Hill-UGL joint venture will design and supply the balance of plant as well as undertake the complete construction of the project.

GE will supply five GE Frame 6B gas turbines and three SC4 single-flow steam turbines that will provide 500 MW of installed power capacity for the facility. Design, procurement and fabrication for the combined cycle power plant works are expected to commence immediately.

Europe

GE bags wind turbine agreement

A consortium of GE and Spanish energy services company Tamoin Energías Renovables has signed a wind turbine maintenance agreement with Iberdrola Renovables that is the largest contract of its kind covering GE wind turbines.

The contract covers 310 GE wind turbines installed in Spain and is set for three years, with an option to extend for two years.

GE will act as the technology partner in the consortium to provide high availability and reliability for the installed GE wind turbine fleet by supplying parts, specialised labour and technological support, while Tamoin will supply skilled labour.

The GE-Tamoin consortium has been working with Iberdrola for the past two years under an existing services agreement at Iberdrola wind farms in Germany and Poland.

The agreement covers planned and unplanned maintenance.

UK orders Nordex units

The Infinis Group has placed orders with Nordex for 22 wind turbines for installation at wind farms around the UK.

In Scotland, five N80/2500 turbines will be installed at the Gordonstown Hill wind farm and five N90/2500 turbines at the Westfield wind farm.

A further twelve 2.5 MW machines will be installed in England at the Wingates, Blackstone Edge and Tedder Hill wind farms.

The projects will bring Nordex's installed capacity in the UK and Ireland to over 1 GW, underscoring the German firm's position in one of its core markets.

Construction work on the new wind farms is to commence this year.

GE boosts Poland wind output

GE is to deploy its 2.5 MW-class wind turbines with 103 m rotors for the first time in Poland.

The company has won an order to equip four wind projects in Poland known collectively as the Darlowo Phase 2 project. GE provided 32 wind turbines for Darlowo Phase 1, which was commissioned in March 2011 and today produces 80 MW.

The Darlowo projects are being developed by Invenergy Wind LLC and Polish firm Enerco. The wind turbines for Darlowo Phase 2 will be assembled at GE's facility in Salzbergen, Germany.

ABB boosts Swiss hydro output

ABB has received orders worth around \$20 million from two power utilities

managed by Axpo, a leading Swiss power utility, to refurbish the generators at two of its hydroelectric power plants.

The plants are located in the picturesque and mountainous canton of Wallis (Valais) in southern Switzerland, bordering France and Italy. The Mattmark and Mauvoisin power plants are capable of generating 680 MW of electricity and represent around 15 per cent of the canton's installed power generation capacity.

International

Wärtsilä signs service agreement with Sasol

Wärtsilä has signed an Operations & Maintenance (O&M) agreement with Sasol New Energy Holdings, a wholly owned subsidiary of Sasol, the integrated global energy and chemical company. The three-year agreement covers the company's gas engine power plant project in Sasolburg, South Africa.

Wärtsilä will take responsibility for operating and maintaining the power plant, which is expected to start operating towards the end of 2012. It will be the largest power plant running exclusively on gas engines to be installed on the African continent, and because of its low emissions, will be a major advance in developing Sasol's electricity business.

The plant has an installed capacity of 180 MW and will provide the energy needed to power Sasol's major new production facilities.

EETC orders Alstom GIS

The Egyptian Electricity Transmission Company (EETC) has placed an order with Alstom Grid for a gas insulated substation (GIS) to connect a new wind farm to the grid.

The new substation will transmit power produced by the 3 GW Gabal El-Zayt wind farm on the Gulf of Suez to the electricity network. The wind farm will be the largest onshore wind farm in Egypt and will be fully operational by 2020.

The substation will be commissioned at the end of 2013. Alstom Grid's scope of supply includes civil works, eleven 220 kV GIS bays, medium voltage switchgear and two 125 MVA power transformers.

Metso automates greenfield CCGT

Metso has signed an agreement with AGE ENERJİ Yatırımları AS, one of Turkey's major energy companies, to automate a greenfield combined cycle power plant in Denizli, Turkey.

Metso's delivery scope consists of a high-tech Metso DNA automation system with which the power plant will be controlled. The 205.5 MW greenfield power plant fuelled by natural gas is scheduled to start up by the end of 2012.

Siemens to maintain solar hybrid

Siemens Energy has been awarded a contract to provide long-term maintenance services at Algeria's first solar-combined cycle hybrid power plant.

The order was placed by Abengoa for its 150 MW solar hybrid plant operating at the Hassi R'Mel natural gas field in northern Algeria.

The contract includes preventative and corrective maintenance for two SGT-800 gas turbines, which Siemens installed in April 2011.

The service contract for the gas turbines at the power plant will help to ensure long-term reliability and predictable maintenance costs for Abengoa at Hassi R'Mel.



Oil

Improved supply puts prices in \$100/B neighborhood

- Saudi Arabia passes Russia as world's largest producer
- US crude inventories highest since August 1990

David Gregory

The price of West Texas Intermediate (WTI) dipped below \$90/b in late May as crude stocks continued to build in the US and in other OECD countries, the result of rising Opec production, particularly from Saudi Arabia. Brent declined to around \$105/b in the midst of worries over the future of the euro and geopolitical tension eased as talks began in Baghdad between Iran and the P5+1 group over Tehran's nuclear programme.

The strength of the dollar over the euro influenced trading, but rising supply, despite the growing absence of Iranian crude from the market, made a greater impression and prompted traders to question whether crude prices could fall further.

The US Energy Information Administration reported that commercial crude inventories in the country rose

to 382.5 million barrels during the week ending May 18, the highest since August 3, 1990.

In its May *Oil Market Report*, the Paris-based International Energy Agency (IEA) said global oil supply increased by 600 000 b/d during the month of April to 91 million b/d. Opec crude output accounted for more than 70 per cent of the increase, the report said, adding that compared to a year ago, global oil production was 3.9 million b/d higher, 90 per cent of which stemmed from increasing output of Opec crude and natural gas liquids.

"Opec has increased output for seven months running and volumes are now nearly 3 million b/d above April 2011 levels," the IEA said. "Higher Opec production has, in part, offset constrained non-Opec supplies stemming largely from unplanned outages. Opec's Gulf producers also appear to have ramped up output ahead of the

anticipated disruption in Iranian crude flows in the coming months as the EU's 1 July oil embargo nears."

It added that crude supply from Saudi Arabia during April was unchanged at an estimated 10 million b/d, noting that Saudi Oil Minister Ali al-Naimi said in early May that the country holds 80 million barrels in inventories. The IEA said that Saudi crude production would likely rise to 10.1 million b/d during May. It has been 30 years since Saudi Arabia produced 10 million b/d. During May it passed Russia as the world's largest producer of crude oil.

In the May issue of its *Monthly Oil Report*, the London-based Centre for Global Energy Studies (CGES) said Saudi Arabia was concerned about another price spike that could occur through the loss of Iranian oil exports due to sanctions.

Measures taken to prevent Iran from

delivering crude oil are already having an impact on the country's oil industry. Media reports say that production is down by 10 per cent and an estimated 60 million barrels of Iranian crude was reported in late May to be in storage.

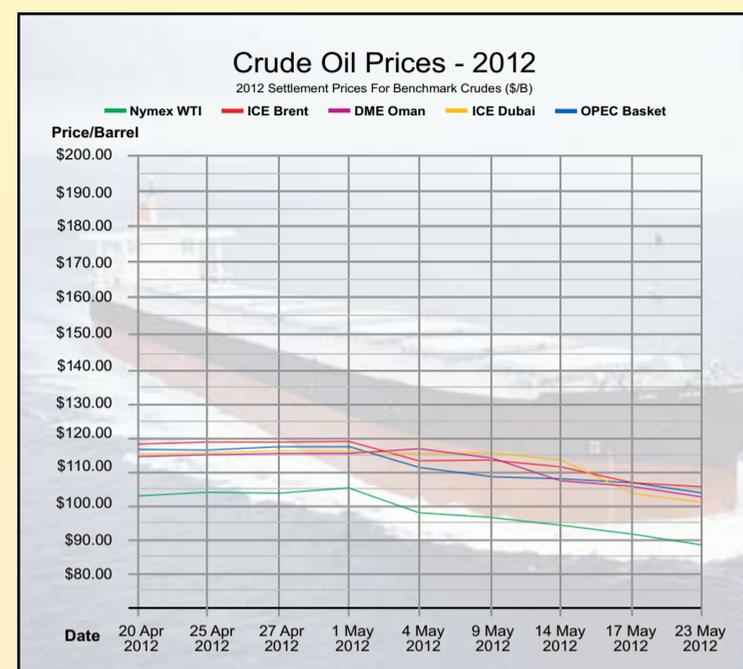
It appears to be Saudi Arabia's concern that the embargo against Iranian crude could create a price spike if the loss of Iranian crude is not covered. A price spike would "tip global oil demand growth back into negative territory, an outcome that [Saudi Arabia] wants to avoid at almost any cost," the CGES said.

During a recent Euromoney conference in Riyadh, Saudi Finance Minister Ibrahim al Assaf was quoted as saying that Saudi Arabia would be satisfied with a crude price average of \$100/b in 2012, suggesting that maximising returns on its top commodity is no longer a priority for the time being. Earlier this year Brent topped \$120/b,

providing little assistance to a global economic recovery that would steady demand and allow Saudi Arabia some assurance over future market prices.

Meanwhile, demand during 2012 is seen as rising by 800 000 b/d to 90 million b/d according to the IEA. Gain in the non-OECD countries would more than offset declining demand in the developed OECD states, it said, adding that the world's four largest markets – China, the US, Europe and Japan "should dominate the demand story in 2012".

Poor economic data from the US and Europe suggest that demand for crude will continue to slip compared to last year. According to the IEA, demand for crude in Europe is seen as falling by 300 000 b/d and in the US by 200 000 b/d during 2012. Demand in China is seen as growing by 400 000 b/d, while demand in Japan is forecast to rise by 40 000 b/d.



Gas

Nord Stream gears up for full capacity

The Nord Stream gas pipeline has taken another step toward being fully operational with successful testing of Line 1.

Mark Goetz

Load testing on Line 1 of the Nord Stream gas pipeline has proved successful, Russia's Gazprom announced on 25 May. The dual pipeline system, 51 per cent owned by Gazprom, runs through the Baltic Sea from the Russia port of Vyborg to Greifswald in north-east Germany.

When fully operational it will transport some 55 billion cubic meters per year (bcm/y) of Russian gas to Europe through the German terminal.

Line 1 became operational in November last year and has been transporting gas at about a third of its full capacity rate of 27.5 bcm/y since. Line 2, put in place beside Line 1 in April, is to become operational by the end of 2012. The 1200 km pipeline will remain in operation for 50 years.

Once fully complete, the pipeline will give Russia the ability to transport

a large amount of gas to customers in Western Europe without having to ship it through Eastern European countries that have proved troublesome for it in the past.

When the Nord Stream project was first announced several years ago, Poland interpreted the move as a way for Gazprom to deliver gas to its wealthier customers without having to think of supplying its poor neighbours and Soviet-era allies.

As more capacity becomes operational in Nord Stream, Gazprom intends to shift gas shipments that had been traveling via Ukraine to the new Baltic Sea route. Shipments of Russian gas through Belarus and Poland via the Yamal-Europe pipeline have declined with the opening of Nord Stream.

A statement released by Gazprom on May 24 said tests on Line 1 had been under way for the previous three days.

It said tests would continue for another three weeks. "The tests have shown that all systems are up and running," Gazprom Chairman Alexey Miller said in the statement.

Citing data from the International Energy Agency (IEA), Nord Stream noted that gas imports by the European Union in 2009 amounted to some 312 bcm and that gas demand in Europe is projected to rise to 523 bcm by 2030. "By then, the EU will need additional gas imports of 211 bcm/y," it said.

"Nord Stream will meet more than a quarter of this additional gas import requirement by connecting the European gas pipeline network to some of the world's largest gas reserves. The project will be an important contribution to long-term security of supply and a milestone of the energy partnership between the European Union and Russia," the company said.

Russia currently supplies Europe

with about 40 per cent of its gas demand.

On May 11, Nord Stream shareholders said they had asked the company to carry out a feasibility study for possible options to further increase the capacities to transport natural gas. "Over the next two months, Nord Stream will make an assessment of various criteria of up to two potential additional pipelines, including technical solutions, route alternatives, environment and financing," a statement said.

The shareholders want the study in order to evaluate possible solutions to meet future European demand for gas and to secure gas deliveries under existing contracts. "The shareholders will consider the findings of the feasibility study as the basis for further decisions," it added.

Nord Stream AG said the rationale for considering additional infrastructure is twofold: "further diversification

of transportation routes is an integral part of enhanced security of supply, and the EU's gas import requirements will continue to grow in the long term due to the economic and environmental advantages of natural gas and the decline of indigenous production in the North Sea."

Russia has also been considering since 2007 the South Stream gas pipeline project which is designed to carry some 60 bcm/y of Russian gas across the Black Sea to Southeast Europe. This pipeline would also bypass Ukraine and deliver gas to many of the Balkan states.

South Stream, currently estimated to cost as much as €25 billion, would exit the Black Sea in Bulgaria and then split into two separate pipeline routes. The northern one would work its way into Central Europe, the southern pipeline would travel through Greece and across the Adriatic Sea into Italy.

As one of the fastest growing energy sectors in the world, connecting large scale wind farms to the grid is becoming a crucial issue for a reliable energy supply. DNV Kema Energy & Sustainability provides some insights.

Jörg Zillmer

Crucial connections

Although it is unclear to what extent renewables will supply our energy by mid-century, it is evident that wind energy makes up an ever-increasing portion of the energy mix in Europe, especially the North Sea countries.

Germany plays an important role in Europe's wind power generation market. Onshore, it has already installed 30 GW in wind energy capacity, resulting in the highest density of wind farms worldwide. In addition, offshore wind farms in the German North Sea and Baltic Sea will reach 7.5 GW within the next few years.

Europe's increasing reliance on wind poses two serious challenges: large-scale wind farms have to behave more like power plants, reacting more flexibly to changes in wind flux and energy demand. At the same time, storage of surplus wind energy in big pump storage facilities in, for instance, Scandinavia and the Alps, is becoming more and more important for balancing supply and demand.

As an objective and impartial knowledge-based company, DNV Kema has globally built extensive grid expertise to solve connection problems. Transmission System Operators (TSO) like TenneT and 50 Hertz need to find appropriate grid connection points where to install reactive power and how to maintain grid stability during faults.

Regional network operators have to meet requirements based on grid connection codes on the one hand, while on the other hand granting large-scale wind farm developers permission to feed-in. In this area DNV Kema cooperates with operators, as well as with wind farm developers, both on and offshore.

There are a number of questions that often need to be considered. What is the most appropriate and efficient connection to use? Is it really necessary to build an extra cable connection of a mere 20 km? What needs to be done to fulfil the requirements of the network operator grid code? To answer these, we investigate requirements, evaluate the electric system and develop different scenarios about enhanced feed-in of wind farms for future grid structure.

The type of grid connection depends, as a rule of thumb, on length and power. Onshore, below 100 km and 350 MW, this can be realised with a 150 kV AC connector. This is more or less the pivot point.

In offshore wind, the picture completely changes. A wind farm on the Continental Shelf of the German North

Sea of 400 MW is a large investment, ranging from at least €1-1.5 billion. We seek answers to the optimal structure of the network topology. Although large-scale wind farms need to behave like conventional power plants, they have totally different characteristics. When, for instance, is a 300 kV HVDC connector is needed? Contrary to rules and regulations on land, there are no standards on sea.

DNV Kema was one of the first energy consultancy and testing & certification firms to look for solutions when German law, in 2009, obliged TSOs to connect offshore wind farms to the grid. Some 80 per cent of all offshore farms in the German North Sea are currently grid connected. Four years ago, we started off with engineering substations on locations deeper than previously built.

Under the German Renewable Energy Act investors are required to show a certificate to prove they have executed a good job. DNV Kema has audited more than a quarter of all large-scale wind farms, including electrical engineering for ongoing projects in the Deutsche Bucht, Amrum Bank and Godewind. Connections were investigated by desktop research and site visits, and each wind farm under scrutiny was checked to ensure it fulfilled the necessary requirements. Last year, DNV Kema founded a separate accredited body known as Kema Zert for its grid connection-related certification activities.

First of all, as a prerequisite, it is essential to get in close contact with all parties involved – system and network operators as well as wind farm developers. In the study carried out for TenneT, for example, we were asked to identify and analyse a broad spectrum of technological, environmental and policy developments associated with an offshore-interconnected grid between various North Sea countries.

The nature of the problems that have to be solved involve discussions with various stakeholders such as TSOs like TenneT and 50 Hertz, or major wind farm investors. DNV Kema works together with all parties in a cooperative project and discusses ideas in order to develop an appropriate solution to their specific problems.

How to create more efficiency for connections to the international grid is another intriguing question. If TenneT tries to connect one wind farm after the other to converter stations, eventually, one cable will be by far the most efficient. But what would or should be the optimum?



Zillmer: knowledge of how to lay down an infrastructure for grid connections, comes from German experience

In its study DNV Kema worked on the presumption of so-called 'building blocks' for large-scale wind farms, each of them consisting of a collective capacity of 1 GW. We took a broad spectrum of options into consideration: from security of supply, reliability and energy losses, through to market maturity and the degree of innovation, environmental impact and the vulnerability of technology to future developments.

Furthermore, all variables were set against costs and possible impacts. Notably this study is not limited to wind. Interconnection conceptual studies go far beyond the issue of reliable energy. The concept can also be applied to requirements for other renewable power plants, such as gasification of biomass.

The increasing use of renewable energy resources influences the nature of ownership of the energy infrastructure. This is especially the case with offshore wind farms. Until recently, connection for wind farms to the grid was the sole financial responsibility of investors. This is now changing. The UK has already established its neutral 'Offshore Transmission System Operator' (OFTSO) while Germany has obliged TSOs by law to connect large-scale wind farms to the grid. Responsibility and ownership are, therefore, becoming more and more unbundled.

Growing markets such as China are quickly scaling up their wind capacity and can truly learn from experience in the West. In 2011 as well as this year, DNV Kema met with Chinese authorities and investors to discuss planned offshore projects. They expressed great

interest in how issues like reactive power and grid stability are solved.

Germany may rank third worldwide in wind energy behind the US and China but it has the highest density of grid-connected wind farms in the world. While China has installed a great deal of wind power capacity, many wind farms are not connected because safety cannot be guaranteed.

How to lay down an energy infrastructure for grid connections, comes from our German experience. In Europe, we know the hurdles of existing grid connections for large-scale wind farms and have experience of what type of methodology to follow. China can learn a great deal from this. Recently, a team of four experts from the renewable energy department of China Electric Power Research Institute (CEPRI) attended a training session, provided by DNV Kema in Dresden, Germany, about the evaluation and certification of wind farm integration into the grid.

California, one of the biggest economies in the US, is another important market. It requires all electricity retailers to serve 33 per cent of their load with renewable energy resources by the end of 2020. Since the adoption of its Renewable Portfolio Standard in 2002, the state has seen a flurry of interconnection activity. This is posing new challenges, as the availability of wind and solar energy is hard to predict and how to plan them into the energy mix remains a challenge.

Jörg Zillmer is principal consultant at DNV Kema Energy & Sustainability, Dresden, Germany

Large-scale wind farms have to behave more like conventional power plants



Revisiting nuclear new build post-Fukushima

In the wake of the disaster at the Fukushima Daiichi nuclear power plant, the entire nuclear industry seemed to be at stake. Just over one year later, global management consultancy Arthur D. Little looks at the impact on the sector.

Michael Kruse

The nuclear industry was called to a sudden halt on March 11, 2011, as the world watched an earthquake-caused tsunami roll directly into the six unit Fukushima Daiichi nuclear power plant.

In total 14 nuclear power plants (units) along the coast of Japan were affected by the earthquake and tsunami, but none as severely as the Fukushima Daiichi plant. Units 1, 2, and 3 of the plant were at full power when the earthquake struck, but automatically shut-down as they were designed to. Even though the 9.0 magnitude earthquake exceeded the units' design bases, safety systems responded as expected.

About one hour after the earthquake, a tsunami hit the nuclear plant and hindered external assistance. The tsunami severely impacted the first three units and to a lesser extent also units 4, 5 and 6; these units were already in a cold shutdown at the time of the earthquake for periodic inspection and refuelling.

Due to the damage caused by the tsunami, the plant suffered from a station blackout eventually preventing the ability to bring units 1, 2, and 3 to a cold shutdown. At the same time, due to the loss of emergency backup power decay, heat from the reactor and spent fuel pools could not be sufficiently dissipated and only units five and six managed to regain electricity supply.

In the wake of this disaster, the entire nuclear industry seemed to be at stake due to the emotional debates about nuclear safety and the benefits of nuclear energy. Germany, a country with a high performing nuclear fleet, announced its exit from nuclear power by 2022, thereby diminishing the future of its domestic nuclear industry.

At the same time several countries including Italy, Switzerland and Thailand stopped their new build programmes, US nuclear operator NRG Energy ended its participation in the planned new build of South Texas Units 3 and 4, and China put its ambitious plans for more than 200 new units temporarily on hold while it revisits its safety principles.

Prominent examples of countries abandoning the nuclear option suggest that one year after "Fukushima", the future of the entire nuclear industry seems to be as uncertain as it was in the wake of the disaster. The decisions of E.ON and RWE to sell their UK

joint venture Horizon Nuclear Power as well as Delta N.V.'s decision to shelve the replacement of the Borselle plant in The Netherlands have been recognised by the nuclear industry. Furthermore, Brazil, which had ambitions to build several nuclear reactors, has decided that no new nuclear power plants are to be built in the country for at least the next ten years.

However, these examples and emotional debates in several major countries about the benefit of nuclear energy do not shed light on the actual dynamics of the industry. Progress in many national nuclear power programmes has been delayed, but there is no indication that their pursuit of nuclear power has declined.

Poland for example is going ahead with its programme. Its largest power company, Polska Grupa Energetyczna (PGE), announced the launch of a tender by the end of June for the supply of two nuclear power plants by 2030. It expects to select the technology by the end of 2015.

Similarly, Lithuania's government gave its final approval to the development of a new nuclear power plant that could go on-line by 2022. Nuclear new build is one of several plans aimed at reducing Lithuania's dependence on Russian energy sources. There are also other countries that have continued their programmes however; some of these are not public knowledge.

According to Arthur D. Little's nuclear new build database, as of May 14, 2012, there are still 778 commercial units being considered by 62 countries with varying states of progress and expectancy values regarding their implementation probabilities and 73 units are currently under construction. Interestingly the overall number of new build intentions is higher than before Fukushima. The number of units "under discussion", indicates an increasing number of countries considering the nuclear option as an electricity generation means in the long-term future.

China (239 units), India (80 units) and Russia (78 units) alone account for about fifty per cent of all nuclear new build intentions. India's Prime Minister Manmohan Singh said it would be "harmful" if the country gave up the option of nuclear as an additional source of electricity.

As such, the country continues to

develop its national nuclear heavy water reactor programme and in April 2012, the Atomic Energy Regulatory Board (AERB) became a member of the Multinational Design Evaluation Program (MDEP).

At present, the programme has 11 member states – all with nuclear ambitions – pooling resources of national regulators for reviewing new nuclear power reactor designs and driving standardisation and regulatory practices in new reactor licensing, also taking the lessons from Fukushima into account.

Similarly, Russia and China are making a strong pitch for the nuclear option not only as a means to secure demand for electricity, but also as technology exporter.

Russia's nuclear energy giant Rosatom, recently announced unit four of Kalinin nuclear power plant entering trial commercial operation, and completion of the installation of the dome of the containment building at unit one of Novovoronezh II.

At the same time, in addition to having been awarded a contract to deliver two VVER1000 reactors for Tianwan Phase II Units 3 and 4 via its subsidiary Atomstroyexport, Rosatom group is also pushing ahead with the development of an advanced small modular fast reactor design, the SVBR-100.

After having assessed the lessons learned from Fukushima, China's ambition to become a recognised player in the global nuclear industry – taking nuclear safety seriously – has become more evident than before Fukushima. Albeit at a slower pace, the country continues to implement its current national plan of building a fleet of localised nuclear power plants.

There is evidence that China is likely to phase-out its plan to build a large fleet of CPR1000 reactors and move forward with the development of its Chinese Advanced Passive CAP1400 design since the CPR1000 does not reflect the state of science and technology. So far, construction of the first CAP1400 is scheduled for April 2013.

Although to a large extent the nuclear ambitions of China, India and Russia drive the current and future global industry, France and the US also continue to secure their positions in the post-Fukushima nuclear industry. Despite a new president, French utility EDF is still considering the nuclear option (41 units) and the majority of US utilities have continued with their new build programmes (39 units).

However, the competitiveness of the nuclear industry of these two countries might provide a rather mixed picture. At present, Westinghouse's AP1000 reactor is the most favoured western reactor technology. Numerous owners are considering the design of this US supplier, totalling 72 units – of which 11 are currently under construction or close to construction in China, showing China's favour for this technology.

However, in light of China's intention to build-up a local supply chain for a localised version of the AP1000, the design serves as a technology backbone for this effort and Westinghouse's current market share might shrink rapidly if China manages to become an overseas exporter of its



Kruse: Safety requirements will drive up costs

own designs. Similarly Areva's current EPR design is facing competitiveness issues as the reactor of this French supplier of nuclear technology has so far only been formally selected for 23 units.

In summary, this snapshot of the global nuclear industry reveals the following: despite Fukushima, the nuclear industry is still alive and is actively advancing its domain in terms of nuclear new build programmes and reactor technology development. However at the same time the tragedy of Fukushima has caused a significant number of advanced new build programmes to be cancelled.

Furthermore, the current picture does not account for the increasing risks of implementing a nuclear programme. Over the coming years, many owners might struggle to secure financing and the increasing safety requirements of nuclear regulators will drive up the unit cost of electricity produced.

An increasing share of renewable energy within the grid systems will also drive volatility and depreciate the options to fully utilise a nuclear power plant's base load capabilities. Lastly, potential public opposition in some countries and opposition from non-governmental groups will lead to further implementation challenges and in emerging and non-democratic countries, public perception will require an increased effort from owners seeking to implement their programmes.

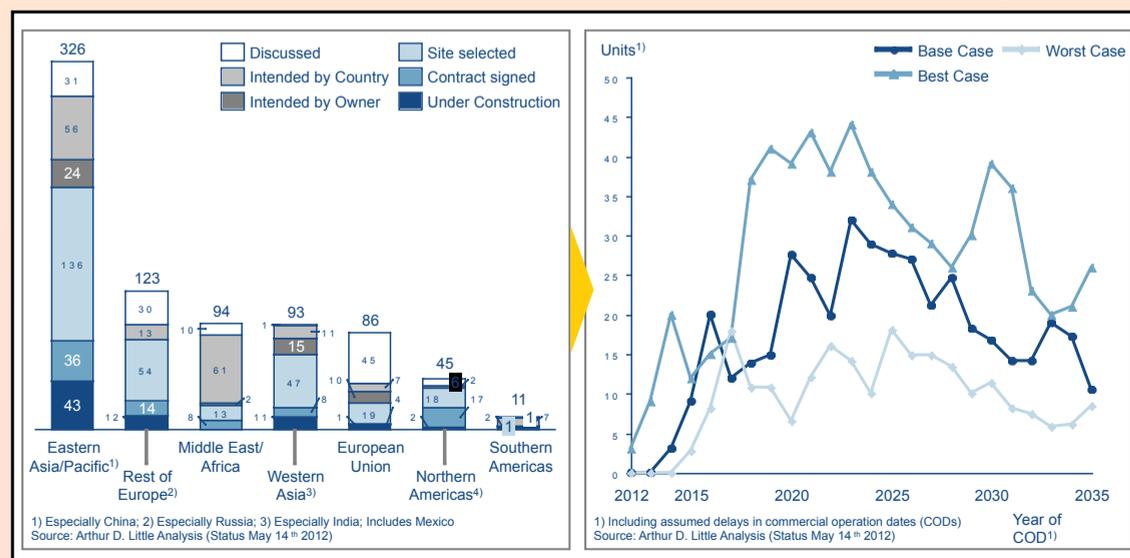
As a consequence the nuclear option will be harder to justify within an owner's stakeholder group, calling for new ways to share risks and financial burden. To an increasing extent, owners will ask suppliers to co-finance their technologies and take a stronger role during the entire lifecycle of the nuclear power plant.

Appropriate design features such as load-following capabilities and the establishment of intelligent energy management systems will become increasingly important for owners, and will need to be considered during project development.

In the end, the nuclear option needs to be considered as a real option for the owner. Every step forward increases or deteriorates the value of the programme and as such has an intrinsic value to be considered in the overall business case.

Michael Kruse is Principal, Global Nuclear, at global management consultancy, Arthur D. Little

Status of nuclear new build by region and units





An 1100 kV GIS: currently the highest operating voltage in the world

As countries like India and China continue to develop, there is a growing need to transmit power from remote locations where the generating sources are often located, to the upcoming 'mega-cities'. For example, in India there is a need to transmit up to 20 GW from the eastern part of the country to the load centres in the west and south.

High voltage direct current (HVDC) technology is often the technology of choice for transmitting bulk power over long distances. Transmission lines operating at 800 kV exist in China and there are developments to increase the voltage even further. The 800 kV ultra-high HVDC North East Agra link now under construction in India will have a converter capacity of 8000 MW, the highest ever built. The link will supply hydropower from north eastern India to the city of Agra over a distance of 1728 km. When operating at full capacity, it will be able to supply enough electricity to serve 90 million people based on average national consumption.

Today's HVDC systems however, are point-to-point systems i.e. power can only be evacuated at the ends of the link and can generally not be tapped at points along the route. Many utilities therefore have a combination of AC and DC circuits.

Over the years voltage levels in both DC and AC lines have been rising steadily. Increasing the voltage level on a transmission line allows a larger amount of power to be transmitted with lower losses and less land use. China has plans to build DC circuits that will operate at up to 1100 kV DC and its AC lines can now transmit power at 1100 kV, currently the highest in the world.

Now the industry is preparing to take this AC voltage to the next level. In April this year, ABB announced that it will develop, design and manufacture a 1200 kV AC circuit breaker and a power transformer. This will be the highest AC voltage level in the world and the innovative circuit breaker and transformer will be deployed at a national test station being constructed by Power Grid Corporation of India (PGCIL), India's central transmission utility, at Bina in the state of Madhya Pradesh.

Commenting on this latest development, Georg Schett, Head of Global R&D for the Power Products division

at ABB said: "Technology is starting to mature for voltages that were not possible before. Today we have new types of materials, simulation tools and manufacturing processes. Additionally the industry has gained a lot of experience over the years on how to insulate transmission lines for these very high voltages."

No doubt such levels were unimaginable at the start of development of the technology. The first HVAC connection in 1891 was a 175 km line in Germany that operated at 25 kV. By 1915, however, the level reached 170 kV on a line also in Germany. Voltages gradually rose to 420 kV, the predominant voltage in Europe today. Since the 1990s, 500 kV has been state-of-the-art globally.

However, with an eye on achieving higher voltages, while maintaining a reasonable size footprint for the substation, ABB began developing gas-insulated switchgear (GIS) for ultra-high voltages (UHV) in the 1980s.

"When you start having very high voltages, you would need huge air-insulated substations," explained Schett. "You would be looking at substations the size of several football fields."

It is mainly a question of the required safety margin in a given environment and this has to be tested locally

The first GIS substation for handling voltages of up to 800 kV was installed in South Africa in 1986. GIS technology allowed the size of the substation to be reduced by 5-10 times compared to an air-insulated substation. "This was a turning point in the history of power transmission; we could build these substations with a much smaller footprint and safer to operate since with GIS the environment is more controlled," said Schett. "Many high and ultra-high voltage (UHV) substations now mainly use the latest GIS hybrid technology."

Schett calls the technology "hybrid technology" since most of the switching equipment – breakers, disconnectors, and earthing switches – are housed in a tank filled with SF₆ (sulphur hexafluoride). The busbars are air insulated.

According to ABB, this hybrid design can result in a space saving of up to 60 per cent compared with conventional air insulated designs. The

Pushing the limits of HVAC

Design is under way of equipment to enable AC networks to operate at 1200 kV – the highest in the world. Testing at a station in India will give the industry a better idea of how far the operating envelope of today's technology can be pushed. **Junior Isles**

configuration also protects critical components from environmental exposure and brings down the centre-of-gravity, thereby increasing its ability to withstand seismic events. Other design features include modular ring-type current transformers, partial discharge sensors and composite bushings.

This design is very similar to that now being developed for testing in India; however the operating envelope is being pushed further.

"Moving from 1100 kV to 1200 kV is not in itself the main technological challenge," said Schett. "You can build an 1100 kV line with sufficient [built-in] performance to also support 1200 kV. It is mainly a question of the required safety margin in a given environment and this has to be tested locally. The main challenge is with the insulation coordination. For example, how do you evaluate the impact of thunderstorms and lightning strikes on the lines and how do you best protect them?"

"On a line with a typical nominal voltage of 500 kV, an operator can choose between two or three switching and lightning pulse withstand levels that are all within the standards, but with higher voltages the impact still needs to be evaluated and this also depends on the specific climatic and operating conditions to some extent and on the over-voltage protection concepts."

India views the move to operating at

manufacturers have set up a UHVAC test station at Bina. A 1200 kV test line is being built at the station along with two 1200 kV test bays in which manufacturers are providing key equipment such as transformers, surge arresters and circuit breakers.

The circuit breaker to be tested is being jointly developed by ABB engineers in Switzerland and India, in close collaboration with PGCIL. It will be manufactured at ABB's production facility in Vadodara, India.

ABB is also developing a 1200 kV AC transformer which will be deployed at the Bina test station. Although it will be designed for operation at a specific point on the Indian grid, its design will form the platform for other UHVAC transformers.

Climatic conditions and elements such as dust and moisture will have an impact on UHV equipment operation, and the Bina station will help with assessing the feasibility and understanding the issues associated with 1200 kV AC operation.

The test station is currently under construction and testing of the GIS and other UHV equipment such as transformers is likely to last one or two years – sufficient time for the equipment to experience the range of climate conditions it will be subjected to during normal operation.

The station will be operated at the nominal voltage for the whole time but there will be periods when it will be subjected to over-voltage, where it will operate at perhaps 1.2 or 1.3 times the nominal voltage. There will also be switching impulse stresses, lightning simulations and other typical stresses the equipment might experience during everyday operation. Parameters such as partial discharge on equipment and insulators will be measured, as this will be an indicator of the performance of the insulation.

But as the voltages get higher and higher, pushing the envelope will become increasingly difficult. Schett believes the challenge will be less to do with the breaker but more related to the air insulated equipment such as bushings.

"The highest possible voltage conceivable today could be somewhere between 1300 and 1500 kV. However, if you go to this level we think there will be challenges on the air insulation of transmission lines. Going from 1200 kV to 1300 kV requires a [technological] leap for instance in controlling propagation of a flashover or insulating at high altitudes."

He added: "Above a certain voltage, you also need to consider economic viability. At present 1100-1200 kV is where we are but one never knows what the future can bring."

1200 kV as a natural progression. Having gone from 400 kV to 800 kV, it sees 1200 kV as a more logical next step than 1100 kV. This new operating voltage, which will be the highest in the world, is cited in the country's latest Five Year National Electricity Plan.

As a planning initiative, considering the need for a higher capacity transmission corridor between Aurangabad and Wardha, the Aurangabad-Wardha 400 kV quad DC line, which is part of the transmission system for evacuation of power from the Mundra 'ultra-mega power project' (UMPP), has been planned and designed so that it can be converted into a 1200 kV line at a later date.

These UHV lines will evacuate power from a number of 4000 MW UMPPs planned for states that include Gujarat, Madhya Pradesh and Andhra Pradesh.

In preparation for the new transmission grid, PGCIL and several leading



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You can't please all the people...

Politicians soon learn you can't please all the people all of the time, whether you are addressing social inequality or economic policy. The recent publication of the UK's draft Energy Bill demonstrates that energy is no different.

The draft Energy Bill proposes radical reform to the UK's electricity market to attract the £110 billion required to build new low-carbon generating capacity.

Presenting the draft, UK Secretary of State for Energy and Climate Change, Edward Davey, said: "By reforming the market, we can ensure security of supply for the long-term, reduce the volatility of energy bills by reducing our reliance on imported gas and oil, and meet our climate change goals by largely decarbonising the power sector during the 2030s."

At the heart of the Electricity Market Reform (EMR) measures are Feed-in-Tariffs (FITs) with Contracts for Difference (CfDs), long-term instruments designed to provide stable and predictable incentives for companies to invest in low-carbon generation. This will be complemented by a 'Capacity Market' that will, if required, provide security of electricity supply by ensuring sufficient reliable capacity is available.

The Bill is by no means the finished article. It has been introduced in draft form to allow pre-legislative scrutiny, which the government says will speed up its passage through

Parliament and ensure more robust legislation. Once introduced into Parliament, is expected to achieve Royal Assent in 2013, so that the first low-carbon projects can be supported in 2014.

Nevertheless, some are already up in arms. The government says the Bill is designed to encourage a balanced portfolio of renewables, new nuclear and carbon capture and storage (CCS),

new reactors in the UK. In April, Centrica, which is planning to build two new reactors at Hinkley Point in Somerset in a joint venture with EDF Energy, also threatened to pull out. It said that it needed assurances about the future price of nuclear-generated electricity.

EDF and Centrica are due to make a final decision by the end of the year on whether to build the reactors.

All may not agree with the proposed EMR but there is at least a broad consensus that there is a need for speed

and to ensure that these technologies can compete fairly in the marketplace. Some environmental groups disagree.

Conservation group WWF expressed concern that the electricity market reform process was overly designed to incentivise new nuclear at the expense of other low-carbon technologies.

Nick Molho, head of energy policy at WWF-UK, said: "As it is, the process has been rigged for nuclear."

Notably, the draft was issued just a week after Energy Minister Charles Hendry gave evidence to Parliament on the UK's nuclear plan, which has recently come under threat. In March German utilities RWE and E.ON AG announced they were selling their Horizon joint venture set up to build

Certainly the content of the draft and timing of its release are sufficient to raise suspicion. Molho noted: "The initial package, which was based around the £30/t carbon floor price and the CfD were the two key elements that the nuclear lobby always wanted, as opposed to what the renewables sector was after."

Davey denies accusations that the legislation is tilted in favour of nuclear power generation. "We're treating all low-carbon generation the same. The carbon price floor helps all low-carbon technologies, and contracts for difference are designed to help low-carbon technologies that all have higher up-front costs [than gas- or coal-fired plants]."

EDF Energy welcomed the bill, saying that the proposed measures were "crucial for the low carbon investment the country needs".

Molho, however, argues that the Bill may well deter investment in renewables. "The complexity of the feed-in tariff with CfDs and the way it provides price certainty is much more suited to a big nuclear project than a small scale renewable project. None of the small-scale renewable players will be able to handle the complexity and settlement issues with the way the CfD works... Even for larger renewable projects our concern is that the development risks under the CfD regime will be greater than with the current Renewables Obligation system."

WWF also believes that a technology neutral approach will not work. The group said that as low-carbon technologies such as renewables, CCS and nuclear are currently all at different stages of maturity and have different technological characteristics, a reliance on the same support mechanisms would be ineffective and the UK will fail to reach its goals.

"Our concern is that with overly optimistic assumptions for nuclear deployment out to 2030 as well as overly optimistic assumptions for CCS deployment, where we have seen several delays with the CCS demonstration programme, we are heading a for a big shortage in low carbon [generating]

capacity," said Molho.

Much will depend on how the details of the CfDs are worked out. Setting of the strike prices will be a factor.

CfDs are supposed to make investment in clean energy more attractive by removing long term exposure to electricity price volatility. They will stabilise returns for generators at a fixed level known as a 'strike price'. It will also insulate consumers by clawing back money from generators if the market price is higher than the strike price. The first strike prices will be published within the Delivery Plan in 2013.

WWF believes there will be different strike prices for the different technologies but is concerned about the structure of the CfDs.

"Our key call on government is to make sure that when working out the details of the CfD and the levels of the strike prices, the different stage of maturity of renewable technology and the way they work is really taken into account. The government must not be blinded by a one-size fits all FIT CfD, which was originally designed for nuclear. There must be an approach that is tailored for each technology," noted Molho.

As with most policies, the devil will be in the detail. Duncan Sinclair, Director of Redpoint Energy, now part of Baringa Partners, a UK-based consultancy group, worked with the government on the original EMR consultation.

He said: "Although the government has correctly laid out its aspiration to move towards the 2020 technology neutral allocation methods of CFDs, more detail is needed probably sooner rather than later. The supply chains need to start ramping up now to meet the capacity requirements of the 2020s."

He added: "The idea will ultimately be to move to uniform priced contracts for the different technologies but it is unclear how this will be done for technologies with different cost structures and different operating characteristics. We cannot expect to have all the answers today but this needs to be worked through soon to provide longer term investor confidence which is essential if costs are going to come down." All may not agree with the proposed EMR but there is at least a broad consensus that there is a need for speed.

Sinclair noted: "The longer the wait for detail, the longer the uncertainty and the greater the impact. Time is now of the essence. Until there is clarity, people won't invest. There has been good progress but there is still a lot to do."

The UK is facing a looming energy gap and the government is right in saying that without these reforms, the UK could in the future "see blackouts affecting millions of homes in some years". The time has come for the government to make its decisions as best it can and move ahead so everyone has a clear picture. Regardless of what it does, someone will be unhappy somewhere.

Davey said: "Leaving the electricity market as it is would not be in the national interest. If we don't secure investment in our energy infrastructure, we could see the lights going out..."

That will not please any of the people any of the time.

