



## Nuclear special

An 8-page pull-out supplement on the nuclear power market

## Ready for the challenge

Øystein Løseth, Vattenfall's new CEO, gives *TEITimes* an insight into just what makes him tick. *Page 14*



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# THE ENERGY INDUSTRY TIMES

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# Support continues for CCS

Recent contracts for projects in Spain and France as well as significant announcements by the US Department of Energy demonstrates that progress in carbon capture and storage is gathering pace, says Junior Isles.

Spain, France and the US all announced significant projects that will help accelerate the deployment of carbon capture and storage (CCS) technology.

In late May, Foster Wheeler AG together with Spanish utility Endesa and the Spanish Foundation, Fundación Ciudad de la Energía (Ciuden), signed a grant agreement with the European Commission for €180 million of EU funding to support CCS technology development applicable to a 300 MWe oxy-combustion power

plant in Spain.

The project is one of six European CCS projects selected for funding under the EC's European Energy Programme for Recovery (EERP) and is unique in that it is the only such project utilising circulating fluidised bed (CFB) technology.

The goal of the project is to demonstrate all aspects of a commercial scale supercritical oxy-combustion CFB power plant with CO<sub>2</sub> capture, transport and storage in an underground saline aquifer for a wide range of domestic and imported

coals, petroleum cokes and biomass.

Endesa's Compostilla plant site has been identified as the location for this full-scale demonstration plant, based on preliminary positive geological surveys of nearby saline aquifers for storing the plant's CO<sub>2</sub>, and the ability to utilise the infrastructure at the existing coal-powered plant.

Notably, the plant will use Foster Wheeler's advanced Flexi-Burn CFB technology, which is not only capable of burning multiple fuels but is also capable of operating either in conventional or carbon capture mode.

In conventional mode, the unit is air-fired but when operating in capture mode, the CFB combustion process is supported by a mixture of oxygen and recycled flue gas. This results in producing a CO<sub>2</sub>-rich flue gas containing over 91 per cent CO<sub>2</sub>, which dramatically reduces the need for expensive and energy intensive CO<sub>2</sub> separation equipment.

Foster Wheeler believes the wide fuel and operational flexibility of its technology reduces commercial and technological risk and will allow faster

*Continued on page 2*

# Nuclear could meet one-quarter of 2050 power needs

Almost one quarter of global electricity could be generated from nuclear power by 2050, the International Energy Agency (IEA) said in a report published in June. According to IEA forecast, nuclear capacity could reach 1200 GWe by 2050, providing 24 per cent of global electricity.

The report came as several countries announced recent decisions to build new nuclear capacity.

On June 17, the Swedish parliament approved a government bill on building new nuclear reactors. The bill was passed by a margin of two votes with 174 against 172 after a debate in the 349-member parliament.

The vote reverses a decision in 1980 to phase-out nuclear power, which accounts for about half of Sweden's

total power production.

Sweden has 10 nuclear reactors and it is expected that new nuclear reactors will be built on the existing sites.

In the run-up to the vote, 50 members of the environmental group Greenpeace were arrested after they breached security fences and unfurled banners at a nuclear plant in Forsmark, north of Stockholm.

Meanwhile in the Middle East, Jordan and Japan agreed on the terms of a nuclear cooperation deal, potentially boosting the chances of a French-Japanese consortium slated to bid to build the Arab nation's first nuclear plant.

Kamal Araj, the deputy chief of the Jordan Atomic Energy Commission, said the deal helps outline the terms

under which Jordan can import a reactor for the planned plant.

Jordan recently short-listed a French-Japanese consortium, as well as a Canadian and a Russian company, for the plant. Bids will be invited within a year.

With US backing, Jordan wants to build a nuclear plant by 2019 to tackle its growing energy needs and reduce spending on energy, which consumes roughly 20 per cent of its annual budget.

Turkey also signed a memorandum of understanding (MOU) with South Korea to cooperate on nuclear power projects, raising the possibility that Seoul would win a plant order from Ankara later this year.

Under the MOU signed between the two countries' energy ministers, South Korea and Turkey will work together on the construction of nuclear power plants in Sinop, Turkey, following an

agreement in March between their state-run firms.

Further east, Vietnam recently said it plans to build eight nuclear power plants by 2030 as the Southeast Asian country strives to meet rising energy demand.

In late June, Prime Minister Nguyen Tan Dung approved eight nuclear facilities, each with at least four reactors, to be built in central Vietnam with a total output of 15 000-16 000 MW over the next two decades.

In November, Vietnam's National Assembly approved the construction of two nuclear power plants in the central province of Ninh Thuan. The two plants, with a total capacity of 4000 MW, are expected to cost \$11 billion.

Last year, Vietnam signed a deal with Russia under which a Russian firm will help build the first plant. Construction is to start in 2014 and be completed in 2020.

*(Continued from page 1)*

wide-scale adoption of CCS. It also says it has the potential to significantly lower the cost of carbon capture as compared with other CCS technologies.

Another CCS technology also received a boost at the end of May when the EDF Group awarded a contract to Alstom to develop, construct, operate and test in partnership an industrial demonstration facility to capture CO<sub>2</sub> at the Le Havre coal fired electric power plant in France.

The project will demonstrate the operability and efficiency of post-combustion CO<sub>2</sub> capture utilising the advanced amine process jointly developed by Alstom and Dow Chemical Company.

Amine-based technologies are already widely used in a number of gas treatment applications in the chemical and hydrocarbon sectors. The advanced amine process to be tested at Le Havre has been specifically developed to capture the CO<sub>2</sub> emitted by burning coal, oil or gas. The demonstration facility will help to verify the optimised performance of this advanced technology, particularly with regards to energy consumption and flexibility in an industrial setting.

Reduction of CO<sub>2</sub> emissions from industry will be important in global efforts to combat climate change.

Accordingly, in June US Energy Secretary Steven Chu announced that three projects have been selected to receive up to \$612 million from the American Recovery and Reinvestment Act – matched by \$368 million in private funding – to demonstrate large-scale CCS from industrial sources.

Potential additional applications for funding of large-scale industrial CCS projects are pending further review.

Last month also saw the US DOE sign a cooperative agreement with NRG Energy Inc. (NRG) for the Parish post-combustion CCS project to design, construct, and operate a system that will capture and store approximately 400 000 tons of CO<sub>2</sub> per year.

The system will employ Fluor's Econamine FG Plus technology to capture at least 90 per cent of the CO<sub>2</sub> from a 60 MW flue gas stream of the 617 MW Unit 7 at the W.A. Parish Generating Station in Thompsons, Texas.

While there have been a number of successful demonstrations of the capture portion of CCS technology, many believe the long term storage aspect could present challenges. The US DOE is therefore also working on this part of the technology chain.

In a significant development, scientists at the Office of Fossil Energy's National Energy Technology Laboratory, successfully tested its 'Sequre' tracer technology to detect and track the movement of carbon CO<sub>2</sub> in underground geologic storage reservoirs.

The test was carried out at the San Juan Basin coal-bed test site in New Mexico. The San Juan Basin is considered one of the best sites worldwide for coal-bed methane recovery, as well as a prime site for CO<sub>2</sub> sequestration.

# Siemens focuses on Russia as Brussels probes Areva NP agreement

■ Brussels investigates 'non-compete' clause  
■ Siemens forms ties with Russian gas sector

Junior Isles

Competition officials at the European Commission are probing the acrimonious nuclear joint venture between France's Areva and Germany's Siemens after the German company complained to regulators about a previously undisclosed 'non-compete' clause.

The developments come as Siemens attempts to set up a competitor to Areva with the Russian state nuclear company, Rosatom, having announced last year that it wanted sell its stake in Areva NP to the French group.

If the complaint is upheld, it could potentially accelerate the creation of the rival Siemens-Rosatom joint venture.

Government officials said it was far too early to judge the significance of the probe. Regulators will focus on contracts activated after Areva agreed to buy out Siemens' 34 per cent stake. The German engineering giant pulled out of the unit, complaining that its minority shareholding did not give it enough say over the business.

Siemens is looking for a bigger role in the nuclear sector and believes it can get this through a tie-up with Russia, a market that plans to massively expand its own nuclear installed base and also increase the export of its technology.

Siemens is not only limiting its Russian ambitions to the nuclear sector. In late May, Siemens Energy and ZAO Iskra-Avigaz set up the new joint venture LLC Russian Turbo Machinery for the manufacturing of gas pipeline compressors in Perm, Russia.

The project provides investments for foundation of the new "green field" manufacturing plant and a stepwise ramp-up of production capacity within the next three years. Siemens will hold 51 per cent of the shares and Iskra-Avigaz the rest. The combined investment is approximately €60 million. The localisation of production in Russia will serve the needs of the customer OAO Gazprom.

"Russia is a strategic market for Siemens," said Tom Blades, CEO of the Oil & Gas Division of Siemens Energy. "Looking back on a 150-year



Tom Blades: Russia is a strategic market

history of Siemens in Russia this project once again underlines the commitment of our company to this important market."

More recently, Gazprom JSC and Siemens signed a Memorandum of Understanding to cooperate in the area of liquefied natural gas (LNG) technology development and will carry out a number of joint development programmes.

At the signing, which took place at the St. Petersburg International Economic Forum, Peter Löscher, CEO of Siemens AG said: "Siemens has always put special attention to cooperation in and with Russia. We are actively developing our business in Russia by making large investments in local facilities along with

implementing energy-efficient and environmentally friendly technologies."

The energy sector is playing an important role in the company's performance. In its third fiscal quarter results which ended on June 30, Siemens said that it had seen an earlier than expected recovery in the energy sector.

Wolfgang Dehen, head of Siemens' energy sector said that clients were ramping up investments in new projects. "Although not all our divisions have yet hit the bottom, the energy market is currently reaching a trough," he said.

Siemens has previously expected orders in the energy sector to bottom-out in the second half of 2010.

## Looming solar tariff cuts cast shadow on Spain

The prospect of retroactive cuts in subsidies for solar power is casting a shadow over what was the leading market for photovoltaic installations just two years ago.

The Spanish government's plans to retroactively reduce subsidies for solar photovoltaic (PV) plants could damage the sector and have a negative impact on future investment.

Hit by the recession, the government plans to retroactively cut by 30 per cent of what existing PV generators receive per kWh, by either cutting feed-in tariffs or capping the number of production hours receiving the subsidy. The plans could come into law as early as this summer.

The plans have caused a backlash from investors and financial institutions, which say they call into

question legal security in the country.

In a letter to the Prime Minister José Luis Rodríguez Zapatero, a group of 10 international investors with € billion invested in the Spanish PV market warn that the cut will "result in the loss of nearly all our shareholders' funds and clients' pension and insurance funds invested in the equity of these projects".

Banks, which have provided up to 85 per cent of financing for an estimated 50 000 PV plants in Spain, are also concerned. The Spanish Banking Association in a letter to Industry Minister Miguel Sebastián,

said that the country's legal security is at stake. It said: "Any alteration to the tariff ... would be damaging to the sector and its financiers ... and set a precedent which would end up seriously complicating Spain's ability to attract investors and financial institutions."

Energy and engineering company, Abengoa, expects its profits to be affected, at least temporarily, by the planned subsidy changes.

The government wants to cut € billion per year from the costs of producing and delivering electricity to consumers. In the past it has kept prices

low through a regulated tariff, a strategy that has resulted in a €18 billion accumulated deficit.

Driven by a very favourable subsidy regime, in 2008 Spain led the world in terms of new PV capacity, installing 2600 MW during that year. Since 2002, €23 billion has been invested in the sector – a quarter of that coming in 2008. However, a dramatic slowdown saw just 69 MW installed in 2009.

The situation has not been helped by abuse of the subsidies, which has seen some wind producers registered as solar generators to claim higher subsidies.

## Obama running out of time on climate bill

US president Barack Obama is running out of time to gain a consensus on a climate bill ahead of the mid-term congressional election campaign.

With what looks set to be a tough mid-term campaign, based on the president's low approval ratings for Congress, Democrats are worried that the 2010 electoral cycle could lead to Obama losing control of both houses. This would seriously impede his ability to push through a climate bill.

In late June Obama made a renewed push to spur the Senate into action on

climate change saying the BP oil spill underlines the urgency for the country to reduce its dependence on fossil fuels.

A cap-and-trade bill passed through the House of Representatives last year but the process has stalled in the Senate amid objections from Democrats representing industrial and rural states. Republicans have since backed away too. A major sticking point has been the bill's approach to carbon emissions, which are blamed for global warming. Capping carbon pollution and putting a price on it is at the heart of the bill. Republicans reject the

idea, calling it a carbon tax.

Independent Joe Lieberman of Connecticut, a Senate sponsor of the climate and energy bill, says about 50 senators support the bill while 30 others oppose it. That leaves about 20 senators undecided.

Sen. Jay Rockefeller wants Congress to halt work – at least for now – on any comprehensive legislation to reduce greenhouse gas emissions and foster alternative energy sources that would help curb global warming.

The West Virginia Democrat said lawmakers should focus instead on channelling more government money to developing clean coal technologies and tackling the oil drilling disaster in the Gulf.

"We need to set aside far-reaching climate proposals and work right now on

energy legislation that protects our economy, protects West Virginia and improves our environment," Rockefeller said.

Spurred by the Gulf of Mexico oil spill, California legislators are working towards adopting the nation's toughest renewable energy law to reduce the state's dependence on oil and serve as a model for other states.

The law would require privately and publicly owned electric utilities to generate a third of their power from wind, solar and other clean sources by 2020, according to the *Los Angeles Times*.

According to the latest energy outlook from the US government's International Energy Agency, global greenhouse gas emissions are likely to rise by 43 per cent in the next 25 years if countries fail to take rapid action.

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# Gulf spill shows addiction to oil

The environmental impact of the BP Gulf oil spill could provide renewable energy firms with a platform for growth, but the right policies and financing must still be in place, writes Siân Crampsie.

The oil spill in the Gulf of Mexico represents a chance for renewable energy companies in the USA to communicate the benefits of clean energy, says the country's green lobby.

President Barack Obama compared the policy implications of the Gulf spill to those of 9/11 and said in an Oval Office address that the disaster would "shape how we think about the environment and energy for many years to come".

An estimated 5000 barrels per day of crude oil is leaking from the BP deep sea well platform located around 50 miles south of Venice, Louisiana. The environmental fallout of the incident is leading Americans to think about the country's so-called "addiction to oil", according to the American Wind Energy Association (AWEA).

"All Americans' hearts go out to the victims of the Gulf tragedy. Their suffering sadly represents our continued addiction to oil," commented AWEA CEO Denise Bode. "That addiction also provides a teaching

opportunity to make a choice and to begin the transition to renewable energy and create an industrial hi-tech economy.

"The President set the right tone in his speech ... and now it is up to Congress to enact policies that will add millions of American jobs and utilise our own domestic sources of clean, renewable, and efficient energy."

But while the disaster presents an opportunity for renewable energy companies and for President Obama to push his plans for clean energy growth forward, investments in the energy sector – conventional or otherwise – are likely to be held back until some form of climate legislation is passed.

In May Alliant Energy President Bill Harvey told the Wisconsin State Journal that the company had shelved plans for the construction of new coal-fired capacity until climate legislation was in place because it was politically "too risky".

Plans for energy investments are also being hampered by economic

conditions. The Global Wind Energy Council said in June that private sector investment is essential for a successful transition to low-carbon technologies.

Nevertheless a number of key renewable energy projects in the US are moving forward.

In early June San Diego Gas & Electric (SDG&E) introduced two new solar power demonstration installations at its El Cajon, California operations centre. They are a demonstration of Infinia's PowerDish technology, which uses a mirrored disc to concentrate the sun's energy onto a compact Stirling engine, and a demonstration of Concentrator Photovoltaic (CPV) technology from SolFocus that concentrates sunlight onto high-efficiency photovoltaic (PV) cells.

"The concentrated solar technology we are hosting on our property is more than a bright idea conceived in the lab, it represents the potential leading edge of new and practical forms of renewable power," said James P. Avery, senior vice president of power supply for SDG&E. "Hosting these



demonstration projects on our property provides us the opportunity to determine the real-world applications of these systems and their potential on a utility scale."

The demonstrations are expected to continue for 12 to 18 months, after which SDG&E will share the results with the manufacturers.

SDG&E has committed to source one-third of its electricity from renewable sources by 2020. It has

signed a power purchase agreement to buy electricity from Imperial Valley Solar, a 750 MW project based on solar Stirling technology from Tessera Solar. Its Californian counterpart, Southern California Edison, is to buy power from another solar Stirling project – the 850 MW Calico Solar project.

The two projects will break ground in late 2010 and are scheduled to start generating power in early 2011.

## Record funding for GEF

- Pledges include Copenhagen fast-start funding
- Canada commits to 50 per cent increase

The Global Environment Fund (GEF) says that record financial pledges from donor countries will help it in its programme to tackle climate change and five other critical environmental focal areas.

The GEF is the world's largest public environment fund and says that 30 nations have pledged \$4.25 billion for its programmes over the next four years. The pledges represent the largest ever increase in funding for the GEF and were "the first significant multilateral step toward the commitments in Copenhagen on climate change", said the organisation.

Around \$1.35 billion of funding will be programmed for the GEF's climate change focal area. "This replenishment is the first tangible confirmation of the financial commitments made in

Copenhagen last December, including some of the Fast-Start Financing, in particular, through the creation of a new initiative inside the GEF linked to sustainable forest management-REDD Plus," explained Monique Barbut, CEO of the GEF Secretariat and Co-Chair of the replenishment negotiations. "It is now the GEF's responsibility to transform these resources into concrete results on the ground."

Canada's environment and international cooperation ministries said that Canada had increased funding by 50 per cent to C\$238.4 million for the four-year funding period. "With increasing threats from climate change, pollution, and shrinking biodiversity, the GEF is helping developing countries to meet the



Monique Barbut:  
CEO of the GEF  
Secretariat

world's goals for development, climate protection, and the conservation of natural resources," said Minister of International Cooperation Beverley J. Oda.

"The additional \$18.5 million per year makes our contribution to the GEF Canada's first instalment on our climate change fast-start funding as part of our commitment under the Copenhagen Accord," said Canadian Environment Minister Jim Prentice.

"Over 50 per cent of Canada's total four year contribution to the GEF will be spent on activities to help developing countries in their efforts to address climate change through both mitigation and adaptation."

The GEF's climate change portfolio helps developing countries to boost clean energy use and reduce fossil fuel consumption. It is one of the largest funding agencies of renewable energy in the developing world.

## Mexico opts for clean energy technologies

A major waste-to-energy plant to be built in the northern Mexico state of Coahuila will help the country to meet greenhouse gas emission targets.

The proposed Madero plant will feature Latin America's largest biodigester and will produce electricity as well as fuel ethanol.

Mexico has set a target of reducing greenhouse gas emissions by 50 per cent below 2002 levels by 2050 and its government is promoting a number of initiatives to help achieve this.

GE and Abengoa recently announced plans to invest \$180 million in the development of Mexico's largest cogeneration plant. The plant will be fuelled with natural gas and as a combined heat and power plant it is classed by the government as an energy efficient technology.

The 300 MW facility will be located at the Nuevo Pemex gas processing complex, owned by Pemex Gas y Petroquímica Basica, a subsidiary of Mexican state oil company Pemex. Located near Villahermosa, Tabasco, the plant will supply Nuevo Pemex with power and steam under a 20-year services agreement.

## Brazil moves to boost energy sector

The signing of a power agreement with Peru and the issue of a construction permit for a nuclear power plant will significantly boost Brazil's energy sector.

In June Brazil and neighbouring Peru signed an energy cooperation agreement, paving the way for the process of building interconnections.

The energy agreement signed by the leaders establishes general rules for Brazil's participation in hydroelectric

projects in Peru and allows the export of surplus electricity to Brazil. Brazilian President Luiz Inacio Lula da Silva put the generation potential of the projects at 7200 MW.

Meanwhile, work on completing Brazil's Angra III nuclear power plant is set to go ahead after regulators in the country issued a construction permit.

State-owned Eletronuclear, a subsidiary of Eletrobras, received

notification of the permit from the National Nuclear Energy Commission at the end of May. The plant will take 66 months to complete.

Angra III will have a generating capacity of 1270 MWe and will provide a significant boost to Brazil's generating capacity and diversity. Electricity consumption in the country has now returned to pre-economic crisis levels and is expected to continue to grow, according to EPE, Brazil's

Energy Research Company.

Brazil wants to build more nuclear reactors and its Energy and Mines Ministry is studying the construction of up to four 1000 MW plants by 2030. It is planning to use its own uranium reserves in the programme.

Angra III will be built by French engineering firm Areva, which the government says will also be considered for the supply of further reactors.

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# Pakistan Five-year Plan to end power shortages

Pakistan has outlined a new Five-Year Plan which the country hopes will see an end to its energy shortages within five years. **Syed Ali**

The Pakistan Electric Power Company (Pepco) is working on a Five-Year Plan aimed at adding 10 000 MW to the national grid by 2015. The recommendations of the plan, which will be completed shortly, will soon be forwarded to the government for implementation.

The multi-billion dollar Public Sector Power Enhancement Plan (2010-15) comes in response to queries raised by the Senate Standing Committee on Finance.

In May, Pakistan's power shortfall surged to 5010 MW, with generating

capacity recorded at 10 306 MW against a total requirement of some 15 316 MW.

In his brief to senators in the parliament house, Tahir Basharat Cheema, managing director of Pepco, stressed that the survival of the country depended on the survival of the power sector.

Giving details of the different power projects mainly benefiting Balochistan and the entire country, Cheema informed the committee that a feasibility report on the construction of a 600 km transmission line between

Zahedan (Iran) to Quetta (Pakistan) has been completed. He said the \$600 million project, which would allow the import of 1000 MW of power from Iran, would be completed in four years.

Cheema also said that the transmission line would be connected with the national grid at Quetta as power forecasts suggest that power demand in Balochistan will increase from 850 MW to 2000 MW in years to come.

Under Pepco's plan, coal will be the main source for power generation. "If we are not able to utilise coal as the main source of generation, the country will not be able to stop the flood of price hikes," Cheema stressed.

Cheema also said that a list of "US Signature Projects" or projects to be financed with the US assistance, are yet to be finalised and initiated.

Delegations from Pakistan and the US met in June to continue a partnership on energy issues. This

meeting of the energy working group under the US-Pakistan Strategic Dialogue follows the October 2009 and March 2010 bilateral energy dialogues.

Discussions focused on short- and medium-term steps to address Pakistan's current energy shortfall and the means to return the sector to a sustainable footing.

In late May, Prime Minister Syed Yousuf Raza Gilani announced the vision statement for the power sector developed by the Ministry of Water and Power, in consultation with the key stakeholders.

In his vision statement, Gilani said the government has undertaken to double the power generation capacity of the country, from the current 20 000 MW to 40 000 MW within the next ten years and to ensure that this capacity development happens along as low a carbon emission path as possible.

## China seeks to balance ETS with economic growth

The Chinese government is currently setting up a state-guided carbon market, aimed to be in operation by 2014, which will see Chinese firms set "half-mandatory" emission reduction targets.

China's plans for a national emissions trading scheme (ETS) in the next few years represents an attempt to rein in the country's greenhouse gas (GHG) emissions. Current proposals see the scheme covering a range of pollutants, including GHGs, acid rain-causing sulphur dioxide and water pollutants.

However, the ETS that is implemented will have to balance international pressure to improve China's emissions record with the country's desire for high economic growth. The government has made it clear that the quest for economic growth takes precedence over environmental concerns.

Industry analysts, Datamonitor, says this raises concerns about how stringent China's ETS would be and whether it would have any real impact on efforts to reduce global warming.

China is the world's biggest emitter of CO<sub>2</sub> and the government has set a target of reducing its emissions intensity (the amount of CO<sub>2</sub> emitted for each unit of economic output) by 40-45 per cent compared to 2005 levels by 2020. However, due in part to the emphasis on heavy industry in the last fiscal stimulus, energy intensity in the country is actually increasing at the moment, with CO<sub>2</sub> emissions having risen by 1.4 per cent in the first quarter of this year.

At the beginning of June, Zhang Lijun, vice minister of environment said China's efforts to cut its greenhouse gas emissions is facing challenges and the situation is not "optimistic".

China relies heavily on coal to sustain its economy and carbon capture technology has been identified as key to cutting GHG emissions. Its first commercial carbon capture and storage plant being built by Shenhua Group at a liquefaction facility in Ordos City is expected to be operational by the end of the year.

The country is also looking to further exploit its use of hydropower resources, a strategy which was boosted last month with the full start-up of the country's first 800 kV HVDC link. Siemens Energy and China Southern Power Grid put the second pole of the link into operation, doubling the transmission capacity to 5000 MW. The line will transport huge amounts of hydropower from Yunnan Province to Guangdong Province.

The link may bring some ease to generators that are being squeezed by high coal prices. Some power plants in Shanxi province have received notice from state-owned coal companies that coal prices would be raised by 60 yuan/tonne from June 1.

The National Development and Reform Commission, China's top economic planner and pricing regulator, recently said that it would not exclude the possibility of intervening by launching a power-coal price linkage within 2010. The power-coal price linkage is an electricity policy aimed at streamlining power and coal prices.

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# Calls for reform as Vietnam suffers power shortages

Blackouts in Vietnam are generating political pressure to break up state utility Electricity Vietnam (EVN).

"The shortage will last forever unless EVN is reformed," said Hoang Van Dung, deputy chairman of the Vietnam Chamber of Commerce and Industry.

With demand for electricity growing at 15 per cent per year, analysts blamed the power cuts on the country's failure to attract sufficient foreign investment in new power plants. They say foreign investors have been discouraged by EVN's monopoly over generation and distribution and regulated low power prices.

Although the government has raised the fines it charges EVN for unexpected outages, many believe it is still far too low to have an effect.

Cao Sy Kiem, former head of Vietnam's state bank told the *Financial Times*: "To solve the roots of the problem, we have to break EVN's monopoly."

Responding to calls for reform, Pham Manh Thang, director of the ministry's Electricity Regulatory Authority said: "There is only one plan to reform EVN, and we, the Ministry of Trade and Industry, submitted it to the government. I don't know whether it has been approved or not."

Despite the calls for reform, Vietnam has still attracted some level of international investment. On June 1, EVN inked a contract worth \$981 million for the construction of a coal fired plant with Japan's Marubeni Corp. With a capacity of 600 MW, the Nghi Son 1 power plant, located in Tinh Gia district of Thanh Hoa province, will provide an annual generation of 3.6 billion kWh.

In April, US power plant developer AES signed a deal to invest \$400 million in a 1200 MW coal fired plant.

These plants are two of many large projects currently under way that will

ease the long-term power situation.

In June, Prime Minister Nguyen Tan Dung approved the construction of the 1200 MW Lai Chau hydropower plant. Construction is expected to start in late 2010, with the first turbine to be put into operation in 2016 and finished in 2017.

The country also recently announced that it expected to build a pumped-storage hydropower plant with total capacity of 1500 MW in the northern mountainous province of Son La in 2013. The plant will be the first pumped-storage hydroelectric power station in the country. It is expected to be operational in 2018.

## Philippines makes low carbon moves

The Philippines' efforts to develop low carbon generation will benefit from financing from the Asian Development Bank (ADB).

The ADB has said it is willing to invest at least \$1 billion in the next five years for the country's renewable and energy efficiency programme.

Sohail Hasnie, ADB principal energy specialist for Southeast Asia Department, said the \$1 billion investment could provide 1000 MW of combined renewable energy and other energy projects.

Hasnie said the majority of the financing will be in the form of loans and also through grants and added that the ADB will coordinate with the Department of Finance and the National Economic Development Authority (NEDA) to identify the beneficiaries and recipients of the funding.

He said the ADB is already in talks with the Philippines for a \$125 million funding for a 100 MW solar power project it secured through the World Bank's Clean Technology Fund but there was no final sealing of the project yet.

Philippines progressed its plans for clean generation last month with the establishment of the Wind Energy Development Association of the Philippines (WEDAP).

WEDAP is composed of 14 firms led by EDC, Alternergy Philippines Holdings Corp., Trans Asia Oil and Energy Development Corp., Petro Energy Resources Corp. UPC Renewables Corp. and Northwind Development Corp.

"The association's main function is to promote and support the development of wind power as a viable energy resource, particularly in this period of policy formulation under the Renewable Energy Act," Niels Jacobsen, WEDAP president.

In a separate development, Clenergen Philippines Corporation said it has started installation of its first 2 MWe biomass gasification power plant on the island of Romblon.

Commenting on the project, Mark Quinn, executive chairman of Clenergen said: "The negative emission generated from gasification biomass power plants will support the Philippine government's target of lowering emissions by up to 20 per cent over the next 10 years."

Clenergen intends to have installed over 500 MW of power generation facilities by 2014.

## Egat upgrades to avert shortage

Expected delays of a year or more in completing new power plants will force the Electricity Generating Authority of Thailand (Egat) to upgrade some old generators to serve as temporary substitutes.

"The delay in constructing new IPP (independent power producer) plants is likely to cause a shortage of power by 2011-12," said Egat governor Sutat Patmasiriwat.

The two delayed power plants have a total capacity of 2000 MW.

Egat is expected to upgrade old generators to produce up to 2000 MW, including its gas fired South Bangkok plant and its coal-fired Mae Mo site in Lampang. The total cost of the upgrades is around Baht 2 billion (\$62 million).

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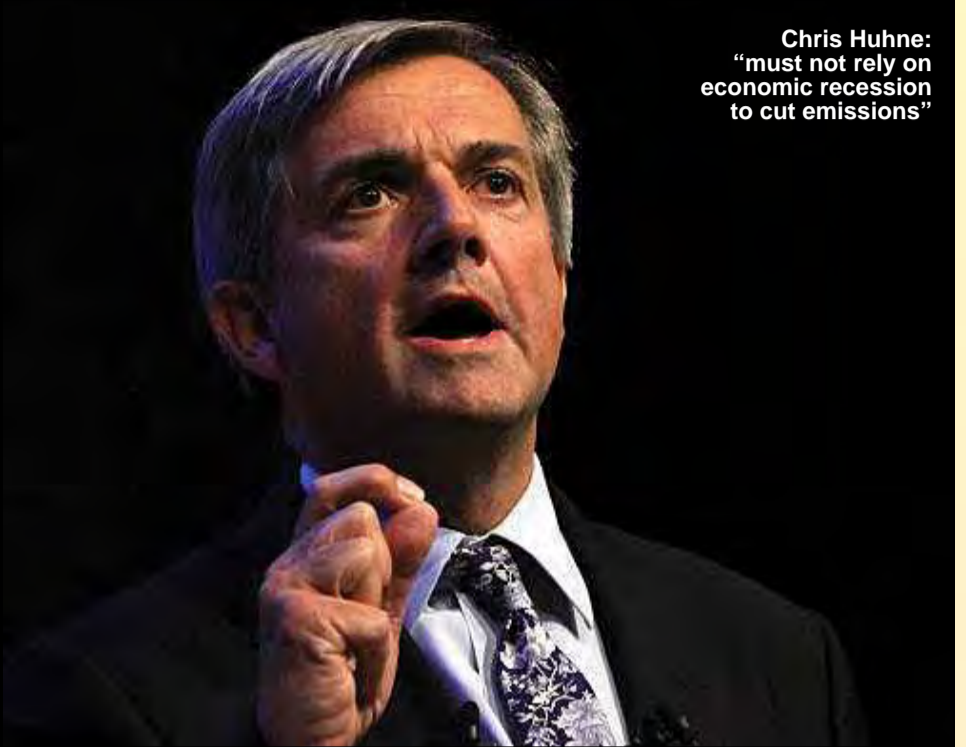




# UK considers step change in policy amid tighter budget

The UK must do more to cut carbon emissions, says a new report.

Chris Huhne:  
"must not rely on  
economic recession  
to cut emissions"



Sian Crampsie

Britain's new coalition government is reviewing the country's energy policy in order to adhere to the Prime Minister's 'green' pledges while dealing with national debt.

The Conservative-Liberal cabinet is keen to capitalise on the country's renewable energy resources as a means of boosting economic growth but says that the transition to a low carbon economy will require additional private sector funding.

In June the UK's Committee on Climate Change (CCC) warned the government that more action is required if the country is to meet its target of cutting greenhouse gas emissions by 80 per cent by 2050.

The CCC's second progress report to parliament came just a week before the government's emergency budget announcement, which set out a plan

for reducing the budget deficit and promoting economic growth.

In the budget the government said that the UK needs £200 billion of investment to 2020 to provide secure low-carbon energy. The government is counting on a mixture of renewables, low-carbon technologies and nuclear energy to help achieve greenhouse gas emission targets.

According to the CCC's report, a "step change" in the pace of underlying emissions reductions is still required in the UK if it is to meet legislated carbon budgets. It says that emissions in the UK have fallen by 8.6 per cent over the past year, but this is almost entirely due to a reduction in economic activity and an increase in energy prices.

"The recession has created the illusion that progress is being made to reduce emissions," said Chair of the CCC Lord Adair Turner. "So we are

repeating our call for new policy approaches to drive the required step change, in order that the UK can ensure a low-carbon recovery."

The new government has already made a number of pledges regarding energy efficiency, energy security, smart grid development, energy market reform and regulating emissions from coal-fired power plants. However, the CCC says that more needs to be done.

One of the CCC's key recommendations is that the proposed emission performance standard (EPS) for coal-fired power plants should also be developed for application to natural gas-fired plants. This would help to ensure a continued role for coal in the 2020s and keep a renewed 'dash for gas' in check.

It has also recommended that carbon capture and storage (CCS) technologies currently being developed for coal-fired plants should be applied

to natural gas-fired combined cycle plants. The committee says that the government's promise to fund up to four CCS trials on coal-fired plants should be altered to include at least one gas fired plant.

Other recommendations from the CCC include reform of the electricity market to introduce a new system with appropriate incentives for investment in secure and low-carbon generation.

"As the Climate Change Committee makes clear, we mustn't rely on economic recession to cut emissions," said Energy and Climate Change Secretary Chris Huhne. "There has to be an enduring shift to low carbon, driving growth in new technologies, and it must be locked into the fabric of our economy in good times and bad.

"This government will be the greenest ever. We will overhaul the energy efficiency of homes through our Green Deal, we are working to

create a Green Investment Bank to help low carbon investment, and we have committed central government itself to cut emissions by ten per cent within a year."

The government also says it will publish proposals to reform the climate change levy in order to provide more certainty and support for the carbon price. The CCC says that there is a strong case for the introduction of a UK carbon price floor.

One victim of the government's spending review was Sheffield Forgemasters, which in March agreed a £80 million loan from the UK's previous government to build a 15 000 tonne press capable of making large parts for nuclear reactor pressure vessels.

The new government has cancelled the loan, a move described by the Department for Business as "essential" for reducing the deficit.

## Ireland examines grid report

■ Wind power poses technical challenges

■ Wave project takes shape

The Republic of Ireland must make additional adaptations to its power system if it is to achieve its target of generating 40 per cent of its electricity from renewable resources by 2020, according to a new report.

Commissioned by EirGrid, the country's transmission system operator, the study shows that while the power system could handle 40 per cent renewable electricity penetration, the expected high levels of wind generation pose problems.

"Already, at times, the Irish system

has been operated with levels of up to 50 per cent generation from renewables," said EirGrid Chief Executive Dermot Byrne. "These studies are the first of their kind and will help enable us to develop operational strategies to achieve Ireland's renewable energy targets."

In a statement EirGrid said that the study analysed the technical challenges of high instantaneous penetrations of wind and has provided "unprecedented results" that "will allow the development of a secure reliable

operational strategy by 2020 consistent with the policy targets".

Ireland is expecting to meet much of its renewable energy target through the addition of wind power projects. Northern Ireland is currently considering setting similar targets.

The Irish Wind Energy Association said recently that the green economy could become a major export market for Ireland and Northern Ireland if the right structures and strategies were put in place.

In June Electricity Supply Board

International (ESBI) and Vattenfall unit Tonn Energy signed an agreement to develop ocean wave energy projects off the west coast of Ireland. The first project would have a generating capacity of up to 10 MW.

Head of Ocean Energy at Vattenfall, Ulf Tisell, said: "Ireland is a strong candidate for the development of large quantities of clean ocean energy because of its massive natural wave resources. Once proven, we envisage investing significantly in ocean energy."

## German utilities meet Merkel

The heads of Germany's main utilities have met with the government to voice their opposition to a proposed nuclear tax.

E.On, EnBW, RWE and Vattenfall AB would have to pay an estimated combined €2.3 billion per annum under the scheme, proposed by Chancellor Angela Merkel as part of a new austerity package.

The utilities fear that the tax – paid on the production of electricity from Germany's 17 operating nuclear power plants – would undermine their finances at a time when significant investments in energy infrastructure are required. The government says that the tax is a necessary measure to keep a ceiling on the country's debts.

The government says that the proposed tax and the issue of nuclear plant life extension are not linked. The government is due to publish a final decision on nuclear plant extensions this month (July).

## EWEA says investor confidence remains strong

The European Wind Energy Association (EWEA) is predicting another strong year for the wind power sector in 2010 in spite of concerns over financing and subsidies in the current economic climate.

In its latest analysis of the market, EWEA says that 2009 was a record year for wind power installation in Europe and that it expects the trend to continue in 2010. "What is encouraging is that, unlike in 2009, the 2010 results consist of orders placed after the start

of the financial crisis," said EWEA CEO Christian Kjaer.

"This shows continued and strong investor confidence in the technology."

Current government spending reviews are putting energy subsidies – including those underpinning the renewable energy market – at risk. Moves in Spain to cut subsidies for solar photovoltaic (PV) plants have alarmed investors and utilities alike.

In the UK, Dong Energy CEO Anders Eldrup has sought assurance from the

government that subsidies for offshore wind power will continue after the current system of rules expires in 2014, according to the *Financial Times* newspaper.

Dong officially inaugurated the 172 MW Gunfleet Sands offshore wind farm in the UK last month. It is also building the 630 MW London Array project and recently received the concession from the Danish Energy Agency to construct a 400 MW offshore project off the Danish island of Anholt.

According to EWEA, up to 1 GW of new offshore capacity will be installed in 2010, compared with 577 MW installed in 2009. The UK is likely to lead the offshore market.

The organisation expects France and Italy to again install around 1 GW each in 2010. The expected decline in installations in Spain will be more than compensated for by a doubling of installations in the new member states, particularly Romania and Bulgaria, says EWEA.

# Saudi Arabia signs new agreements



**John Krenicki: wants to be efficiency partner**

Saudi Arabia is continuing to expand and diversify its electricity sector to help overcome rapidly rising energy demand.

Above-average temperatures in June caused power failures in the west of the country, where electricity demand is rising at 7-8 per cent per year.

The Saudi Electricity Company (SEC) said that the high demand for electricity to power air conditioners

## ■ Fuel research centre planned ■ PPA signed for Riyadh 11

forced eight turbines to go offline, cutting off supplies to several cities.

However the company has told local media that shortages are unlikely for the rest of the summer. Blackouts are not uncommon during the summer months and the high temperatures have also caused problems in Kuwait and Iraq.

Saudi Arabia's energy demand growth rate and investment programme is attracting major energy companies and investors from across the world. The country is aiming to develop conventional and renewable generating capacity, improve energy efficiency as well as build new nuclear power plants to add 60 GW to the grid by 2020.

"Saudi Arabia is one of the fastest growing countries in the world in terms of energy consumption and water consumption, so GE wants to be Saudi Arabia's efficiency partner and technology partner on both the water front and the power front," said John Krenicki, President and CEO of GE Energy.

Commenting on an announcement by GE and the King Fahd University of Petroleum and Minerals to establish a new fuel research centre in Saudi Arabia, Krenicki said that energy efficiency was the company's "top priority in Saudi Arabia".

The Dhahran fuel research centre

will focus on furthering the understanding of alternative fuels produced in Saudi Arabia and identify ways to overcome technical barriers and promote the use and distribution of these fuels. The programme is expected to improve the region's ability to maximise the use of alternative fuels and increase fuel efficiency for power plant and refinery applications.

GE is also investing \$80 million in the development of a 10 000 m<sup>2</sup> manufacturing technology centre that will be its largest repair centre of excellence worldwide. It is also eyeing Saudi Arabia's plans to develop solar, wind and nuclear capacity.

Last month SEC signed a power purchase agreement for the Riyadh 11 project, one of six independent power projects under way in Saudi Arabia that will add a total of 11 GW of capacity to the grid.

Riyadh 11 is being developed by a consortium of GDF Suez, Aljomaiah Holding Co of Saudi Arabia and Japan's Sojitz Corporation and will produce 1730 MW of power when it is completed in March 2013. Total investment in the project is \$2.1 billion, says GDF Suez.

Equipment for the gas-fired plant is being supplied by GE and Hyundai Heavy Industries.

# Masdar reviews city project



**Dr. Sultan Al-Jaber says 'ecopolis' project will not be scaled back**

Abu Dhabi is expected to reveal a new master plan this month for its flagship zero-emission Masdar City project after conducting a review of the development.

Dr. Sultan Al-Jaber, Chief Executive of the emirate's Masdar Initiative, told the *Emirates News Agency* that plans for the \$22 billion 'ecopolis' project would not be scaled back.

The review of the project – a 6.5 km<sup>2</sup> city designed to showcase a variety of renewable energy technologies as well as other advanced clean energy technologies – has been carried out in response to the global economic crisis which has resulted in delays as well as staff redundancies.

Masdar City is the cornerstone of the Masdar Initiative, a programme of investment designed to transform Abu Dhabi into a major developer and exporter of renewable and clean energy technologies.

Other aspects of the Masdar Initiative are moving forward. Last

month saw the appointment of Total and Abengoa Solar as Masdar's partners to build, own and operate the Shams 1 concentrated solar power (CSP) in the UAE.

At 100 MW, Shams 1 is being claimed as the world's largest CSP plant but has also been hit by delays. Philippe Boisseay, Total's president of gas and power told the *Financial Times* that Abengoa and Total worked for a year to reduce the costs of the project.

The Masdar Initiative also includes an Institute of Science and Technology established in conjunction with the Massachusetts Institute of Technology, a venture capital firm and Masdar Carbon, a unit that invests in CDM projects. Masdar City will host the headquarters of the International Renewable Energy Agency (Irena) and is also aiming to attract numerous international companies.

So far, only GE has committed to renting space in the city when it opens its first phase in 2016.

## Wind firms look to Kenya

Kenya is hoping to attract international energy companies to help it develop its wind power sector.

The government wants wind energy to play a part in overcoming electricity shortages in the country and has already implemented a feed-in tariff system for wind and other renewables.

A number of companies, GE included, are reported to be carrying out feasibility studies into the potential for wind energy in the country. Three wind power projects with a total capacity of 365 MW are currently planned, including the 300 MW Lake Turkana project in northern Kenya.

Developers of the Lake Turkana project have already signed a power purchase agreement with Kenya Power and Lighting Company and is aiming to start power production from the site in mid-2011. Turbines for the site will be supplied by Vestas.

Government figures show that Kenya has an installed power capacity of around 1500 MW and needs to add a further 2000 MW by 2014.

# New President revives sell-off plans

## ■ New nuclear considered ■ Gas supply agreement in the pipeline

Nigeria is considering the possibility of selling off its power system in order to boost investment and overcome chronic power shortages.

President Goodluck Jonathan is reported by local media to be keen on a plan to restructure the industry and sell-off assets, a move that could earn up to \$4 billion as well as trigger the investments required in the country's electricity sector.

Power shortages have crippled the country's economy and other plans to mobilise funds have all but failed. In February this year the government said

it would invest \$1 billion in the power sector and also pledged to intensify efforts to implement the National Integrated Power Projects.

Privatisation of the electricity sector could involve the break-up of the Power Holding Company of Nigeria (PHCN) into 11 electricity distribution companies and six generating companies.

In addition to building new generating capacity, investors would have to spend money on repairing existing infrastructure and overcome issues such as power theft.

President Jonathan, who was sworn

in at the beginning of May, is also pushing for the development of nuclear power in Nigeria.

Available generating capacity has fallen to as low as 2500 MW in 2010 as the result of gas shortages. Available generating capacity at the end of 2009 was closer to 4000 MW.

Nigeria's government is reported to be close to signing a new gas supply contract with Addax Petroleum Corp to supply power plants with fuel.

Nigeria's National Integrated Power Projects programme was designed to add 1 GW to the grid by 2010.

## World Bank supports Egypt renewable strategy

Egypt says that a World Bank loan of \$220 million will help to support its renewable energy strategy.

The World Bank has approved the loan to support Egypt's Wind Power Development Project, with \$150 million being financed from the Clean Technology Fund (CTF). The loan was approved in June and follows a \$600 million loan agreed earlier that month for the Giza North power project.

The wind sector loan will help Egypt to develop transmission infrastructure and construction of the first 250 MW wind project in the Gulf of Suez and Gabel El-Zait. The World Bank says that up to 7200 MW of wind power could be developed by 2022 in the Gulf of Suez alone.

The Giza North project comprises development of a 1500 MW combined cycle gas turbine power plant near Cairo.

# World Nuclear Review

July 2010 Supplement

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# Reviving an industry

The global nuclear revival is gathering pace. In an effort to meet increasing electricity demand and combat climate change, many countries are resurrecting what was not so long ago thought to be a dying industry. **Junior Isles.**

Most forecasts predict a slight drop in the share of nuclear power in the power generation mix through 2030. The IAEA projections give nuclear power a 13.5 to 14.6 per cent share in electricity production in 2020, and 12.6 to 15.9 per cent in 2030. The International Energy Agency's (IEA) *World Energy Outlook 2009*, projects that the share of nuclear power will decrease from about 14 per cent in 2007 to 11 per cent in 2030.

But despite this fall in global market share, there will be a significant amount of new generation in the coming years with the two key drivers being electricity demand, which will double by 2030, and the need to cut global CO<sub>2</sub> emissions to prevent climate change.

According to the World Nuclear Association (WNA), there are currently 436 commercial nuclear power reactors operating in 30 countries. With a total capacity of about 372 GWe, they provide roughly 15 per cent of the world's electricity. A WNA projection shows that installed nuclear capacity will reach at least 1100 GWe, and possibly as much as 3500 GWe, by 2060.

Some 50 reactors are currently under construction around the world. Another 130 or more are planned to come online during the next 10 years and there are over 200 further back in the pipeline.

A number of countries in Europe have either come out strongly in support of nuclear or are at least seriously considering it. Among the newer EU members, these include: Poland, Czech Republic, Hungary, Bulgaria, Romania, Slovakia and

to replace its ageing nuclear fleet and has already established a number of sites.

The UK government's firm commitment to the future of nuclear energy is due to energy security concerns following the retirement of its nuclear plants and the need to limit CO<sub>2</sub> emissions. The country has 19 reactors generating up to one fifth of its electricity and all but one of these will be retired by 2023. Under the current plan, the first of 16 GWe of

1600 MWe at Borssele, and began seeking preliminary approvals for it in June last year. Delta plans to start building in 2013 and have the plant operational in 2018, using MOX fuel.

Most recently, the Swedish parliament voted to overturn a 30-year-old ban on the construction of new nuclear reactors and to allow the replacement of the country's existing fleet of 10 reactors, which are due to begin decommissioning from 2020.

The nuclear debate has also been re-

would add 2-3 GWe per year to 2030.

At the start of this year, the government approved the federal target programme designed to bring a new technology platform for the nuclear power industry based on fast reactors. Rosatom's long-term strategy up to 2050 involves moving to inherently safe nuclear plants using fast reactors with a closed fuel cycle.

Nuclear will play a central role in the Russian economy. In addition to building domestic plants, it also hopes to export as much as 300 GWe of new nuclear capacity by 2030.

In neighbouring Ukraine, the government plans to maintain the nuclear share in electricity production to 2030. This will involve substantial new build.

While Russia will have a significant programme, most new build will be in Asia – mostly in China and India.

In China, nuclear power has an important role, especially in the coastal areas remote from the coalfields and where the economy is developing rapidly.

Mainland China has 11 nuclear power reactors in commercial operation, 20 under construction, and more about to start construction.

Additional reactors are planned, including a number of third generation reactors, to give a six-fold increase in nuclear capacity to at least 60 GWe or more by 2020, and then a further increase to 200 GWe by 2030.

Meanwhile the last 12 -18 months has seen a great deal of international attention focused on India.

Because India is outside the Nuclear Non-Proliferation Treaty due to its

## ...the Swedish parliament voted to overturn a 30-year-old ban on the construction of new nuclear reactors...

Slovenia.

Within the longer-standing member states, France and Finland are notably pioneering the next generation of nuclear technology with both countries building what will be building the first Generation III reactors. Meanwhile, both the UK and Italy have both announced their intentions to revive their nuclear power programmes.

While much remains to be done in Italy, the UK has made concrete plans

new-generation plants could be on line as early as 2017.

With some countries having made firm commitments, others are now coming around to the idea.

In the Netherlands, public and political support is increasing for expanding nuclear energy and a previous decision to phase out nuclear power has been reversed. In September 2008 Delta announced that it would build a second unit of 1000-

opened in Europe's economic powerhouse, Germany, which is planning to shut down its nuclear plants by 2020. With a new government in 2009, the phase-out is on hold.

Europe's neighbours Russia, the main supplier of gas to Europe, is progressing with plans for a greatly expanded role for nuclear. It plans to double nuclear output by 2020. In 2006 the government projected it

*Continued on page 2*

*(Continued from page 1)*

nuclear weapons programme, for the last 34 years it has been largely excluded from trade in nuclear plant or materials. This hampered its development of civil nuclear energy until 2009.

Following the Nuclear Suppliers Group agreement, which was achieved in September 2008, the scope for supply of both reactors and fuel from suppliers in other countries became possible. To date, civil nuclear cooperation agreements have been signed with the USA, Russia, France, UK and Canada (pending), as well as Argentina, Kazakhstan, Mongolia and Namibia.

The country already has a flourishing and largely indigenous nuclear power programme and expects to have 20 000 MWe nuclear capacity on line by 2020 and 63 000 MWe by 2032. It aims to supply 25 per cent of electricity from nuclear power by 2050.

Now, foreign technology and fuel are expected to boost India's nuclear power plans considerably. All plants will have high indigenous engineering content.

Like India, neighbouring Pakistan

may draw controversy over its announcement earlier this year that it is to build two more units at Chashma. Pakistan has just 425 MWe of nuclear capacity but plans to increase this substantially.

At the end of April the Chinese Foreign Ministry said that Chinese and Pakistani officials had signed an agreement to finance the construction of two nuclear reactors to be built by Chinese firms. Under the agreement, Chinese companies will build at least two new 650 MW nuclear reactors at Chashma in Punjab province. The two units are to be completed in eight years.

Nuclear plans are also taking shape in a number of countries in southeast Asia. Vietnam, Indonesia and Malaysia are all planning to pursue the nuclear option. At the end of May Vietnam selected Russia as its partner to build two nuclear power plants, each with a capacity of around 2000 MW, in Ninh Thuan. Construction of the first plant will kick-off in 2014 and the first turbine will be put into operation in 2020.

The two mainstays of nuclear in Asia – Japan and South Korea – will also

be making significant new capacity additions.

In Japan, the country's 54 reactors provide almost 30 per cent of the country's total electricity production, from 47.5 GWe of capacity (net). There are plans to increase this to 41 per cent by 2017.

South Korea, notably, will not only be making significant capacity additions but is also positioning itself to become a major exporter of nuclear technology.

Nuclear energy is a strategic priority for South Korea and capacity is planned to increase by 56 per cent to 27.3 GWe by 2020, and then to 35 GWe by 2030. Today 20 reactors provide almost 40 per cent of South Korea's electricity from 17.7 GWe of plant.

In a high profile bid at the end of last year, a consortium led by Korea Electric Power Company beat consortiums led by Areva and GE Hitachi to supply four reactors to the United Arab Emirates. The four reactors will have a total capacity of 5.6 GWe and are scheduled to start-up by 2020

Indeed the Middle East is becoming an important region for international companies. In addition to the UAE, Israel, Syria and Jordan all announced their nuclear ambitions at an international conference held by the Organisation for Economic Cooperation and Development (OECD) in Paris in March.

Civil nuclear programmes in the Middle East are being closely scrutinised by Europe and the US. The US has imposed sanctions on Iran on suspicion that the country is developing a uranium enrichment programme in order to develop nuclear weapons. Iran says that the programme is for civil nuclear purposes.

While seeking to prevent Iran from developing nuclear, the US itself is hoping to revive its own nuclear power industry. The USA is the world's largest producer of nuclear power, accounting for more than 30 per cent of worldwide nuclear generation. The country's 104 nuclear reactors produced 809 billion kWh in 2008, almost 20 per cent of total electricity output.

Following a 30-year period in which

few new reactors were built, it is expected that between four and eight new units may come on line by 2018, the first of those resulting from 17 licence applications to build 26 new nuclear reactors made since mid-2007.

Elsewhere in the Americas, Canada plans to expand its nuclear capacity over the next 10 years by building as many as nine new reactors with a total capacity of up to 9 GWe. Four reactors are planned in Ontario, one is proposed in New Brunswick and one (or possibly four smaller reactors) in Alberta.

Construction on Brazil's third reactor is about to commence. In Argentina, which has two nuclear reactors generating nearly one-tenth of its electricity, completion of a third reactor is expected early next year.

Mexico, the location for the COP16 meeting on climate change later this year, is now showing support for expanding nuclear energy to reduce reliance on natural gas.

No doubt the nuclear industry will be hoping for a positive outcome in Cancun later this year, as climate change will continue to be a clear driver in the nuclear revival.

# Can Italy deliver on its nuclear ambition?

Despite the government's plans to revive its nuclear industry, experts familiar with the Italian energy sector are less optimistic about the prospects of nuclear power plants being erected across Italy any time soon. **Francesca Fox**

## Italy

The Italian government is pressing ahead with plans to reignite the country's dormant nuclear industry. Shortly after the third Silvio Berlusconi-led coalition took power in the spring of 2008, plans were announced for an imminent return to nuclear power.

Following the announcement, in early 2009 Italy's Enel joined forces with EDF of France to cooperate on the construction of at least four third-generation nuclear power plants in Italy, starting from 2020. More recently, Germany's E.ON and French multi-utility GDF Suez created a partnership to "explore nuclear opportunities in Italy".

The government's intentions are clear: in its draft renewable energy action plan, released on June 11, the ministry for economic development mentions nuclear power as one of the tools, alongside renewables and energy efficiency, that Italy intends to deploy to achieve its security of supply and climate goals.

But experts familiar with the Italian energy sector are less optimistic about the prospects of nuclear power plants being erected across Italy any time soon.

Italian nuclear plants were decommissioned after a referendum

in 1987 annulled legislation allowing their construction and operation.

While popular opposition to nuclear energy is less strong now than in the immediate aftermath of the Chernobyl disaster, the prospect of nuclear power plants in their backyards continues to fill Italians with dread. Mr Berlusconi himself has felt compelled to announce plans for a year-long campaign of television commercials extolling the virtues of nuclear power plants to Italians.

On the other side of the fence, Green Party Leader Angelo Bonelli has claimed that "tanks on the streets would be needed to build nuclear plants in Italy".

Independent polls show Italians to be fairly evenly split over the pros and cons of nuclear power. But stronger feelings emerge when the practicalities are discussed. During the April 2010 electoral campaign for local authorities, candidates from the government coalition parties were all supporting nuclear power but guaranteeing to their prospective voters that plants would not be sited in their area.

Environmental campaigners and politicians on the left have already said they will promote a referendum to annul Italy's new pro-nuclear legislation. Meanwhile, a lawsuit filed in the Constitutional Court by several Italian regional authorities against a

centralised and streamlined approval process for nuclear power introduced by the government has been rejected. This is a significant boost for the government's policy of a swift return to nuclear energy generation.

Beyond the legal arguments, the economic case for nuclear power generation is also under scrutiny.

Alfiero Grandi of left-wing green organisation Sinistra Ecologia e Libertà says that the costs of building, operating and decommissioning nuclear power plants in Italy would be far higher than promoting energy efficiency and renewable sources.

He also argues that a few large nuclear power plants would not create as many jobs – and over a long timescale – as a much larger number of decentralised renewable energy-fuelled plants.

Alarm bells are also ringing concerning the possibility of criminal involvement in a new nuclear programme. According to the latest annual report on environmental crime by green group Legambiente, criminal gangs are heavily involved in illegal waste handling and the construction business. Generous public funding has recently attracted criminal gangs to the lucrative wind power business. It is hard to refute concerns that criminals would seek to get a slice of the nuclear cake too.

But beyond the legal, economic and



**Berlusconi: compelled to announce plans for a year-long campaign of television commercials extolling the virtues of nuclear power plants to Italians**

environmental arguments, the issue of social acceptance continues to dominate the debate. Although nuclear plants will probably be built in Italy, it is likely to take a few more years.

Expert Piero Risoluti summed it up well: "The thorniest issue is not what type of plants, how many, when or even at what cost – but rather where to build them with the consensus of the local population."

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**HITACHI**



# Why the world has a growing appetite for nuclear energy

The benefits of nuclear power are numerous. In addition to being a weapon against climate change, it offers countries a chance for electricity independence. **Luis Echávarri**

## Industry View

In March, the OECD Nuclear Energy Agency (NEA) co-organised with the French government the first *International Conference on Access to Civil Nuclear Energy*, which was a major success with more than 62 countries represented and 1200 participants.

The significance of this event cannot be overlooked: nuclear energy raises an increasing interest among countries, both newcomers and experienced. Several rationales explain this renewed appetite for nuclear energy.

First, global warming brings about an urgent need for CO<sub>2</sub> emission reductions while there is a mounting awareness that nuclear power is emitting virtually no CO<sub>2</sub>, or at the level of renewable energies. Cutting CO<sub>2</sub> emissions implies a global shift to a low carbon economy. And, as a matter of fact, the alternatives to nuclear energy are limited today.

The central finding of the *Nuclear Energy Technology Roadmap*, recently published by the International Energy Agency (IEA) and the NEA, is that almost one quarter of global electricity could be generated from nuclear power,

making nuclear energy a major contributor to cutting greenhouse gas emissions. The related expansion of nuclear power does not require a major technological breakthrough and the roadmap describes it as ambitious but achievable.

The future of conventional resources is also a rationale. Fossil fuels may become less available in the forthcoming decades. For the sake of future generations and the environment, the depletion rate of natural resources, such as oil and gas needs to be controlled. Moreover, accidents associated with oil drilling and shipping are causing alarming levels of environmental damage; the possibility of new deep sea oil drilling is now questioned by some.

The nuclear community should obviously not rest on its laurels in the light of recent dramatic events in other energy sectors; however it should be recognised that over the past two decades, nuclear safety performances have been kept at very high levels.

Another, and related, strong argument in favour of nuclear power is its potential contribution to the security of energy supply. Nuclear energy is fuelled by uranium. Soon, the biannual edition of the NEA/IAEA so-called "Red Book"

on the world's uranium resources, production and demand will be released and is expected to show that currently identified uranium resources are already sufficient for over 100 years of supply (at 2008 levels of consumption), being available in geographically diversified, politically stable regions.

Future advanced nuclear systems would multiply by roughly 50 times the amount of energy extracted from one kilogram of uranium. All this will eventually bring nuclear energy into the family of virtually renewable sources.

Last but not least, nuclear-generated electricity is very competitive in most countries and its cost is very stable. The *Projected Costs of generating Electricity, 2010* edition, a joint publication recently released by the IEA and the NEA, provides in-depth analyses on this subject and evidence about the competitiveness of nuclear power, with the latest data available for a wide variety of fuels and technologies, including coal and gas (with and without carbon capture), nuclear, hydro, onshore and offshore wind, biomass, solar, wave and tidal as well as combined heat and power (CHP).

Even though nuclear power looks good economically, its development is still

dependent on a number of key factors. It is still a challenge to finance such projects for some countries, particularly in developing countries. It is therefore fundamental that public development banks finance nuclear power plant projects. Developing the necessary manufacturing capacities, which have disappeared in some countries, is also key.

Last but not least are human resources. Engineers, scientists and technicians are needed in many fields. This is an issue but also a considerable opportunity for countries launching nuclear programmes, it means they start a process that will build skills and create jobs over a long period of time. In fact, uranium accounts for less than 5 per cent of electricity generating costs in nuclear power, the rest can be considered as "human brain".

In that way and to conclude, nuclear energy may illustrate Jean Bodin's quote: "there is no richness except humans" because countries which decide to include nuclear in their energy mix will rely essentially on their own workforce, rather than imported commodities.

*Luis Echávarri, is Director-General of the OECD Nuclear Energy Agency*



*The opinions expressed and arguments employed herein are those of the author and do not necessarily reflect the official views of the OECD or of the governments of its member countries*

# Safeguarding the renaissance

As the nuclear industry continues to evolve technologically, the IAEA will need to be prepared to safeguard new, more advanced and larger-scale nuclear fuel cycle facilities. **Olli Heinonen**

## Non-Proliferation

Interest in nuclear energy production is increasing across the globe, much of which is centred in Asia. At the start of 2010, there were 437 nuclear power reactors in operation and another 55 were under construction. More than 60 countries – mostly in the developing world – have said they might be interested in launching nuclear power programmes. Some projections indicate that this 'nuclear renaissance' could lead to as many as 480 new reactors on line by 2030.

As a result, the number of facilities that will be subject to safeguarding by the International Atomic Energy Agency (IAEA) looks set to increase significantly. At the end of 2009, in accordance with agreements with host governments, the IAEA was already applying safeguards covering over 1100 facilities and related locations, including 229 power reactors and 153 research reactors.

The IAEA was established over 50 years ago to help States reconcile the dual nature of the atom: to ensure that nuclear energy would serve peace and development, and not weapons. Hence, the IAEA developed a safeguards system that was intended to provide assurance to the international community that nuclear material and other specified items are not diverted from

peaceful uses.

By signing up to the Nuclear Non-Proliferation Treaty (NPT), all States without nuclear weapons are obligated to accept the IAEA's right, through a Comprehensive Safeguards Agreement, to apply safeguards to verify that fact. The safeguards system is based on an assessment of the correctness and completeness of what a State declares to the IAEA concerning nuclear material and nuclear-related activities.

Until the early 1990s, the IAEA's safeguards approach was based on 'nuclear material accountancy',

particular to enhance the IAEA's ability to detect possible undeclared nuclear material and activities. This proved a major catalyst for the development of important new tools for verifying the completeness of States' declarations.

In 1997, a Model Additional Protocol was agreed, under which a State is required to provide the IAEA with broader information covering all aspects of its nuclear-fuel-cycle-related activities, including research and development and uranium mining.

States must also grant the Agency broader access rights thereby

integrated safeguards the IAEA is able to adopt a more customised approach, better suited to the specific circumstances of a particular State.

This creates a "win-win" situation for both the State and the IAEA. While the IAEA can focus its verification where it really matters, confident that increased rights of access are available should they be required, the State enjoys a reduced level of routine inspection work. Both parties can save time and money without sacrificing quality of assurance that non-peaceful activities are taking place.

The discovery in Iraq after the 1991 Gulf War of a clandestine nuclear weapons programme, part of which had been concealed within Iraq's declared nuclear programme, highlighted the need to strengthen the IAEA safeguards system

complemented by containment and surveillance measures (e.g. applying seals, continuous observation by cameras). Although these continue to be important, the implementation of safeguards has evolved in response to new challenges, the development of new technologies, and on the basis of practical verification activities.

The discovery in Iraq, after the 1991 Gulf War, of a clandestine nuclear weapon programme, part of which had been concealed within Iraq's declared nuclear programme, highlighted the need to strengthen the IAEA safeguards system and in

enabling IAEA inspectors to fill in any gaps in information. As such, implementation of the Additional Protocol, to which over 100 States have now signed up, significantly increases the IAEA's ability to verify the peaceful use of all nuclear material.

The combination of a Comprehensive Safeguards Agreement and an Additional Protocol enables the IAEA to apply safeguards more efficiently and effectively in what are referred to as 'integrated safeguards'. Rather than applying safeguards in a prescriptive manner, under

As the nuclear industry continues to evolve technologically, the IAEA will need to be prepared to safeguard new, more advanced and larger-scale nuclear fuel cycle facilities, and more States are likely to seek help from the IAEA.

In 2009, 58 Member States of the IAEA participated in regional or national technical cooperation projects related to the introduction of nuclear power. The IAEA's assistance to such countries includes technical guidance, advice on best practice, and direct training.

At the same time, the IAEA is able to provide assistance related



to the refurbishment and modernisation of ageing existing nuclear research reactors (three-quarters of which have been in operation for more than 20 years).

Working closely together, the IAEA, national governments and the nuclear industry, can both help to meet increased demand for nuclear energy, and continue to provide credible reassurance to the world that this is being used exclusively for peaceful purposes without imposing an undue burden on industry.

*Olli Heinonen is Deputy Director General, Department of Safeguards, IAEA.*



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# Generation III takes centre stage

While much of today's existing nuclear power capacity is based on proven, Generation II designs, it is the advanced Generation III and III+ reactor designs that will meet the demands of the nuclear renaissance. **Siân Crampsie**

## Generation 3 reactors

Nuclear technology companies around the world are busy developing advanced reactor designs. Early Generation III reactors have been in operation since the mid-1990s and Generation III+ designs are now being constructed in Asia and Europe. Other designs are still under development.

Learning from major nuclear incidents such as Three Mile Island and Chernobyl, and accounting for the demands of competitive electricity markets, reactor suppliers have introduced major enhancements to their designs to improve safety and reduce construction times as well as operating and maintenance costs.

Generation III reactor designs therefore have simpler, more rugged designs over their predecessors, with greater levels of standardisation to help speed up the licensing process as well as construction times. They also have longer operating lives – around 60 years – and in some cases are designed for load-following.

A key evolutionary feature from Generation II to III designs is the use of passive safety features that rely on gravity and natural convection rather than active controls or operational intervention in the event of a malfunction. In addition to enhancing safety, these features have led to significant reductions in equipment

and therefore major savings in plant costs and construction times.

It was the 1990s that saw the first Generation III reactor to be certified and start operating, with GE's Advanced Boiling Water Reactor (ABWR) entering operation at unit 6 of the Kashiwazaki-Kariwa power plant in Japan. Today the ABWR reactor is the foundation of GE Hitachi's (GEH's) advanced reactor portfolio, with four units operating in Japan and another three units under construction – one in Japan and two in Taiwan. Nine more units are planned in Japan and two in the USA.

The ABWR is licensed in Japan, Taiwan and the USA, and has a proven construction schedule of 39 months from first concrete to first fuel load – an achievement made possible by the

reduction in capital and operation and maintenance (O&M) costs compared with previous BWR designs.

GE Hitachi has continued the development of its BWR technology with the Economic Simplified Boiling Water Reactor (ESBWR), a 1500 MW-class reactor design that is currently undergoing design certification in the USA. Combined Operating Licenses (COLs) for four ESBWR units have been submitted in the USA.

GEH's ESBWR technology is a Generation III+ design that is distinguishable from the ABWR by its simplified design and the reduction of active systems. Its evolutionary design features, such as passive safety systems and natural circulation, not only enhance safety but also cut construction and operating costs.

Westinghouse's AP1000. The two-loop, 1090 MWe plant uses the same basic design of the AP600, a 600 MWe PWR that emerged from Westinghouse's PWR technology development programme of the 1980s.

The main purpose of developing the AP1000 was to retain the same design objectives and licensing basis of the AP600 while optimising the power output. Simplification was also a major design objective. As a result, the AP1000 generating costs are expected to be very competitive, according to the World Nuclear Association.

The construction schedule for the AP1000 is 36 months, achieved through modular construction and a smaller footprint compared with other PWRs. In designing the AP1000, Westinghouse has reduced the number

of pumps required by 35 per cent, the amount of safety-related piping by 80 per cent and the number of safety-related valves by 50 per cent.

Four AP1000 units are now under construction in China and are scheduled to start operating between late 2013 and 2015. The AP1000 has been given as the preferred technology for 14 new nuclear units in the USA. In Europe, Westinghouse has also applied for generic design assessment in the UK, and has also been certified as compliant by the European Utility Requirements.

In Europe the first Generation III+ reactor to enter the construction phase is the European Pressurised water Reactor (EPR) at the much publicised and delayed Olkiluoto 3 project in Finland. Developed by Areva's nuclear unit, the EPR is a 1650 MWe reactor designed on the basis of the German Konvoi and French N4 reactor types. Its design incorporates both active and passive safety systems and will achieve significant reductions in uranium consumption compared with existing PWRs.

Of all the Generation III light water reactors, the EPR is expected to be most flexible in terms of load-following and will also have the highest thermal efficiency, at 36 per cent. These performance levels have been achieved through the use of an axial economiser inside the steam generator that allows a higher level of steam pressure, and a heavy neutron reflector surrounding the reactor core that lowers uranium consumption.

While Finland's Olkiluoto and another EPR project under construction in Europe – at Flamanville in France – have suffered from negative publicity due to delays and cost overruns, utilities around the world have expressed confidence in the EPR design. Two further units are under construction in China, and four Combined Operating Licenses referencing the EPR have been submitted to the US NRC.

Utilities have also expressed interests in developing EPR projects in the UK, Italy and India. An EPR unit will also be developed at Penly, in France. Design certification for the US version of the EPR is expected in 2012. Elsewhere in Europe, work is in progress on a number of Generation III reactors in Russia based on VVER-1000 and VVER-640 designs. Most recently Russian firm Atomstroyexport commissioned two light water VVER-1000 reactors at the Tianwan nuclear power plant in China. Other units are being developed in Russia, India, Ukraine and Bulgaria.

The Tianwan plant comprises two VVER-1000/428 reactors, an improved version of the VVER-1000/320 reactor incorporating features such as four-train safety system redundancy, a core melt localisation device, and entirely digital I&C system and double-wall containment. The design for Tianwan underwent IAEA verification and was confirmed as complying with international standards for safety and safety-related systems.

Further work on the VVER-1000 design has resulted in the VVER-1000/466 reactor, which has been selected for two new reactors being built at Belene, Bulgaria. This design incorporates a 60-year design life, an increase in the maximum average fuel burn up, reduced outage times and an increase in availability, and improved load following. Additional passive safety systems have also been incorporated into this 1060 MWe reactor.

Another Generation III nuclear reactor to feature enhanced passive safety systems is AECL's Advanced Candu Reactor (ACR). In designing the ACR series, Canada's AECL has moved away from using heavy water for cooling to a reactor that uses light water cooling and heavy water as a moderator. The ACR1000, a 1200 MWe, Generation III+ reactor, has become the focus of AECL's activities.

While retaining key strengths of the Candu series such as passive safety systems, a simple fuel bundle design and a horizontal fuel channel core, AECL has added key innovations to the ACR1000. These include a compact core design, the use of higher pressures and temperatures to improve thermal efficiency, enhanced passive safety features and a four-division separation of essential operational and safety systems.

These features, together with advances made in project engineering, construction and manufacturing, have resulted in reduced capital cost and construction schedule for the ACR1000. The design-basis lifetime capacity factor for the ACR1000 is greater than 90 per cent over its 60-year operating life.

The design has been reviewed by domestic and international regulatory bodies and has received a positive response regarding its licensability in Canada and abroad. The Canadian regulator, the Canadian Nuclear Safety Commission (CNSC) completed Phase 1 and 2 pre-project design reviews and concluded in August 2009 that there are no fundamental barriers to licensing the ACR1000 design in Canada. The generic ACR-1000 PSAR was completed in September 2009; the final stage of the ACR-1000 design is currently underway, to be completed in 2011, and will be the basis for new-build construction projects.

AECL is providing technical support to Ontario Power Generation in its Darlington site environmental impact review and site licence application for new build. This process is scheduled for completion in May 2011.

...reactor suppliers have introduced major enhancements to their designs to improve safety and reduce construction times as well as operating and maintenance costs...

use of large, pre-fabricated modules.

The 1350 MW (net) ABWR is a light water reactor that reflects the evolution of GE's boiling water reactor technology, incorporating technologies such as fine motion control rod drives and reactor internal pumps that improve both the plant operating performance and safety. Operating ABWRs have also demonstrated a

In designing the ESBWR, GEH has eliminated 11 systems from previous designs as well as reduced the number of pumps, valves and motors by 25 per cent. It estimates construction schedules to be 42 months.

The first Generation III+ reactor design to receive final design certification from the US Nuclear regulatory Commission was

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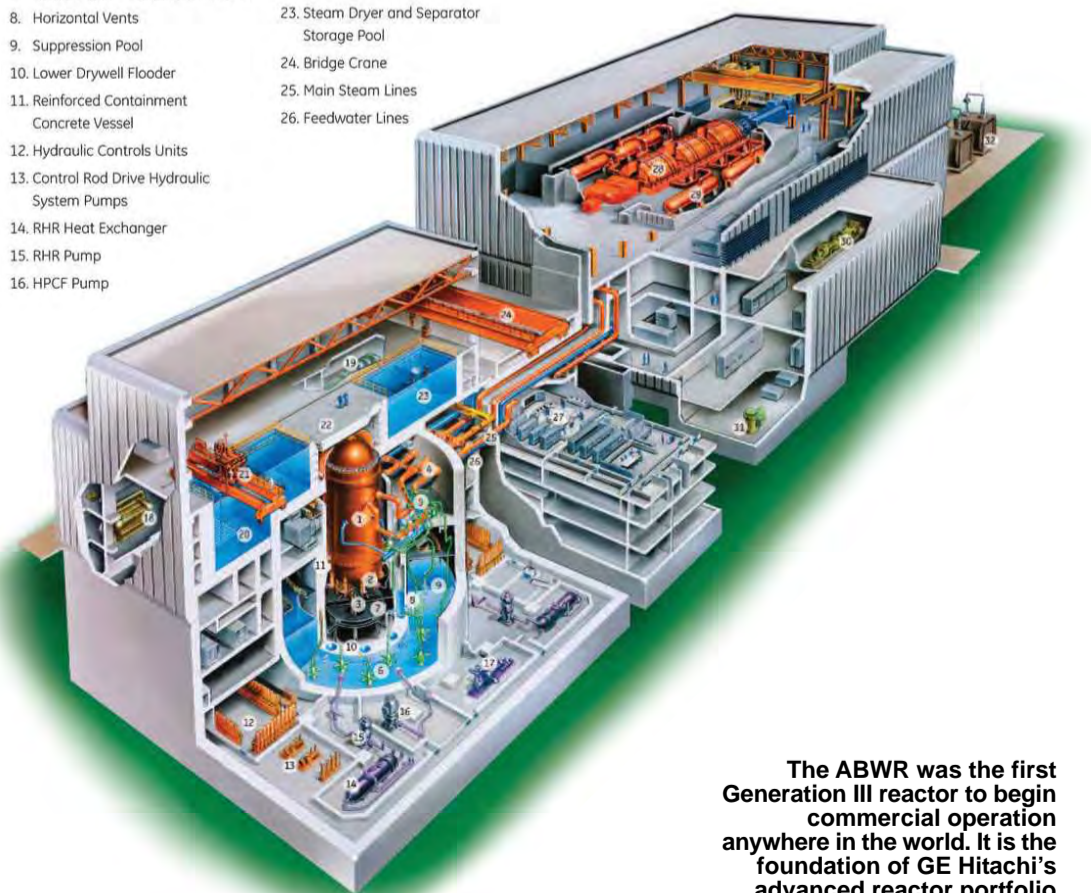
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### ABWR Plant Layout

- |  |  |                                  |
|--|--|----------------------------------|
| 1. Reactor Pressure Vessel                   | 17. RCIC Steam Turbine and Pump            | 27. Main Control Room            |
| 2. Reactor Internal Pumps                    | 18. Diesel Generator                       | 28. Turbine-Generator            |
| 3. Fine Motion Control Rod Drives            | 19. Standby Gas Treatment Filter and Fans  | 29. Moisture Separator Reheater  |
| 4. Main Steam Isolation Valves               | 20. Spent Fuel Storage Pool                | 30. Combustion Turbine Generator |
| 5. Safety/Relief Valves (SRV)                | 21. Refueling Platform                     | 31. Air Compressor and Dryers    |
| 6. SRV Quenchers                             | 22. Shield Blocks                          | 32. Switchyard                   |
| 7. Lower Drywell Equipment Platform          | 23. Steam Dryer and Separator Storage Pool |                                  |
| 8. Horizontal Vents                          | 24. Bridge Crane                           |                                  |
| 9. Suppression Pool                          | 25. Main Steam Lines                       |                                  |
| 10. Lower Drywell Flooder                    | 26. Feedwater Lines                        |                                  |
| 11. Reinforced Containment Concrete Vessel   |  |                                  |
| 12. Hydraulic Controls Units                 |  |                                  |
| 13. Control Rod Drive Hydraulic System Pumps |  |                                  |
| 14. RHR Heat Exchanger                       |  |                                  |
| 15. RHR Pump                                 |  |                                  |
| 16. HPCF Pump                                |  |                                  |



The ABWR was the first Generation III reactor to begin commercial operation anywhere in the world. It is the foundation of GE Hitachi's advanced reactor portfolio



# Small is beautiful

One issue that could threaten the nuclear renaissance is finance. Much smaller decentralised reactors, which will be cheaper and quicker to build, are therefore beginning to attract attention **says Junior Isles.**

## Small reactors

The idea of very small nuclear power reactors i.e. up to 50 MWe is not new. The US has used them at military installations for decades. A Russian design has also been used in icebreakers and is now being proposed for wider use in desalination and on barges for remote area power supply.

It is this possibility for remote or decentralised power supply combined with affordability that is seeing increased efforts to bring a number of new designs to market.

In addition to Russian designs such as the KLT-40S, which produces 35 MWe as well as up to 35 MWth of heat, Invap of Argentina is developing the Carem reactor. This is a modular 100 MWth (27 MWe) pressurised water reactor to be used for electricity generation or for water desalination.

Following renewed interest in nuclear, the US is also making serious efforts to commercialise small reactor technology. Steven Chu, the US secretary of energy has expressed support for the development of small modular reactors. In May he announced awards totalling \$38 million to help fund university-led research and development for new nuclear

technologies.

With the support of the US government, NuScale Power is commercialising a 45 MWe small nuclear power system that it says is safe, modular and scalable.

Each NuScale module has its own combined containment vessel and reactor system, and its own designated turbine-generator set. The company says its power plants can have just one or up to 24 units. In a multi-module plant, one unit can be taken out of service without affecting the operation of the others.

NuScale secured rights to the design through a technology transfer agreement with Oregon State University. OSU developed a one-third scale, electrically heated, fully integrated test facility that replicates the entire NuScale system at temperature and at pressure.

The company anticipates filing a Design Certification Application with the NRC early in 2012 and says a plant could be in operation as soon as 2018.

But perhaps the most high profile of the very small reactors is the 25 MWe unit announced last year by Hyperion Power Generation. The small mobile, modular reactor, measuring just 1.5 m x 2 m is a self-contained, self-regulating reactor specifically designed for applications in remote areas where cost, safety

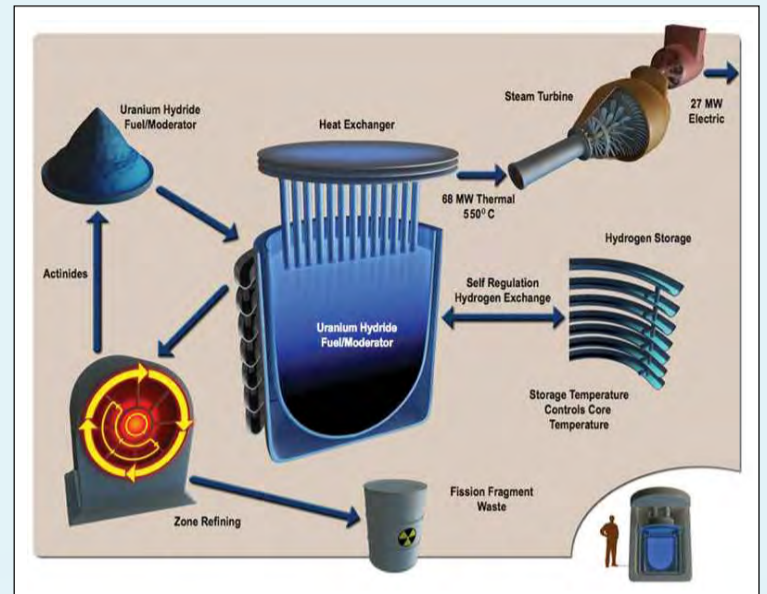
and security are a concern.

The Hyperion Power Module (HPM), conceived at Los Alamos National Laboratory in the US and licensed to Hyperion for commercialisation, will generate 70 MWth of heat or 27 MWe of electricity, depending on the application.

Commenting on the technology, John "Grizz" Deal, CEO of Hyperion Power Generation said: "The idea behind the reactor is fairly simple. If you maintain criticality with the right kind of fuel, you can generate heat. Nuclear is about how you control that heat and what you do with it. Large commercial reactors are specifically designed to produce electricity; the idea behind the HPM from the beginning was to generate heat. It's then up to the user what they want to do with that heat. It could be for generating electricity, district heating etc. We basically see it as a kind of thermal battery."

The HPM, weighing less than 25 t, will be installed in a concrete vault measuring 10 m x 10 m. According to Hyperion, a unit can be installed in just a couple of days.

Speed of construction and costs are important selling points for the HPM. At about \$50 million per unit, capital costs are about \$2000/kW. According to Hyperion it already has more than



The HPM fuel, energy power cycle. The small illustration (bottom right) shows the reactor core and its relative size

150 purchase commitments from customers such as mining and telecomms companies.

In March 2010, Hyperion notified the US Nuclear Regulatory Commission that it planned to submit a design certification application in 2012.

Last month the company signed a

memorandum of understanding with Alternate Energy Holdings, Inc. as the start of a joint venture under which the two companies will license, build and market the reactors on a worldwide basis. Initial deliveries, slated to begin in the second half of 2013, are being scheduled.

## Decommissioning

# Undertaking safe decommissioning

As nuclear facilities around the world now near the end of their operating lives, countries must undertake the process of decommissioning and dismantling them. Chooz A in France and Zorita in Spain are two projects currently under way. **Joseph Boucau**

## Case study

Many facts drive the nuclear power station decommissioning process – the design life may have been reached, safety issues preventing further plant operation, or country-specific decisions regarding nuclear operation and the availability of a decommissioning fund. Additionally, a new build programme can sometimes push a utility to clean up a shutdown plant for better public acceptance of nuclear energy.

In December 2009, Westinghouse won the contract to dismantle the Chooz A nuclear reactor in the municipality of Chooz in the Ardennes region of France. Westinghouse designed the Chooz A plant, the first pressurised water reactor built in France, and provided nuclear services during its plant life. Chooz A was shut down in 1991, and its dismantling was deferred to allow minor radiation to decay naturally.

In May 2010, Westinghouse was also awarded the contract for the segmentation of reactor vessel internals at the José Cabrera (or Zorita) nuclear power station. This plant, located near Madrid, Spain, houses a 142 MWe pressurised water reactor and was closed by ministerial order in April 2006 after 38 years in operation.

At the end of any nuclear plant's operation, the process of decommissioning must take place so that the site can be re-used with the assurance that any remaining radiation has been addressed. Most parts of a nuclear power plant do not become radioactive; in any nuclear reactor, 99 per cent of the associated radioactivity is associated with the fuel.

Management of spent nuclear fuel is not considered to be part of the decommissioning process as spent fuel has been removed from the facility before actual decommissioning and dismantling work has started. Any remaining radioactivity comes from small amounts of surface contamination such as steel components that have been subjected to neutron irradiation for extended periods of time, and most of the metal can be recycled.

The main objective of the decommissioning strategy is to separate the activated components from the other low- and intermediate-level waste material, so that they can be disposed of in the most cost-effective and safe manner.

Typically in the US, activated components cannot be shipped off site, so they must be packaged so that they can be dry stored with the spent fuel in an Independent Spent Fuel Storage Installation

(ISFSI). Low and intermediate waste can be shipped to off-site repositories depending on space availability.

Since Chooz A is located inside two caves, the project will involve waste transportation from the reactor cave through long galleries to a 'waste buffer' area. The project will end after the entire dismantling work is completed, and the waste storage is outside the caves and ready to be shipped to one of two places.

Low-level waste and very-low-level waste, which is considered to be short-lived, will be shipped to the French National Radioactive Waste Management Agency, or ANDRA, facility. For low- and intermediate-level waste that is considered to be long-lived, waste will be shipped to the EDF Interim Storage Facility, which is planned to be built on another site.

At the Zorita site, the low- and intermediate-level waste will be stored in concrete containers and shipped to the El Cabril repository. The activated material will be stored in multi-purpose canisters/concrete casks and sent to an interim storage facility on the site.

As with any activity in nuclear operations, safety is a primary concern of all involved. This process of decommissioning nuclear power plants in every country is controlled closely by government

agencies dedicated to the regulation of civilian nuclear power within each country.

Intergovernmental agencies such as the International Atomic Energy Agency (IAEA), the European Union, and the Nuclear Energy Agency also promote the safe use of nuclear power and provide governments with safeguards associated with nuclear decommissioning.

With respect to both Chooz and José Cabrera, Westinghouse is following the local requirements defined by the customer. Furthermore, the dismantling technique that will be used in both Chooz A and Zorita is based on mechanical cutting technology that has been applied successfully for more than 10 years. It is safe and relies on a long track

record of success.

Over the past 40 years considerable experience has been gained in decommissioning various types of nuclear facilities. More than 80 commercial power reactors, 45 experimental or prototype power reactors, as well as more than 250 research reactors and a number of fuel cycle facilities, have been retired from operation.

Proven techniques and equipment are available to dismantle nuclear facilities safely, and these have now been well demonstrated in several parts of the world.

*Joseph Boucau is director of Global Decommissioning and Dismantling for Westinghouse Electric Company.*



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# Alstom targets North America

Alstom is starting a new drive to increase its presence in the US while seeking to close the gap with rivals GE and Siemens in the wind power market, writes Siân Crampsie.

French engineering firm Alstom has started a new drive to tackle the North American power market with the opening of a new manufacturing facility and a new strategy for its wind power business.

The company, which early in June completed the acquisition of Areva's Transmission and Distribution business with partner Schneider Electric, has also inaugurated a new production facility for steam turbines, gas turbines, large turbo-generators and other equipment in Chattanooga, Tennessee.

The facility cost \$300 million to build and will serve the North American market for fossil fuel and nuclear power

plants.

The official opening of the facility came just a few weeks after Alstom said that its new strategy for the North American wind market would centre around the construction of a wind turbine assembly facility in Amarillo, Texas.

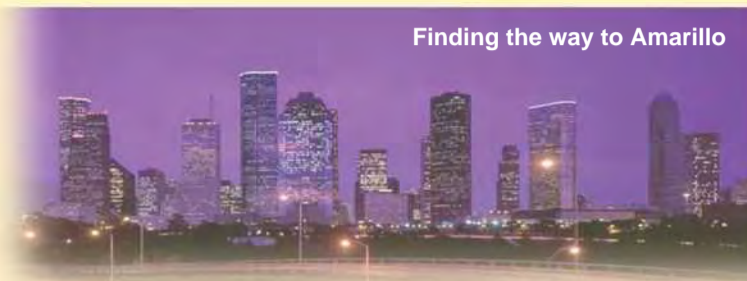
Like other large energy companies Alstom is targeting the North American wind power market due to its significant growth potential, particularly for onshore projects, which are cheaper to install than offshore projects. GE, Vestas and Siemens are currently the dominant manufacturers in the market.

The Amarillo facility will assemble

wind turbine nacelles and Alstom says that it will offer North American customers a product that includes any combination of the complete unit and the engineering, design, construction, and maintenance of the facility.

Alstom's strategy for its wind energy business also includes long-term collaborative R&D agreements with both the US Department of Energy's National Renewable Energy Laboratory (NREL) and the National Institute for Renewable Energy (NIRE).

NREL will complete a comparative study of Alstom's wind power technology while collaborative research



Finding the way to Amarillo

efforts – which will also result in the North American certification of Alstom's 3 MW ECO 100 wind turbine – is scheduled to begin in the fall of 2010 and be completed by the middle of 2011.

Alstom Wind and NIRE's

collaborative efforts will initially focus on grid integration research and development. The programme is scheduled to begin in the fall of 2010 and will also include the North American certification of Alstom's 1.67 MW ECO 86 wind turbine.

## ABB, Wärtsilä and HUG join forces

- Demand rising for distributed generation
- GE unveils world's first two-stage turbocharged gas engine

ABB Turbo Systems and Wärtsilä have welcomed a third member to their existing cooperation in pursuit of the development of 2-stage turbocharged medium speed diesel engines.

The two companies have announced

their intention to cooperate with HUG Engineering, an after-treatment specialist, with the aim of developing an innovative compact selective catalytic reduction (SCR) system especially tailored for operation with two-stage turbocharging.

ABB and Wärtsilä in April announced plans to cooperate in a development programme for a new and groundbreaking application of two-stage turbocharging on large diesel engines. The agreement was made in response to

a growing global demand for high-efficiency distributed power generation systems.

Under the latest agreement, Wärtsilä, ABB Turbo Systems and HUG Engineering will target a further expansion of flexible engine operation at reduced NOx emissions and optimised fuel consumption, as well as targeting savings in initial and life cycle costs.

Two-stage turbocharging technology is also being developed by GE and MAN Diesel & Turbo.

In early June GE unveiled the world's first two-stage turbocharged gas engine that will provide significant output and efficiency increases compared to the single turbocharged version. GE has piloted the technology in its Jenbacher J624 gas engine and says that it will eventually offer it in other engines in its portfolio.

GE also developed the technology with ABB Turbosystems and says that the two-stage turbocharged J624 achieves approximately ten per cent higher output, increasing from 4 MW to 4.4 MW and offers an electrical efficiency of 46.5 per cent, an increase of about one percentage point over the single turbocharged version.

"The J624 two-stage turbocharged is a real-game changer, especially for applications in countries with hot and humid conditions," said Prady Iyyanki, CEO of gas engines for GE Power & Water. "The advanced boost pressure allows us to significantly push the gas engine operating range and maintain full output and efficiency at high ambient temperatures and high elevations. We view this enabling technology as a key for future success in the gas engine business."

## Barclays buys carbon trader

UK bank Barclays plc says it will build on its strong reputation in the carbon trading markets through the acquisition of Tricorona AB of Sweden.

Barclays subsidiary TAV has made a recommended £98 million (\$147 million) cash offer to buy all the shares in Tricorona, which runs carbon offsetting projects in developing countries.

A Barclays statement said: "The acquisition of Tricorona would build on Barclays Capital's strong reputation in the carbon markets and would position it as a leading global origination and trading house." Barclays Capital is the bank's investment banking arm and is the leading player in the European carbon trading market.

Carbon trading has come under scrutiny in recent months after allegations of tax evasion and so-called "carousel fraud" surrounding deals in the EU. More recently, the *Financial Times* reported that a planned deal involving a British company that intended to rent forest land in Liberia was under investigation by police because of allegations of bribery.

## Toshiba buys into USEC

- Cash injection for centrifuge plant
- Toshiba secures fuel supplies



Ohio centrifuge plant

Uranium firm USEC says that its plans to construct a centrifuge plant in Ohio, USA have received a major boost through a \$200 million investment by Toshiba Corp and Babcock & Wilcox.

Toshiba and Babcock & Wilcox Investment Company have signed an agreement to invest \$100 million each in USEC over three years. The move is seen as a way for Toshiba to expand its presence in the global nuclear market.

USEC supplies more than half of the US nuclear fuel market and more

than one-quarter of the world market. It says that the investment will strengthen its position in the growing nuclear power industry and strengthen its financial position for the deployment of its American Centrifuge Plant.

Under the agreement Toshiba and B&W will receive preferred stock in return for their investments, the first phase of which is expected to occur in late 2010. Toshiba will also acquire rights to receive enriched uranium necessary to fuel nuclear energy plants.

Toshiba already has stakes in Kazakhstan's Kharasan uranium project and Canada's Uranium One. Last year it signed a deal with Russia's Tenex to cooperate on nuclear plant construction and in the civilian nuclear fuel business.

The US Department of Energy last year delayed loan guarantees worth \$2 billion for USEC, saying the company had failed to meet financial and regulatory standards for the guarantees.

## Emerson and KOSEP target developing markets

Emerson Process Management and Korea South East Power Company (KOSEP) are to join forces to expand their presence in the power markets of a number of emerging regions.

The two companies have signed a memorandum of understanding (MOU) to collaborate on modernising existing power plants as well as constructing new ones in the Middle East, Africa, Southeast Asia and Latin America as well as Korea.

While Emerson is already active globally, KOSEP is just embarking on plans to expand activities outside its domestic South Korea market. It currently provides more than ten per cent of Korea's electricity generating capacity, and says that it will bring its experience as a developer, operator and owner of thermal and hydropower plants to the partnership.

Under the agreement KOSEP will standardise Emerson's automation, control and instrumentation technologies, including PlantWeb and Ovation. The two companies will also exchange technology that helps power plants improve boiler and turbine efficiency.

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## Tenders, Bids & Contracts

### Americas

#### Vogt Power to supply Progress HRSGs

Progress Energy Carolinas has selected Babcock subsidiary Vogt Power International to supply the heat recovery steam generators (HRSGs) for the Lee and Sutton combined cycle power plants.

Vogt will design, manufacture and deliver three HRSGs to the H. F. Lee Energy Complex in Goldsboro, NC, and two HRSGs to the Sutton Energy Complex in Wilmington, NC. The projects are part of plans by Progress to reduce carbon emissions by switching from coal to natural gas in its generation fleet.

The HRSGs will be auxiliary fired, three-pressure units with reheat, natural circulation, with Selective Catalytic Reduction (SCR) systems to operate behind Siemens SGT6-5000FD gas turbines. The equipment also includes CO systems for the removal of carbon monoxide.

Progress Energy recently announced the retirement of 11 coal-fired units that lack emissions control equipment at four sites in North Carolina.

#### Capital selects Vestas

Canada's Capital Power has selected Vestas for the supply and maintenance of wind turbines for three proposed projects in Ontario and British Columbia.

Under the deal Vestas will supply and commission 44 model V100 and 35 model V90 wind turbines for the 142 MW Quality wind project in British Columbia, 58 V90 wind turbines for the 105 MW Port Dover and Nanticoke wind project in Ontario, and 150 V90 units for the 270 MW Kingsbridge II project, also in Ontario.

The contract also includes all scheduled and unscheduled maintenance for the towers and turbines for ten years. The Quality and the Port Dover and Nanticoke wind projects are scheduled to start operating in 2010 and 2012, respectively.

#### Landis+Gyr chosen for smart grid project

CPS Energy, the largest electric and natural gas municipal utility in the USA, has announced the selection of Landis+Gyr smart meters for deployment in San Antonio, Texas.

In a deal that bolsters Landis+Gyr's position as the leading smart meter solutions provider in the US state, the company will supply its Gridstream RF technology including advanced meters and supporting network infrastructure for over one million gas and electricity customers.

Deployment of the equipment will start later this year and be completed by 2015. Landis+Gyr has also won contracts with other Texas utilities – including Oncor, AEP-Texas, Austin Energy and CPS Energy – to deploy smart meters.

#### FPL orders six Siemens H-Class GTs

Siemens' H-Class gas turbine technology has broken into the US market with an order for six units from Florida Power & Light (FPL).

The six H units will be installed in two existing FPL power plants as part of a programme to modernise its generating fleet. Each power plant will utilise three 274 MW SGT6-8000H gas turbines and are scheduled to start up in 2013.

Siemens says compared to turbines in existing combined cycle power plants, H gas turbines consume one-

third less natural gas and emit one-third less CO<sub>2</sub>, while generating the same amount of power.

Siemens spent 10 years developing the technology and expects the H-Class market worldwide to total at least 10 turbines a year in the medium-term. Depending on specifications and equipment, the cost per turbine is in the two- to three-digit million range.

#### Iberdrola wins Mexico wind farm contract

Gesa Eolica Mexico has awarded a contract for the construction of a 228 MW wind farm in Oaxaca state, Mexico to a consortium led by Iberdrola Ingenieria.

Working with partner Global Energy Services Mexico, Iberdrola Ingenieria will build the wind farm and its associated infrastructure at Piedra Larga. The consortium will also operate and maintain the facility.

The first 90 MW phase of the project will be commissioned by March 2011, while the remaining 138 MW will be brought on stream a year later.

#### GE collaborates on freshwater offshore wind farm

Lake Erie Energy Development Corporation (LEED) and GE have embarked on a partnership to develop the first fresh water offshore wind farm in the USA.

Under the deal, GE will provide direct-drive wind turbines for LEED's 20 MW offshore wind project in the Ohio waters of Lake Erie. The project is a significant step towards accelerating the deployment of offshore wind in the Great Lakes, says GE.

The initial 20 MW wind farm is scheduled for completion in late 2012. It could be followed by the development of up to 1000 MW of capacity in the offshore waters by 2020.

### Asia Pacific

#### Sinopec Wuhan buys FW CFBs

China's Sinopec Wuhan has awarded a contract for the design and supply of three circulating fluidised bed (CFB) boilers to Foster Wheeler.

The three 80 MWe steam generators will be used in the Sinopec Wuhan cogeneration plant, which will supply energy to an 800 000 t/year ethylene plant in central China's Wuhan city. Commercial operation of the power plant is scheduled for mid-2012.

In addition to supplying the boilers, Foster Wheeler will supply auxiliary equipment and provide site advisory services for the project. The boilers will be designed to burn coal and petroleum coke.

#### Wärtsilä receives Bangladesh orders

Finland's Wärtsilä has won two contracts from independent power producers to supply equipment for new power plants in Bangladesh.

Summit Naryanganj Power Co Ltd has ordered Wärtsilä 46D gas-diesel engines and auxiliary equipment for the Naryanganj power plant, while Khulna Power Unit II Ltd has ordered Wärtsilä 46 engines and auxiliary equipment for its Khulna extension project. The contracts are worth a combined €68 million.

Both orders are being handled on a fast-track basis and the plants are scheduled to be in operation as early as March 2011.

Bangladesh is suffering from power

shortages and the government has established an urgent plan to boost generating capacity.

#### Vestas wins China order

Danish wind turbine manufacturer Vestas is to supply 25 wind turbines to the Dashiuboluo wind farm in Linxi in Inner Mongolia Autonomous Region after receiving an order from China Datang Renewable Power.

The deal includes the supply, installation and commissioning of the V80-2MW units as well as a SCADA system.

Delivery is expected in the third quarter of 2010.

#### KEPCO wins Indonesia deal

Korea Midland Power Co., a unit of Korea Electric Power Corp., has won a 1 trillion won (\$820 million) deal to operate two coal-fired power plants in Indonesia.

Under a deal with power firm PT Perusahaan Listrik Negara (PT PLN), Korea Midland will operate and maintain two 660 MW coal fired power plants at the Tanjung Jati power plant complex in central Java.

The plants are scheduled for start-up in early 2012 and Korea Midland will operate them for 22 years.

### Europe

#### Siemens wins Anholt contract

Siemens Energy has secured an order from Dong Energy to supply 111 wind turbines for the Anholt project, Denmark's largest offshore wind farm.

The 400 MW wind facility will be located 20 km off the northeastern coast of the Jutland peninsula and equipped with Siemens' 3.6 MW turbines. Siemens will manufacture, install and commission the wind turbines as well as provide a service and maintenance agreement for the first five years of operation.

The Anholt wind farm is due to be commissioned in 2013.

#### UK 9Fs scheduled for upgrade

RWE npower has awarded GE a contract to uprate two 9F gas turbines at the Little Barford power station in Cambridgeshire, UK.

The UK utility has awarded the contract as part of a wider programme of investment at the gas fired power station and says that the project will reduce emissions, improve efficiency and extend the life of the plant.

The contract also includes the installation of GE's dual fuel DLN2.6+ combustion system technology and a six-year maintenance support agreement. The uprated 9F gas turbines are scheduled to be in commercial operation by the third quarter of 2012.

The station's gas turbine control system also will be upgraded with a GE Mark VIe control system.

The project represents GE's first DLN2.6+ installation in the UK.

#### Siemens chosen for Italy PV project

Marseglia Group subsidiary Ital Green Energy has placed an order with Siemens Energy for construction of a photovoltaic (PV) power plant in the Apulia region of Italy.

The San Donaci PV plant will have a peak output of 15 MW and will be connected to the Italian grid in late 2010. Siemens will carry out plant design and engineering as well as provide inverters, transformers,

medium-voltage equipment and the monitoring and control system.

Siemens' partner will be Italiana Costruzioni 2000, a Marseglia Group company, which will be in charge of all the civil works, and supply and erection of the support structures.

#### Foster Wheeler wins CSP contract

The joint venture that is constructing the Valle 1 and Valle 2 concentrating solar power (CSP) plants in Spain has awarded Foster Wheeler a contract to design and supply the solar steam generators and feedwater heaters for the projects.

Spanish companies Sener and Cobra are building the two 50 MWe projects in Cadiz on behalf of Torresol Energy, a venture between Sener and Masdar. Foster Wheeler will supply two sets of steam generators as well as the high- and low-pressure feedwater heaters.

The equipment is scheduled for delivery in early 2011.

### International

#### Siemens ST chosen for Riga TPP-2 facility

Siemens Energy has won a contract to supply a steam turbine generator for the Riga TPP-2 combined cycle cogeneration facility in Latvia. The order is the largest ever received by the company's Industrial Power business unit.

The Siemens condensing turbine-generator will feature three industrial steam turbines, two SST-800 machines and one SST-500 steam turbine. The order also includes a generator, a condensing plant, and three district heat exchangers.

The new cogeneration district heating plant will have an overall electrical capacity of approximately 420 MW and a thermal capacity of as much as 270 MW.

#### Emerson wins order in Kazakhstan

Emerson Process Management has received two contracts to modernise controls at the Ekibastuz GRES-1 thermal power plant, the largest power facility in Kazakhstan.

Under the first contract, Emerson will modernise the controls for the steam turbine and turbine drives for feedwater pumps at six 500 MW units (Units 3-8). Under the second contract, it will digitally automate all major equipment and processes, including unit coordinator and startup and shutdown sequencing at Unit 8.

The 4000 MW Ekibastuz plant is located at the heart of a bituminous coal mining basin and produces 13 per cent of Kazakhstan's power.

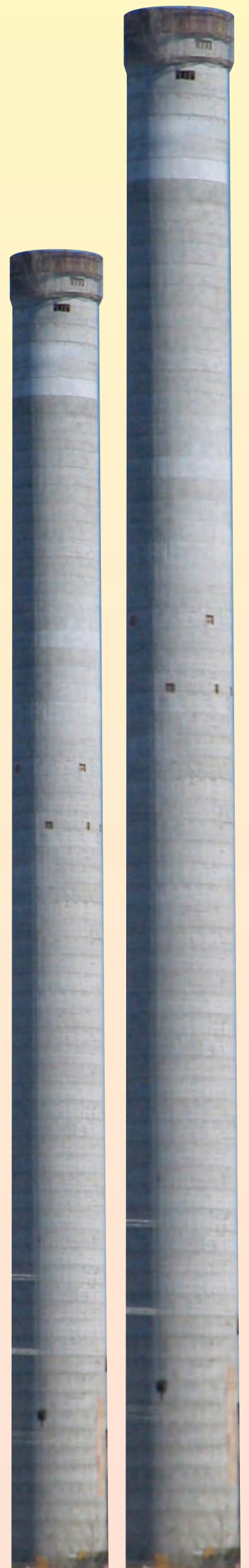
#### Areva wins €90m UAE order

Areva Transmission & Distribution (T&D) has won an order worth close to €90 million to supply a 400/132 kV gas insulated substation (GIS) to the United Arab Emirates (UAE).

Areva will deliver the substation to Transco, a subsidiary of the Abu Dhabi Water and Electricity Authority (Adwea), for installation in Ajman. The equipment will strengthen power supplies in the Northern Emirates region, where the population is growing rapidly.

The contract also includes the delivery of four power transformers, four shunt reactors, a digital control system and a telecommunications system along with protection relays.

The project is scheduled to be completed by 2012.



# Ready for the challenge

After just three months in the job, Vattenfall's new CEO, Øystein Løseth talks to *TEITimes* about his new position and gives an insight into just what makes him tick.

Following in the footsteps of Lars G. Josefsson is no small task. But it should be no problem for Øystein Løseth. After all, he is a man who in his own words "cannot resist a good challenge".

Perhaps that is why he enjoys cross-country skiing and mountain biking – outdoor pursuits that require stamina.

Being outdoors helps to clear his mind and provides that much needed balance between work and private life. Mr Løseth does indeed seem to be at ease. Having officially taken over the helm at Vattenfall, Europe's fifth largest energy group in April, he exudes a calm air of confidence when talking about this latest move in his impressive career.

He says: "I like problem solving. I like challenges. That is probably why I have taken positions around Europe for the last 25 years. To challenge yourself, you go to places like the Netherlands, as I did in 2003. I was also based in the UK in the early 90s."

Løseth was referring to the new frameworks and developments related to deregulation, which was just getting under way at the time. "I wanted to be in that area and meet the new challenges," he notes.

The importance of energy in society also runs deeply in Mr Løseth. As he explains: "Deep down, I need a meaning for what I am doing. Producing electricity, oil and gas drives the economy, our society, and improves people's living standards. This is important to me."

Løseth sees himself as being lucky in terms having the opportunity to be involved in the energy sector for most of his working life.

He started his professional career at Statoil in Norway where he held various positions in 1984-1993. "It was boom time in the oil industry at the time and for a young engineer, it was a lot fun," Løseth reminisces.

Løseth, born 1958 in Oslo, Norway, holds a Master's degree in Civil Engineering from the Technical University of Trondheim, Norway (Norges Tekniske Høyskole), and studied Economics at Bedriftsøkonomisk Institutt, Bergen, Norway.

The position at Statoil was a good start for a young engineer says Løseth. However, he moved to the UK in 1993-1994 to take a position as Planning Manager for Alliance Gas. On returning to Norway in 1994, he joined Naturkraft in Oslo as Commercial Director until 1997 when he moved on to Statkraft Norway.

At Statkraft he was responsible for establishing Statkraft Energy Europe in the Netherlands and Germany, after which he was appointed Director of the Strategy Division. In 2002 he was appointed member of the Board of Management of Statkraft, responsible for production and project development.

His time at Statkraft saw him set up two trading offices from scratch – one in Amsterdam and another in Düsseldorf. "This was very exciting," recalls Løseth.

In 2003, Løseth joined Nuon in Amsterdam, Netherlands, as Managing Director for Nuon Energy Sourcing. He became member of the Board of Management in 2006, responsible for the segments Production and Trade, and for Nuon's activities in Belgium and Germany.

His appointment as President and CEO of Nuon N.V. in 2008 was, according to Løseth, "a highlight" in his career, as was his later appointment as CEO of Vattenfall. When Nuon was acquired by Vattenfall in July 2009,

Løseth became Senior Executive Vice President and Head of Business Group Benelux. He has been President and CEO of Vattenfall AB since April 12.

"This gives me the message that the way I am thinking and leading, is also acknowledged by other people," notes Løseth.

Indeed many, and not just in Vattenfall, will be now looking to Løseth for leadership in the industry. Vattenfall is an important company for the Swedish population. It is Sweden's biggest state-owned company and so places huge responsibility on the people managing the company.

"For the whole industry, times are different compared to two years ago. After Vattenfall's acquisition of Nuon, it's time for consolidation. It's time for taking out the synergies and to give value back to the owner. This may sound boring but looking at it from a helicopter view, the main purpose is to give value back to the owner and to society."

During his 25 years in the business Løseth has seen many changes in the industry. The main development he has seen is going from a monopoly market to one where consumers have choice, especially in Europe. "Both the electricity and gas industries have changed to provide what I think is a better service for the customers because they now have a choice."

He added, however: "I thought this development would go faster but everything takes time. You have to have respect for what each country in the EU decides is best for them but I hope it will converge into an integrated market. The Nordic market is a very good example that it is possible to have one exchange, and for the transmission system operators to work together and have a single market. It is under development and we are not there yet but there have been many changes over the last 20 years. I am not sure there will ever be a 100 per cent single European market. I think it will develop into regional markets first, which are more integrated than today."

The other important issues that Løseth sees the industry is struggling with are CO<sub>2</sub> and the impact of renewables.

**I am not sure there will ever be a 100 per cent single European market. I think it will develop into regional markets first, which are more integrated than today**

He notes: "While I hope we will see a lot more new renewable energy coming into the system, it will make prices more volatile. This will make it more difficult to predict the rate of return on our investments."

Predicting the economic impact of renewables is a task that most energy companies are tussling with. Løseth takes the UK scenario. "If you look at all the wind capacity in the UK, how are we sure that our base load will also give a good return? It is something everyone in the EU is looking at. I have no single answer."

Vattenfall has an investment plan which will see the company operating in six different energy areas. It has a long-term target of being CO<sub>2</sub> neutral by 2050 and renewables will continue to be a big part of its investment plans. "At the moment we are committed to cutting emissions from coal plants in Germany such as the Boxberg and Moorburg power stations, and continuing our investment in renewables."

Wind is, and will, continue to be a



Øystein Løseth  
"cannot resist a good challenge"

key part of Vattenfall's renewables drive. Together with Scottish Power, Vattenfall already has a large area of offshore wind and he says the UK will be a target area. "There is a potential 7000 MW and we plan to develop this over a period of years. Construction will kick-start in 2015."

Vattenfall is also investing in the Irish Sea, and operates the 300 MW Thanet and 150 MW Ormond wind farms in the North Sea.

Løseth is happy with the progress that is being made in the wind sector. "Wind is here to stay. Many countries are putting a lot of emphasis on wind

It is an area in which Vattenfall is making a great deal of effort.

"We are working hard to solve the technological questions surrounding CCS. We have applied for subsidies from the EU and have invested €180 million in a demonstration plant in Germany," he says.

Yet Løseth cautions on the flipside of the coin. "Public opinion is a bit more sceptical about having CO<sub>2</sub> injected underground. So it's important to have good information and good communications. As well as ensuring that it is safe."

Public opinion and safety is no more important than in the nuclear sector. At the moment, building new nuclear plants is not on the table. Vattenfall's immediate goal is to make sure that its existing nuclear plants remain up and running safely. "Before we start thinking about investing in new plants, we have to show that we are a good operator of our existing plants."

Ensuring its house is in order is at the moment at the top of Løseth's list of priorities. The company's first quarter results showed that net sales rose 34.5 per cent to €5.528 billion. However, operating profit fell by 21.3 per cent to €12.86 billion, largely caused by low industrial demand for electricity as a result of the financial crisis.

On announcing the results in April, Løseth said: "Vattenfall is reporting a good underlying result for the first quarter of 2010... However, profitability is below the owner's required rate of return, and we must reverse this negative trend."

Two months on, Løseth says: "We are under pressure when it comes to margins and prices but we cannot do anything about market prices. We therefore have to do things within the company."

While he could not say what those things are, it is safe to say that Løseth has the clarity of mind and stamina to do whatever needs to be done.

One solution, says Løseth, is to burn it with biomass but the other solution is carbon capture and storage (CCS).



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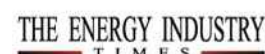
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## Oil

# Crude price moves closer to \$80/b

- Optimism will lose ground during second half of 2010
- IEA says demand will grow over next five years

David Gregory

Crude oil prices began moving towards the \$80/b mark during the second half of June as perceptions about the US economy began to improve. This followed a period in early May when prices fell below \$70/b as worries over sovereign debt problems in the European Union threatened Europe's economic recovery.

While Europe's financial matters continue to warrant attention, crude oil prices have improved, moving above the \$75/b mark on June 14, a settlement price that was last reported a month earlier. Improved demand for products in the US suggests that its economic recovery is making headway.

Meanwhile, China continues to purchase large volumes of crude oil

from the Middle East and West Africa. Whether this will eventually translate into stronger prices for crude – as was the case in mid-March and April when prices were over \$80/b – remains to be seen.

Some analysts see the current optimism losing ground during the second half of 2010 as austerity measures in Europe begin to take hold.

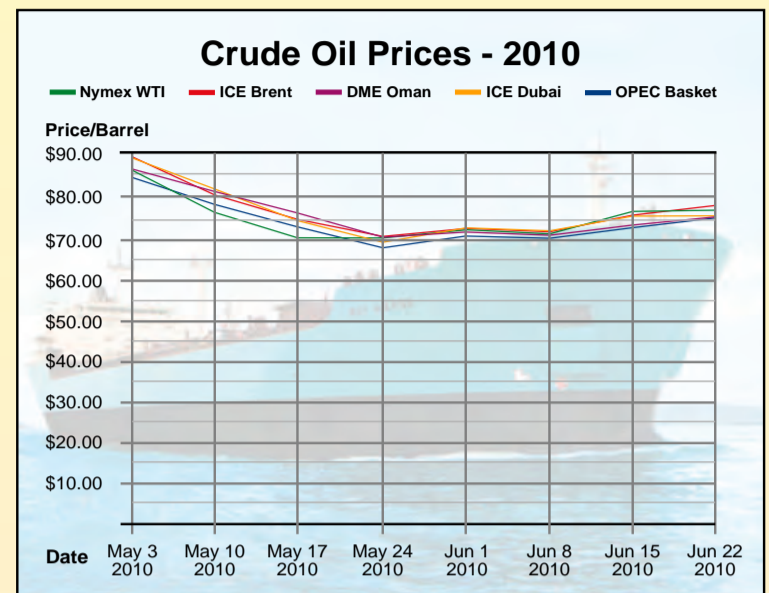
However, improvements in the global economy and growth in crude oil demand will materialise over the next five years, according to a recent report issued by the Paris-based International Energy Agency (IEA).

The IEA's *Medium-Term Oil and Gas Markets 2010* has forecast growth in oil product demand by an average of 1.4 per cent or by 1.2 million b/d between the years 2009 and 2015. That would take annual demand from an average of 84.8 million b/d in 2009

to 91.9 million b/d in 2015.

The IEA presented two scenarios when making its projections. The scenarios offer two contrasting references for global economic recovery. The IEA's base case scenario sees higher GDP and efficiency gains where oil demand grows by an average of 1.2 million b/d per year, or by 1.4 per cent, reaching close to 92 million b/d by 2015. With this scenario, oil demand recovers to pre-crisis 2007 levels again by 2010, and it presupposes GDP growth around 4.5 per cent annually from 2010 onwards and a reduction in oil use intensity of 3 per cent annually, near the level seen in the last five years.

In the second scenario, global GDP grows by a weaker 3 per cent annually, while the progress in oil use efficiency is slowed by the weaker investment environment, pushing anticipated



reductions in oil use intensity back to the 15-year average, near 2 per cent per year. In this case, annual oil demand growth averages 840 000 b/d, or 1 per cent, taking global demand to 90 million b/d by 2015, with oil demand not reaching the 2007 demand level until 2011.

In both cases, the IEA says, non-OECD countries will drive global oil demand growth, while crude oil consumption will decline in the OECD. Under the base case, non-OECD oil demand is expected to increase by 3.5 per cent on average per year over 2009-15 from 39.3 million b/d to 48.2 million b/d, equivalent to almost 1.5 million b/d per year.

By contrast, OECD demand is projected to fall annually by 0.7 per cent or 290 000 b/d on average, from 45.5 million b/d in 2009 to 43.7

million b/d in 2015. Under the lower case, oil demand would grow by only 2.8 per cent in the non-OECD and by minus 0.8 per cent in the OECD.

The IEA put 2009 global crude production at 91.0 million b/d in 2009 and at 96.5 million b/d for 2015, under its base case. Non-Opec crude supply is forecast to grow from 51.5 million b/d in 2009 to 52.5 million b/d in 2015. Most of this will come from Latin America, Canadian oil sands, biofuels and the Caspian Sea region. The IEA said with prices expected to be in the \$70-80/b range, upstream projects have been reactivated or brought forward.

The IEA report said Opec is expected to increase crude oil production capacity by 1.9 million b/d during 2009-15 to 36.8 million b/d. Most of this growth will come from Iraq, Saudi Arabia, Angola and the UAE.

## Gas

# Markets “revolutionised” by unconventional gas

The “unconventional revolution” has already changed the US supply picture. The daunting question is how long will the gas glut last?

Mark Goetz

Two revolutions have taken place in the global gas market, the International Energy Agency (IEA) said in its recently released *Medium-Term Oil and Gas Market 2010*: the “much-anticipated” growth of liquefied natural gas (LNG) capacity and the “less expected” supply revolution in unconventional gas.

These revolutions occurred within the context of a sharp drop in demand for gas during 2009 as a result of the economic crisis.

The IEA said that the revolution in LNG capacity is well under way and will see liquefaction capacity grow by 50 per cent during the 2009-2013 period. Some 60 billion cubic meters (bcm) of new capacity started operating in 2009 and another 10 bcm started up during the first half of 2010, the report said. A further 50

bcm is expected to come on line by the end of 2013.

The report stated: “LNG production increased only by 5 per cent in 2009... the relentless growth of LNG supply happens in a market with much less appetite than anticipated when those projects were sanctioned.”

Despite this, global LNG trade increased by 5.3 per cent during 2009 to 245 bcm (or 180 million tons per year), the IEA reported. Growth in trade was due primarily to the expansion of LNG capacity, most of which took place in Qatar, and also as a result of switching from Russian pipeline gas to LNG in Northwest Europe.

The growth in LNG capacity has had its downside as increased LNG trade has applied downward pressure on spot market prices. Nevertheless, the IEA reported that more LNG

markets are emerging around the world.

The IEA cited China as one of the world's fastest growing LNG markets. It only began to import LNG in 2006. By 2009 commercial operations had expanded to two new receiving terminals, at Fujian and Shanghai, and long-term contract delivery from Indonesia, Malaysia and Qatar.

Meanwhile, the rise of unconventional gas in North America has had regional and global consequences the IEA said, adding that many countries, including Australia, China, India, Indonesia, European and Latin American countries, are investigating their unconventional gas potential.

Prospects look good in some countries, but it noted that effective development of unconventional gas in Europe, the Middle East and North

Africa, or Latin America will face more challenges. These will include detailed assessment of the geological potential, environmental questions about the impact of drilling on water reservoirs, and the failure to obtain landowner acceptance of production.

The report said five years had made a big difference in the industry. In 2005 the US was expected to become a large importer of LNG by 2010. In 2005 the US Energy Information Administration (EIA) forecast LNG imports to amount to around 50 bcm in 2008 and 2009 and to increase to 70 bcm by 2010.

However, by 2008 the “unconventional revolution” had already changed the US supply picture reducing LNG import needs, the IEA said. “As US production increased by 29 bcm in 2008 and again by 19 bcm in 2009, LNG imports were reduced to 9 bcm and 13 bcm respectively,” it said. “In 2009, the effect of increasing US production combined with rising global LNG production and the economic crisis had spill-over effects

on both regional and global gas markets, the latter often described as a ‘gas glut,’” it added.

The IEA estimated that world gas demand fell by 3 per cent in 2009, the largest decline since the 1970s, falling most sharply in OECD countries. The fall in demand was unprecedented, the agency said, noting that world gas demand has fallen only twice, in 1975 and 1992, and never by more than 1 per cent.

The “daunting” question is “how long will the gas glut last?” the report said. The exact duration of the current gas glut will depend on many factors, it said, the two most important being economic recovery and the growth of gas demand in the power generation sector.

This will play out differently in different markets. The report noted it is hard to see a “tightening situation” in Europe before 2015, while much uncertainty lies in Asia and the Middle East/North Africa regions. It stated that in particular, China's demand continues to grow at 10 per cent per year.

# Countdown to Montreal

With the recent oil spill disaster in the Gulf of Mexico and the upcoming COP16 meeting scheduled for Cancun in December, this year's World Energy Congress comes at a sensitive time. **Junior Isles** talks to WEC Chairman and former EDF chief, **Pierre Gadonneix** on the key issues.

As this year's G8 and G20 Summits kicked off in Canada at the end of June, there was little expectation that targets and timetables on climate change would be reached by the close of discussions. It was expected, however, that there would be talk of sustainability, the 'greening' of global economies and the funding of resource and development projects. Certainly, countries attending the G20 were expecting to report on plans to enable the shift to low carbon development and maintain access to energy for the poor.

But regardless of the outcomes of the G8 and G20, many see the World Energy Congress in Montreal in September as the platform where all the stakeholders from industry and government will be able to exchange ideas and define concepts in a way that is acceptable to everyone.

Pierre Gadonneix, chairman of the World Energy Council and honorary chairman of Electricité de France said: "A think-tank like WEC is a unique platform to develop new concepts and dialogue between developed and emerging countries."

The congress will also be an opportunity to exchange ideas on events that have emerged in the last year. Gadonneix notes: "The oil spill will clearly have an impact on the energy sector. The financial crisis will challenge the concept of investing for the long term. There is also the issue of the nuclear renaissance, which has developed over the last two years, mainly in Asia. The timing of WEC 2010 therefore presents a great opportunity."

Challenges in the energy sector are typically long term. Decisions can take five years to implement but the duration of investments can be as long as 50 years. "In Davos last year, when the financial crisis was at the top of the agenda, I said that if there is an industry where you can invest without making a wrong decision, then clearly it is the energy sector because there will always be a demand for energy."

Nevertheless, with the need to reduce the impact of energy on the environment by reducing CO<sub>2</sub>, there is an increasing argument that there is need for immediate action. The theme of WEC 2010 is attempting to promote this through its theme: 'Responding *Now* to global challenges'.

Gadonneix points out that the technologies needed to meet the key challenges of sustainability, security of supply and CO<sub>2</sub> emission reduction are already available. "Some are already mature – for example, energy saving technologies and technologies for improving the efficiency of power generation. But we can also invest in research to develop new technologies. There is an arbitration in energy sector policies to promote existing technologies and new technologies," he says.

Although many considered the outcome of the COP15 meeting on climate change in Copenhagen last year to be a failure, Gadonneix believes there are some positives that can be taken into WEC 2010.

Now is the first time, he notes, that every country acknowledges that it needs to have an energy policy. The issue, however, is how to make these national policies compatible with each other since many of the issues in the energy sector are global. "I was recently in China and they are completely aware that we must

Pierre Gadonneix's role is to ensure that all participants converge to a common understanding



develop some solidarity," he said.

COP15 has given WEC 2010 the impetus to provide this much needed solidarity by providing the opportunity to promote and discuss solutions.

As chairman of WEC, Gadonneix's role is to ensure that all participants converge to a common understanding. "WEC was created in 1923 and has always been characterised by very open access for all participants. It has always been keen to have both developed and developing countries exchange [ideas] in a very open way."

WEC 2010 is the 21st such congress but the WEC believes there are a few

things that will set this one apart from previous congresses. It is the second time the congress has come to Canada – one of the largest energy exporters and also a large consumer of energy. The location of Canada this time, however, is particularly timely. Canada plays an active role in all of the issues that are topical today i.e. security of supply, renewables, the nuclear renaissance. It is also developing its enormous resources of oil sands. In addition, having just held the G8 and G20 summits, energy will still be fresh in the minds of the public.

Gadonneix said this time the major issues are at the top of the agenda for all politicians. He added: "However, complex or sensitive the issue, WEC

is able to tackle it in a way so that all points of view can be expressed and understood. I expect there will be discussions on the oil spill in the Gulf of Mexico because it will have an impact on the oil sector. Chernobyl did not end the nuclear industry but pushed the industry to improve safety. In the oil sector, it will be the same. We have made a great effort to also have the developing countries present in Montreal to discuss the issues."

WEC 2010, he says, has the benefit that it will bring together professional people with top-level leaders. There will be a number of topics at the

reviews have been very successful in promoting safety. There will be a session on nuclear. Compared to three years ago, many more countries are now considering nuclear as an option. Three years ago, it was just France, Finland and Asia. Now we can also include the US, UK, Italy and others. Most of the nuclear development is in Asia and if we want that industry to be successful, we must once again agree on common rules, predominantly with regards to safety."

There will also be a roundtable on public policies, at which WEC will present a first draft of the 2010 WEC Annual Assessment of Public Policies of Energy.

Gadonneix explained: "We have analysed and described all public policies developed by countries in the energy sector, qualifying and ranking the different aspects of these policies. We have identified what tools are the most efficient for a given objective. All energy policies should be implemented in a way that promotes pricing of energy at its real cost in order to avoid distortions."

"The big challenge, however is how to make energy available to those that have the lowest income."

Gadonneix hopes to show that WEC is an opportunity for all stakeholders in the energy industry to tackle issues that are both very sensitive and complex.

In summary he says: "Politicians and governments need a very engaged discussion with the industry. The message is that we all have to work together on technical issues in a way that is professional and at the same time politically responsible."

Another issue, which was tackled in Copenhagen and will again be tackled at WEC 2010, is how to make energy policies developed by individual governments compatible with the need for free trade

conference on which Gadonneix believes that WEC can bring some interesting ideas.

He pointed to a study that WEC has developed on the rules of trade. Another issue, which was tackled in Copenhagen and will again be tackled at WEC 2010, is how to make energy policies developed by individual governments compatible with the need for free trade in order to promote development. "We are willing to collaborate more with the World Trade Organisation on this issue and will organise a roundtable on the topic."

The concept of global safety rules will also be promoted. Using the nuclear industry as an example, Gadonneix said: "Nuclear peer

reviews have been very successful in promoting safety. There will be a session on nuclear. Compared to three years ago, many more countries are now considering nuclear as an option. Three years ago, it was just France, Finland and Asia. Now we can also include the US, UK, Italy and others. Most of the nuclear development is in Asia and if we want that industry to be successful, we must once again agree on common rules, predominantly with regards to safety."

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## Technology

# Schwarze Pumpe prepares for next stage in CCS testing

The pilot oxy-combustion carbon capture plant at Schwarze Pumpe has operated for nearly two years on lignite. In a further phase of testing, the plant will be operated on hard coal. During a recent visit to the plant, **Junior Isles** found out what technology provider, Alstom, expects in this next phase and discusses scaling up to commercial size.

Even at close quarters, the Schwarze Pumpe power plant has a futuristic appearance – a fitting site for what some see as a key technology for the future.

Schwarze Pumpe is a 2 x 800 MWe lignite fired power plant located in Spremberg, Germany. The plant, owned by Swedish-based energy company Vattenfall, is significant in the power industry's battle to combat climate change as it represents the site of the world's first pilot plant to use the oxyfuel process to capture CO<sub>2</sub> emissions.

Oxyfuel, also known as oxy-combustion, works by burning a solid fuel in oxygen instead of air. In addition to heat, the resulting combustion produces an exhaust gas that is mainly a mixture of water and CO<sub>2</sub>. After purification and water condensation, the CO<sub>2</sub> stream can be compressed and stored.

The pilot has been running on pre-dried lignite since the autumn of 2008 and is the basis for a scale-up to a larger 250 MWe demonstration plant that Vattenfall is planning for its Jämschwalde power plant in Germany.

According to Alstom, the boiler has operated for more than 6000 hours, of which 4000 hours have been on oxygen.

During a visit to the site, Philippe Paelinck, Alstom's director of CO<sub>2</sub> systems business development told reporters: "This is quite a successful rate of utilisation for a pilot unit."

During its operation, the Alstom team has been studying the combustion fundamentals; heat transfer; selection of materials, with a special focus on oxidation; and validating models for design of boilers. The dynamic behaviour of the boiler has been under study along with the interaction of all the components inside the plant.

"The plant has achieved CO<sub>2</sub> capture rates in excess of 90 per cent and the quality of CO<sub>2</sub> captured has been monitored for storage considerations," noted Paelinck.

In the next test period expected to



Face of the future: the Schwarze Pumpe power plant is the site of Vattenfall's oxy-combustion pilot plant

start at the end of this year, the pilot will switchover to burning hard coal.

Burning hard coal will not require significant changes to the plant. The burners are designed to burn hard coal as well as pre-dried lignite. However, secondary NO<sub>x</sub> reduction measures may be required downstream to control NO<sub>x</sub> coming mainly from the coal nitrogen. A selective catalytic or non-catalytic NO<sub>x</sub> reduction measure (SCR or SNCR) is not needed with lignite since the nitrogen can be controlled by primary NO<sub>x</sub> reduction measures (e.g. air staging). To meet the requirements for NO<sub>x</sub> emissions, especially in air-firing mode, it is foreseen that a secondary NO<sub>x</sub> reduction measure will be installed in the boiler. This is a decision that will be taken by Vattenfall.

The bituminous coal used will come from the world trade markets. Coal will be pulverised to a similar state to the lignite before it is fed into the boiler. The coal will have a heating value of about 24-26 MJ/kg. For a 30 MW pilot, coal flow will therefore be around 4-4.5 t/h.

The switch to hard coal may cause some minor changes in operating parameters. Alstom says, however, that the flexible design of the firing system and boiler means the expected minor changes can be easily managed.

The lignite fired to date has a moisture content of 8-12 per cent. It is expected that due to the different composition, the bituminous coal will produce a slightly smaller volume of flue gas. This will change conditions in the boiler with regard to heat transfer as well as in downstream components.

Paelinck noted: "The composition of flue gas will be different. With less moisture, there will probably be more CO<sub>2</sub>. The drier gas may make operation easier."

According to Alstom, the different flue gas flow will only have a small effect on heat transfer conditions.

Frank Kluger, R&D programme manager within Alstom's power systems division said: "It will not be much because the difference in the heating values is relatively low and we have a fixed furnace outlet temperature of 1000°C. The boiler performance can be maintained by the adjustment of the amount of recirculated flue gas. We would like to see the results of firing with air and compare them to oxy-combustion. This will help to see the amount of flue gas that has to be recycled to achieve similar conditions to air firing."

Operation with bituminous coal will impact the carbon burn-out. Kluger said: "Dry lignite is a more reactive fuel and bituminous coal therefore produces a higher carbon content in the ash."

The parameters that were varied for lignite will also be varied for bituminous coal. This initial hard coal testing period is expected to last about six months. "There may have to be some adjustments in the boiler control system to operate the boiler with comparable parameters as with lignite combustion," added Kluger.

The Schwarze Pumpe pilot testing will run at least until 2013, after which it is hoped that enough data and experience is available to serve the design, manufacturing and operation of the larger Vattenfall Jämschwalde demonstration plant.

In moving from the pilot to the demonstration boiler, several systems and components (e.g. burners) will have to be scaled-up. As Kluger explained: "Burners will have to be scaled-up by approximately 2-2.5 times and will be installed in a multi-burner arrangement to handle the coal combustion. State-of-the-art steam parameters will be applied, which calls for a corresponding material selection. Heat transfer via convection and radiation will also be a consideration."

Alstom says items such as the developed control logics, oxygen handling, coal feeding gas-gas heater for heating recirculated flue gas are easily scalable and sees no real challenges in moving to demonstration size.

However, moving to fully commercial size boiler will be a bigger challenge. Alstom considers a commercial scale boiler to be one that can be made supercritical i.e. above 400 MWe.

Paelinck said: "This is where you find the first turbines that can deliver power from supercritical steam. But the reference design today is 800 MWe, so this is what would we would consider to be a commercial reference unit."

Alstom does not expect any challenges in terms of the mechanics and construction. In terms of heat transfer etc., Alstom says data from the 30 MW pilot plant operation provides a sound basis for further development. It believes that the upcoming demonstration plants (e.g. Jämschwalde) will provide the additional experience needed to scale-up to commercial size.

One area of uncertainty, however, will be in the selection of boiler materials due to the changed flue gas composition.

Paelinck said: "There is no experience of extended operation of boiler tubes at high temperatures in an atmosphere where CO<sub>2</sub> is enriched. Such conditions can result in changes in metallurgy and possibly result in cracks or corrosion."

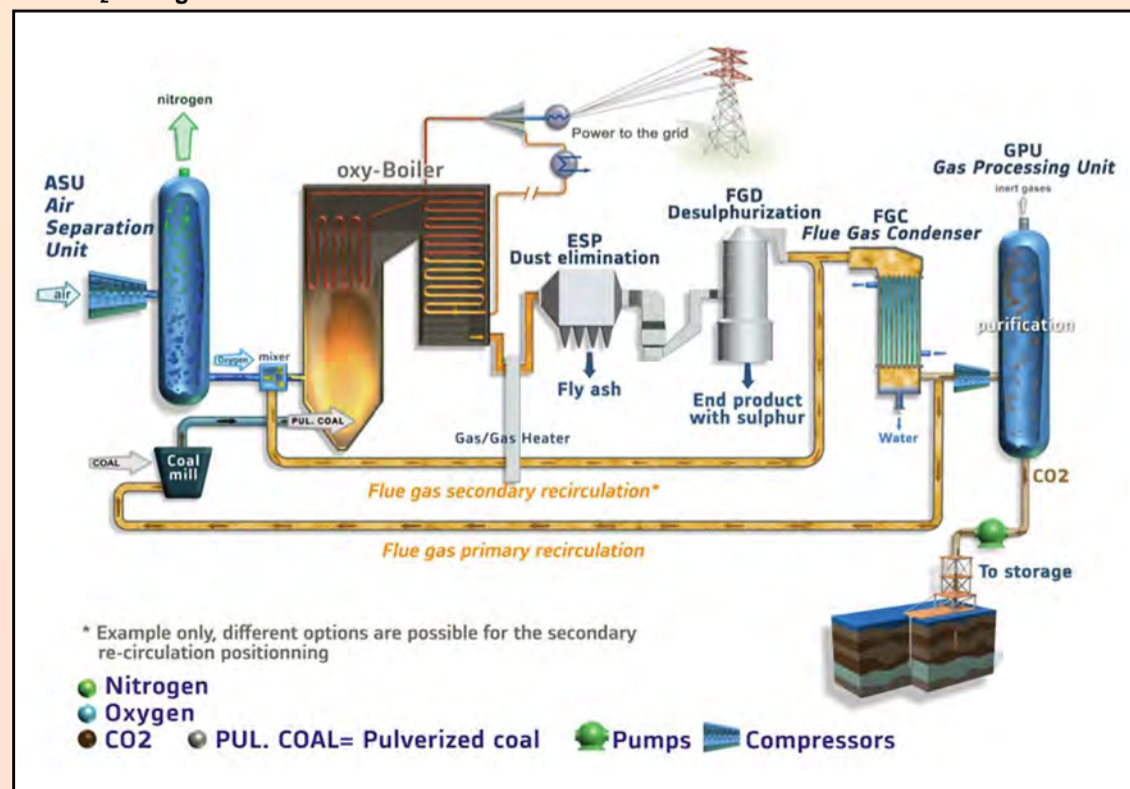
Another challenge will be the cryogenic air separation units and the need for a reliable supplier. The air separation unit removes nitrogen, which makes up 80 per cent of air, and produces the oxygen for the boiler.

"We will need very large air separation units. Today, the largest units are 5000 t/day. An 800 MW unit will probably need two trains, each capable of delivering over 7000t/day. So these will be the first-of-a-kind. But it is not breakthrough technology; we are just working at huge scale," explained Paelinck.

However, Paelinck believes that currently oxy-combustion is technically the most credible carbon capture option with the fewest question marks.

The pilot at Schwarze Pumpe will continue operating for a number of years and will hopefully continue to deliver the information that is needed to commercialise a technology that will be one of the keys to combating climate change.

Flow schematic of an oxy-combustion power plant with CO<sub>2</sub> storage





Junior Isles

# Time to get smart

There was almost as much interest in the World Cup finals as there was in the conference sessions at this year's annual Eurelectric conference in Dublin. During the dinner speech we were reminded that the reason why Ireland was not in the tournament was due to the literally underhand tactics of a certain Frenchman called Thierry Henry. No doubt the people of Ireland were happy to see Henry and his men make an unceremonious exit from the competition, having not even made it past the group stage.

The use of a TV replay could have changed Ireland's fate; it is just a matter of adopting a policy to make use of technology. One could draw parallels with the energy sector and the deployment of smart grids, although the technology is a bit more complex than rolling out a few TV cameras. Moving to a 'new energy world', the theme of this year's conference, not only requires the adoption of policies but also development of complex information technology.

In his opening keynote speech at the Dublin conference the Prime Minister of Ireland, Mr Brian Cowen, said: "Deploying the most modern technologies is very important in controlling future energy supply and demand and integrating wind onto the electricity grid."

The task of integrating wind into the system is one that is particularly challenging in Ireland. It already has a high penetration of wind with 1260 MW connected to a system with a total capacity of 5000 MW. One aspect of the system believed to be unique in Europe is that more than 80 per cent of its wind generation is connected at the distribution level.

Ireland's target is to have wind account for 40 per cent of its electricity production by 2020. It has also said that 10 per cent of all vehicles will be electric.

Accordingly, national utility ESB is investing more than €10 billion in renewables and smart grids as part of a larger investment to be carbon neutral by 2045.

Jerry O'Sullivan, Executive Director for Networks at ESB outlined the company's strategy for renewables development and grid integration. Referring to the major ambitions for renewables in Ireland – with 6.6 GW of wind already approved, O'Sullivan said: "Renewables on its own is not the whole game. For ESB, it is part of a wider push for smart grids. You cannot absorb the high level of wind integration without demand side management."

ESB is already piloting smart grid systems, with a major study under way to assess what

level of demand response is possible, with results expected by the end of the year.

Commenting on electric vehicles, O'Sullivan said they have "real potential to flatten the load curve". ESB is working on the rollout of charging points across the whole of Ireland by the end of 2011.

Ireland has also established a well co-ordinated structure for energy research that ESB says will help it to develop and deliver the necessary smart grid technologies. With wind development well under way, and a relatively isolated system, O'Sullivan said that Ireland will "see the challenges of renewables earlier than other countries".

He added: "This is why so many big companies such as Siemens and Intel for example, have bought into what we are doing. Progress on integration

amount of energy they are bringing online every year is phenomenal. They have some interesting approaches in terms of laying down rules. The principle behind what they are doing seems to be: what rules do you lay down to encourage innovation and development, as opposed to stifling it? For example there are perhaps 50 wind turbine manufacturers in the country. So while there is command and control, there is also competition. It's an interesting paradox in some ways. We should all be watching China to see how they handle things and what products come out of there."

Yet the "command and control" approach that China can use to get things done is not one that other energy markets around the world can adopt, especially the deregulated markets of the west.

US software giant Microsoft

**Renewables on its own is not the whole game. For ESB, it is part of a wider push for smart grids. You cannot absorb the high level of wind integration without demand side management**

is well under way, with smart grids and EVs already coming to Ireland. I call that breaking the inertia."

As an island with a small grid and single electricity supplier, Ireland is well placed to demonstrate what a future, smart electricity system could look like.

Stephen Woodhouse, director of Poyry Energy Consulting noted that Ireland was about "five years ahead of Great Britain in terms of what has to happen regarding wind integration".

But it is not only small islands such as Ireland that are able to make smart grids a reality in the near future.

China is also establishing a strategy for setting up a smart grid. Mr. Min Wang, Senior Advisor to the President of State Grid Corporation of China (SGCC) said that by 2020, the country will connect 411 GW of wind to the grid, accounting for 25 per cent of generation, and will have 30 million electric vehicles. "SGCC is striving to promote the construction of a strong and smart grid system. Such efforts would reduce about 1.65 billion tons of CO<sub>2</sub> emissions in 2020 compared to 2005," he noted.

China's progress demonstrates that policy is just as important as technology in the development of smart grids.

Speaking on the sidelines of the conference John Shaw, chief information officer of Mainstream Renewable Power said: "China is a fascinating country. The

conducted a survey on smart grids that showed that only 8 per cent of utilities around the world have completed their smart grid technology implementations, while 37 per cent have projects under way and more than half have not yet started.

Jon Arnold, managing director of Microsoft Worldwide Power and Utilities said: "The vast majority haven't really started yet. A lot of them are waiting – for the right technology, the right signals from the regulator."

Microsoft surveyed almost 200 professionals within electric, gas and water utilities and related companies around the world. The survey highlighted a range of challenges – from financial and regulatory to technology and return on investment – for utilities already unsure of the right path to building the smart grid.

A key message from the survey was that many believed that to really envisage a smart grid, their organisation would have to be restructured.

Commenting on the findings, Arnold said: "As this study clearly shows, the disruptive nature of the smart grid revolution, and the

innovations it brings, has caught many in the industry by surprise, including many utilities that already have embraced smart grid technologies.

"Some incorrectly assert that the utility industry is unwilling to change, but the survey shows the opposite. It's the magnitude of change to everything from business models to systems that's overwhelming, especially given utilities' existing asset and technology investments combined with the need to ensure profitability and reliability."

If we can believe the results of the survey, the utility industry is at least willing to usher in smart grids and the new energy age – even if, due to their conservative nature, they are not necessarily the ones best suited to do so.

This is more than we can say for football (or soccer to the Americans). The sport has the technology but chooses to remain stuck in the dark ages. It is high time that FIFA got smart and deployed some technology of its own. English football fans would have more than welcomed some goal-line technology in the game that saw them take a thorough beating from Germany. It is likely that Germany had little sympathy for England, and understandably so. After all, it was a similar lack of technology that helped England beat them in the World Cup finals in 1966. If you wait long enough, what goes around comes around.

*"Now we're out of the dark regarding smart grids, surely touch line technology is next!"*

