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Kyoto extension insufficient to prevent climate change

Figueres: hailed the extension as a "historic day"

Climate change negotiators in Doha managed to agree on an extension to the Kyoto Protocol. However, progress on avoiding climate change remains well short of what is needed.

Junior Isles

Climate change negotiators in Doha, Qatar, for the 18th Conference of Parties (COP18) ended two-week talks with an extension of the Kyoto Protocol, which was due to expire at the end of 2012. However, with several developed countries, including Japan and Canada, opting out, the Protocol now only covers 15 per cent of global emissions. The US has never ratified the accord.

The United Nation Framework Convention on Climate Change (UNFCCC), which led the conference hailed the extension as a "historic day".

UNFCCC Executive Secretary, Christiana Figueres, said: "We have seen the adoption of the second commitment period of the Kyoto Protocol, something which Parties have been working toward for seven years."

She added that the second commitment period would have greater ambition than the first. "Under the first commitment period of the Kyoto Protocol, those countries [that ratified the Protocol] as a total, complied to a 5 per cent reduction. Here in Doha, the overall reduction is 18 per cent [from the 1990 level]. So it is an increase with respect to the first commitment period."

Figueres stressed, however, that the current pledges – whether under the Protocol or under the convention in a voluntary form – are clearly insufficient to guarantee that global temperature rise will stay below the 2°C limit agreed under the Copenhagen Accord at COP15 in 2009.

As heat-trapping emissions hit a record high, scientists allied with an Australian research group said it may already be too late to cap global warming at 2°C

Overall global emissions jumped 3 per cent in 2011 and were predicted to jump 2.6 per cent in 2012, researchers from the Global Carbon Project and Britain's Tyndall Center for Climate Change Research reported in the journal *Nature Climate Change* last month.

"An immediate, large and sustained global mitigation effort" will need to begin if the world has any hope of staying below the 2°C limit, biologist and Global Carbon Project Executive Director Dr Josep Canadell said in a statement.

If emissions continue growing at an average annual 3.1 per cent, as they have since 2000, the global mean temperature is likely to rise more than 5°C by 2100, the Global Carbon Project-Tyndall Center study forecast. A recent projection by the World Bank showed temperatures are expected to increase by up to 4°C by 2100.

As COP18 closed, six of the largest

Continued on Page 2

Coal shortages threaten investment

A chronic coal shortage in India is threatening investment in the country's power sector.

CLP Holdings Ltd, one of the largest foreign investors in India's power sector – has threatened to "reconsider" its projects in the country, saying it is bleeding every day because of a fuel shortage, infrastructure bottlenecks and lack of policy initiatives to support growth.

The statement, made in a letter to Prime Minister Manmohan Singh, comes at a time when the country is trying to attract as much as $1 trillion of investments in infrastructure in the five years through March 2017.

The hurdles that Hong Kong-based CLP is facing in India have "led to a serious loss of confidence amongst our shareholders and investors," who are now questioning the "viability of our business in India," Andrew Brandler, chief executive of CLP Holdings, said in the letter which was reviewed by *The Wall Street Journal* recently.

"This pressure is mounting and the management needs to urgently find remedial solutions or reconsider present and future investments in the country," he wrote in the letter.

Brandler stated that Coal India Ltd., the state-run coal miner which has an agreement to supply the fuel to CLP's 1300 MW project in northern Haryana state, has not met its full contractual obligations.

CLP India Managing Director Rajiv Mishra said the company "is not contemplating exiting the Indian power sector." But until issues related to coal supply are resolved, it "would be difficult for us to justify further investments in the thermal power sector in India," he told *The Wall Street Journal* last month.

CLP plans to focus further India investments in the renewable energy sector, especially to grow its existing wind energy portfolio, Mishra said.

The recently released *India Wind Energy Outlook* says wind energy could soon supply 5 GW annually to fight chronic power shortages in the country.

The report states that up to 89 GW of wind power could be installed by 2020, up from current 18 GW. This would attract around $16.5 billion of annual investment to the sector. By 2030, the installed capacity could reach as much as 191 GW.

"India's wind power sector has a mature manufacturing industry, and enormous growth potential. Now we need to get the right policies in place both nationally and at state level for India to meet its target of 15 per cent renewable electricity supply by 2020, said Steve Sawyer, Secretary General, Global Wind Energy Council, one of the joint author's of the report.

The report shows that India's potential for wind power development reaches up to 400 GW, and more if the potential of offshore wind and repowering are fully exploited.

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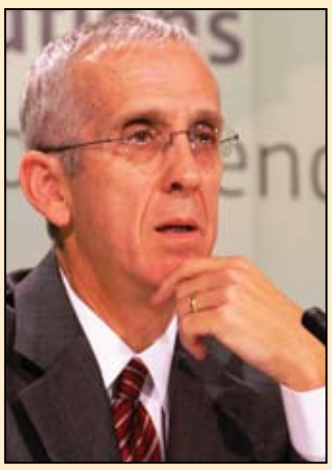
and most respected environmental and development organisations condemned politicians in particular from the USA, Canada, New Zealand, Japan, Russia and Poland for blocking any progress, and the EU and Australia for failing to live up to their responsibilities on emissions cuts and finance.

The conference could not take ambitious or meaningful decisions on financing commitments of developed countries. No specific targets for mid-term financing (2013-2020) were adopted. The work programme on long term finance has been extended with a view to continuing discussion on sources of likely finance in the long term.

The fast-start finance came to an end at the end of 2012 and developed countries started making commitments at Doha for 2013.

Speaking at a closing press briefing in Doha Figueres said: "There is a total of approximately $6 billion that has been pledged, mostly by European countries as well as by the European Union, for funding for next year [2013]. We expect that funding will be complemented by further pledges."



US climate envoy Todd Stern says both the US and Europe are facing fiscal challenges

The Doha deal included vague language on how rich countries would scale up climate aid to $100 billion annually by 2020 – a goal agreed to three years ago. With budgets under stress from financial turmoil, developed countries resisted calls by developing countries to make firm commitments.

"I think in general donor countries with some exceptions were not in a position to put hard numbers on the table for all sorts of reasons, among them fiscal challenges that we are facing in the US and Europe," said Todd Stern, the US climate envoy.

The WWF said negotiators in Doha failed to deliver even the minimum expectations.

"The acid test for these negotiations was real emissions cuts; real and concrete financial commitments for climate change; and the basis for a new global deal by 2015 that is both ambitious and equitable. But instead we got a shamefully weak deal, one that is so far away from the science that it should raise ethical issues for those responsible," said Samantha Smith, leader of WWF's Global Climate and Energy Initiative.

"Some developed countries have made a mockery of the negotiations by backing away from their past commitments and refusing to take on new ones. And to make matters worse, it was only a handful of countries – such as Poland, Russia, Canada, the US and Japan – who held the negotiations to ransom."

UK puts faith in gas

The UK government has given the go-ahead to resume shale gas exploration and has outlined a new gas strategy that sees an even greater role for gas in power generation. But some argue that the government's faith in gas might be misplaced. **Junior Isles**

A range of measures to incentivise new gas fired generation, including support for shale gas exploration, may not be enough to guarantee the UK government's expectations for gas in the future generating mix.

In its gas generation strategy, published alongside the Autumn Statement, the government said that up to 26 GW of new gas fired capacity could be required by 2030. This is much higher that the 10-20 GW in an earlier government analysis.

The gas strategy contains measures to ensure the required amount of gas fired generating capacity is built. One of the key measures is the introduction of a capacity market, setting up auctions for power capacity that oblige winners to deliver energy at times of peak demand.

A new office for unconventional gas will also be set up to encourage investment in Britain's shale gas industry and there will be consultations on tax incentives to encourage shale gas exploration.

The gas strategy has been well received by some industry experts. Ajay Sadanha, head of energy M&A at KPMG told the *Financial Times*: "I don't care whether they're saying 20 or 30 or 40 new gas plants are needed. The main thing is that for the first time, someone has actually said that gas will have a wider role within the UK generation mix."

But others warn that the government's proposals are not enough. An executive from one of the UK's main energy suppliers told the *FT* that he did not think anyone would be "rushing out to build" on the basis of the statement.

The gas strategy was announced as the government gave the go-ahead for the controversial practice of hydraulic fracturing or 'fracking' to resume across the UK.

The independent research company Wood Mackenzie also stressed that the announcements by the government concerning shale gas, including establishing the 'Office of Unconventional Gas and Oil' and new fiscal incentives are not enough to ensure the development of UK shale gas.

In its new report '*UK Shale Gas – fiscal incentives unlikely to be enough*' Wood Mackenzie concludes that commercially viable UK shale gas development will only be possible if the subsurface is as good as the very best shale plays in North America. Wood Mackenzie's economic assessment shows that due to higher costs in the UK, average performing plays would need gas prices in excess of US$9 per thousand cubic feet (mcf) to break even.

Niall Rowantree, Unconventional Play Analyst for Wood Mackenzie said: "Until many, many more wells are drilled, fractures stimulated and flow-tested, it is not possible to accurately predict the ultimate recoverable volume of shale gas in the UK and therefore any estimates of the ultimate impact on UK gas supply are premature. In the US, tens to hundreds of wells have been required to determine whether a play is commercially viable or not."

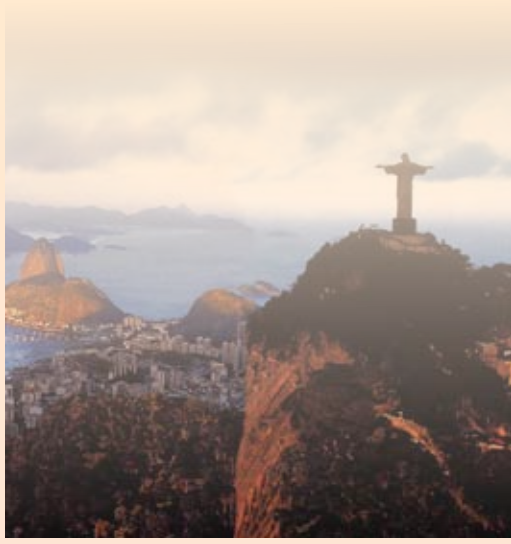
Wood Mackenzie estimates that the UK's dependency on gas imports in the 2020 to 2025 timeframe will grow to 60-85 per cent, 50 to 75 billion m^3 per annum.

Commenting on the decision to resume fracking, Peter Kiernan, Energy Analyst at The Economist Intelligence Unit said: "The UK's domestic gas production has halved in the last ten years, so any decision to prioritise gas in the UK's energy mix would mean that this fall in domestic output would need to be reversed in order to avoid greater dependence on imports.

The focus on gas has, however, angered the green lobby. Greenpeace Energy Campaigner Leila Deen said: "Pinning the UK's energy hopes on an unsubstantiated, polluting fuel is a massive gamble and consumers and the climate will end up paying the price."

Jenny Banks, Energy Policy Officer at WWF-UK, said: "One thing which is absolutely clear is that more reliance on gas is a high risk gamble which is totally incompatible with meeting the UK's legally binding carbon budgets. Gas has been the main cause of hikes in people's bills over the past decade and gas prices are expected to continue to rise. The sooner senior government figures wake up from their shale gas fantasy and see the renewable success story going on right in front of them, the better."

Licence renewal hits Eletrobras outlook



Brazil's biggest utility, Eletrobras, may face a difficult year after the company accepted revenue cuts going forward.

As part of an effort to lower prices and spur competitiveness Brazil's government has requested that utilities agree to revenue cuts in exchange for renewal of expiring operating licenses. While many utilities have rejected the request, the federally controlled utility Eletrobras accepted renewal and lower revenues starting this year.

The decision has seen ratings agency Fitch Ratings cut the credit ratings of Eletrobras and its subsidiary Furnas to BB from BBB, and the outlook cut to "negative" from "stable."

Fitch said Eletrobras's proposed capital structure is unsustainable without government support, based on the expected use of concession renewal proceeds and the elimination in operating cash flow. It also said the cut in revenues means Eletrobras will likely see "zero to negative Ebitda (earnings before interest, taxes, depreciation and amortisation)".

Eletrobras is counting on financing from Brazil's treasury and national development bank BNDES to keep operating its troubled distribution units, *Valor Economico* newspaper reported. Eletrobras, which in recent years has taken over six struggling power distributors, does not expect the units to turn a profit before 2014, *Valor* said.

Marcos Aurelio Madureira da Silva, Eletrobras director of distribution expects the distributors will need as much as BR1.2 billion ($578 million) over the next two years to update equipment and restructure the company.

MHI to boost global competitiveness

■ MHI purchases Pratt and Whitney ■ Merger with Hitachi

Japanese equipment manufacturer Mitsubishi Heavy Industries (MHI) Ltd has made significant moves to boost its international competitiveness.

Last month the company agreed to buy the Power Systems segment of US jet engine maker Pratt & Whitney. Terms of the transaction, expected to close in the second quarter of 2013, were not disclosed.

Pratt & Whitney Power Systems designs, builds, and supports aero-derivative industrial gas turbines and geothermal power systems.

The deal follows an announcement at the end of November that MHI and Hitachi Ltd. will merge their thermal power generation and other power production businesses to boost competitiveness in the global market amid growing demand.

The operations to be merged include geothermal generation and their fuel battery business, with combined sales reaching around Yen1.1 trillion ($12.8 billion), the companies said in a statement.

The two companies plan to consolidate their thermal power operation into a new company to be established in January 2014. The new company will be owned 65 per cent by MHI and 35 per cent by Hitachi, they said.

The two partners say they will strive to leverage the complementary strengths of both companies. For example, MHI has focused on highly efficient large gas turbines, while Hitachi sees its mainstay products as small and medium-sized models.

Regionally, MHI has strengths mainly in Southeast Asia and the Middle East, while Hitachi is strong in markets such as Europe and Africa.

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WTO rules against Ontario FIT regulations

The first WTO ruling on a renewable energy trade dispute could open the doors for many more complaints.

Siân Crampsie

The Ontario government's policy to enforce a local content requirement in renewable energy projects qualifying for subsidies in the Canadian province is illegal, the World Trade Organization (WTO) has ruled.

The international trade watchdog has released a report that supports a complaint brought by Japan and the European Union against Ontario in 2010.

It is the first judgment reached in a WTO trade dispute over renewable energy, although there are currently several on-going trade disputes in the renewable energy field involving EU, US and Asian renewable energy technology firms.

Canada says that it will appeal the ruling, which has highlighted the difficulties of applying international trade rules to industries that domestic governments want to promote.

The WTO ruling states that Ontario's feed-in tariff (FIT) programme breaks international trade regulations because it forces companies that are developing renewable energy projects to source half of their goods and services in Ontario.

This breaks the General Agreement on Tariffs and Trade (GATT), because local content requirements treat imported equipment and components differently from domestic products.

Notably, the WTO did not uphold the part of the Japanese and European complaint claiming the local content rules amount to an illegal subsidy.

There is concern in Ontario that the ruling will be a setback for the province's renewable energy programme and its ambitions to develop a green energy technology industry.

The ruling was welcomed elsewhere.

The European Wind Energy Association (EWEA) said that the ruling would send a clear message to other governments that local content requirements are incompatible with WTO requirements.

"The European Commission must use the impetus provided by this ruling to enter discussions on an international free-trade agreement on renewable energy, tackling both tariff and non-tariff barriers, ensuring a level playing field for wind power products and services, with all willing parties," said Justin Wilkes, Policy Director for the European Wind Energy Association (EWEA).

"A free trade agreement on renewable energy goods and services would bring more renewable energy online and drive down costs," he added.

In November 2012 the Chinese government lodged a complaint with the WTO over solar power generation programmes in Greece and Italy. The filing alleges that the two countries' FIT programmes favour local suppliers over foreign ones and are therefore illegal under WTO rules.

Beijing has also launched an anti-dumping probe into European exports of polysilicon – a material used in PV panels – to China.

Other ongoing renewable energy trade disputes centre on subsidies paid to solar panel and wind turbine manufacturers.

Although designed to boost economic growth in domestic economies and build up expertise in renewable energy technology, these subsidies have become highly contentious.

The European Commission has launched an investigation into Chinese solar panel manufacturers selling goods in Europe after an alliance of European manufacturers known as EU Pro Sun complained that Chinese firms were dumping products at cheap prices.

A similar investigation by US authorities led to the imposition of import duties on Chinese solar panels.

In December, the US authorities also pressed forward with plans to slap duties on wind turbine towers imported from China in order to combat Chinese government subsidies.

BNDES agrees Belo Monte financing

■ Transmission licenses auctioned ■ Bolivia reviews hydro projects

The controversial Belo Monte hydropower plant in the Brazilian Amazon is to become the largest project ever financed by BNDES, the Brazilian development bank.

The bank has approved BR22.5 billion ($11 billion) in loans to the Norte Energia consortium that is building the 11 GW project on the Xingu River.

Belo Monte will flood an area of 500 km² and displace 16 000 people

BNDES says that 60 per cent of the financing will be a direct contribution to Norte Energia, which is 49.98 per cent owned by Brazilian state energy company Eletrobras. The remaining 40 per cent of the loan will be made indirectly through two other banks.

Construction on the project started in 2011 but has been delayed amid legal actions brought by environmental and indigenous groups opposed to the project. Officials expect the project to start generating electricity by 2015.

BNDES says that it is providing BR3.2 billion in loans for social and environmental programmes.

Belo Monte will flood an area of 500 km² and displace 16 000 people, according to the Brazilian government. Environmental groups believe that up to 40 000 people would be displaced.

In December 2012 a consortium led by China's State Grid Corp won a coveted license to build a transmission network to carry energy from Belo Monte to Brazil's south and southeastern states.

Spain's Abengoa won three licenses to build power lines from Belo Monte to Brazil's northeast.

Another Chinese firm, Sinohydro Corporation, has signed a memorandum of understanding with the government of Bolivia to review existing studies into a hydropower project in the northern Amazon region of Beni.

Sinohydro will review and optimise design plans for the Cachuela Esperanza hydroelectric dam project. If the government accepts Sinohydro's report, a second phase will commence to negotiate the financing and construction of the plant.

Another Chinese firm, Hydrochina, is currently reviewing plans for the Rositas hydropower plant in the eastern region of Santa Cruz.

Wind sector faces 'fiscal cliff'

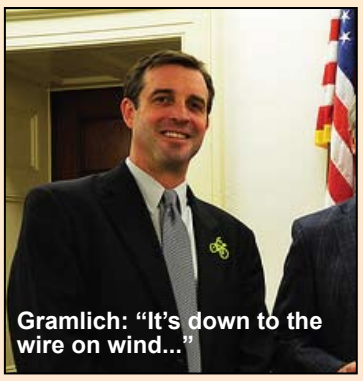
America's pro-wind lobby stepped up the pressure on legislators last month to extend the country's wind production tax credit (PTC).

The American Wind Energy Association (AWEA) called on Congress to include an extension of the PTC in any legislation drawn up to avoid the so-called economic 'fiscal cliff'.

The PTC was due to expire at the end of December and the country's wind energy sector believes that the industry will collapse without the credits.

AWEA said in a December statement that failure to renew the PTC could result in the loss of up to 37 000 jobs in the first quarter of 2013. It would also pull the plug on much of the $15.5 billion per year invested in US wind farms.

"It's down to the wire on wind, and Congress has a choice," said Rob Gramlich, Senior Vice President for Public Policy at AWEA. "If they do nothing, the wind industry will fall over its own fiscal cliff and America will lose most of its wind installations next year."



Gramlich: "It's down to the wire on wind..."

The production tax credit, first enacted in 1992, offers 2.2 cents per kilowatt hour of wind energy generated and costs US taxpayers an estimated $12 billion per year.

Opponents of the PTC say that the costs of the programme outweigh the benefits and that the wind sector should be left to compete in a free market against other forms of energy.

Dominion opts for fuel cells

US utility Dominion is adding fuel cell technology to its portfolio of clean energy plants.

The company has announced plans to build a 14.9 MWe fuel cell power plant in Connecticut and says it has signed contracts with FuelCell Energy to build, operate and maintain the facility.

The project is part of Project 150, a Connecticut programme that aims to increase installed clean energy capacity in the state by 150 MW. Dominion said it is also an important part of its strategy to identify and develop reliable and cost-effective clean energy technologies.

Connecticut-based FuelCell Energy will equip the facility with five 2.8 MW DFC3000 fuel cell units as well as an organic rankine cycle turbine. Energy from the plant will be purchased by Connecticut Light and Power (CL&P) under a 15-year fixed energy purchase agreement.

FuelCell says that the project is the largest that it has developed in the USA.

The plant will start producing electricity in 2013.

Chile approves coal project

Endesa Chile is to go ahead with the construction of a coal fired power plant after receiving the approval of the Chilean government.

The 740 MW Punta Alcalde power plant will provide a much needed boost to generating capacity in Chile's copper-rich Atacama Desert region but has at the same time been criticised by environmentalists.

The go-ahead for the $1.4 billion project was given in early December. Endesa Chile says that it will use special domes to cover the fields used for stockpiling coal as well as a system of sleeve filters that will reduce emissions.

The project had been blocked earlier in 2012 by a regional environmental commission on the grounds that it would pollute northern Chile's Huasco Valley.

Environmental campaigners are concerned that the plant will be located just 60 km from protected areas such as the Llanos de Challe National Park and the Humboldt Penguin National Reserve.

Philippines requires Energy Plan $24.3 billion

The Philippines' latest Energy Plan aims to nearly treble the country's existing installed generating capacity, while reducing dependence on oil imports. **Syed Ali**

The Philippines says it will need about P3.1 trillion ($24.3 billion) in investments for power generation projects under its recently launched Philippines Energy Plan (PEP) 2012-2030.

Department of Energy (DOE) Secretary, Carlos Jericho Petilla, said that securing the country's future energy needs will require an increase in power generation capacity, an interconnected transmission system, a reliable distribution network through electric cooperatives and timely implementation of downstream energy infrastructures particularly for natural gas.

"We envision a more secure energy sector, less energy-intensive economy, more efficient and sustainable energy systems and facilities, and reduced dependence on oil imports," Petilla said.

Of the P3.174 trillion required for energy projects, P1.212 trillion will be spent for downstream natural gas supply; P959.7 billion for alternative fuels; P556.7 billion for renewable energy projects; P397.1 billion for power generation projects; and P48 billion for upstream resource development.

The DOE estimates it will have to add 29 329 MW to its existing 16 163 MW by 2030.

As part of its renewables expansion plan, the DOE recently said it will push through with the first auction of a number of mini-hydropower projects in the second half 2013.

Conglomerates and small firms alike have expressed interest in bidding for 40 potential mini hydropower project sites, a DOE official said.

Mario Marasigan, director of the Energy Utilization and Management Bureau of the DOE, said that the DOE cannot award service contracts 45 days before and after the elections, which are scheduled on 13 May 2013.

Meanwhile, investors are also looking for opportunities in geothermal and solar. In December there were reports that the SM Group is set to enter the power sector through a partnership with global energy giant Chevron, which is seeking a 25-year geothermal operating contract in the Philippines.

Separately, a Memorandum of Understanding (MOU) was also signed last month between the provincial government of Cavite and South Korean company LG CNS Co., Ltd on a plan to set up one of the country's largest photovoltaic (PV) solar power plant in the municipality of Tanza.

Despite the increased focus on renewables, fossil fuelled power generation will continue to offer the greatest investment opportunities.

Another Korean firm recently said it was looking at investing in the country's thermal power sector. The local unit of Korea Electric Power Corp. (Kepco) said it is planning to build a 200 MW power plant in Subic, Zambales and is interested in putting up a power plant in the Visayas.

Earlier, Redondo Peninsula Energy Inc. secured an environmental compliance certificate (ECC) from the Department of Environment and Natural Resources for its second 300 MW unit. The approval will see RP Energy increase the size of its 300 MW power plant inside Subic Bay Freeport to 600 MW. The plant will come on line in 2016.

Meanwhile in an effort to provide a long-term solution to the current power shortage in Mindanao, the Alcantara Group last month signed a P9.3 billion loan facility with a consortium of local banks to finance the first phase of a planned 210 MW coal fired project in Maasim, Sarangani.

The first phase of the power plant will have a capacity of 105 MW and is expected to begin start-up by August 2015.

■ The consortium behind the oil and gas field in Palawan started a $1 billion expansion of the Malampaya gas-to-power project in December. New investments and infrastructure will ensure continuous supply of natural gas for three key power plants in Luzon until 2024.

China steps up emissions efforts

China continued to demonstrate its commitment to reducing air pollution with the unveiling of a plan to cut emissions of air pollutants in its most economically active areas. The Ministry of Environmental Protection says it will reduce overall air pollution between 2011 and 2015 by cutting the intensity of particulate matter (PM) in 13 major areas covering 117 cities.

It said it would reduce PM2.5 intensity by at least 5 per cent by 2015. PM2.5 refers to fine particulate matter 2.5 microns or less in diameter, while PM10 refers to particulate matter of 10 microns or less in diameter.

It also made a commitment to reduce the intensity of PM10, sulphur dioxide (SO_2) and nitrogen dioxide by 10 per cent, 10 per cent and 7 per cent, respectively.

For the Beijing-Tianjin-Hebei region, the Yangtze River Delta region and the Pearl River Delta region, the PM2.5 intensity will be cut by at least 6 per cent.

The 13 major areas produce nearly half of the nation's SO_2, nitric oxide, smoke and dust.

China also published a report detailing policies and efforts that have been made over the past year in facing up to the challenges of global climate change.

The report, titled *China's Policies and Actions for Addressing Climate Change (2012)*, was released before the United Nations Climate Change Conference, in Doha, Qatar.

China expected to reduce its carbon intensity by 5 per cent in 2012, on track to meet its 2015 target. Xie Zhenhua, deputy director of China's National Development and Reform Commission (NDRC), said the first nine months of 2012 registered a reduction of 3.4 per cent.

By 2015, the nation aims to cut CO_2 emissions per unit of GDP by 17 per cent, reduce energy consumption per unit of GDP by 16 per cent, and raise the proportion of non-fossil fuels in the overall primary energy mix to 11.4 per cent, said the report.

Japan elections throw nuclear lifeline

Japan's beleaguered nuclear industry was thrown a lifeline as the country re-elected the Liberal Democratic Party (LDP), the party that built the nuclear industry.

Parliament's election of LDP leader Shinzo Abe as Prime Minister saw shares in Tokyo Electric Power (Tepco), the owner of the crippled Fukushima Daiichi nuclear plant, soar. Shares in Tepco jumped 33 per cent in December, while Kansai Electric rose 18 per cent.

Ahead of the election, Tepco's president, Naomi Hirose said he expected the 2030s target of eliminating nuclear to "disappear" if the LDP regained power.

Japan's Nuclear Regulation Authority Secretariat, which will adopt new nuclear safety standards, was already considering restarting more halted nuclear reactors this summer. The nuclear management agency will make some preliminary checks on the suspended reactors during the spring before restarting the reactors in July.

But although the LDP is pro-nuclear, its ability to revive the sector could be hampered by public opposition. Following the crisis at the Fukushima Daiichi plant, Japan decided on an energy strategy that would enable it to move away from nuclear power.

The International Energy Agency recently said it expects Japan to triple electricity generated from renewable energy sources, including hydropower by 2035. At present, renewable energy resources, including solar, wind and hydropower, make up only about 10 per cent of Japan's total power supply.

The IEA chief, however, cautioned against Tokyo's policy of reducing the country's reliance on nuclear energy to zero by the 2030s, saying "it is not easy to phase out nuclear power, taking into consideration the implication for energy security, the spending on energy imports and efforts required to meet climate" challenges.

Vietnam progresses Power Master Plan

■ Nuclear feasibility reports to be completed by summer
■ Duyen Hai 3 coal plant starts construction

Vietnam is making steady progress with its Power Master Plan VII (2011-2020), which will see the country's installed electricity generating capacity reach 75 GW in 2020, up from around 21 GW.

Moves to have nuclear power represent 6.6 per cent of the generating mix in 2030 are advancing as it was announced that the feasibility reports on the country's first two nuclear reactors are due to be completed during the first half of this year.

The feasibility report on the 2000 MW Ninh Thuan 2 nuclear power plant must be completed by the end of March, while the report on Ninh Thuan 1 is due at the end of July. The design for the plant's infrastructure will also be completed in 2013 so that construction can begin the following year.

The majority of new capacity under the Master Plan, however, will be in the form of new coal plants. Following a loan agreement between Electricity of Vietnam (EVN) and Vietinbank at the end of November, construction has kicked-off at the 1244 MW Duyen Hai 3 power plant project.

Vietinbank, one of the leading commercial banks in Vietnam, will provide a VND 6200 billion ($291 million) loan to help build the plant, which is one of the government's key projects under the Master Plan VII. Start-up is expected in the 2015-2016 period.

A contract was also signed last month to provide and install VND1.57 trillion worth of equipment for the Mong Duong power station. Under the contract between Viet Nam Machine Installation Corporation (Lilama) and the primary contractor, Hyundai Engineering & Construction Co Ltd (HDEC), Lilama will install all of the electro-mechanical equipment at the 1080 MW Mong Duong 1 coal fired power plant in northern Quang Ninh Province from December 2012 to October 2015.

Construction of the Ninh Thuan nuclear units could start next year

Tenaga to invest Ringgit 9.7 billion in new capacity

Malaysia's state-owned utility Tenaga Nasional Bhd (TNB) will invest close to Ringitt10 billion ($3.27 billion) in new capacity for the next five years in a bid to meet domestic electricity demand, which is forecast to grow by between 3.5 and 4.6 per cent a year during the period.

TNB president and CEO Datuk Wira Azman Mohd said in a statement that the New Economic Model and Economic Transformation Programme are expected to boost demand to 20 699 MW from 15 826 MW this year, necessitating an investment of Ringitt9.7 billion.

The power company is building two hydroelectric projects in Hulu Terengganu, Terengganu and Ulu Jelai, Pahang, a biomass plant in Jengka, Pahang with Felda and a coal fired power plant in Manjung, Perak, which would collectively add 1632 MW to current capacity, he said.

UK energy bill scrutinised

Yeo: UK "risks being left behind"

The UK government faces amendments to its proposed electricity market reforms.

Siân Crampsie

Environmental groups have applauded attempts by legislators to improve the green credentials of the UK government's proposed electricity market reform (EMR) bill.

Tim Yeo MP, Chair of parliament's Energy and Climate Change Select Committee, has pledged to table an amendment to the government's proposed legislation to ensure that the UK leads "the world in energy reform again" and embraces clean energy technology.

The new EMR bill was published at the end of November and has been hailed as the biggest transformation to Britain's electricity market since privatisation.

It is designed to encourage billions in investment in the country's electricity sector while ensuring security of supply and reducing carbon emissions. Although generally well received by the UK's electricity industry last month, some criticised the government for not including a specific decarbonisation target in the bill.

When taken together with December's gas strategy announcement by the government, there is concern that a 'dash for gas' will push renewable energy out to the margin of the electricity sector, rather than becoming a back-up to renewables.

Yeo said last month that the UK "risks being left behind" in the green industrial revolution as countries such as China, Japan and Germany are pushing ahead with investment in clean technologies. "Only last month [November], the UK fell from fifth to sixth place in the renewable energy attractiveness rankings globally," Yeo said. "China is at the top and shows no signs of slowing down its low-carbon investment."

Yeo said he would amend the EMR legislation to include an emissions target to "clean up the power sector by 2030". The amendment would include a target range that would require power plants to produce less than 100 g of carbon dioxide per kWh of electricity produced.

"The Energy Bill is an opportunity for us to create a world-leading, clean and advanced electricity system that is fit for the twenty-first century," said Yeo. "But without a target to phase out fossil fuels it may fail."

RenewableUK Deputy Chief Executive Maf Smith said: "[Yeo's] comments highlight the need for the UK to stand up and be counted as a growing number of countries seek to decarbonise their energy markets and secure a clean and abundant source of energy for the future.

"A clear decarbonisation target for the way we generate our electricity by 2030 is essential to achieving this."

The EMR bill sets the level of support for low-carbon electricity at £7.6 billion ($12.16 billion) by 2020, more than treble the current budget of £2.3 billion for 2012-13. Much of the support will be delivered through long-term "contracts for difference", designed to guarantee stable revenues for investors in low-carbon energy.

The measure will add £95 a year to the average household bill by 2020 – an increase of seven per cent.

Wind turbine technology powers on

- Siemens, Alstom test large-scale units
- Poland grants offshore licences

The development of advanced offshore wind turbine technology is moving ahead in Europe as governments look to meet green targets.

Both Alstom and Siemens last month announced major milestones in their offshore wind turbine technology programmes.

Siemens said it had installed the prototype of a new 4 MW unit in Østerild, Denmark, while Alstom announced that its new generation Haliade 150 offshore turbine had commenced the official type testing phase at an onshore site in Le Carnet, France.

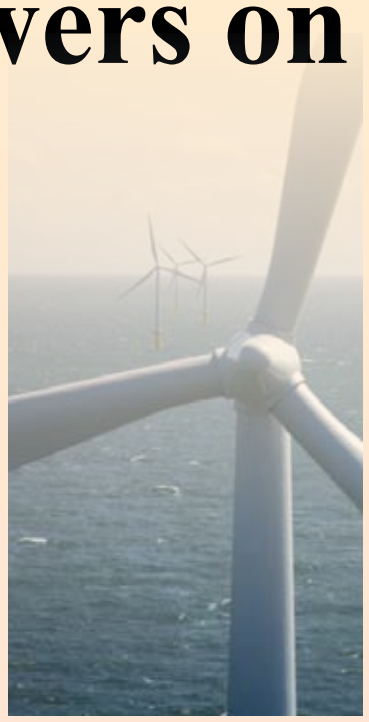
The UK, France, Germany and Belgium continue to be strong markets for offshore wind technology, while newer markets such as Poland have also started opening up.

The design of Siemens' new unit is based on that of its successful 3.6 MW turbine, 500 units of which have already been installed in Europe. It hopes to offer the new turbine for sale in the spring of 2013.

Alstom's Haliade 150 unit is a 6 MW-class turbine and is due to be installed at three sites around France. Alstom will test the unit's power performance and carry out power quality certification in the coming months.

"We are enthusiastic following the initial tests of our new Haliade 150 wind turbine," stated Alstom Wind Offshore VP Frederic Hendrick. "We are particularly satisfied with the excellent pure torque results of the generator's air gap stability, which confirms our decision to develop a turbine with no gearbox."

In addition to the onshore unit, a second turbine will be installed during the first half of 2013 at the offshore Belwind wind farm 45 km off the Belgian coast. The offshore tests will target specific marine operations and procedures and will complete the technical and product performance, says Alstom.



In late November Poland granted 14 licenses for the development of wind farms in the Baltic Sea and announced plans to review more than two dozen more.

Nuclear costs rise

French firms EDF and Areva have once again revised upwards their estimates of the costs of constructing new nuclear power plants in Europe.

Areva said last month that the new unit at the Olkiluoto nuclear power plant in Finland will ultimately cost €8 billion to build, while EDF said that the new EPR reactor at Flamanville in northern France would cost €8 billion to construct.

EDF and Areva last month won approval from UK regulators to deploy the EPR design in the UK.

EDF says that additional engineering studies, the development of the boiler design and the integration of new regulatory requirements in the wake of the Fukushima disaster have all contributed to the €2 billion increase in costs.

Flamanville is the first nuclear reactor to be built in France for 15 years. The project is on track to be commissioned in 2016.

"The EPR will contribute to the country's energy supply and also represents one of the essential links which will ensure the continuity of our nuclear know-how, both in France and internationally," said Hervé Machenaud, EDF Group Executive Director.

The Olkiluoto reactor, which is also an EPR design, was estimated to cost around €3 billion in 2006 and was due to be commissioned in 2012. The unit is now expected to start producing power in 2015, according to the Areva-Siemens consortium building it and its client, Finnish utility TVO.

EDF is planning to build up to four new reactors in the UK, and in November 2012 received a site licence for Hinkley Point in southwest England, where it intends to build two EPR reactors.

In anticipation of the construction of reactors at Hinkley Point, Areva has signed memoranda of understanding with 25 UK-based companies for the supply of components and services. The firm welcomed the UK regulator's decision to licence its EPR technology.

Two other EPR reactors are being built in China for the China Guangdong Nuclear Power Holding Corp. Both are on schedule and under budget.

Spain backs energy tax

Legislators in Spain have pushed through legislation that places a seven per cent levy on electricity generation in an effort to combat the country's tariff deficit.

The Spanish senate approved the reform bill, which had originally proposed a six per cent levy. The majority Popular Party of Prime Minister Mariano Rajoy said that a higher rate was needed in order to combat the €25 billion deficit.

Spain's tariff deficit has amassed because of the gap between the price that consumers pay for electricity and the actual cost of producing it.

The Spanish wind energy association (AEE) said that at the higher rate, the new tax would hit the sector by about €300 million annually. Spain's cogeneration industry also expressed concerns over the impact of the tax.

Cogen Spain wrote last month to the European Commission expressing its reservations over the "disproportionate negative impacts" that the tax would have on cogenerators "compared to pure electricity generators who are the original target of these changes".

In a statement the group said "the net result of the changes would be a budget contribution from cogeneration plants almost on parity with the coal-fired power plants or the whole nuclear sector. When put in €/MWh, the changes would result in a tax burden (including taxes on the energy product and the electricity generated) on cogeneration 45 per cent higher than that on pure electricity generators using coal and more than twice the level of that on wind producers."

If approved by Spain's lower house, the tax would take effect at the beginning of 2013.

Ghana builds $400 million PV plant

The 155 MW Nzema plant could serve as a model for future renewable energy developments in Sub-Saharan Africa, says its developer.

Siân Crampsie

Renewable energy developer Blue Energy says that its plans for a $400 million solar photovoltaic (PV) plant in Ghana could kick-start a "renewable energy revolution" in West Africa.

The UK-based company says that the 155 MW Nzema project will be the largest in Africa and will play a major role in Ghana's ambitions to boost renewable energy capacity.

Chris Dean, CEO of Blue Energy, said: "Ghana's forward-thinking strategy puts it in a strong position to lead the renewable energy revolution in sub-Saharan Africa. Nzema is a case study in how governments can unlock the huge potential for solar energy in Africa."

He added: "There's huge potential to develop renewable power in the region. We believe Nzema will show other countries what can be achieved and spur them to action."

Construction of the plant is due to start by the end of 2013. The project is viable because of characteristics and availability of sunlight at the site and the fall in prices for solar PV panels. Ghana's favourable investment environment for renewable energy is also attractive, says Blue Energy.

Ghana's 2011 Renewable Energy Act set up a system of feed-in tariffs for renewable energy plants and is designed to enable the country to meet a target of sourcing ten per cent of its electricity from renewable energy sources by 2020.

Blue Energy was also attracted to the country because of its rapid rate of economic growth – over 14 per cent in 2011 – and corresponding high electricity demand growth rate. Investment in new generating capacity has not kept pace with demand, however, and blackouts are estimated to have cost Ghana's economy 1.9 per cent of GDP in 2006.

The government has set a target of more than doubling its installed generating capacity to 5500 MW by 2015.

The plant will be directly connected to the 161 kV West African Power Pool transmission line, which runs alongside the site, linking Ghana to Ivory Coast, Togo, Benin and Nigeria, and has available capacity for its load. It is expected to start operating in 2014.

Blue Energy has secured all the consents it needs to go ahead with the Nzema project. Ghana's electricity regulators, the Energy Commission and the Public Utilities Regulatory Commission, have awarded it a generation licence and a feed-in tariff for the plant's 20-year operational life.

Blue Energy says that the project will help Ghana to develop skills, industries, and government and regulatory experience to take advantage of future renewable investment opportunities.

■ GE has confirmed that it is to build two wind farms in Kenya at a cost of $100 million. The two projects will be built in the town of Kinangop and will add a total of 150 MW to the grid.

UAE, Russia seal nuclear deal

The United Arab Emirates and Russia have agreed to share nuclear technology, equipment and material in a deal designed to bolster the Gulf state's nascent nuclear power industry.

The civil nuclear cooperation agreement between the two countries is the latest in a line of international accords and commercial deals sealed by the UAE, which in 2012 embarked on the construction of its first nuclear power plant.

The UAE is aiming to build four nuclear power plants by 2020 and is one of several Gulf states taking up the technology as a means of improving energy security and reducing the use of fossil fuels.

In November officials from Saudi Arabia's government said that the country would build 17 nuclear reactors by 2030 in order to help meet growing electricity demand.

The UAE's latest civil nuclear pact would enable Russia to supply uranium as well as conversion and enrichment services. It follows the signing of long term uranium supply contracts by Russia's Rosatom and the Emirates Nuclear Energy Corporation (ENEC) in 2012.

The UAE has signed similar cooperation agreements with Australia and Canada, both important uranium producers, as well as with the UK, France and South Korea.

These pacts provide the framework for the commercial contracts signed by ENEC for uranium concentrates, conversion and enrichment services with Areva of France, for natural uranium with Canada-based Uranium One and UK-based Rio Tinto, conversion services with Converdyn of the USA and with UK-headquartered Urenco for enrichment services.

ENEC has awarded a license for the construction of four APR-based nuclear power plants to a consortium led by South Korea's Kepco.

Saudi Arabia's existing plans indicate that the country will build 16 nuclear power plants with a combined capacity of 17 GWe and at a cost of $80 billion by 2032.

In late November the *Saudi News Agency* quoted Vice-president of King Abdullah City for Nuclear Energy Dr Khalid Al Sulaiman as saying that 17 reactors would be built at a cost of more than $100 billion by 2030.

Russian deal will bolster the UAE's nascent nuclear power industry

Renewable index adds UAE, Saudi Arabia

Strong government initiatives and track records in the development of energy infrastructure have earned the UAE and Saudi Arabia a place in Ernst & Young's Renewable Energy Country Attractiveness Index (CAI).

The CAI scores 40 countries from across the world on the attractiveness of their renewable energy markets, energy infrastructure and the suitability for individual technologies. It places the UAE in 35th place and Saudi Arabia in 37th.

According to Ernst & Young, Saudi Arabia and the UAE are among the emerging renewable energy markets that are learning from the mistakes of more mature renewable energy markets. The analysts believe that the Middle East and North Africa (MENA) region as a whole has such good wind speeds and high solar radiation that it is neatly positioned to become "the next rising star" in the renewables market.

Ernst & Young's latest survey identifies Saudia Arabia, the UAE, Qatar, Jordan and Egypt as the most attractive MENA markets. Saudi Arabia, the UAE and Qatar are attractive because of the availability of financial resources.

However, it warns that these countries need to find ways of attracting private investment in order to avoid over-reliance on government-driven growth.

India, China drive coal demand

The IEA believes that coal demand will rise in every part of the world over the next five years with the exception of the USA.

The agency's medium term coal market report shows that coal's share of the global energy mix will rise and will come close to surpassing oil as the top energy source by 2017.

"The world will burn around 1.2 billion more tonnes of coal per year by 2017 compared to today – equivalent to the current coal consumption of Russia and the United States combined," said Maria van der Hoeven, IEA Executive Director. "Coal's share of the global energy mix continues to grow each year, and if no changes are made to current policies, coal will catch oil within a decade."

The greatest rise in demand will be seen in emerging markets such as India and China. The report says China will surpass the rest of the world in coal demand during the outlook period, while India will become the largest seaborne coal importer and second-largest consumer, surpassing the United States.

The IEA notes that in the absence of a high carbon price, only fierce competition from low-priced gas can effectively reduce coal demand.

"The US experience suggests that a more efficient gas market, marked by flexible pricing and fuelled by indigenous unconventional resources that are produced sustainably, can reduce coal use, CO_2 emissions and consumers' electricity bills, without harming energy security," said Van der Hoeven. "Europe, China and other regions should take note."

In response to the report, the World Coal Association (WCA) called on governments to encourage the deployment of advanced, high-efficiency coal fired power plants as a means of meeting growing energy demand while keeping energy costs low. It criticised the IEA for looking at coal use only "through the lens of climate change".

"These two global challenges, energy access and climate change, should be treated as integrated priorities," said Milton Catelin, Chief Executive of the WCA. "Governments, the international community and the IEA need to recognise that the increasing demand for coal means they must treat it as part of the climate solution, not part of the problem.

"The IEA's own research has shown that deploying modern, highly efficient coal plants can reduce CO_2 emissions by as much as 30 per cent from coal-fired power generation and it can do this at a much lower cost than renewable energies. That means there are huge economic and climate benefits from building more efficient coal-fired power stations."

GDF Suez shifts focus from Europe

French utility GDF Suez is adjusting its strategy to fit the new global energy landscape.

Siân Crampsie

GDF Suez has warned that Europe's harsh trading environment will affect its business for the next two years.

The French utility has revealed a cost-cutting programme which, alongside a shift in focus to faster-growing, non-European energy markets, will improve its financial position.

GDF Suez is aiming to save €3.5 billion per year from 2013 and reduce capital expenditure in 2013 and 2014 by €7-8 billion per year. It says that its profits in 2013 and 2014 will fall.

The company's warning comes a month after E.On announced it was abandoning its profit targets for 2013 and 2014 and reviewing its outlook for 2015.

Both companies blame a fall in energy demand and low wholesale power prices in Europe for their difficulties. E.On CEO Johannes Teyssen said last year that some of the company's gas fired power plants were barely profitable.

GDF Suez says that it will accelerate its business development in fast growing countries, focusing on the LNG and independent power production businesses. It will also simplify its structure and increase its focus on energy after a decision not to renew a shareholder agreement concerning Suez Environnement, the waste and water utility.

The strategy will enable it to take advantage of and adjust to the "new global energy landscape" created by the US shale gas revolution and strong demand growth in regions such as Latin America, Asia and the Middle East.

The French company has already announced plans to reduce debt by selling its stake in Italian wind energy company IP Maestrale for €800 million as well as a 60 per cent interest in its Canadian renewable energy activities for €1.5 billion.

It said in a statement that 2012 was marked "by stricter regulations and higher tax on the group's historic markets and increased power production overcapacity". It noted that higher nuclear taxes and transmission grid fees in Belgium had affected its electricity production business "while sales in the retail segment were affected by the temporary freeze on gas and electricity prices".

In France, it said, partial price increases agreed by the government on July 1st and October 1st have not offset the rise in supply costs. It has set a target of reducing net debt to around €30 billion by the end of 2014.

GDF Suez says that it expects its business to rebound in 2015, benefiting from the development of strongholds forged in fast-growing energy markets, largely through UK-based subsidiary International Power.

In Europe, GDF Suez says it will focus on renewable power production and energy efficiency. In most countries renewable energy production is subsidised, making it hard for conventional power plants to compete, especially in an environment where demand and wholesale power prices are low.

But Europe's focus on renewable energy growth is worrying industrial energy consumers.

Two EU-based trade associations said in late 2012 that the EU's focus on renewable energy was pushing up power prices and would affect the competitiveness of the industrial sector.

Orgalime and Ceemet, which together represent 200 000 companies across Europe, believe that Europe's renewable energy strategy coupled with the game-changing US shale gas revolution present a problem for energy-intensive European businesses. They say that European manufacturers are paying nearly twice as much for electricity and nearly three times as much for gas as their US counterparts.

DNV grows with GL merger

Two major players in classification and risk management for the energy and shipping industries have agreed to combine their expertise to create the world's largest classification society.

DNV and GL (also known as GL Garrad Hassan) have signed a merger agreement to create a new combined company known as DNV GL. Combining their expertise and global networks will, they say, benefit their customers in the oil and gas, shipping, power and renewable energy sector.

The DNV Foundation will hold 63.5 per cent of the new company while GL's owner, Mayfair SE, will hold 36.5 per cent. DNV GL will be a global leader in pipeline verification and asset integrity services as well as in renewable energy certification and advisory services.

It will also be a strong player within power transmission and distribution as well as testing and certification services. To enhance its service offering the DNV GL Group will strengthen its focus on R&D and innovation.

"The merger with DNV supports our long-term goal of being recognised as one of the most respected technical assurance and advisory companies in the world," said GL Group CEO, Erik van der Noordaa.

Both companies have historical roots in the shipping sector but more recently have expanded into offshore oil and gas, renewables and power. In 2012 DNV bought a majority stake in energy consulting firm Kema

Areva, STX seek optimised design

Areva and STX France are aiming to improve the competitiveness of offshore wind energy through a new co-operation agreement.

The two companies have announced plans to pool their expertise to reduce the costs of foundations for offshore wind turbines.

Areva says that it will use its expertise in the design and production of wind turbines, while STX France will bring its expertise in specialised offshore foundations to the partnership. The companies are planning to make joint wind turbine-foundation offers for major European offshore wind projects.

The manufacturing, logistics and installation costs associated with wind turbine foundations and towers account for almost one-third of investment expenditure in offshore wind farms.

Optimising the foundations could lead to savings in the order of tens of millions of euros for a 100-unit wind farm, according to Areva.

"This cooperation agreement with Areva, whose technology is proven for the European offshore wind market, will benefit our future customers. By bringing our engineering ability to the table, we will be in a position to offer an extremely efficient and competitive global solution," said Laurent Castaing, CEO of STX France.

Louis-François Durret, CEO of Areva Renewables, said that the partnership would "strengthen the competitiveness of the French manufacturing base in the offshore wind French market and for export". The company expects the installed capacity of offshore wind in Europe to reach 40 000 MW by 2020.

E.On pushes into Turkey

- Verbund takes over Bavarian hydro plants
- Enerjisa set for growth

E.On has agreed an asset swap with Austria's Verbund that will give the German firm a foothold in Turkey's fast-growing energy market.

The German firm has agreed to acquire Verbund's share of Enerjisa in return for handing over shares in certain hydropower stations in Bavaria to Verbund.

The deal gives E.On a 50 per cent share of Enerjisa, which owns power plants as well as an electricity distribution business in Turkey, and is part of E.On's strategy to find new growth opportunities outside of Europe's sluggish energy market.

"Following our entry into Brazil at the start of the year, our entry into the Turkish energy market represents significant progress in the implementation of our corporate strategy," said E.On CEO Johannes Teyssen. "Turkey has one of the fastest-growing economies in the world, and the rise in its energy demand has been strong and steady. This transaction gives us a superb platform for value-enhancing growth outside our markets in Europe."

E.On, together with Sabancı Holding, Enerjisa's other 50 per cent shareholder, plan to have up to 8000 MW of generating capacity operating in Turkey by 2020, giving them at least a ten per cent share of the market.

Enerjisa's current generation portfolio consists of gas fired, hydro, and wind assets totaling nearly 1700 MW of installed capacity. The company has 2000 MW of capacity under construction and 1500 MW under development. Enerjisa also operates a power distribution business with about 3.5 million customers in the Başkent region.

Sabancı Holding said that a new partnership with E.On would enable it to realise Enerjisa's growth ambitions.

Verbund will acquire E.On's interest in hydropower capacity in Bavaria in which it is already a joint owner. Most of the capacity is on the Inn River and includes the Nussdorf, Ering-Frauenstein, and Egglfing-Obernberg run-of-river plants.

E.On will pay Verbund €300 million in cash as part of the deal, which is subject to regulatory approvals.

Broadening its global footprint: German utility giant E.On

Tenders, Bids & Contracts

Americas

Siemens extends service contracts

Siemens Energy has signed deals to extend two service contracts covering wind power plants in the USA.

The Germany-based engineering giant has signed a two-year extension to a service contract with White Creek Wind I (WCWI), owners of a 205 MW wind power project in Washington state, USA.

It has also extended by two years a service agreement with Edison Mission Energy for a 161 MW wind farm near Amarillo, Texas.

The contract with WCWI covers 89 of Siemens' SWT-2.3-93 wind turbine units operating at the White Creek wind project near Roosevelt. It extends the original five-year service agreement between Siemens and WCWI, which is managed by Summit Power Group, and includes modernisation improvements.

In Texas, Siemens will continue to provide maintenance and service on the 70 SWT-2.3-93 wind turbines operating at the Wildorado wind ranch.

Texas plans HVDC link

ABB has won an order worth around $36 million from Sharyland Utilities L.P. to supply and install a high voltage direct current (HVDC) converter station in Texas, USA.

The 150 MW back-to-back HVDC converter station will be built in Mission, Texas, where an identical installation was delivered by ABB in 2007. The two stations, part of the Railroad DC Tie Expansion project, will work in parallel to provide a transmission capacity of up to 300 MW. This will increase the power transfer capacity between Texas and Mexico and secure power supply.

ABB will design, engineer, supply and install the converter station including high-voltage equipment such as power transformers and thyristor valves. The station is scheduled to go into operation in 2014.

Bishop Hill agrees service deal

Bishop Hill Energy II LLC has signed a multi-year operations and maintenance contract with EDF Renewable Services for the 81 MW Bishop Hill II wind power project in Illinois state, USA.

The wind farm consists of 50 GW 1.62 MW wind turbines and achieved commercial operation in December 2012. EDF will provide selected operations and maintenance services as well as remote monitoring from its operations control centre.

The deal is EDF's first operation and maintenance agreement with MidAmerican Renewables, the owner of Bishop Hill II.

SNC-Lavalin wins CCGT contract

SNC Lavalin and Skanska have been awarded a contract to build a 655 MW combined cycle gas turbine power plant in Newark, New Jersey, USA.

The Newark Energy Centre Center is being developed by a joint venture of Hess Newark Plant Holdings, LLC, a subsidiary of Hess Corporation and EIF-NEC, LLC, a subsidiary of private equity funds managed by Energy Investors Funds.

SNC Lavalin will provide engineering, procurement, start-up and commissioning services, while Skanska will be responsible for construction and site management. The power plant will use GE's F class 5-series-gas turbines and is scheduled to start up in 2015.

Asia-Pacific

Malaysia floats coal plant tender

The Malaysian Energy Commission has announced plans for an open tender for the development of two coal-fired power plants with total capacity of 3000 MW.

It said last month that the first would be a 1000 MW plant built on a fast-track basis and the second would be a 2000 MW plant at a new site.

"The fast track 1000 MW plant will be operational by October 2017 and the second power plant, which is to be developed at a greenfield site, will be commissioned by 2018/19," said the Energy Commission.

The Commission said the open tender followed the recently concluded international competitive bidding for the Prai power project.

Harbin orders GT13E2 GTs

Alstom has been awarded a contract by Harbin Turbine Company Limited (HTC) to supply two sets of GT13E2 gas turbine generators for a new combined cycle power plant being built in China.

This is Alstom's second gas turbine order awarded by HTC within half a year. The two new sets are scheduled to enter commercial operation by the end of 2013.

Huaneng Power International's (HPI) 517 MW Tongxiang combined cycle power plant is located in Zhejiang province. Alstom's contract is valued at €40 million.

Alstom already has an existing relationship with HPI and is building a gas fired power plant in Singapore for Tuas Power Generation Pte Ltd (TPG), a fully owned HPI subsidiary in the country.

Taiwan Power signs service deal

Taiwan Power and GE have signed a five-year full service agreement covering wind turbines operating in Taiwan.

Under the $11.4 million agreement, GE will provide a full scope of services including planned and unplanned maintenance and spare parts for 26 GE 1.5 MW-class wind turbines.

The agreement guarantees fleet availability of more than 95 per cent.

Of the 26 GE wind turbines, 23 are located in Taoyuan County, and three are located in Kenting Township. The fleet contributes more than 110 GWh of green electricity to the Taiwan power grid.

MHI wins Thai order

Mitsubishi Heavy Industries (MHI) has received a turnkey order from a unit of Japan's Electric Power Development Co. for the construction of a combined cycle power plant in Thailand.

Under the deal, MHI will supply four gas turbines and two steam turbines for the 1600 MW plant, which is to be built in Ayutthaya province, 70 km north of Bangkok.

The plant's two 800 MW generation units are to go on-stream in June and December of 2015. Civil construction and installation work will be handled by Sino-Thai Engineering and Construction Public Co., a local construction firm.

Europe

ABB boosts Scottish grid

SP Energy Networks has placed a $26 million order with ABB for the supply and installation of gas insulated switchgear (GIS) equipment at three substations in Scotland.

ABB will design, supply and commission its recently introduced 420 kV GIS solutions at new substations being constructed in Hunterston and Wishaw and support the upgrade of an existing substation at Torness.

The work will help to strengthen the Scottish Power network and enable the integration of renewable energy. Scotland has abundant renewable sources and met 35 per cent of its electricity demand from a generation mix including hydro, wind, wave, tidal, solar and biofuels in 2011.

Iberdrola selects Areva turbines

Iberdrola has chosen Areva's offshore wind turbine technology for the 400 MW Wikinger project in the German Baltic Sea.

Areva is to supply its M5000 5 MW wind turbine for the project, which will be built in 2016 and 2017. Last year, Iberdrola, in partnership with Eole-RES, selected Areva's technology for the 500 MW project in the area of Saint-Brieuc, off the coast of Brittany, as part of the first French offshore wind tender.

Luc Oursel, CEO of Areva, said: "We are honoured by Iberdrola's renewed confidence in Areva's offshore wind technology which further comforts the group's strong ambitions in Europe. This new success further demonstrates the credibility of our long term growth strategy and our long term commitment towards renewable energies."

ABB supplies HVDC link

ABB Ltd. has won an order worth $130 million from Kraftnat Aland AB to supply a new power transmission link between the Finnish mainland and Aland.

The high voltage direct current (HVDC) transmission system will be capable of transmitting 100 MW of electricity with minimum losses across a distance of 158 km.

ABB will design, engineer, supply and commission two 100 MW, 80 kV HVDC Light converter stations, one situated in Ytterby, Aland and the other in Nadendal, Finland. Two 80 kV submarine cables, each 158 km long, will enable the transmission of power.

The link is scheduled to become operational in 2015.

Gibraltar finds temporary fix

Gibraltar has selected Energy International (EI) to supply temporary generating capacity while a permanent solution is found to a current power shortage.

USA-based EI is to provide 15 MW of capacity through four dual-fuel, portable turbine generating sets. The two-year contract includes an option to increase the capacity to 20 MW and another to extend the contract to three years.

GE selected for refinery upgrade

GE has announced that it is to provide a range of equipment and services to a major project to upgrade the Izmit Tupras refinery in Turkey.

Under a contract with Técnicas Reunidas of Spain, GE will supply two Frame 6B gas turbines, one steam turbine and three generators for the cogeneration plant that supplies the refinery with a reliable source of electricity and steam. GE will also provide performance testing, spare parts and technical advisory services.

GE also has signed a contractual service agreement (CSA) to provide maintenance services to Tupras for 12 years.

RheinEnergie invests in new plant

RheinEnergie is investing around €350 million in the development of a 450 MW combined cycle heat and power plant in Cologne, Germany.

The German utility has awarded Alstom a contract for the turnkey construction of the plant, which will help Germany to replace some of the nuclear capacity planned for closure.

The Niehl 3 CHP power plant will be based on Alstom's gas-fired KA26 combined cycle plant design. Alstom will deliver one GT26 gas turbine, one steam turbine, the turbo-generator, heat recovery steam generator and district heaters as well as power plant control systems.

Commissioning of the power plant is scheduled for 2016.

International

Samsung group wins Saudi deal

A consortium led by Samsung Engineering Co., South Korea's largest industrial plant builder, has secured an order worth $3 billion to build a power plant in Saudi Arabia.

Under the deal with Saudi Arabia's Saline Water Conversion Corp., the South Korean company will build the 3100 MW power plant in Yanbu, 350 km north of the country's second-largest city of Jeddah, by December 2016.

The power plant will supply electricity to the Yanbu Industrial complex, Samsung said.

Samsung Engineering and its consortium partners, Al Toukhi and Shanghai Electric, also have a $1.5 billion interest in the project. The plant will take 48 months to build.

Mozambique orders gas engine plant

Wärtsilä has signed a contract to engineer, supply and install a major gas fuelled power plant in Mozambique.

The power plant will be the largest gas power plant ever installed in Mozambique and second largest power plant running exclusively on gas engines to be installed on the African continent. It will be equipped with 18 Wärtsilä 34SG engines.

In addition to the power plant itself, the turnkey contract with Central Termica de Ressano Garcia – a joint venture between Sasol New Energy from South Africa and the Mozambique state utility, Electricidade de Moçambique (EDM) – includes the construction of a substation and a gas pipeline.

The power plant is scheduled for completion by May 2014.

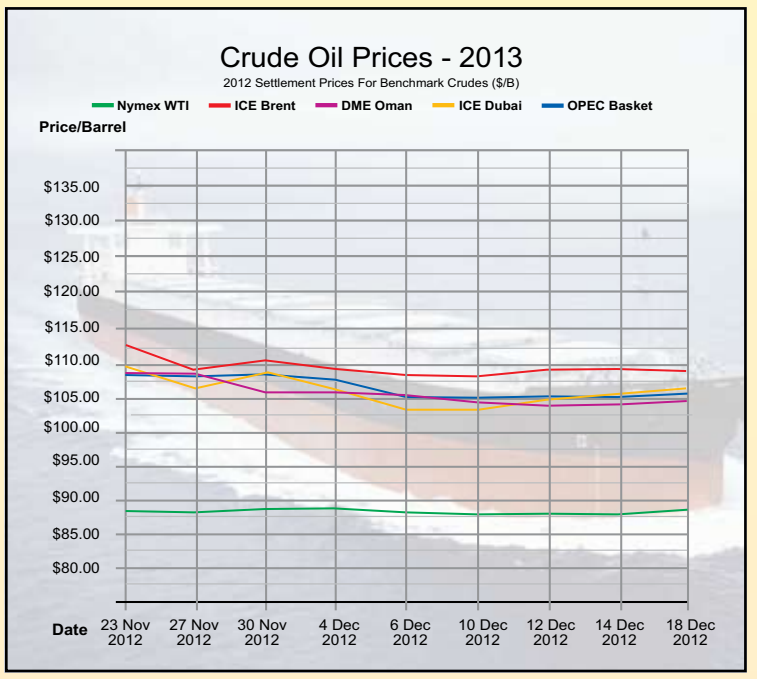
ABB supplies South Africa PV plants

ABB has won orders worth around $225 million to supply two turnkey photovoltaic (PV) power plants that will be built in the northern province of Limpopo in South Africa. The orders were awarded by two special purpose entities, Core Energy and Erika Energy, whose primary stakeholders include Sun Edison, a leading global solar energy services provider.

The two plants located at the Witkop and Soutpan Solar Parks, will be located close to the city of Polokwane, the capital of Limpopo province. They will have a generating capacity of 33 MW and 31 MW respectively and will be among the first utility-scale PV power plants to be built in phase 1 of the South African government's renewable energy programme.

Oil

Year closes with stable prices and market balanced



- Price volatility in 2012 primarily due to speculation
- Biggest challenge in 2013 is uncertain global economy

David Gregory

The price of West Texas Intermediate (WTI) crude has remained below $90/b since November 1 and for a number of days during early December was in the $85/b range. Brent stayed below $112/b during that time period and frequently touched $107/b. An explanation based on a fundamental interpretation would say that supplies are sufficient and demand is low.

The recent gathering in Vienna of Opec ministers concluded with a decision for the group to stick with its 30 million b/d production target, even though aggregate output, including Iraq, is averaging more than 31 million b/d.

Persistent concerns about the global economy and the looming US fiscal cliff eclipsed those about the political risks in Israel, Gaza, Syria and Iran, the Paris-based International Energy Agency (IEA) said in its most recent *Oil Market Report*. It forecast that global demand during the fourth quarter of 2012 would increase to 90.5 million b/d, but added that demand growth in 2013 was forecast to remain "relatively sluggish" as global economic expansion "remains tepid."

Opec is in no position to complain about the oil market. In fact, Saudi Arabia's Minister of Petroleum, Ali al-Naimi, said "leave the market alone" during the Vienna meeting. The Opec basket price has remained well above the $100/b mark throughout much of the year. The group is expecting its highest income for oil revenues ever during 2012.

Saudi Arabia and other Gulf producers have come through with promises to keep the market in balance as UN and US sanctions began to bite into Iranian crude oil production and crude supplies from Libya, Sudan, Syria and Yemen were removed from the market.

In its latest *Short Term Energy Outlook*, the US Energy Information Administration (EIA) described world oil as loosening during the fourth quarter of 2012 compared to the same period last year. "Projected world liquid fuels production increases by 0.1 million b/d from the third quarter to the fourth quarter of 2012 as members of Opec continue to produce more than 30 million b/d of crude oil and non-Opec countries recover from unplanned outages and scheduled maintenance," the report said, adding that it expects global inventories to build during the first half of 2013, "mostly due to continued growth [in output] in US and other non-Opec supply."

For its part, Opec sees global demand as rising from 88.04 million b/d in 2011 to 88.80 million b/d in 2012 and increasing to 89.57 million b/d during 2013. The call on Opec crude in 2011 was 30.22 million b/d and is expected to average 30.12 in 2012 and fall to 29.75 million b/d in 2013 as production from non-Opec suppliers rises to 59.82 million b/d.

Analysts say that considering Opec's own forecast for demand for its oil compared with its current production, the group is nearing a time when it may have to address the issue of its quota system and readjust its members production levels. But for now, statements from a number of ministers made during the meeting suggest that Opec is happy.

Opec's output rose by 75 000 b/d during November to 31.22 million b/d, according to the IEA. This, it said, was due to higher production in Saudi Arabia, Angola, Algeria and Libya. Production was constrained in Nigeria, as well as in Iran where production fell as a result of difficulties with shipping and stepped-up international sanctions.

Non-Opec production rose to 54 million b/d in November, the IEA stated, adding that non-Opec output would hit 54.3 million b/d in 2013.

In assessing the market during the Vienna meeting, Opec ministers accepted that the price volatility witnessed throughout 2012 was due primarily to speculation in the commodities market that was exacerbated by geopolitical tensions.

Opec ministers noted, according to the conference communique: "Indeed, the biggest challenge facing global oil markets in 2013 is uncertainty surrounding the global economy, with the fragility of the Euro-zone remaining a major concern." And it added that given these uncertainties, the group would continue its 30 million b/d production level.

However, member countries will, if necessary, "take steps to ensure market balance and reasonable price levels for producers and consumers. In taking this decision, member countries confirmed that they will swiftly respond to developments that might have a detrimental impact on an orderly oil market."

But it is vital that Opec "remains vigilant in the face of the uncertainty surrounding the outlook for the world's major economies, as well as the implications of the enduring weaknesses in the international financial system that are expected to continue to pose downside risks for both the global economy and the oil market," the communique said.

Gas

US senator urges LNG exports to NATO allies

A US senator has put forward a bill to allow the export of US shale gas to help alleviate the dependency of its NATO allies in the Baltics, Central and Southeastern Europe and Turkey on Russian supplies.

Mark Goetz

In December former US Senator Richard Lugar introduced a bill, the LNG for NATO Act, that calls for other members of the North Atlantic Treaty Organization to be given the same automatic approval for purchasing US-exported LNG as those countries that are US free-trade partners.

Senator Lugar, who retired from the Senate last January and is now the ranking minority leader on the Senate Foreign Relations Committee, commissioned a Committee report urging the US to support its European allies, particularly those in Eastern Europe that are dependent upon Russia for their supplies of natural gas, with deliveries of LNG. Although he is no longer in Congress, it is expected that other representatives will endorse and promote the legislation.

The Federal Energy Regulatory Commission is now reviewing proposals for the construction of eight new gas liquefaction plants in the US. Once considered a potentially large market for LNG imports, the US is now seen as an eventual LNG exporter due to the advent of shale gas, which has made the country a major international natural gas producer. Domestic shale gas production has caused a significant drop in gas prices in the US to around $3.50 per million BTUs.

A report focusing on LNG exports recently completed by the Department of Energy gave full support to the issue of exporting US gas in the form of LNG. The report – *Macroeconomic Impacts on LNG Exports for the United States* – said that in all the market scenarios examined LNG exports provided benefits that more than outweighed the losses from reduced capital and wage income to US consumers, "and hence LNG exports have net economic benefits in spite of higher domestic natural gas prices."

The report said that LNG exports are viable as long as there is high gas production and low production costs in the US and high demand overseas.

The reasoning fits in with Senator Lugar's argument that US LNG exports could contribute to Europe's energy security and reduce its dependence on Russian gas supplies. Demand for gas amongst the European Union's 27 members is currently around 540 billion m^3 and Russian gas meets around 40 per cent of that demand.

The senator's point is that the US has the opportunity to strengthen NATO members in Eastern Europe with supplies of US gas.

"The US must make it clear that our strategic interest lies in Caspian gas reaching our NATO allies in Turkey, Central and Southeastern Europe, and beyond, who are in acute need of energy diversification due to the vulnerability to Russian energy cutoffs," Lugar wrote in the report's cover letter.

"Unlike in past years," he added, "US domestic shale natural gas production affords us the opportunity to directly alleviate the dependency of our NATO allies in the Baltics, Central and Southeastern Europe and Turkey on Russian supplies and further isolate Iran, while benefiting the US economy by opening new markets."

Lugar also proposed that the US strengthen its support for the Southern Corridor, which is designed to transport natural gas by pipeline from the Caspian region and Central Asia to Southeastern and Central Europe via Turkey. There is also the possibility that Iraqi gas could also be transported to Europe through the Southern Corridor. The senator states that the pipeline system would have the additional strategic virtue of reducing Iranian gas exports to Turkey.

The report throws its full support to the construction of the Nabucco West gas pipeline, a scaled-down version of the original Nabucco Gas Pipeline project that has since given way to a plan devised by Azerbaijan and Turkey to build an alternative pipeline across Turkey.

The Committee report states that Nabucco West "would offer direct and immediate diversification to those countries in Central and Southeastern Europe in need of diversification away from Russia.

"Most critically," the report says, "Nabucco West would introduce international competition in the region that would improve negotiating posture with Russia, reduce the potency of supply disruption threats, and bolster internal stability of NATO allies and friends."

Nuclear risks, uncertainties and future potential

Today, several nuclear programmes are facing significant challenges. A recent Arthur D. Little study identifies more than 10 nuclear programmes that have ceased to exist during the last five years. At the root of the failure often lies an inaccurate understanding of project risks.

Michael Kruse

Kruse: inherent management challenges are the root cause of ultimate failure

In 2011 the tragic events at Fukushima called the nuclear industry to a sudden halt. In the months after the accident, several nuclear programmes for example in Switzerland, Thailand, the Netherlands and to some extent also in the US, were put on hold or stopped entirely.

Now, almost two years later, it is evident that the global nuclear industry has recovered from this shock and is back to speed, albeit at a slower pace. At the end of 2012 more than 430 reactors had been in operation in 31 countries and just under 800 units had been proposed by owners to be built and operated in the future.

This large number of proposed reactors reveals a remarkable fact: it is expected that the number of operated nuclear power plants will increase until 2030 compared to today's status-quo despite contradicting indications from some media.

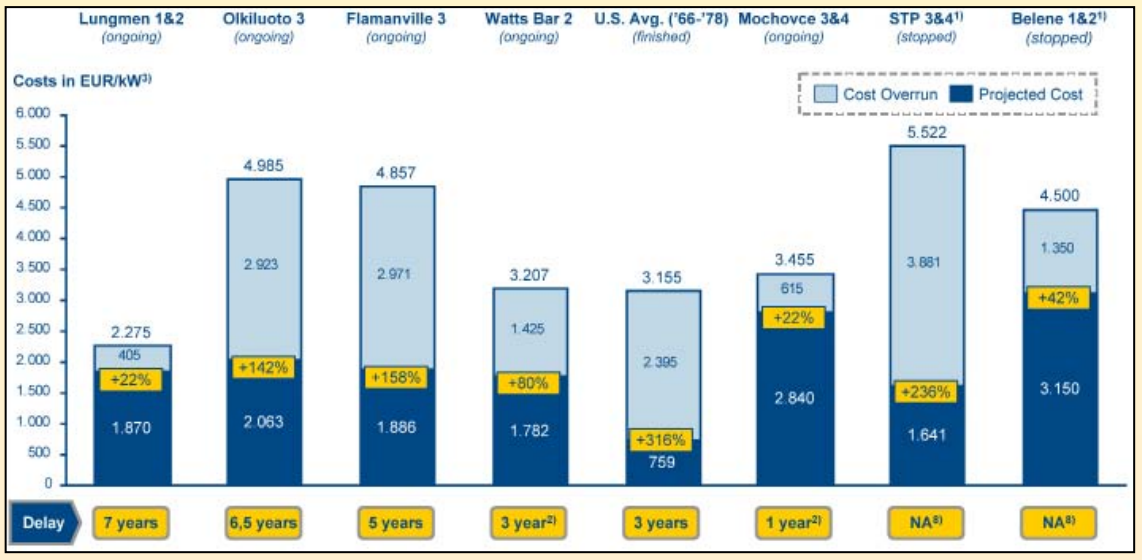
This positive scenario however, does not show the number of nuclear programmes, which "failed" to continue with their project development or construction activities and have either stopped entirely or been put on hold indefinitely.

A recent Arthur D. Little study identifies more than 10 nuclear programmes totalling 45 planned reac-tors, which have ceased existence during the last five years, several of them already before Fukushima. Another 25 nuclear programmes with about 70 reactors have been put on hold during this period, to a large extent after Fukushima. If and when these programmes continue is uncertain.

There are two main reasons why a nuclear new build programme fails. The most obvious is to a large extent exogenous to the owner and originates in a country's nuclear policy and state or public opinion to nuclear power as an energy source.

In Switzerland for example, despite an expected electricity demand supply gap within the coming decades and a low carbon energy policy, the Swiss Bundesrat decided to abandon nuclear power as an option in the wake of Fukushima, due to a wave of public opposition. As a consequence, three Swiss energy companies stopped their nuclear new build plans only a few months after Fukushima.

Similarly, in Lithuania, the Social Democrats forced a non-binding public referendum on whether Lithuania should build a nuclear reactor.



Selected current and historic nuclear programmes

The referendum was held in conjunction with the national election. About 63 per cent of those voting in the referendum said they did not want additional nuclear power.

These examples show, unless there is an exceptionally strong link between the country's ambition to establish a self-sustainable nuclear industry – meaning jobs to the people – and the nuclear programme, earning public trust and confidence is crucial for the programme's success. This is a major reason why the nuclear programmes in countries like China, India, Russia and Saudi Arabia progress well.

The other reason for failure originates in economic realities. Investment costs for several nuclear power plant new builds averaged around € 3900/kW. In contrast, the investment cost for one of the world's most advanced combined cycle gas turbine (CCGT) plants, Irsching 5 in Germany (860 MW), was less than €500/kW. As long-term prices for gas are expected to continue to be comparably cheap, the nuclear option is also less attractive from a fuel perspective and hardly reaches its required return on investment.

The rationale of economic viability is not new to the nuclear industry. Even before the Fukushima tragedy, sceptics of nuclear energy argued that the nuclear industry's prospects were dimmed by delays and escalating costs long undermining the economic viability, and hence competitiveness, of nuclear energy. Since Fukushima, this view has received even stronger justification, especially in liberalised energy markets where increasingly volatile electricity prices put the high number of reactors – which are still proposed – at a certain risk.

The first wave of commercial nuclear reactor programmes in the US for example, which were introduced during the late 1960s and 1970s, faced on average three years delay and a remarkable 300 per cent cost overrun relative to the original estimated investment cost. However, at that time, in many industrialised countries including the US, nuclear energy was viewed as a state industry vehicle driving economic advancement, and overall cost was less of an issue as energy market prices were regulated.

Nowadays however, several nuclear programmes are facing significant challenges to meet their envisaged return on investment due to schedule delays and exceeding cost projections.

Hence, a major driver avoiding failure of a nuclear new build programme is to maximise the plant's economic viability by limiting cost escalations and schedule delays. Interestingly, this premise is well known to owners of nuclear new build programmes. However, remarkably few projects, notably Chinese and South Korean ones, seem to be able to execute their venture within the limits of this premise.

At the root of the failure often lies an inaccurate understanding of project risks. In addition, inaccurate prioritisation of critical activities and lacking capabilities of the project organisation and suppliers, has led to significant delays and budget overruns. In the past, several projects tended not to be ready for this challenge. Projects in Finland (Olkiluoto 3), the US (South Texas 3 & 4), France (Flamanville 3) and Russia (Kursk 5) have demonstrated these risks dramatically. Historically, several factors have led to cost overruns, including:

- Start of construction before design completion and inability of the owner to communicate its utility requirements in a comprehensible manner
- Lacking ability to incorporate regulatory requirements into the plant's design and lack of reliability of the licensing process
- Insufficient schedule integration (starting by having the end in mind) and communication between first tier suppliers, sub-suppliers and owner
- Lack of strategic and operational planning by the owner (governance, milestones and so on),
- Insufficient project management capabilities including controlling progression of the new build project (time, costs, quality), across all key suppliers
- Poor interface definition and management between involved parties (including the regulator)
- Non-transparency of major project risks and hesitant implementation of counter-measures for identified risks and constraints
- Lack of understanding of needed capabilities over time and hence lack of timely provision of suitably qualified and experienced staff.

As an example: during project development some owners, especially in countries with weak grid infrastructure, tend to underestimate the effort and time needed to provide sufficient grid infrastructure for the plant. Instead, they focus their efforts entirely on the technology choice of the plant, not considering the impact the plant will have on the entire electricity system of the country.

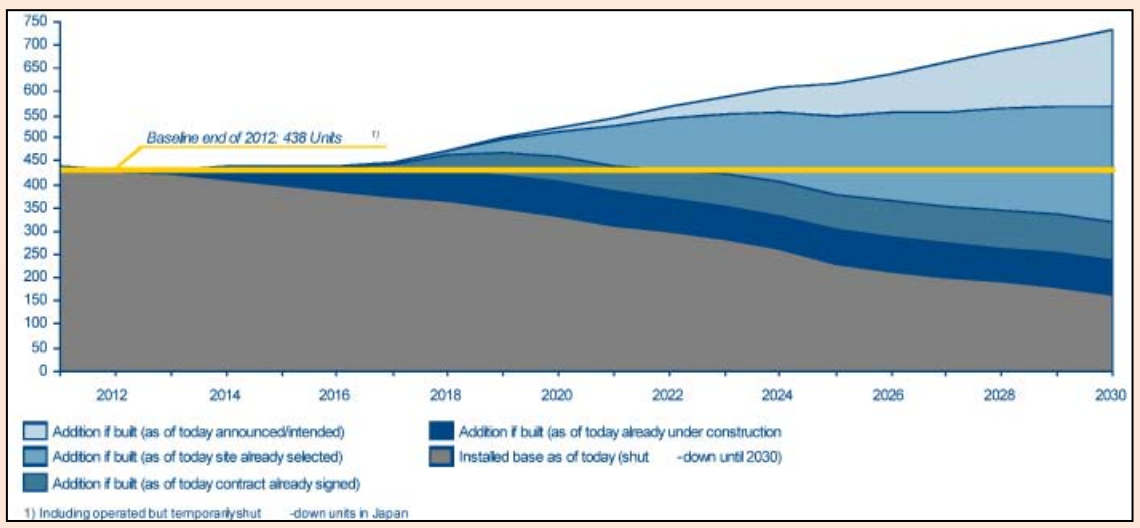
These challenges of not understanding the interdependencies of a nuclear venture are amplified by an unspoken reluctance among project members to deal with the high degree of uncertainty involved in nuclear new build, which sometimes impedes progression further.

All these issues show that, while the technical complexity of nuclear new build is widely recognised, the root cause for ultimate failure of a nuclear new build are the inherent management challenges. These are often underestimated and call for professional management of new build ventures, which goes far beyond methodical proper programme management.

Deep understanding of the nuclear programme itself is needed. Remarkably, on a theoretical level many owners are quite aware of these factors, which determine cost overruns to a large extent. However, they fail in building the needed capacity within their own organisation to address these existing challenges.

Michael Kruse is Principal of Global Nuclear, Arthur D. Little

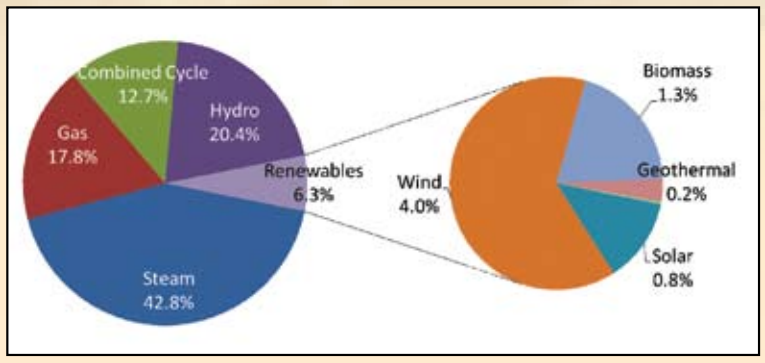
Development of the installed nuclear base until 2030



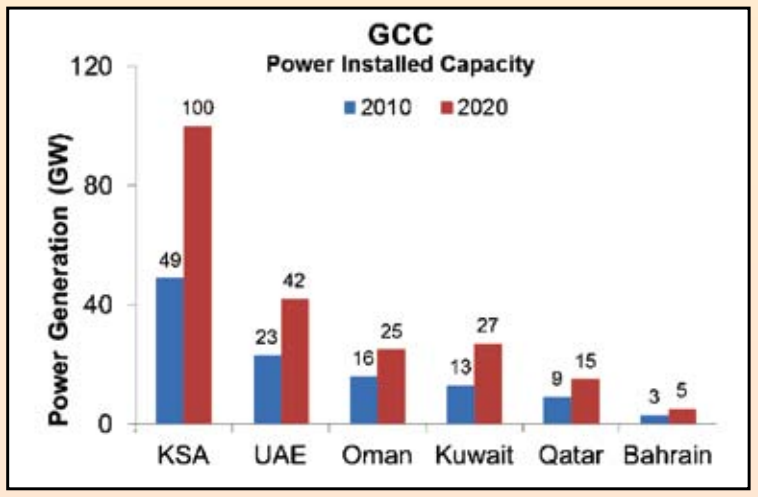
Realising a renewable vision in the GCC

Vital components of a framework to promote the growth of renewables in the GCC are missing, which could lead to a decline in potential. However, the challenges are not insurmountable. **Abhay Bhargava**

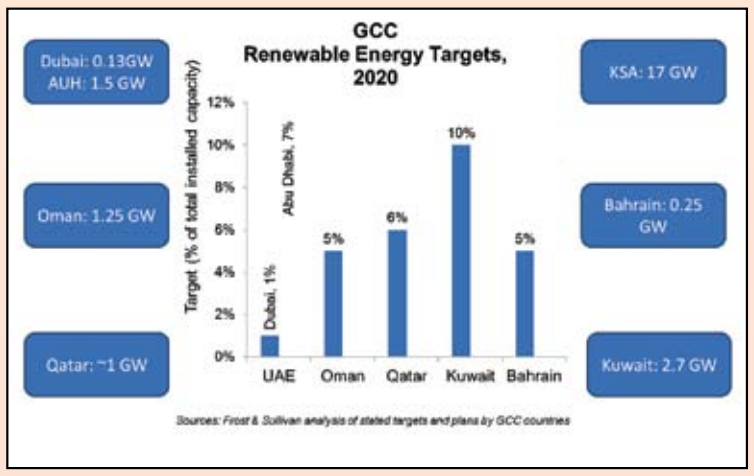
The Gulf Cooperation Council (GCC), formed by the six neighbouring countries – Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates, is one of the most significant energy regions in the world, possessing 22.5 per cent of the world's proven natural gas reserves, and 35 per cent of the world's proven oil reserves (*BP World Energy Outlook 2030*, published January 2012). Hence, it is now surprising for many that the GCC is reconsidering its energy mix and is looking to incorporate renewable energy as a significant contributor.



Global energy mix, 2010. Source: Frost & Sullivan analysis



Installed generating capacity in the GCC. Source: Frost & Sullivan analysis of stated targets and plans of the GCC countries



Renewable energy targets in the GCC, 2020

Currently, renewables are a small percentage of the total energy mix globally. However, this is expected to change, with high growth forecast for various renewable technologies. Frost & Sullivan forecasts wind energy to grow at a Compound Annual Growth Rate (CAGR) of 16-20 per cent, solar photovoltaic (PV) based generation to grow at a CAGR of 25 per cent and concentrated solar power (CSP) to grow at a CAGR of approximately 40 per cent for the period 2010-2020.

Some key factors that are driving this forecasted growth are the heavy incentives for renewables by nations, enhanced bankability of renewable projects and technology advancements that have resulted in enhanced efficiency and reduced costs.

The GCC, too, is undergoing a major change in the wake of economic diversification programmes, the global recession, and the Arab spring. The future is forecast to be exceptionally challenging from an energy perspective, with the demand for power expected to double by 2020.

The GCC is unlikely to cater to this demand through conventional energy sources. While diesel has been used as an option to manage peak loads, it is not a long term sustainable solution. Nuclear too is an available option, though not achievable in the current decade except for the UAE, which is currently on the path to implementing it. This demand-supply gap, and the abundant availability of solar as a resource in the GCC, has led to solar power being considered as a viable energy source to meet emerging needs.

The GCC has been active in announcing plans for the adoption of renewable energy. Based on announced plans, there is a 25 GW potential for solar energy in the GCC up to 2020 – a commendable though ambitious effort on the part of countries, which have significant hydrocarbon wealth.

Some projects are already under way, as part of efforts to attain these goals. Prime examples are the Abu Dhabi (UAE) Shams and Noor projects for 200 MW, the proposed Mohammed bin Rashed Solar Park in Dubai (UAE) with a proposed capacity of 1000 MW by 2030, Public Authority for Electricity and Water (PAEW) of Oman's projects that would lead to installations amounting to 200 MW, Kuwait's 60 MW Al Abdaliyah ISCC, Qatar's preparations for the 2022 football World Cup, and Saudi Arabia's 100 MW Makkah project and the 600 MW Dibba 1 IPP project, which would be Saudi Arabia's first CSP integrated combined cycle plant.

According to Frost & Sullivan, the adoption of renewables is expected to yield multiple benefits for the GCC.

Firstly, it will generate skilled jobs. For the GCC, with a fast growth youth segment and relatively high unemployment rates, the potential for renewables to generate skilled jobs is a highly valued benefit.

Secondly, it would free-up fossil fuels. Currently, the GCC is burning up expensive oil and gas at highly subsidised rates to generate power. With renewables, this fuel can be freed up for potential export at market rates, allowing for a windfall for the countries.

Finally, it will help industrial development. A review of proposed plans laid out by some GCC countries reflects the strategic importance that is being attributed to renewables. Some countries, especially, Saudi Arabia, are pushing for the development of a localised value chain, including both services as well as products. Considering the domestic demand and export potential, this could result in the development of an entirely new industry in the GCC.

However, these efforts on the part of the GCC could fall short of attaining stated targets, resulting in the achievement of just one third of targets, if adequate measures are not taken to handle some specific challenges that could hinder development of renewables.

Intermittency is a major issue with renewables, which is likely to hinder these sources from taking on the role of base load power generation.

Irrelevant research and development (R&D) is another issue to be tackled. The GCC has a unique environment and the combination of dust, humidity and high heat can prove to be challenging for the various technologies that exist today. The GCC requires region specific R&D, which is currently lacking.

The continued use of subsidised hydrocarbons is the largest issue that needs to be managed. With the GCC governments supporting subsidised electricity and feedstock, renewable energy is simply not competitive and faces the risk of losing momentum.

Globally, renewable energy has flourished in a supportive regulatory framework. However, vital components of such frameworks are missing in the GCC, and this could lead to a decline in potential.

None of these challenges are insurmountable. What is required is a customised and focused approach to create an environment that can nurture the growth of renewable energy in the GCC.

The development of supporting infrastructure is perhaps the most critical prerequisite for renewables in the GCC. Such a structure can facilitate manufacturing in the GCC, which in turn can contribute to adoption. Additionally, this can facilitate renewables in terms of increasing their attractiveness from a financing point of view, making future projects bankable.

It is also important for the GCC to work towards developing an appropriately localised value chain to ensure that only relevant components are manufactured in the GCC, capitalising on the offerings available locally. In addition to manufacturing, it is also important to ensure that sufficient effort is focused on developing storage systems and locally relevant R&D, both of which are critical to the future of renewables.

The GCC needs to relook at policies and related framework, to ensure that it is appropriate for the highly customised requirements of renewables. Capital subsidies, feed-in-tariffs, renewable purchase obligation, public-private-partnership agreements are some examples that need to be considered for the development of a framework.

Finally, it is also important for the GCC to facilitate a cultural and mindset shift in the population residing in these countries. It is well known that the GCC boasts of some of the highest per capita consumption and emission statistics globally. It is therefore quite important to educate the population on the benefits of conservation and clean fuel, which in turn builds bottom-up support for renewables.

The GCC is going through a turbulent time. Renewables, through underlying benefits of employment opportunities, increased export potential of hydrocarbons, enhanced industrial development and reduced dependence on fossil fuels, can prove to be the one key stabilising factor that can support the GCC's plans for accelerated development.

Abhay Bhargava is Head of Energy and Power Systems Practice, Frost & Sullivan. For feedback and enquiries contact: deepshrii@frost.com/tanu.chopra@frost.com

Pay now or pay later

The uptake of CCS has been slower than anticipated, not least because the technology costs are more than industry is accustomed to paying. But many studies have confirmed that CCS is cost competitive with other early-stage low- and zero-emission technologies and costs will fall with wider deployment. **Barry Jones**

Jones: others would be wise to follow countries like China and the UK in embracing all available low carbon technologies

If the world is committed to lowering greenhouse gas emissions at least cost, governments and industry must act now to ensure that carbon capture and storage (CCS) is included in the mix of technologies used to tackle climate change and limit the rise in temperature of our planet.

In its '*World Energy Outlook 2012*', the International Energy Agency (IEA) estimated that global primary energy consumption will increase by at least 35 per cent between 2010 and 2035, and that developing countries will account for 93 per cent of the demand growth. Fossil fuels will dominate the growth in energy demand, with dramatic emission increases resulting. This will have a significant and profoundly negative impact on climate change.

As an example of the challenge, in the period 2001 to 2010, despite the welcome and increasing rate of uptake of renewable energy technologies, the global increase in energy provided by coal alone was more than 10 times the increase in energy provided by hydro, solar, wind, marine and geothermal combined over the period.

The good news is that CCS is already making a significant contribution, with eight operational projects preventing more than 23 million tonnes of carbon dioxide (CO_2) from reaching the atmosphere each year. This is expected to increase to 36 million tonnes a year by 2015, by which time a further eight projects under construction will all be in operation.

Indeed, the annual abatement from these 16 CCS projects will exceed current energy-related abatement in the UK by a large margin. This also represents a substantial share of the abatement being delivered by solar technologies in Germany, which have received higher total funding support than all of the government support available to all CCS projects worldwide.

The uptake of CCS has been slower than anticipated, not least because the technology costs more than we are accustomed to paying. But many credible studies have confirmed that CCS is cost competitive with other early-stage low- and zero-emission technologies, such as offshore wind, wave and solar. And like any emerging technology, costs will fall with greater deployment.

Exclusion of CCS as a technology option in the electricity sector alone would increase investment costs by more than $3 trillion by 2050 if emission reduction targets are to be met and, beyond the electricity sector, completely decarbonising the energy system would be unlikely without CCS, according to the IEA.

Fossil fuels provide the basis of power generation across the world and are the primary form of fuel used for electricity in developing countries.

> The good news is that CCS is already making a significant contribution, with eight operational projects preventing more than 23 million tonnes of CO_2 from reaching the atmosphere each year

To mitigate emissions created in power generation using CCS technology requires additional capital and operating investments for the capture facility used to separate the CO_2 from the flue gases. Combined, these costs make it challenging to apply CCS to power generation, but it can be done.

Indeed, the largest number of CCS projects in the planning stages of development is in the power generation industry, with 40 large-scale integrated projects (from a total of 75) accounting for more than 70 million tonnes per annum in potential CO_2 capture capacity.

The Searles Valley Minerals project in California, in the US has captured around 270 000 tonnes of CO_2 a year from a coal fired power plant since it began operating in 1976. And at the Plant Barry power station in Alabama, US, the aim is to capture between 150 000 and 200 000 tonnes per year of CO_2 and geologically store it in a nearby reservoir. The capture plant has been operational since June 2011, becoming an integrated CCS project in August 2012.

A key challenge in deploying CCS in power generation involves finding innovative ways to bridge the commercial gap. Two commercial-scale power plants that have done so are currently under construction in North America. These plants – Kemper County and Boundary Dam – have received capital support for their construction and operational support from a range of grant schemes.

The $2.4 billion Kemper County project, a new 582 MW power station, will aim to capture 65 per cent of its emissions, equivalent to 3.5 million tonnes of CO_2 per annum. The $1.2 billion Boundary Dam project – a retrofit to a 110 MW Canadian power station – will aim to capture 90 per cent of the CO_2 produced, equivalent to one million tonnes of CO_2 a year.

Other projects are considering polygeneration, where as well as electricity, products such as urea, sulphuric acid and other chemicals are produced, providing additional revenue streams to close the commercial gap. Many of these projects will also create revenue by selling the produced CO_2 for use in enhanced oil recovery operations.

Increasingly, national energy and climate change policy frameworks are favouring natural gas-based rather than coal-based power generation, while low natural gas prices continue to support the business case for natural gas-based power generation.

Six of the eight operational CCS projects around the world – three in the US, two in Norway and one in Algeria – are in the natural gas industry and are responsible for the capture of 19.5 million tonnes of CO_2 each year.

About a third of the CO_2 captured each year by the eight CCS projects under construction – that is, about 4.5 million tonnes a year – will be due to two natural gas processing plants, one each in the US and Australia. Furthermore, three additional gas industry CCS projects are in the 'pipeline'.

Encouragingly, seven of the 11 natural gas industry demonstration projects are adopting CCS in the 'new build construction' phase. Three projects involve retrofitting CCS technology to an existing plant and one plant under construction is being retrofitted with the technology.

A significant step forward in the acceptance of CCS as a vital technology for dramatically reducing carbon emissions was made at the UN climate change talks in Doha in late 2012. A group of leading international environmental non-government organisations, the ENGO Network, released a report entitled *'Perspectives on carbon capture and storage*' endorsing CCS and urging governments and industry to accelerate its deployment.

The report was authored by Clean Air Task Force, The Climate Institute, E3G, Natural Resources Defense Council, The Pembina Institute, World Resources Institute, and Zero Emissions Resource Organisation. They carefully and independently examined the latest available science and analysed real life experiences of CCS, concluding that it is a safe, clean, effective and necessary technology – in a portfolio of technologies – for tackling climate change.

However, challenges remain for the commercial-scale demonstration of CCS in the power sector, most of which are associated with overcoming the commercial gap of these projects. The commercial gap may be closed through innovative approaches. But moving to large-scale deployment of CCS in industry and the power sector will also require effective – and global – climate change policy and regulatory regimes.

Throughout the world, renewables have enjoyed strong support through a range of government schemes, including mandatory targets and feed-in tariffs, to deploy mature technology types as well as subsidies in support of research and development, and ongoing technology development.

In contrast, the approach taken by many countries to support the development of CCS technologies and applications has been more 'traditional', often in the form of capital grants, for example, that do not cover the costs of operating large-scale CCS demonstration projects. It is difficult to not form the view that in demonstrating and developing technologies, CCS is at a disadvantage.

In the UK, the government has established progressive climate change policies that support all low-carbon technologies, including renewables and CCS, as it plans to restructure its electricity sector over the next 20 years.

Acknowledging that a carbon price is the cornerstone of action to reduce emissions, the UK government is handling the necessary technology transformation with a carbon floor price and technology-specific pricing agreements with renewables, CCS and nuclear.

The aim is to reduce risk and uncertainty through long-term instruments that provide stable incentives for companies to invest in low-carbon generation, including CCS, and reduce existing policy risk. This is a leadership model for the future.

Two CCS projects highlight the benefits of public and private sector support in advancing cost-effective technology. The first, the $1 billion Technology Centre Mongstad in Norway, an industrial-scale test centre for carbon capture, should demonstrate the potential for CCS costs to be significantly reduced over time. It is funded by the Norwegian State, Statoil, Shell and Sasol.

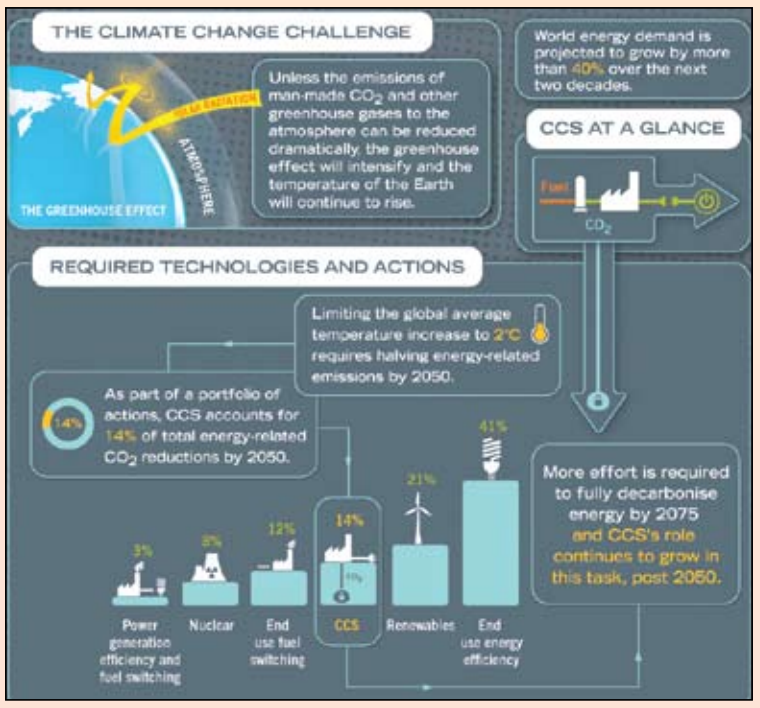
The second, Shell's Quest project in Canada, will capture and store more than one million tonnes of CO_2 per year produced at the Athabasca Oil Sands Project. The costs of the CA$1.35 billion 10-year project will be met by the governments of Canada and Alberta, and Shell, Chevron and Marathon.

The recent fast mover in CCS, however, is China, with 11 large-scale projects. The Chinese government has also included CCS as a priority in its 12th Five-Year Plan for building clean energy.

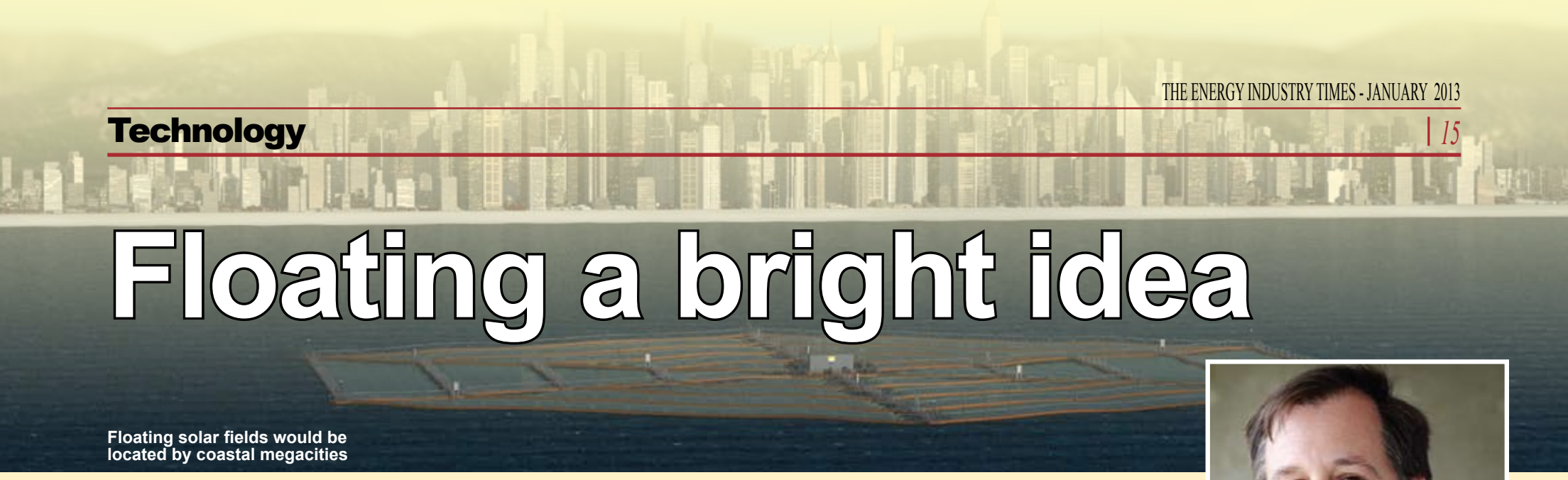
China, like the UK, has embraced the need to get behind all available and emerging low- and zero-emission technologies. In a world expecting a 35 per cent increase in energy consumption between 2010 and 2035, others would be wise to follow their lead.

Barry Jones is General Manager of Policy and Membership at the Global CCS Institute

CCS is one of several technologies required to combat climate change



Floating a bright idea



Floating solar fields would be located by coastal megacities

Locating floating solar fields offshore is a concept that could offer a solution to delivering abundant, sustainable energy to densely populated coastal areas. ***TEI Times*** explains.

As the world's population continues to rise, an increase in energy demand is inevitable. Population growth is predominantly in coastal megacities – with some 50 per cent of the world's population already living within 100 km of the coast, putting pressure on land and fresh water resources in these areas.

Yet abundant solar energy resources are available. Every hour the earth is bathed in more energy than mankind uses in a year. Traditional barriers to solar power are being broken, and with new technologies increasing efficiency and reducing costs, photovoltaic systems are the fastest growing renewable energy source.

Almost 30 GW of operating capacity has been added, increasing total global capacity by 74 per cent to more than 69 GW according to the *Renewable Energy Policy Network 2012* report. While the EU again dominated the global market, markets are expanding in other regions, and China has rapidly emerged as the dominant player in Asia. Emerging markets, such as Southeast Asia, are also aiming to grow their renewable energy production with an increased presence in the solar sector.

But tapping solar as a truly sustainable resource demands a fresh solution. Accordingly, DNV and DNV KEMA developed a concept for a large-scale floating offshore solar field concept.

Photovoltaic (PV) systems are typically installed on residential and commercial rooftops and ground-mounts in utility scale plants. In congested coastal cities there is little opportunity for rooftop solar power, and land surrounding urban areas commands premium prices – pushing large-scale ground mounted solar production to remote areas, far away from where the power is needed. This results in long transmission lines, issues with public acceptance, wildlife, and cost.

The solar industry is currently striving to lower the cost of energy and achieve grid parity from land and building deployment. Yet land and building space is not always plentiful in locations where electricity demand is high.

Given the densely populated coastal line, it makes sense to look beyond the current challenges for the solar industry by offering visionary offshore possibilities. This is the thinking behind what DNV KEMA calls its SUNdy concept: a 50+ MW dynamic floating offshore solar field.

"This concept came out of an extraordinary innovation programme of the DNV Group," explains Kevin Smith, Global Director Renewable Energy Services at DNV KEMA. "We have a long history of reinvesting a portion of our earnings into research and innovation efforts on the order of 6 per cent of earnings per year. In one of the programmes, impactful projects are developed that reach beyond incremental innovation and look at more significant changes possible in the three- to five-year time horizon.

"In this spirit, experts from solar energy, who have provided services to this industry in the US and beyond for more than 15 years, combined with the expertise of offshore and maritime teams looked into the future and developed a floating solar PV concept. This concept combines different elements of new knowledge or technology being developed in their respective industries."

The project focused on technologies that are available in the marketplace today, thus making the concept technically feasible and within an estimate cost of energy range that is plausible and comparable with emerging technologies.

The core of SUNdy is a 2 MW hexagonal array, which floats on the sea surface. The scalable design can be deployed independently or linked together with others, providing electricity that can grow with society's needs.

The SUNdy concept is made possible using thin-film 560 W solar panels. At present, wafer panels based on crystalline silicon solar cells are the most common, making up about 85 per cent of the installed market, but thin-film solar panels are cheaper and gaining market share, with efficiencies approaching those of crystalline silicone. These thin-film panels are flexible and lighter than the traditional rigid glass-based modules, allowing them to undulate with the ocean's surface.

The thin-film solar panels are mounted onto a pliable flotation mat, housing a three-phase micro inverter, converting direct current to alternate current, to create a simple plug-and-play module using marine grade connectors.

An array of SUNdy floating modules would be manufactured as a prewired unit, significantly reducing the number of electrical connections while also minimising the need for offshore assembly. A collection of these arrays, totaling 4200 solar panels, forms an expansive solar island the size of a large football stadium, capable of generating 2 MW of power. Multiple islands connected together constitute a solar field of 50 MW or more, producing enough electricity for 30 000 people. Islands would ideally be located in benign waters with depths ranging from 20-100 m and approximately five miles from shore away from shipping lanes.

The key to creating an ocean-based structure of this size is the use of a tension-only design. Rather like a spider's web, this dynamic, compliant structure yields to the waves, yet is capable of withstanding considerable external loads acting on it. Cables form the elegant hexagonal geometry employed to minimise the number of anchor points, while also allowing the energy islands to be nested or grouped.

Separating the solar arrays into prefabricated sections allows for large scale manufacturing and streamlined assembly offshore. The cable grid enables maintenance access in the form of floating gangways. Below the surface, the shape of the island is maintained by the tensile forces from the lengthy spread mooring.

The island has been optimised for solar capability and cabling efficiency. The solar arrays are divided into electrical zones feeding electricity produced into two main switches collecting the power for voltage step-up at a central transformer (2 MVA 480/34.5 kV). From the offshore solar farm's central island, 30 kV electrical transmission lines connect, tying other islands in series to form a closed loop and continue to the electrical substation onshore for grid connection.

SUNdy has a system-wide modular design including electrical connectors, arrays, cables and walkways, while the mid and perimeter markers are also common components and house water cannon for automatically cleaning the arrays. Perimeter buoys double as warning markers with navigational beacons. The entire island is therefore built up from a small number of repeated components. The modules have no moving parts, creating a reliable predictable and scalable system with low maintenance.

"Key areas where further technology breakthroughs would further enable this concept include developing more efficient and cost-effective thin film photovoltaic materials," said Smith. "Current thin-film technology is capable of meeting the large scale application envisioned in SUNdy. However, limits on the conversion efficiency (combined with the necessary structural element to enable the floating application) elevates the overall estimated cost of energy above that possible with glass panels installed on land."

Smith: the concept came out of an "extraordinary innovation programme" of the DNV Group

DNV KEMA also says that technology development around robustness and longevity of floating mats, lightweight yet robust tether systems and possibly dynamic anchoring systems could further enable the concept.

Smith said: "We envision numerous possible applications for floating solar PV across Southeast Asia, the Caribbean, and coastal cities, where floating solar could conceivably be deployed to bring utility scale renewable power generation close to demand.

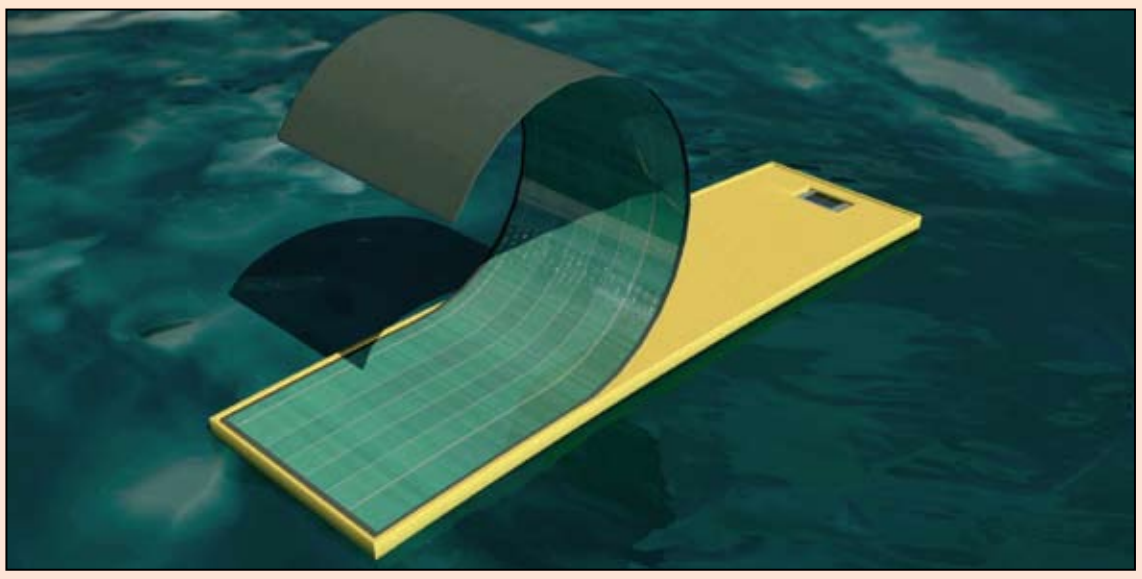
"In addition, floating solar PV could be deployed in response to natural disasters such as the earthquake in Haiti in 2010 or the tsunami's in 2011, and deliver crucial early stage power for relief operations while the grid infrastructure is being rebuilt."

The SUNdy concept has not been built or piloted but DNV KEMA says it expects to collaborate with industry partners and possibly research universities or institutes. This will allow it to move the project from conceptual development to more detailed engineering and pilot operation in order to prove the concept.

At this point, only limited economic analysis is possible given that pilot or full-scale deployment has not been achieved yet. In addition, PV technology continues its evolution of lower equipment and module costs with increased energy capture efficiency.

"We do understand and expect floating solar PV will still have a premium over land-based solar PV due to the added structural complexity needed in a floating deployment," Smith admitted.

He added: "For offshore wind, installed costs are higher than onshore but in many cases the wind resource is also greater, enabling a more competitive overall cost of energy. However, the solar resource is not significantly greater offshore than onshore, therefore the cost of energy will remain greater for floating solar PV than onshore PV. The challenge will then be to find the deployment situations where other factors inhibit onshore PV installation."



The thin-film solar panels are mounted onto a pliable flotation mat

Junior Isles

The reports of my death…

Professor Richard Lester speaking at the *SimWorld International* conference in Dubai in November said: "Predictions that we all heard in the immediate aftermath of the [Fukushima] accident that it would spell the end of nuclear energy have turned out to be exaggerated."

Looking at the fallout almost two years after the nuclear accident at the Fukushima Daiichi plant in Japan, Professor Lester's summation appears accurate. Certainly public resistance has grown since the accident and the future prospects for nuclear do not look as rosy post-Fukushima, yet the industry is very much alive and kicking.

Although there has been a great emphasis on expanding the use of renewables, it is probably fair to say that no single source of low carbon energy will be sufficient to achieve the targets set by major countries for reducing overall carbon emissions or carbon intensity.

"Without a major expansion of nuclear energy around the world it simply doesn't seem credible that the world will be able to achieve deep reductions in carbon dioxide and at the same time have even modest economic growth," said Professor Lester.

In his keynote address, Professor Lester – who is Japan Steel Industry Professor and Head of the Department of Nuclear Science and Engineering at the Massachusetts Institute of Technology (MIT), where he is also the faculty co-chair and founding Director of the MIT Industrial Performance Center – divided the world into four groups of countries.

There are the "retreaters", countries such as Germany, Switzerland and Italy; "advancers" like China, India, Russia and the UK; those that are "treading water" i.e. France, Sweden, Taiwan and the US; and the "new entrants", countries that are embarking on a nuclear programme for the first time, or seriously considering it.

> "Without a major expansion of nuclear energy around the world it simply doesn't seem credible that the world will be able to achieve deep reductions in carbon dioxide and at the same time have even modest economic growth"

This last group is a fairly large number of countries and in many ways is the most interesting group. In addition to the likes of Turkey, Belarus and a host of others, it notably includes several countries in the Middle East.

The United Arab Emirates heads this group, having started construction on the first of four reactors last July. The UAE hopes that nuclear energy will eventually help it meet 25 per cent of its consumption even as its economy expands. Importantly, in December it signed an agreement with Russia covering the development and use of civilian nuclear power. The agreement is a necessary precursor to commercial contracts that would involve the transfer of nuclear technology or material between the two countries.

A much more extensive programme is planned for Saudi Arabia. In November, *Saudi News Agency* reported that the Kingdom plans to build 17 nuclear reactors worth more than $100 billion by 2030 to help meet an electricity demand that is growing by 6-8 per cent annually. Dr Khalid Al Sulaiman, Vice-president of King Abdullah City for Nuclear Energy told the agency that some of these reactors are expected to be operational by 2020. He said that nuclear projects would be established after the approval of the national plan by the beginning of 2013.

Meanwhile, Jordan's plans for a commercial reactor are serious, if less concrete. There are firm plans for a research and training reactor, which was scheduled to begin construction last month (December). However, it is still too early to say with any high degree of certainty that a commercial nuclear programme will materialise. Much rests on how the reactor would be financed.

US nuclear energy consultants Lightbridge wrote the roadmap for the UAE's nuclear programme and helped in the reactor procurement. Its CEO, Seth Grae, commented: "Jordan is serious and is taking a careful look at it. They have a lot of expertise within the regulator and the generating company but we are not certain they will go forward with a commercial nuclear power programme. Financing is an issue – as it is everywhere with nuclear. It would be a major commitment by the government but we are seeing many creative ways of financing around the world."

He noted that Russia would build Turkey's first reactor and recoup its investment from electricity sales over a period of time. Indeed this looks like the route that Jordan is favouring.

Also speaking at *SimWorld*, Dr Khaled Toukan, Chairman of the Jordan Atomic Energy Commission (JAEC) said they were in the final stages of selecting the technology provider for its planned reactor.

"We have shortlisted two technologies and will select the provider by the second quarter of 2013. It will use Generation III or Generation III+ technology," he said.

He also pointed out that Jordan was soliciting proposals for a partner to take a 50 per cent equity share in the project, and proposals were scheduled to be received at the end of 2012.

"The government will give [the partner] a 15-year power purchase agreement. But having a strategic partner is key; the technology will not be selected until a strategic partner is in place. Having a strategic partner is a must," Dr Toukan stressed.

Post-Fukushima, financing nuclear plants will be a huge challenge for most countries considering nuclear. Yet for several countries in the Middle East, it makes perfect sense. It offers a path for wealthy oil and gas producers to meet growing power demand without eating away at increasingly valuable oil and gas exports.

There is also a strong rationale for countries that are energy resource-poor, like Jordan. The Kingdom imports around 95 per cent of its energy needs and until as recently as 2010 depended on Egyptian gas for 80 per cent of its electricity generation. Energy independence and security of supply are therefore the big drivers behind its desire for nuclear.

Dr Toukan said: "Every 10 years our demand for electricity doubles. We need viable and affordable power. We don't have big oil and gas resources in the country and have to diversify our energy resources away from hydrocarbons, which are becoming very high cost and have volatile prices."

The need for energy security was highlighted in 2011 when Jordan lost a big portion of its gas supply from Egypt as a result of the Arab spring and unrest in Egypt. Expensive oil was used to replace gas for power generation, which, according to Dr Toukan, resulted in direct losses amounting to $1440 million.

Nuclear no doubt faces huge challenges – not least the high construction costs, which became even more prohibitive due to increased safety requirements after Fukushima.

Nevertheless, the desire for energy independence and preserving hydrocarbon resources will continue to make it attractive in the Middle East. Elsewhere climate change will continue to be the major driver.

New analysis from Frost & Sullivan – *European Nuclear Power Sector* – claims that nuclear energy is the answer to meeting aggressive EU targets on carbon dioxide emissions and fossil fuels. It says that despite the environmental risks, nuclear energy shows potential to reduce emissions and dependence on fossil fuels, and therefore, will be a major contributor to the European energy mix in 2020.

"It is difficult to envisage Europe phasing out nuclear power from its energy mix, despite the antagonistic stance of countries like Germany, Switzerland, Italy and Belgium where there are likely to be embargoes on further nuclear power development," noted Frost & Sullivan Energy & Power Supplies Research Analyst, Neha Vikash. "Nuclear power will play an active role in Europe's energy generation and in meeting the region's environmental goals."

Such predictions are hard to dispute and it is unlikely that nuclear will ever disappear, despite the efforts of anti-nuclear hardliners.

"The news of my death has been greatly exaggerated" was a slightly skewered newspaper version of a famous line by 19th century American writer Mark Twain. Today power sector pundits in a post-Fukushima world might tailor Twain's quote to say: "Forecasts of the end of nuclear look exaggerated."