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THE ENERGY INDUSTRY TIMES

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Brazil attracts investors as economy rebounds

Guiding the economy: President Luiz Inacio Lula da Silva

Brazil's solid economic performance is translating into a robust growth in electricity demand that is proving attractive to both domestic and international energy companies, says Junior Isles

The strong recovery of the large emerging economies is resulting in heightened activity in Brazil's power market. State Grid Corporation of China, Duke Energy of the US, and GDF Suez in partnership with Eletrobras, are all looking to strengthen their position in the country's burgeoning power market.

In early September, French energy giant GDF Suez announced a partnership with Eletrobras, Brazil's largest power utility, to jointly develop energy production schemes in Latin America and Africa.

"The agreement provides for joint

research, project development, and energy production and transmission ventures in renewable energy and/or other energy sources," the French group said in a statement.

GDF Suez sees the Brazilian state-owned firm as a springboard to reach new and promising markets in Latin America and generate high profits.

"With its very high demand for energy and strong potential for renewable energies, Latin America is a key market for GDF Suez," it stated.

According to the International Monetary Fund (IMF), Brazil has

recovered from the global crisis sooner and faster than most other economies, and has already registered a full year of strong growth. After contracting by a cumulative 4.8 per cent in the fourth quarter of 2008 and the first quarter of 2009, the economy grew at an average annualised rate of 8.9 per cent over the four quarters up until July 2010.

The rebound has been reflected in growth in electricity demand. Brazil recorded a 14 per cent increase in industrial electricity consumption in July, while its household electricity consumption in 2009 rose to the highest

level in 11 years.

To meet demand the Brazilian government said last month that it plans to accept bids this year for licenses to build 10 hydroelectric power stations with a combined generating capacity of close to 4000 MW.

The president of the EPE energy research company, Mauricio Tolmasquim, said the government has already submitted plans for three large hydroelectric projects to the Court of Auditors and plans to do the same with the other smaller dams before

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Per capita income and energy use around the world:



Schneider Electric

(Continued from page 1)

October 10.

"We want to hold the auction by mid-December at the latest. The timeframe is very short and everything still depends on whether the environmental licenses are issued on time," Tolmasquim told reporters after a seminar at the Sao Paulo State Federation of Industries.

The three large hydroelectric projects and one of the smaller ones are to be located on the Teles Pires River, at a site in the western state of Mato Grosso near the southern edge of the Amazon jungle. The largest of them, called Teles Pires, will be located near the town of Paranaita and have a generating capacity of 1820 MW.

The news of further hydro expansion follows President Luiz Inacio Lula da Silva's signing of a decree authorising construction of the controversial 11 000 MW Belo Monto hydroelectric plant in Brazil's Amazon region. The hydropower plant will be built by the Norte Energy consortium, which consists of 18 companies.

The increase in hydro is part of the government's plans to massively increase its generation from renewables. At the end of August the government held an auction for the supply of 11 000 MW from alternative energy sources (wind, biomass and small hydro) by 2011.

Speaking at last month's World Energy Congress in Montreal, José Lima de Andrade Neto, president of Petrobras Distribuidora S.A said: "We are bringing people to Brazil because the market is there." He said since the first oil shock Petrobras has been "committed to producing biofuels". He also noted that it has a generating arm that produces 5000 MW of electricity mainly from gas.

The auction saw contracts awarded for 50 wind parks with average capacity of 643.9 MW, five hydroelectric plants with average capacity of 48.1 MW and a 22.3 MW sugarcane bagasse plant.

Spanish energy giant Iberdrola was a big winner in the Brazilian wind energy auction, with nine of its projects, representing an installed capacity of 258 MW, being approved.

With opportunities in a number of areas, Duke Energy Corp.'s Brazilian unit is now seeking authorisation to change its company statute in order to expand beyond hydroelectric power generation. The company will ask Aneel, Brazil's electricity regulator, to approve the change in statute, Duke Energy International Geracao Paranapanema SA said in a regulatory filing.

Meanwhile, State Grid Corporation of China, China's largest grid operator, is waiting for approval to complete the purchase of seven Brazilian energy companies, the *21st Century Business Herald* reported. The deal is said to be worth Reals 3.1 billion (\$1.8 billion), including Reals 1.3 billion in debt. The seven companies, mainly engaged in power transmission, include Elecnor SA, Abengoa SA, Isolux Ingenieria SA and Cobra Instalaciones y Servicios SA.

Former climate chief calls for practical steps to start in order to cut GHG emissions

■ Technology already out there
■ Monitoring, reporting and verification needed



Yvo de Boer: "put the debate on targets aside"

Junior Isles

Yvo de Boer, the former UN climate chief, is calling for practical implementation of what was achieved at the climate change meeting in Copenhagen, as world leaders prepare for the next COP16 meeting in Mexico at the end of November.

De Boer, who stepped down as UN Framework Convention on Climate Change Executive Secretary in July, is now a sustainability and climate change adviser at consultancy KPMG.

He told delegates at the World Energy Congress in Montreal that it was time to start implementing the work that is necessary to reduce greenhouse gas (GHG) emissions to the levels needed to avoid the consequences of climate change.

According to the International Energy Agency, under "Plan A" – the business as usual scenario – emissions are forecast to increase by as much as 50 per cent by 2050.

However, if the global warming is to be limited to a temperature rise of

2°C, it will require global emissions to peak in the next decade. This "Plan B" will call for an 80 per cent reduction in industrialised countries and a 50 per cent reduction globally.

According to De Boer, a great deal of the technology needed to end up with Plan B as opposed to Plan A, "is already out there" but the question is how to get that technology into the market.

He said that the politics of climate change is critical in that process. De Boer noted that Copenhagen could be viewed positively, despite not achieving a global legally binding agreement.

"Since Copenhagen, all industrialised countries, including Canada have submitted national emission reduction targets for the year 2020. More than 35 developing countries, including China, India and Brazil have submitted national action plans indicating what they intend to do. This group of [emerging] countries accounts for more than 80 per cent of global energy-related CO₂ emissions. Significant financial commitments were also made in Copenhagen," said De Boer.

De Boer says that the challenge in moving from Plan A to Plan B now

lies in turning political ambiguity into business reality. Looking ahead to the next stage of negotiations in Mexico later this year he said: "In the next stage of international negotiations, I would strongly recommend we put the debate on targets aside. We need to take what was achieved in Copenhagen and build on that to turn it into a business reality... once we have the encouragement of action to encourage us towards progress, we can return to the political debate and see to what extent we are making the journey from Plan A to Plan B at an adequate pace and in an intelligent way."

He said the industry has to develop reporting guidelines, at both the company and international level, and determine how countries would be held accountable to their contribution in moving from Plan A to Plan B.

"We have to develop international methodologies for monitoring, reporting and verification of the actions to which nations commit in the context of the Copenhagen Accord. We also have to take up the debate on market-based mechanisms which we all know offer us the opportunity to achieve the journey from Plan A to Plan B at the lowest possible cost," said De Boer.

EPA to unveil new greenhouse gas controls guide

The US Environmental Protection Agency says it is close to determining new greenhouse gas controls for power plants, refineries and other facilities that have to comply with landmark new rules starting early next year.

In mid-September an EPA official told *Dow Jones Newswires* that it plans to submit that guidance to the White House's regulatory-review office in "days rather than weeks" and then hopes to release the guidance "as

quickly as possible".

The EPA is developing its BACT (Best Available Control Technology) guidance in the months before power plants, refineries, cement-production plants and other large emitters of greenhouse gases have to comply with new rules starting January 2, 2011.

Although the EPA will not mandate the use of any particular technology, the agency's guidance is likely to influence the equipment or other tools

that companies use to limit greenhouse gas emissions, according to *Dow Jones*.

Power companies have been among the industries awaiting the BACT guidance, in part to see if the agency requires them to change the fuels they use to generate electricity. Specifically, the companies do not want to be forced to switch from natural gas to coal.

"Certainly, what we want to avoid is having a state come in and say fuel

switching or major modifications to power plants already up and running are needed," said Dan Riedinger, a spokesman with the Edison Electric Institute.

Instead, power plant owners would prefer to upgrade and repower plants to allow them to produce more electricity from the same amount of fuel, thereby reducing emissions from the plant.

The EPA started to develop GHG rules after the US Supreme Court decided in 2007 that carbon dioxide and other GHGs were air pollutants that could be regulated under the US Clean Air Act.

Pebble bed modular reactor bites the dust

Ten years after the start of development, South Africa has pulled the plug on its project to build modular gas-cooled nuclear reactors. Some 9.2 billion rand (\$1.2 billion) had been invested in the project but a working model was never produced.

According to local media, Public Enterprises Minister Barbara Hogan said she was winding up the Pebble Bed Modular Reactor (PMBR) programme after South Africa failed to find an anchor customer or investment partner for the technology.

The PBMR is a helium-cooled,

graphite-moderated High Temperature Reactor (HTR) that uses particles of enriched uranium dioxide coated with silicon carbide and pyrolytic carbon. The particles are encased in graphite to form a fuel sphere or 'pebble' about the size of a billiard ball. The core of the reactor contains approximately 360 000 of these fuel spheres.

PBMRs are much smaller than conventional nuclear plants and have a modular construction so that plant output can be more easily tailored to customer requirements. The high temperature operation also means that

the technology is suited to cogeneration applications.

The technology was originally developed in Germany and subsequently licensed to both South Africa and China.

Although China was the first to develop an operational model – a 10 MW research unit – South Africa hoped to be the first on the market with a commercial model. However, the developers repeatedly missed deadlines to produce a demonstration plant.

Hogan told parliament that the project might have required another 30 billion

rand in funding to be viable but that government, which had covered 80 per cent of the costs to date, now had other spending priorities.

In March this year, Jaco Kriek resigned from his position as Chief Executive Officer of Pebble Bed Modular Reactor (Pty) Ltd (PBMR). In May, US nuclear giant Westinghouse – originally one of the PBMR's partners, along with South Africa's state electricity supplier, Eskom – pulled out.

Hogan said a handful of staff would be kept on to protect the intellectual property built up over the project.

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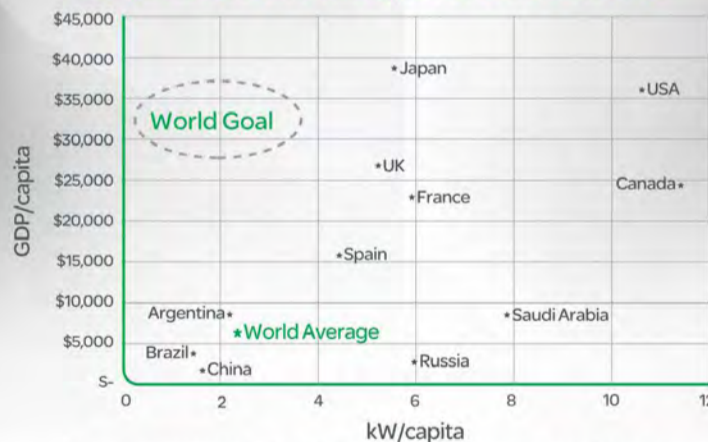
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California thinks small

■ “Innovative” policy overcomes barriers
 ■ Solar thermal projects approved

The US state of California is hoping to plug the gap between its policies encouraging large, utility-scale renewable energy plants and small-scale facilities in the domestic market with a new incentive programme aimed at mid-sized renewable energy systems.

The California Public Utilities Commission (CPUC) has proposed that the new programme should consist of a feed-in tariff system and require utilities to purchase electricity from renewable energy systems between 1 MW and 20 MW in size.

Supporting the development of mid-sized renewable energy systems would help to overcome some of the challenges associated with the development of renewable energy markets, and also confirms California as one of the leading US states in terms of renewable energy

policy.

The US Congress has so far failed to make any headway on a nationwide renewable energy mandate, in spite of pressure from powerful lobbyists. This, and a lack of legislation governing greenhouse gas emissions, is affecting investment in the US renewable energy industry, according to several renewable energy-focused associations and groups.

The Interstate Renewable Energy Council (IREC) said that California's proposed policy would provide the foundations for long-term market growth “through an innovative pricing mechanism that also protects California ratepayers and overcomes the legal challenges that have hindered widespread feed-in tariff development in the US”.

The CPUC proposal establishes a 1 GW pilot programme for power from

eligible mid-sized renewable energy systems, and requires California's three largest investor owned utilities to hold biannual competitive auctions, into which renewable developers can bid. Utilities must award contracts starting with the lowest cost viable project and moving up in price until the MW requirement is reached for that round.

The programme will use standard terms and conditions to lower transactional costs and provide the contractual transparency needed for effective financing. Development security and relatively short project development timelines would ensure project viability, says CPUC.

The CPUC says that developing mid-sized renewable energy plants would help to overcome one of the largest barriers to the development of large-scale renewable energy projects – transmission. Smaller projects will not only be easier to finance, but can also be incorporated into existing utility

infrastructure while the state works out its transmission solutions.

But large-scale renewable energy developments are still on the cards in California, which in late August and September granted approval to three major solar thermal power projects.

The projects – the 250 MW Abengoa Mojave solar project, the 250 MW Beacon solar plant and the 1000 MW Blythe solar plant – were approved by the California Energy Commission and are eligible for federal stimulus funding. Six other large solar thermal projects are awaiting approval in the state and will also qualify for federal funding if they are approved by the end of 2010.

Together the projects will generate over 4 GW of renewable energy and will help California to meet its Renewable Portfolio Standard (RPS), which requires utilities in the state to generate 20 per cent of their electricity from renewable resources by 2010, rising to 33 per cent by 2020.

IPCC must work on credibility, says report

The Intergovernmental Panel on Climate Change (IPCC) has welcomed a report examining its management and procedures that says it needs to be overhauled to reduce the risk of errors and improve its credibility.

The report from the InterAcademy Council – a group of major scientific academies from around the world – said that the IPCC needs to put in place a strong executive committee to lead from the front, and that it should also improve its review process in order to prevent bias and errors creeping into its conclusions.

The IPCC is seen as the world's official voice of climate science but has been criticised in recent months over erroneous statements in its assessment reports. Such errors, and this year's “climategate” controversy in the UK, have not helped the credibility of climate science as a whole.

New technology funnels solar energy

A research team at the Massachusetts Institute of Technology (MIT) says that solar photovoltaic arrays could be made smaller and more powerful by using carbon nanotubes to concentrate solar energy.

The team of chemical engineers has developed the carbon nanotubes to form antennas that can capture and focus energy from the sun and has described them as “solar funnels” in the journal *Nature Materials*.

The nanotube antenna boosts the number of photons that can be captured, compared with conventional photovoltaic panels. The research team has not yet built a photovoltaic device using the antenna, but say that they plan to.

Elsewhere in the USA, a research team from Western Washington University has developed a new approach to solar electricity generation they say could eventually cut solar power to one-tenth of its current cost.

Their system relies on plastic polymers containing special dyes that capture solar energy for transport to silicon chips that turn it into electricity.

While conventional silicon solar panels collect energy only from the red portion of the sunlight spectrum, the new approach uses the entire spectrum, which enables it to convert more sunlight into electric power. The new approach also would be much more effective on cloudy days.

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The next stop on the tour of World Future Energy events is London. The European Future Energy Forum will be staged at ExCeL London in October 2010 and will be the first major showcase of the new UK Government's renewable energy policy. Held in association with Masdar and UKTI, the Forum will provide a global leadership platform for energy ministers, heads of state and international renewable energy manufacturers, investors and service providers to debate the policy, financing and infrastructure required to ensure energy security and sustainability throughout Europe.

Comprising a high-level conference, round table debates, an international exhibition and a plethora of interactive features, international pavilions and networking opportunities, EFEF 2010 will be a valuable trip out of the office for any professional working within the renewable energy or clean technology markets.

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Canadian wind sector set for growth

Next year will be a record year for Canada's wind energy industry, according to the Canadian Wind Energy Association (CanWEA).

Continued government support for wind energy has helped the addition of over 700 MW of new capacity in 2010 and the industry is likely to add a further 1000 MW in 2011, said the association at the recent World Energy Congress (WEC) in Montreal.

WEC also saw an announcement from the Canadian government that it would spend up to C\$65 million in the next decade on two key wind farm projects in Quebec province.

The government has also promised to support biofuels development in a bid to reduce greenhouse gas emissions and boost the economy.

"Building on the growth in 2010, we can also state with a high degree of certainty that 2011 will be a record year for wind in Canada with more than 1000 MW likely to be installed," said Robert Hornung, president of CanWEA. "We expect wind energy's rapid growth in Canada to continue with production tripling in the next five years."

Canada currently has 3499 MW of installed wind energy capacity, one-third of which is located in Ontario. Quebec's installed capacity is 663 MW.

The Canadian government is supporting renewable energy development through its EcoENERGY programme, which will provide a C\$0.01/kWh incentive to projects. Its Economic Action Plan will also provide C\$2.4 billion to support the development and deployment of cleaner energy technologies and supporting infrastructure.

The goal is to increase Canada's renewable energy capacity by more than 4000 MW.

With a total of six wind power projects online or in development, Cartier Wind Energy is poised to be the largest producer of wind energy in the province of Quebec.

FutureGen 2.0 takes shape

Development of the world's first commercial-scale oxy-combustion power plant with carbon capture and storage is set to go ahead after the US Department of Energy signed an agreement with the FutureGen Alliance.

The Alliance has agreed to cooperate with the DOE and Ameren Energy to develop the FutureGen 2.0 project – a revised version of the advanced clean coal project that first started planning in the 1990s. The Alliance will be primarily responsible for the project's permanent CO₂ storage site and transport pipeline.

The CO₂ pipeline will link the storage site and the power plant at Meredosia, Illinois, where Ameren Energy Resources, Babcock & Wilcox and Air Liquide Process & Construction, Inc. will repower Ameren's 200 MW Unit 4 with advanced oxy-combustion technology.

The plant's new boiler, air separation unit, CO₂ purification and compression unit will deliver 90 per cent CO₂ capture and eliminate most SO_x, NO_x, mercury, and particulate emissions.

The project has been awarded \$1 billion in Recovery Act funding.

Court ruling delays Chilean coal plant

■ GDF Suez project on hold
■ Investors raise concerns

Siân Crampsie

A court ruling in Chile is threatening to derail plans to build Latin America's largest coal-fired power plant.

The appellate court in Copiapo, northern Chile, has upheld a legal challenge to the 2100 MW Castilla thermal plant, which is being developed by Brazilian energy company MPX Energia.

The legal case against the project was filed by non-governmental organisation (NGO) Atacama Sin Carbon, which said that an official acted illegally during the project's certification process by changing the wording on some documentation.

The ruling in September came just two weeks after plans for the construction of a 600 MW coal-fired power plant in northern Chile by European firm GDF Suez were halted when Chile's new President Sebastian Piñera requested that the project be moved to another location.

GDF Suez was planning to invest \$1.1 billion in the Barrancones project, which had already received environmental approval.

According to Atacama Sin Carbon, an official in the Atacama regional government – who had been appointed by Piñera – changed the Castilla plant's environmental impact from "polluting" to "bothersome". The change allowed the project to

be approved by Atacama's Regional Environmental Council.

MPX filed the Environmental Impact Assessment (EIA) for the project at the end of 2008 and has told local media that it intends to continue with the project.

The Atacama Regional Environmental Council will have to backtrack on its approval of the plant.

The Brazilian firm maintains that the project would help to improve the security of Chile's energy supplies as it would account for around one-fifth of installed capacity in the country. It would also provide MPX with a growth platform in Chile.

The first of Castilla's 350 MW generating units is scheduled to start operating in 2011.

The delays caused by the court ruling and Piñera's request to move the Barrancones project has raised concern among investors in the region over the risks associated with infrastructure projects in Chile. Piñera wanted to move the Barrancones plant because environmentalists had objected to its location near a nature reserve.

The International Energy Agency (IEA) in 2009 praised Chile for creating an attractive investment environment and said that the country needed to boost energy security and diversity.

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Australia still contemplates how to put price on carbon

Having twice failed to gain approval for an Emissions Trading Scheme (ETS), the Australian government is still looking at how it can put a price on carbon in an attempt to meet its target of reducing greenhouse gas emissions by 5-25 per cent on 2000 levels by 2020.

Recently elected Prime Minister Julia Gillard said last month: "If we are going to reduce our carbon emissions, then we need to put a price on carbon."

Although the government's preferred system is an ETS, Gillard recently said her Labour government would not rule out introducing a new tax on carbon emissions. With a carbon tax, polluters would pay the government a set price

for each ton of carbon that they emit.

Gillard said she would not rule out her government imposing such a carbon tax after a multi-party climate change committee meets next year to consider how to charge carbon polluters.

Gillard's comments came as Marius Kloppers, chief executive of the world's biggest miner BHP Billiton, urged Australia not to wait for the rest of the world to charge polluters. Kloppers recommended that Australia introduce a carbon tax for its long-term economic interests. He also said it was in Australia's interest to reduce its emissions through a carbon tax before a new global agreement is

reached.

The government had previously shelved its plans to introduce a market for trading carbon pollution permits until 2013, when it would become clearer how the United Nations would replace its Kyoto Protocol on reducing greenhouse gases.

Meanwhile, Australia's newly appointed Climate Change Minister, Greg Combet, promised to fight for coal industry jobs, as he pursues a price on carbon.

The former Australian Council of Trade Unions leader predicted the coal industry "absolutely" has a future, even when considering his three key policy reform objectives: pursuing renewable

energy, energy efficiency and the development of carbon price for Australia.

He said: "I've got a responsibility to support those people's jobs. The coal industry is a very vibrant industry with a strong future. What you've got to do is look to how we can achieve in the longer term, things like carbon capture and storage for coal-fired power stations."

Combet is, however, in a difficult position. As part of its deal to secure government, Labour signed a formal alliance with the Greens, whose policies include the eventual phasing out of coal, Australia's biggest export earner.

Indonesia needs private investment

The exit of Japan's Tomen Power Corp. and UK-based International Power, now part of GDF Suez, from the Tanjung Jati A project is sending out a negative signal to private investors at a time when the country's electricity sector is in need of significant investment.

Indonesia's state-owned power company Perusahaan Listrik Negara (PLN) predicts that the country will require \$9.74 billion of investment to generate an additional 6248 MW of electricity for 2011.

"This amount is required for Indonesia to reach its targeted growth in electricity production of around 9 per cent per year," said PLN's Planning and Technology Director Nasri Sebayang.

He said that if the investment falls short, growth in production would also not meet expectation.

Of the total \$9.74 billion required, up to \$6.61 billion is for power generation, \$2.05 billion for transmission and \$1.09 billion for distribution.

PLN's forecast follows the news at the end of August that Tomen and International Power will quit as investors in the 1200 MW Tanjung Jati A coal fired power project in Cirebon, west Java, following protracted power price negotiations.

Tomen and International Power had formed a consortium with PT Bakrie Power and PT Maharani Paramitra to build the project.

PT Bakrie Power president Ali Herman Ibrahim said they had failed to reach an agreement on the price to be paid by PLN for the power to be generated by the project. He said work on the project was stopped as PLN failed to give an answer to the latest price proposal.

South Korea approves renewable rules

South Korea will soon introduce revised rules that will require most power generators to begin replacing an increasing part of their supplies with power generated from renewable energy sources.

"The government has completed revising all its related regulations and decrees on the development, use and distribution of renewable energy to introduce a new Renewable Portfolio Standard (RPS)," the Ministry of Knowledge Economy said in a press release.

According to the ministry, the RPS requires all electric power companies generating and selling more than 500 MW of electricity per hour to gradually increase the proportion of their power supplies generated from renewable energy sources from 2 per cent in 2012 to 10 per cent in 2022. The plan will see the country build 1000 x 5 MW wind turbines in the Yellow Sea by 2019.

The new government rules on the use of renewable energy will be announced this month and will be officially enacted from the beginning of 2012, the ministry said.



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India nuclear liability bill receives cool US reception

India's nuclear liability bill could hamper US involvement in the country's lucrative nuclear power market, potentially threatening the country's plans for new nuclear capacity. **Syed Ali**

The US is in discussions with the Indian government over concerns on the recently passed nuclear liability bill.

The US is unhappy with the bill, which it believes could hamper its involvement in India's nuclear power market. Some industry observers believe the dispute could have an adverse effect on India's plans to massively increase its installed nuclear generating capacity.

The bill passed in both houses of India's Parliament at the beginning of September and sets the terms for corporate participation in the estimated \$150 billion nuclear power market in India.

The Civil Liability for Nuclear Damage Bill, 2010, was approved after

the government accepted 18 amendments, including one that permits victims to seek compensation even 20 years after a nuclear accident. Though there is no ceiling on the compensation amount, the liability of the operator was trebled from R500 crore (\$110 million) to a maximum of R1500 crore (\$330 million).

In his initial comments after the bill was passed by both houses of Parliament, US department of state spokesman P. J. Crowley said the US would continue "discussions" with the Indian government on the issue.

The US-India Business Council, an industry body with representatives from both countries, representing 300 top US companies doing business with India, is also unhappy.

The US companies are wary of liability clauses that they feel can allow operators to pursue them for damages years after equipment or services have been provided. They have argued that in most business transactions there are "warranty periods" which limit liability but this line is not firmly drawn by the Indian law.

Lisa Curtis, from the Washington-based Heritage Foundation, described the legislation as one with the potential to "cast a pall over the historic US-India civil nuclear deal".

She said the bill retains "language inconsistent with international standards for engaging in nuclear commerce", referring to a section that "makes suppliers of equipment, raw materials, and services liable - beyond

the recourse already available through the courts - for 80 years after the construction of a plant in the unlikely event of a nuclear accident". This is in contrast to legislation passed by other countries that restricts liability exclusively to the plant operator and implicates suppliers only if "gross" and "wilful" negligence has been proved against them.

The Indian government, meanwhile, has ruled out any possibility of amendments to the nuclear liability bill.

Seeking to allay US fears at the end of September, Prithviraj Chavan, Minister of State in the Prime Minister's Office, dismissed apprehensions that the terms of the new law on nuclear suppliers' liability

in case of an accident would discourage investment in the sector.

He said that the bill was prepared on a set of internationally accepted principles in the civil liability jurisprudence.

The view in government is that these concerns are largely limited to US firms and have not been heard so strongly from French and Russian companies who will be involved in constructing nuclear power plants in India.

He said foreign companies would be allowed as suppliers only. The operator of nuclear power projects would be the government, through the Nuclear Power Corporation of India Ltd, which would approve the designs for the projects.

Philippines power companies to go public

The Philippines Energy Regulatory Commission (ERC) has issued draft rules ordering power generation and distribution utilities to sell shares to the public. Under the draft rules, generation companies, distributors and their respective holding companies are required to sell at least 15 per cent of their common shares three years from the date of approval of the guidelines.

The proposed rules also cover electric

cooperatives and qualified third parties (QTPs) operating in waived areas of franchised distributors.

ERC said the rules were drafted "to enhance the inflow of private capital and broaden the ownership base of the power generation, transmission and distribution sectors". It also said the rules were formulated to protect public interest, which is affected by rates and services of the distribution utilities and

other providers of electric power.

The Electric Power Industry Reform Act (EPIRA) of 2001 decreed that these companies must sell their shares to the public by 2006, but the implementation was shelved due to unresolved issues on how the rules should be obeyed.

Francis Saturnino Juan, ERC executive director said that the EPIRA is very clear that power generation firms and distributors should comply

with the listing requirement. "The law is clear. If you are engaged in power generation, then you have to comply," he said.

The draft rules said generation companies, distributors and their respective holding companies that are already listed in the Philippine Stock Exchange are deemed in compliance with the requirement of the public offering.

The ERC said, however, that the offer of securities through an Employee Stock Option Plan or any other plan should not be deemed as a public offering since such an offer is limited only to employees.

Generation companies under the Build Operate and Transfer (BOT) scheme will also not be deemed in compliance with the public offering requirement.

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Merkel outlines Germany's renewable future

The nuclear debate rages on in Germany, but plans to source 80 per cent of electricity supplies from renewable sources by 2050 – and the potential impact on electricity prices – could spark further discussion.

Siân Crampsie

The German government has put renewable energy and energy efficiency at the heart of an ambitious policy aimed at making the country's energy supplies secure and low in carbon by 2050.

The country's cabinet has approved the new energy plan – known as Energy Concept 2050 – under which emissions of carbon dioxide (CO₂) are targeted to fall by 80 per cent over 1990 levels over the next 40 years.

The move came just weeks after the government signed off a deal with four energy utilities to extend the lives of the country's nuclear reactors.

Chancellor Angela Merkel's government wants to take Germany into the renewable energy age while keeping energy prices affordable. It says that nuclear power is an important element of the plan, as it will act as a 'low-carbon bridge' between today's energy system and the renewable future.

Norbert Röttgen, environment minister, said it was "the most ambitious energy programme ever seen, not only in Germany". Germany's industrial lobby appears pleased with the plan but utilities have warned about its impact on energy prices.

E.On chief executive Johannes Teysen said that the "extremely ambitious" plan would "not come free of charge".

The nuclear agreement will allow

Germany's nuclear power plants to run for an average of 12 years longer than planned, putting back the country's planned exit from nuclear energy to 2036. It came after months of negotiations between Merkel, her ministers, utilities and Germany's industrial giants.

To compensate for the longer nuclear power plant running times, the four utilities – E.On, RWE, EnBW and Vattenfall Europe – will have to share some of the extra profits they will make and pay additional levies estimated at around €30 billion.

The levies come on top of a proposed nuclear fuel tax designed to help reduce Germany's budget deficit, and will put the utilities' margins under pressure in years to come. The levies will help to fund research and investment in renewable energy, says the government.

Environmentalists have criticised the plan to extend nuclear plants' operating lives because of the profits it will allow utilities to make.

In its Energy Concept 2050, Germany has set a target of sourcing 18 per cent of its entire energy needs from renewable energy by 2020, 30 per cent by 2030 and 60 per cent by 2050. Some 80 per cent of electricity demand will be sourced from renewables by 2050.

To support the massive expansion in renewable energy, the German government is relying on its system of feed-in tariffs, and has pledged €5 billion in cheap loans for offshore

Chancellor Angela Merkel's government wants to take Germany into the renewable energy age



wind development. It is also determined to accelerate investment in the transmission grid – a factor that will be crucial to renewable energy development.

An energy efficiency fund will also be established to help maximise energy savings.

Key areas of grid investment will be construction of a long-distance grid to transport wind energy from the north to the south, and the development of

smart grid and energy storage technologies. The government says it will ease planning restrictions for power lines.

It envisions the construction of 25 GW of offshore wind energy capacity by 2030, requiring a total investment of €75 billion.

The nuclear fuel tax is expected to raise €2.3 billion per year from 2011 to 2016. After that, Germany's nuclear utilities will have to make payments

amounting to around half of the additional profits they make from running their nuclear capacity, linked to inflation.

Germany was planning to close all of its nuclear reactors by 2022 under a law passed by the previous Green-SPD coalition government. The proposal to reverse this decision has caused major controversy, as many Germans are opposed to nuclear energy.

Commission proposes carbon credit restrictions

- CDM projects under fire
- ETS needs overhaul, says Sandbag

The European Commission is to scrutinise certain types of carbon credits with a view to restricting their use in Europe's emissions trading scheme (ETS).

European Commissioner for Climate Action, Connie Hedegaard says that her staff is preparing a proposal that would prevent companies from selling certified emission reductions (CERs) generated by offset projects falling under the UN's Clean Development Mechanism (CDM).

News of the proposal led to a rise in CER prices, according to market intelligence firm ICS Heren. "If the EU bans all industrial carbon credits, the supply of credits would drop by around 75 per cent," said Isabel Save, carbon editor at ICIS Heren.

The restrictions would come into effect during the next phase of the

ETS, which starts in 2013. Companies participating in the ETS have so far been allowed to trade CERs, but controversy surrounding CDM projects has put pressure on the Commission to rethink their role.

"The CDM has been successful in some aspects but has also given rise to criticism, e.g. with regard to environmental integrity," said Hedegaard. "As a first step towards a more advanced carbon market the CDM therefore needs a major overhaul."

Green groups claim that CDM projects actually result in a rise in emissions because of the money that can be made from selling CERs. The UN has also launched an investigation into certain types of CDM projects.

In September a UK-based campaign group highlighted other problems with



Connie Hedegaard: European Commissioner for Climate Action

the ETS, including a severe over-allocation of carbon permits to companies operating in the scheme.

The report from Sandbag claims that continued operation of the ETS will result in a rise in emissions unless major changes are made. It says that the European Commission should remove millions of permits from the scheme and prevent companies from carrying permits over from one phase of the scheme to the next.

"The recession has rendered the ETS caps thoroughly obsolete," said Sandbag campaigner Damien Morris.

"Unless they are adjusted to reflect our new circumstances, the EU ETS risks becoming an albatross around the neck of European climate policy, a carbon trap rather than a carbon cap, obstructing the mitigation efforts of the EU and its Member States."

France launches renewable energy package

- €1.35 billion over four years
- Czech Republic cuts subsidies

Emerging clean energy technologies are to receive new funding in France under a new package of government measures aimed at boosting renewable energy supplies.

The French government says that the new programme – known as *démonteurs énergies renouvelables et chimie verte* – will provide €1.35 billion of financial support over the next four years. The government hopes to attract a further €2 billion of private sector investment to support the programme.

The move marks a departure for France from its traditional support of nuclear energy. It also bucks the trend in Europe where some governments have reduced support for renewable energy in the face of the economic recession.

Much of the funding will be directed at emerging technologies that face relatively high development costs, such as solar, marine and geothermal energy, as well as advanced biofuels and carbon capture and storage (CCS).

Some €450 million of funding will be provided in the form of subsidies and a further €900 million in low interest loans. The French Environment and Energy Management Agency is now seeking applications for funding and will invest €190 million before the end

of the year.

France currently sources 75 per cent of its electricity through nuclear but was targeted to achieve 21 per cent electricity generation from renewable energy by 2010 under the EU Renewable Energy Directive. According to market analyst firm Datamonitor, the contribution of renewables to total electricity generation is still estimated to represent only around 2 per cent.

France could face a penalty of €0.04/kWh for non-compliance with the 2001 Renewables Directive.

In the Czech Republic, the government has approved a plan to scrap a state subsidy programme for some newly built solar energy plants.

The measure will affect solar plants built in land rather than roof-mounted facilities, and will become effective in March 2011. It is designed to prevent electricity prices from becoming too high.

The Czech Republic's generous solar energy subsidies have led to a boom in solar energy production and there is concern that the uptake of the technology will result in increased prices. The government's proposed amendment could halt the construction of 700 MW of solar energy capacity.

Earlier this year, Spain reduced generous feed-in tariffs paid to solar and energy plants.

Computer virus will not delay Bushehr

- Fuel loading starts
- Enrichment continues

Siân Crampsie

The detection of a complex worm on the personal computers of staff at Iran's Bushehr nuclear power plant will not delay the start up of the plant, according to Iranian officials.

The power plant is Iran's first nuclear plant and is due to start operating in the coming weeks. The malicious software – or 'malware' – is not thought to have affected any of the plant's control systems.

The computer worm – known as Stuxnet – was detected at the plant in September and is designed to target weaknesses in control systems used in facilities such as oil rigs and power plants. It has been described as being "very sophisticated" by Western experts and is believed to be the first known worm designed to target such infrastructure.

Project managers at Bushehr began loading fuel rods into the new plant in late August. However, attention has turned once again to other areas

of Iran's nuclear programme.

A new report from the International Atomic Energy Authority (IAEA) says that in spite of international sanctions and technical problems with its enrichment programme, Iran has increased its total stockpile of low-enriched uranium. The country is also reported to be intensifying its search for uranium deposits, and has also submitted a proposal to Russia for the joint assembly of fuel for the Bushehr reactor.

According to the IAEA, Iran now has 2803 kg of uranium enriched to the purity needed to run a nuclear power plant. This would be enough to produce nuclear weapons if it were further enriched, although the IAEA has also indicated that less than half of the centrifuges at the Natanz enrichment facility are operational.

Tehran is also hampering international surveillance of its nuclear programme, says the IAEA, a factor that is preventing the agency from confirming that "all nuclear

material in Iran is for peaceful activities".

Iran's request that it participates with Russia in the manufacture of fuel for Bushehr is seen as a move to gain more control of the nuclear fuel cycle for the plant. Russia, which is building Bushehr, is supplying all the fuel for the plant and is also supposed to retrieve all the spent fuel for reprocessing.

Iran maintains that its nuclear programme is only for peaceful purposes and that it wants to develop the infrastructure to produce and enrich uranium to fuel a planned fleet of nuclear power plants.

Iran's own principal source of uranium is the Saghand mine in the centre of the country, which has the capacity to produce 120 000 metric tonnes of ore per year. Located about 480 km south of Tehran, the mine consists of an open pit with minimal reserves and a deep mine. It has a total estimated uranium ore reserve of 1.58 million metric tonnes.

It also has smaller uranium deposits near the southern port city of Bandar Abbas where a mill is reportedly converting raw uranium into uranium ore concentrate known as yellowcake.



Bushehr control room: staff PCs were the target of 'malware'

Iran announced discoveries of new uranium deposits in 2006 at three sites in the central Khoshoomi, Charchooleh and Narigan areas.

The country's nuclear chief, Ali Akbar Salehi, has pledged to survey the whole of the country in search of uranium deposits.

Nigeria outlines privatisation plans

Nigeria is to dissolve its state-owned power monopoly in a bid to attract much-needed investment to the sector.

The country's daily blackouts are a threat to its economy and President Goodluck Jonathan has announced plans to establish 11 separate distribution companies and allow private firms to set up new power plants.

Current available electricity generation capacity in Nigeria is thought to be around 3000 MW, compared with a demand of 6000 MW. A number of initiatives implemented by the government over the last few years aimed at boosting generating capacity and the country's transmission infrastructure have failed.

In a speech made in late August, President Jonathan said that Power Holding Co. of Nigeria (PHCN) would be dissolved, and 11 new distribution companies would be created and sold to the private sector. The government wants to boost generating capacity to 14 GW by 2013.

The government's plans to expand power generating capacity will rely on the country's natural gas reserves.

Nigeria has the largest proven reserves of natural gas in Africa but poor infrastructure has so far hampered efforts to distribute the fuel domestically.

Jordan signs nuclear agreement with Japan

Jordan is paving the way for the construction of its first nuclear power plant with the signing of a nuclear cooperation deal with Japan.

Under the agreement, Japan will support Jordan in its activities to develop a civil nuclear programme, including the exploitation of uranium reserves and the construction and operation of nuclear power plants.

Jordan is also negotiating a similar agreement with the US, with a deal expected "within months", according to a senior government official quoted in *The Jordan Times*.

Jordan wants to develop nuclear power plants in order to reduce dependence on energy imports. The government has also prioritised renewable energy projects and wants renewables to account for ten per cent of the energy mix within a decade.

The deal with Japan paves the way for Japanese companies to sell nuclear technology to Jordan and lends weight to a Japanese-French consortium vying to participate in the Kingdom's nuclear programme.

Jordan has also signed nuclear agreements with France, Spain, China, South Korea, Canada, Russia, the UK and Argentina. The Kingdom wants to establish a 1000 MW nuclear reactor on a site near Aqaba by 2020, plus three further plants to follow.

A possible sticking point in negotiations over a nuclear pact between the US and Jordan is the former's desire to see Jordan renounce its right to establish an enrichment programme.

Jordan has said that it has no immediate plans to enrich or reprocess fuel, mainly because it would not be economically feasible given the size of its planned nuclear plant programme. However, it is a signatory to the nuclear non-proliferation treaty (NPT) and wants to retain its right to enrichment so that in future it could establish a joint venture enrichment programme with an international partner in order to maximise the value of its uranium reserves.

Last year the UAE signed a nuclear cooperation agreement with the USA



Jordan capital: Amman

under which it voluntarily waived its right under the NPT to enrich and reprocess uranium on its own soil.

Other countries in the region seeking to establish nuclear energy programmes include Kuwait and Egypt.

Mitsubishi Heavy Industries has teamed up with France's Areva to bid for the contract to build Jordan's first plant. They have proposed the ATMEA1 reactor, which incorporates technology from Areva's Evolutionary Power Reactor and Mitsubishi's Advanced Pressurised Water Reactor.

Other bids are expected from Canada's AECL and Russia's AtomStroyExport.

Last month saw Kuwait issue a formal statement on nuclear energy, saying that it is planning the construction of four nuclear reactors over the next 12 years. Meanwhile the Egyptian government has named el-Dabaa on the Mediterranean coast as the site for the country's first nuclear power plant.

Egypt says it will open bid proposals for the plant's construction at the end of the year.

EU, Africa set targets

Leading figures from Africa and Europe have pledged to improve access to energy for Africa's citizens as well as boost energy security and renewable energy capacity in the region.

The first meeting of the Africa-EU Energy Partnership (AEEP) established a number of targets to be met by 2020, and also marked the official launch of the Africa-EU Renewable Energy Cooperation Programme.

Targets set at the Vienna meeting, which was attended by energy and development ministers from all over Africa and the EU, include the provision of access to energy for 100 million people in Africa, a doubling of cross-border electricity interconnections within Africa and between Africa and the EU, and the addition of around 15 GW of renewable energy.

The AEEP was established at a meeting of African and European heads of state in Lisbon, December 2007. It forms one of the eight strategic partnerships that together make up the Africa-EU Joint Strategy.

"The partnership is a long term framework for broad political dialogue and reinforced cooperation," said Andris Piebalgs, EU Commissioner for Development. "One important function is to increase European and African investments in energy infrastructure and interconnections within Africa and between the two continents. The Partnership will also help Europeans and Africans to better coordinate their activities to benefit from complementarities and synergies."

AES plans storage growth

AES is to strengthen its position in the growing energy storage market through a joint development and supply agreement with Samsung SDI of South Korea.

The two companies say that the agreement will allow them to develop and deploy multi-megawatt energy storage systems that can increase the capacity, improve the responsiveness and enhance the efficiency of electric grids.

There is a growing demand for

energy storage systems around the world, as the installed capacity of renewable energy generating plants rises. AES Energy Storage has so far installed 16 MW of energy storage capacity and has a project pipeline of 500 MW.

Under the agreement, Samsung SDI will supply an initial 20 MW battery energy storage system to AES for one of its new projects. The US firm will also be able to source additional products from

Samsung, which is a leading developer of lithium-ion batteries.

The agreement will give AES a "competitive offering within the growing grid energy storage market", according to AES Energy Storage President Chris Shelton. Samsung SDI said that the venture would enable it to expand its business portfolio "from small-sized batteries for IT application and EV batteries to energy storage systems".



USEC closes first phase of investment

Plans to construct a centrifuge plant in the USA have gained ground with the closure of a \$75 million investment in uranium firm USEC by the Babcock & Wilcox Company and Toshiba Corp.

The investment represents the first of three phases of investment in USEC and will be used to progress plans for the American Centrifuge Plant in Piketon, Ohio as well as general corporate purposes.

B&W and Toshiba signed an agreement in May 2010 to invest \$100 million each in USEC, which supplies nuclear fuel to more than half of the US market and over one-quarter of the world market. Toshiba and B&W will receive preferred stock in return for their investments, and Toshiba will also acquire rights to receive enriched uranium necessary to fuel nuclear energy plants.

"This investment is an important vote of confidence by two leaders in the nuclear power industry and will strengthen the deployment of the American Centrifuge Plant," said John K. Welch, USEC president and chief executive officer. "Further, this is another essential step in the development of a strategic relationship that we believe will create new business opportunities for all three companies as the global fleet of nuclear power reactors grows."

Closing of the second, \$50 million phase of the investment will occur when USEC secures a conditional commitment on a loan guarantee from the US Department of Energy (DOE). The balance of the investment - \$75 million - in phase three is conditioned, among other things, on closing on a \$2 billion loan under DOE's loan guarantee programme for the American Centrifuge Plant.

"This investment also initiates the formation of American Centrifuge Manufacturing, a joint venture between B&W and USEC which will provide integrated manufacturing and assembly of centrifuge machines for USEC's American Centrifuge Plant," said S. Robert Cochran, President of Babcock & Wilcox Technical Services Group, Inc.

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.

Suzlon sees shift to high growth markets

Indian wind turbine manufacturer Suzlon is planning to focus its business on growth markets in developing economies in response to flat demand for its products in more established markets such as the USA and Europe.

Markets such as Brazil, China, India and South Africa are at the forefront of Suzlon's plans as government support for wind energy technology in these regions increases.

The economic recession, meanwhile, has affected plans for new wind farms

in Europe and the USA. Some European governments are reassessing their renewable energy fiscal support mechanisms, while the failure of the US Congress to pass renewable energy mandates or climate change legislation is expected to curtail demand for wind turbines there.

Suzlon is also planning to increase its stake in German subsidiary REpower as well as streamline its overall corporate structure. The *Financial Times* reported that the company may also reposition

REpower to focus on developed markets such as the USA, Europe and Australia, with an emphasis on offshore wind farms.

According to Suzlon, there is accelerating government support for wind power in India, including a recommendation for State Commissions to specify a minimum Renewable Purchase Obligation (RPO) of five per cent by 2010. In Brazil, the market is expected to grow from 700 MW to 6 GW of cumulative installations by 2019.

India to sell energy stakes

India's government has announced plans to sell minority stakes in several major energy companies in an effort to reduce its fiscal deficit and boost investment.

Oil companies Indian Oil and Oil and Natural Gas Corp (ONGC) have been lined up for the sell-off alongside other energy firms including Coal India and Power Grid Corp. The latter two are to be listed on the stock exchange.

The plans for the sale need to be approved by India's Cabinet. There are concerns that the success of the sale could be damaged by the uncertainty that has hit global capital markets, although India's energy sector is generally viewed as appealing by investors.

EDF cuts debt with UK network sale

■ Greater competition foreseen in French market
■ SPE Luminus takes over EDF Belgium activities

EDF will cut its net debt by €6.8 billion through the sale of its UK electricity distribution network business to a Cheung Kong Infrastructure Holdings-led consortium.

EDF's board of directors has approved the €5.8 billion deal, which still requires the approval of Cheung Kong's shareholders, the French government and European competition authorities.

EDF's debt is estimated at around €45 billion.

Cheung Kong's offer was made in late July and is over £1.2 billion more than EDF's target price for its UK

network business. The buying consortium includes Cheung Kong Infrastructure Holdings Ltd., Hong Kong Electric Holdings Ltd and Hong Kong tycoon Li Ka-shing's foundation.

Sale of the UK business will enable EDF to turn its attention to other matters, including pending legislation in France that would force the utility to sell around one-quarter of its nuclear output to competitors.

The move is designed to improve competition in the French electricity market and would erode EDF's market share. It could also have a

negative impact on EDF's financial performance if the price set for the sale of power to competitors is too low.

EDF says that the cost of the nuclear power it generates is around €42/MWh, but its competitors are pressing for a price closer to €35/MWh.

Elsewhere in Europe, EDF has reorganised its Belgian business with the sale of EDF Belgium's sales activities to SPE Luminus.

SPE Luminus, Belgium's second-largest energy company, has taken over EDF Belgium's sales activities

in order to strengthen its position in the market. EDF owns 63.5 per cent of SPE-Luminus.

The French firm says that the integration of EDF Belgium's sales activities with those of SPE-Luminus is a "first significant realisation of the existing synergies" between the two firms.

EDF Belgium sells electricity and gas to industrial and commercial consumers in Belgium with a portfolio of around 5000 customers. SPE-Luminus sells electricity and gas to around 1.6 million residential and commercial customers.



TECHNOS factory based in the outskirts of Paris

Tenders, Bids & Contracts

Americas

Tognum delivers Brazil gensets

Tognum has completed a \$12 million order with the delivery of 36 generating sets to its Brazilian partner Electricidade do Brasil.

The German company says that the MTU Onsite Energy gensets will be installed near the city of Manaus in northwest Brazil, generating 54 MW of electricity for the city's inhabitants.

The gensets are based on MTU 16V 4000 G83 engines and were delivered just seven weeks after contract signing.

NRG orders Flex Plant CCGTs

US power company NRG Energy has placed an order with Siemens for the supply of two combined cycle power plants that are specifically designed to meet the needs of the peaking and intermediate markets.

Under the deal Siemens will supply two of its SCC6-5000F Flex-Plant 10 combined cycle power islands, which can generate an output of 300 MW within ten minutes of start-up. The plants will be located in El Segundo, California, and will come on-line in early 2013.

The Flex-Plant 10 plants will be equipped with an SGT6-5000F gas turbine and will operate with a net efficiency of 49 per cent.

"The Siemens Flex 10 technology provides the California grid what is needed to meet aggressive environmental goals," said Steve Hoffmann, President of NRG's West Region. "The fast-start features help firm intermittent renewable resources while the high efficiency meets new clean air standards."

MPX to build Brazil solar plant

Brazilian power company MPX is to build Brazil's first commercial solar power plant, according to Brazilian news reports.

The 1 MW plant will be built in Taua, Ceara state at a cost of R\$10 million and will supply electricity to around 1500 households. MPX has already applied to regulator Aneel for authorisation to raise the capacity of the plant to 5 MW by 2012.

MPX is planning to build a total of 50 MW of solar capacity in Brazil over the next few years.

Babcock wins solar boiler contract

BrightSource Energy has signed a series of contracts with Riley Power Inc., a subsidiary of Babcock Power Inc., for three boilers for a solar thermal power plant in California's Mojave Desert.

The 392 MW Ivanpah solar electric generating system will consist of three separate solar thermal plants based on BrightSource Energy's Luz Power Tower technology and will be the world's largest solar power project.

Gamesa supplies Brazil wind farms

Gamesa has been named as the designated supplier of wind turbines for nine projects under development in Brazil by Iberdrola Renovables.

The Spanish wind turbine manufacturer will supply a total of 258 MW of installed capacity and will also be responsible for transport, installation and start-up of the units.

The agreement comes after Iberdrola Renovables and Neoenergia won a bid to build the nine projects in a tender held by the Brazilian government.

Asia Pacific

KVK adds eight Wärtsilä engines

Wärtsilä has signed an agreement with KVK Energy Group to supply power generating equipment and engineering for a gas power plant to be built in Rajahmundry, Andhra Pradesh, India.

The scope of supply includes eight Wärtsilä W20V34SG gas engine generators and auxiliaries, as well as the engineering, erection and commissioning of the power plant.

Together with three more Wärtsilä engines ordered in March 2010, the new power plant will generate over 100 MW. The first engines will start operating this month while the entire plant will be fully operational at the end of 2011.

Mr Ole Johansson, President and CEO, Wärtsilä Corporation, said: "This order is an exciting opportunity for Wärtsilä in terms of gas based power generation in India. Wärtsilä gas power plants can be used for both base load operation and grid stability or peaking applications, and as the customer's need changes, so can the operational profile of our plants."

Order placed for Zhoushan USC boilers

Babcock & Wilcox Beijing Company (BWBC) has signed a contract to build two 1000 MW ultra-supercritical coal-fired boilers for a major coal-fired power plant project in Zhoushan, Zhejiang province, China.

The two Spiral Wound Universal Pressure (SWUP) boilers will be the first 1000 MW SWUP Babcock & Wilcox (B&W) boilers in operation in China and will utilise one of B&W's most advanced and efficient coal-fired boiler designs. Delivery is scheduled for mid-2012.

BWBC is a joint venture between B&W Power Generation Group and Beijing Jingcheng Machinery Electric Holding Company.

South Korea to test new nuclear design

South Korea's state-run atomic energy laboratory has won a contract to carry out computer simulation tests on the safety of a next-generation nuclear reactor design being developed by the USA.

Under the \$620 000 contract, the Korea Atomic Energy Research Institute will carry out system safety transient analysis on the superheated gas mechanisms proposed for use in the Next Generation Nuclear Plant (NGNP). The tests are due to be completed by August 2011.

The analysis is the critical first stage for the conceptual design of the heated gas-powered reactor and aims to see if all accidents that could occur with the NGNP could be controlled with the built-in safety systems. The analysis will also check such areas as accidents caused by extreme pressure, leakage of coolants and mechanical failure in the steam generators.

MHI, Marubeni win Korea USC order

Mitsubishi Heavy Industries Ltd. (MHI) and Marubeni Corporation have jointly received an order for two 1000 MW steam-turbine generator sets for installation in a major new power plant being constructed in South Korea.

The units will be installed in units 9 and 10 of Korea East-West Power Company's (EWP's) Dangjin coal-

fired power complex. The units are the largest coal-fired power units ever built in South Korea and will also be its first 1000 MW ultra-supercritical power generation units.

Units 9 and 10 at Dangjin will help to meet increasing electricity demand associated with South Korea's economic growth. Delivery of the units is expected to begin in 2013.

Europe

Wind Works adds German project

Wind Works Corp is boosting its portfolio through an agreement to develop a 20 MW wind energy project in Germany.

The US-based renewable energy development firm has signed a deal with Germany's Energy Farming International (EFI) to build and operate jointly the wind farm near Wassertrudingen, Bavaria. The project will be Wind Works' third wind power project in Germany.

Under the agreement, Wind Works will make an initial payment of €100 000 as well as contribute €1.4 million towards the cost of the project. Wind Works will hold a 50 per cent stake in the wind farm, which is due to be completed in 2012.

Shaw to build Pembroke HRSGs

The Shaw Group has received an order to build five heat recovery steam generators (HRSGs) for the Pembroke power plant, the largest and most efficient combined cycle gas fired power station in the UK.

The order was placed by Alstom Power, the main engineering, procurement and construction (EPC) contractor for the 2160 MW project. The Pembroke power plant will be owned and operated by RWE and is expected to start operating in late 2012.

GE selected for wind farm expansion

Germania Windpark has announced the selection of GE's 2.5 MW wind turbine technology to expand a wind farm near Magdeburg in central Germany.

GE is to supply three turbines to the Groß-Santersleben Süd wind farm, where eight 1.5 MW GE wind turbines are already operating. GE and Germania Windpark have also signed a full service agreement (FSA) covering the new wind turbines.

Nuon plans new CCGT

Dutch utility Nuon has placed an order with Siemens Energy for the turnkey construction of a 435 MW combined cycle power plant near Amsterdam.

Siemens will be responsible for construction of the plant and will also supply the main components, including an SCC5-4000F gas turbine, an SST5-5000 steam turbine, an SGen5-2000H generator, the entire electrical equipment and an SPPA-T3000 I&C system. The German firm has also secured a contract for the maintenance of the gas turbine, steam turbine and generator.

The Diemen 34 plant will reach efficiency levels of up to 59 per cent, according to Siemens. It will supply enough electricity for 750 000 Dutch households and will also be capable of supplying as many as 25 000 households in the immediate vicinity with district heat by means of steam extraction.

REpower signs Klagerup deal

REpower Systems has signed an agreement with Klagerup Kraft to deliver three wind turbines for a project in Sweden.

REpower will supply three of its 2 MW rated MM92 wind turbines to the Klagerup wind farm near the city of Malmo in Skane province. The project is due to be operational in 2011.

"Sweden is an important market for the future of wind energy," said Per Pedersen, chief marketing officer of REpower Systems. "The Swedish government's concrete and ambitious goals for the expansion of renewable energy sources, the simplified planning and approval process, along with the joint certificate market with Norway, slated to be active by 2012, offers a supportive regulatory framework for wind turbine projects."

Alstom to build Whitelee extension

Alstom has received an order worth over €200 million from Scottish Power Renewables (SPR), a subsidiary of Iberdrola Renovables, to build a 217 MW extension to the Whitelee wind farm in Scotland.

Alstom will install 69 of its ECO 100 wind turbines, each with an output of 3 MW, and six ECO 74 wind turbines, each with an output of 1.67 MW. The turbines will be fully operational in May 2012.

The contract includes supply, transportation, installation, commissioning and operation and maintenance.

Alfonso Faubel, vice president of Alstom Wind, said: "This order represents a major technological milestone, while strengthening our relationship with SPR and, of course, with Iberdrola Renovables, for whom Alstom has installed six wind farm projects in Europe totalling some 185 MW."

International

Doosan wins Rabigh contract

Doosan Heavy Industries & Construction Co. has won a \$3.39 billion order to build a power plant in Saudi Arabia.

The contract for the 2800 MW Rabigh power plant was awarded by state-owned Saudi Electricity Company (SEC) and represents Doosan's largest ever plant deal.

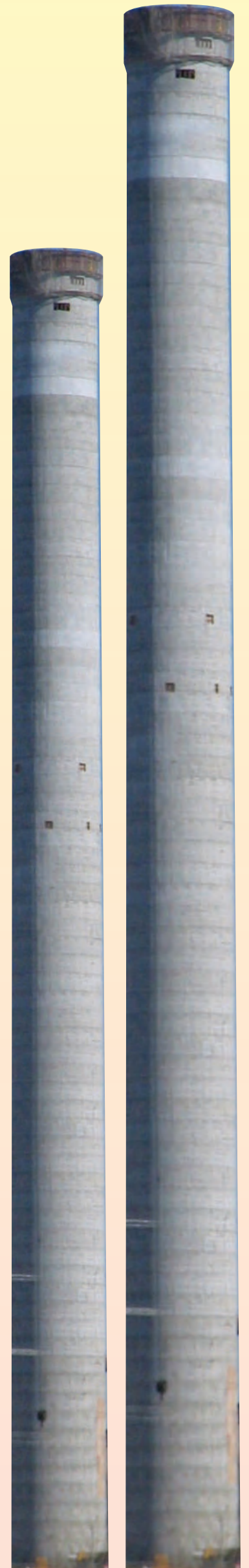
Construction of the oil-fired facility was due to begin at the end of September 2010 and will be completed by the end of 2014.

Siemens wins Geregu II contract

Nigerian utility Niger Delta Power Holding Company (NDPHC) has placed an order with Siemens for the construction of the Geregu II gas turbine plant in Ajaokuta, Nigeria.

Under a deal worth €230 million, Siemens will build the 434 MW plant on a turnkey basis, supplying three SGT5-2000E gas turbines, the electrical equipment and an SPPA-T3000 instrumentation and control system. The plant is scheduled to start commercial operation in late 2012.

Geregu II is a follow-up project to the Geregu I power plant, which Siemens built in 2006. "After construction of the Afam and Geregu I power plants the order for Geregu II marks a further milestone for Siemens in Nigeria and in Africa," said Michael Suess, CEO of the Fossil Power Generation Division of Siemens Energy.



Assessing the case for CCGTs

While gas price volatility could provide an opportunity for investments in combined cycle gas turbine plants, the targets for deployment of low-carbon generation over the next 20 years will create significant volume risk for combined cycle gas turbine plants. This could undermine the investment case.

Stephen Woodhouse

Current uncertainty in the electricity market presents a challenging investment environment for any type of generation. This uncertainty is driven by both markets, through commodity prices, and by policy makers, whose aspirations are not backed by actions. The latter is of particular importance as investors find it much harder to manage policy uncertainty than market uncertainty. Attention of market players can be diverted more towards lobbying behaviour rather than setting corporate strategy based on a clear long-term policy framework.

Recent years have seen unprecedented volatility in fossil fuel prices, which has fed through into a much wider range of prices in future scenarios. Just as the world started to settle in summer 2008 into a new paradigm of prices over \$100/barrel supported by the approach of peak oil, prices crashed through that floor even more quickly than they had risen in the first place.

This was followed by a collapse in gas prices, caused initially by oil indexation but then persisting as the global downturn and the shale gas developments in the USA shifted the balance of supply and demand, weakening the link between oil and gas prices. Much debate now focuses on when and to what extent, oil price indexation will return to its historical strength.

Gas price volatility could provide an opportunity for investments in combined cycle gas turbine (CCGT) plants, which unlike other forms of generation, would be largely shielded from its effects if gas fired plants set prices in most hours. However, the targets for deployment of low-carbon generation over the next 20 years will create significant volume risk for CCGTs, which could undermine the investment case.

Governments have set ambitious targets for the contribution of electricity generation to a low carbon energy future, but their actions are not giving much credibility to their words. The failure to reach real agreement at Copenhagen highlights global disagreements over the future direction of carbon policy and hence, carbon prices.

Although the EU is now pushing ahead with discussions of strengthening their 2020 target from a 20 per cent to a 30 per cent reduction, this reflects the fact that the global downturn has

made the more stretching target easier (and cheaper) to meet. It certainly does not illustrate any faith within the EU that a global deal on emissions will be reached in the near future.

Politicians across Europe are warning of an age of austerity, with a retrenchment in government spending. Against this backdrop, the cost of renewable support schemes will come under increasing scrutiny.

These schemes could become a victim of their own success – as increasing amounts of renewable generation are deployed, support costs will rise, and intermittent generation like wind will exacerbate price volatility and volume risk in electricity markets. Germany and Spain, world leaders in wind generation, have already seen a number of periods of zero or negative prices. Where wind generation is exposed to wholesale market prices, this price volatility could further increase the level of non-market support required.

Worries about a growing incompatibility between low-carbon goals and existing energy market frameworks has moved market reform back up the political agenda. For example, the UK government has launched a wide-ranging Electricity Market Assessment. The creation of new value streams is being discussed as markets adapt to much higher levels of renewable generation, with the result that market players need to position themselves to capture the revenue of tomorrow without knowing its nature.

All of this uncertainty is magnified by the size of the gap between policy aspirations and plausibility, for both supply and demand of electricity. The national renewable action plans published this summer set out impressive projections for renewable growth rates in many countries – it will be even more impressive if these are actually achieved. At the projected levels, renewables would revolutionise the energy markets, as typified by the plans for more than 50 GW of solar to be installed in Germany by 2020.

Underpinning the low-carbon energy policies is an assumption that governments will be able to push through radical improvements in energy efficiency. If ambitious targets are not met on the demand-side, even greater deployment of renewables and other low-carbon generation will be needed to meet the environmental targets.

These developments make the



The investment decision for CCGT is becoming ever more complex says Stephen Woodhouse

investment decision for CCGT developers ever more complex. Indeed, it is fascinating to look at the prospects for CCGTs if the green agenda manages to succeed across Europe.

Meeting the stretching environmental targets would require European electricity systems to accommodate much higher levels of low-carbon generation, which is often variable and/or inflexible. Indeed, one of the most important uncertainties for CCGT developers is whether the large volumes of offshore wind currently proposed are actually built to scale and time.

The combination of variable and inflexible generation would make electricity markets look very different, as captured by Pöyry's robust modelling platform for intermittent and thermal generation, demand-side activity and interconnection. Initially developed to look at Great Britain and Ireland, this model now stretches across North West Europe, considering the balance between wind, nuclear, solar and hydro, and considering the contribution of 'smart grids', a North Sea Grid and the Alpine and Nordic hydro systems.

Pöyry's modelling shows how CCGTs would have to contend with more volatile wholesale electricity prices and greater uncertainty in average capture prices. Volume risk would also grow as many CCGTs get pushed from operating at 'mid-merit' to behaving much more like peaking generation. Pöyry's study of the impact of intermittency on the electricity markets in GB and Ireland found that returns on new CCGT fell to about 6 per cent in 2020, which is probably too low to support new investment based on current cost of capital and the risk profile of operating in such a volatile market.

The challenges for CCGTs in this market would vary significantly depending on the flexibility and running costs of individual stations. Existing CCGTs may provide the flexibility required to balance wind, moving into low load factor/peaking operation whilst new CCGTs may be able to find a place in the generation mix with high efficiency and high load factors. However, optimising efficiency may compromise plant flexibility, and generators would need to factor in the operational consequences of providing flexibility in terms of maintenance costs and reliability, particularly for aging plants.

On the other hand, a focus on investments in flexibility exposes CCGTs to the risk that other sources stop them capturing the value of

flexibility – threats to CCGTs in this area include demand-side response particularly after the electrification of heating and transport, dedicated peaking plant (perhaps supported by contracts with the system operators), expanded interconnection and new forms of bulk storage. This risk would only be exacerbated by any binding requirements to be 'CCS-ready' given the associated operational and investment risks.

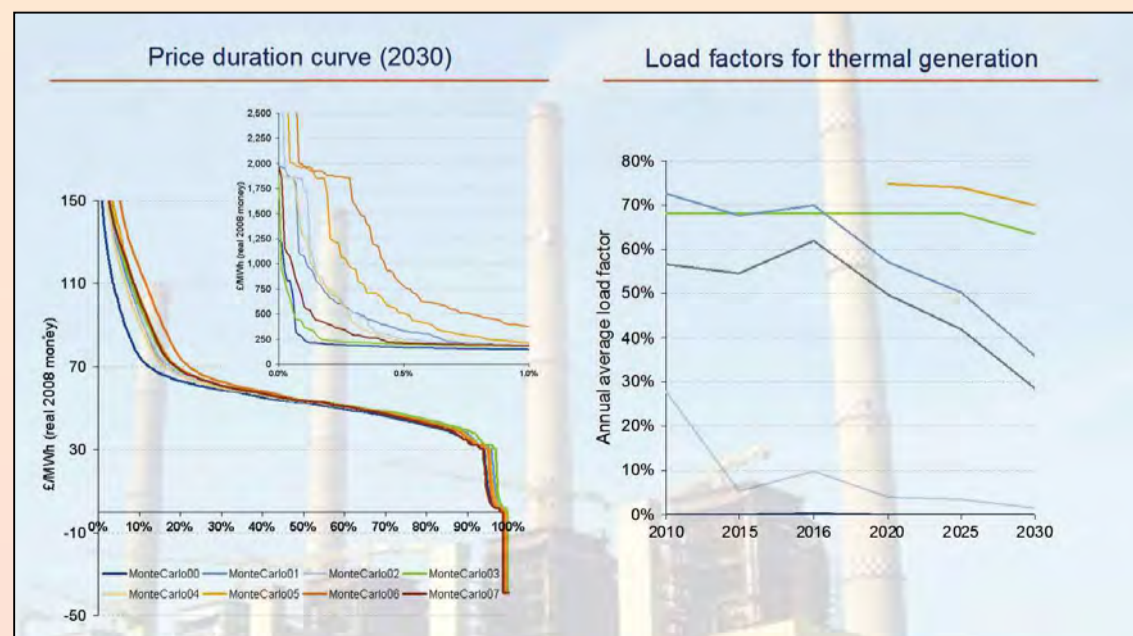
Lower load factors would mean that the plants are much more reliant on being able to recover capital and fixed costs over a much smaller number of hours. This could be either implicitly through price spikes, which may be dampened by policy makers, or explicitly through some form of capacity payment mechanism. Another option would be for the system operator to facilitate some form of 'brokered reserve' market under which generators could offer reserve to other market participants. In real dispatch the system operator could call on this reserve and prices for imbalance would be differentiated between those who had purchased reserve and those who had not.

Without any form of capacity mechanism, a more variable operating pattern, greater price volatility and sensitivity to market design would all push up the cost of capital and hence the required return.

In order to capture the high price periods, a CCGT would be reliant on the gas system to be sufficiently flexible both in terms of networks and in terms of energy supply. The development of networks is reliant on the priorities of regulators and regulated monopolies, whose incentives may not be aligned with that of the CCGT operator. Pöyry's recent gas intermittency study explored the role of investment in gas storage in helping to meet future requirements for flexibility from the power sector.

The impacts on CCGTs will vary by country, as currently being examined in Pöyry's study into the impact of intermittency on North West European electricity markets. It is clear the future environment for CCGT investment and operation would look very different from today's world if political rhetoric on renewables and CO₂ were indeed matched by commensurate action. To remain competitive, players throughout the CCGT supply chain will need to be flexible enough to respond to the changing political and market dynamics.

Stephen Woodhouse is Director of European energy consultancy, Pöyry



Pattern of prices and load factor for thermal generation in GB

Source: Pöyry Energy Consulting – Study into the impact of intermittency on electricity markets in GB and Ireland

SPECIAL REPORT **China**

Liu Zhenya:
leading China's
smart grid
revolution

China's backbone to a low carbon economy

State Grid Corporation of China (SGCC) is making significant progress in building a strong, intelligent transmission and distribution grid, which will form the backbone of the country's new energy infrastructure. The new smart grid will play an important role in China's efforts to reduce carbon emissions.



Liu Zhenya

There are some notable new trends in energy development that will completely change the energy landscape.

A new energy revolution is about to begin, a revolution aimed at addressing the pressing issues in energy supply, energy safety, energy efficiency and environmental protection and to secure safe, economical, clean and sustainable energy supply.

Focusing on electric power and marked by the development of clean energy and the smart grid, the coming revolution is characterised by energy structural diversification, large-scale energy exploitation, greater domination of electricity in energy consumption and smart energy development.

The modern power grid is undergoing profound changes in terms of functionality. In addition to being the vehicle for power transmission as a traditional grid, the modern grid is evolving into an open, efficient, high-quality and convenient public service network that is integrated with other networks such as the internet, TV network and radio network. The new grid will integrate and utilise both energy flow and information flow, therefore becoming an important and effective tool to promote the low carbon economy, and play a vital role in energy transformation and social progress.

There is also a move to ultra-high voltage (UHV) power transmission as

the basis for a strong and smart grid in global power grid development. In recent years, State Grid Corporation of China (SGCC) has attracted a great deal of attention from international communities and counterparts as a result of its achievements in developing UHV power transmission and building a strong and smart grid.

Meanwhile, the US aims to build a smarter, more efficient and highly adaptive power grid. Some EU countries are also actively planning to build a pan-European grid to increase its power transmission area. Based on plans for power transmission from large centralised power plants, countries such as India and Brazil have identified UHV technology as key to their energy development plans. In addition, South Korea is planning to construct a nationwide smart grid by 2030.

SGCC has achieved a number of major accomplishments in UHV power transmission and smart grid technology.

Firstly, it has successfully put both UHV AC and DC demonstration projects into operation. The 640 km long, 1000 kV UHV AC demonstration project, starting from Shanxi Province to Hubei Province, has been operating smoothly since its completion on January 6th 2009. The 1907 km long ± 800 kV UHV DC demonstration project with a capacity of 7000 MW, starting from Sichuan Province to Shanghai, was completed and put into operation on July 8, 2010. The project's voltage level, capacity and length are

the highest in the world.

Secondly, key strong and smart grid projects have made substantial progress. SGCC has developed a masterplan for strong and smart grid construction with dozens of pilot projects covering all sections of the power industry, including power transmission, distribution, consumption and dispatching. One of these projects, the Smart Grid Comprehensive Demonstration Project at Shanghai World Expo Park, has begun operation.

In cities like Shanghai and Beijing, the first batch of Power Fibre to the Home (PFTTH) Smart Community Pilot Projects has been completed. Construction of China's largest wind power, solar power and power storage demonstration project has commenced. The Tianjin Eco-City Smart Grid Comprehensive Demonstration Project with the application of smart city, smart transportation, smart home appliance and renewable energy generation technologies is under construction.

Thirdly, technical breakthroughs have been made in power testing facilities and key technical research. SGCC has constructed a large power grid testing and research system with full functionality and world-leading capability. The Wind Power and Solar Power Generation R&D (Testing) Centre has been preliminarily completed.

Some of the key UHV DC power transmission technologies have been developed and put into use. Key UHV equipment and components such as

large transformers, reactors, converter transformers, converter valves, 6-inch thyristors etc, have been developed. There have also been a number of achievements in smart meters, large-capacity energy storage batteries and low voltage cross-over technology for wind turbines.

With respect to combating global climate change, promoting energy conservation and greenhouse gas emission reduction, SGCC has been improving the grid's functionality to optimise resource allocation, promote the efficient use of environmentally friendly energy and the development of large energy bases.

By 2020 a strong, smart grid with a UHV synchronised grid as its backbone will be established in China, with coordinated development of grids at all voltage levels. By this time, more than 400 GW of clean energy will be connected to the state grid, 320 GW more than in 2005. At the same time, by adopting better performance and larger capacity thermal generation units, efficiency will be improved and coal consumption will be decreased by 38 g/kWh by 2020 compared to that in 2005.

SGCC is fully leveraging the grid's function to optimise the energy consumption pattern and further improve the proportion of clean energy in overall end-user energy consumption. At the same time power consumption efficiency is being optimised. Fossil energy such as coal, oil and gas will be replaced by electric

power through the extensive application of new power technology and equipment – the energy consumption structure will be optimised so that there is a larger proportion of electric power in total energy consumption. This will improve energy conservation and reduce greenhouse gas emissions.

Another important undertaking by SGCC is the comprehensive updating of smart technologies on the grid, while continuing to lower the grid's transmission loss. To this end, a series of refurbishment projects in distribution automation, smart substation, status monitoring of power lines and power consumption information collecting systems have been implemented. This improves the system's safety and operational resilience. By 2020, the state grid's operational loss will be lowered to 5.7 per cent from 6.59 per cent in 2005. In addition, a carbon emission trading mechanism has been set up and SGCC is currently cooperating with the World Bank on a CDM project that involves the early replacement of transformers in the distribution grid.

It is estimated that in the next 10 years, through all of these efforts, with a strong and smart grid as a platform, SGCC will realise emission reductions of over 10 billion tons of CO₂. This is of great significance in China's efforts to cut carbon emissions in the future.

Mr Liu Zhenya is President and CEO of State Grid Corporation of China.

On the clean technology path

China is tackling climate change on all fronts and is likely to step up the pace under the next Five Year Plan.

Giuseppe 'Joseph' Jacobelli and Dr Jian Liang

The outlook for the development of clean technology and renewable energy in China is bright, at the least for the current decade.

For several years, Chinese authorities have been fully aware of China's role in global greenhouse gas (GHGs) emissions. They have gradually put in place, and begun to aggressively execute, a series of national policies addressing climate change. Examples of these are the "Policies & Actions for Addressing Climate Change" White Paper, and the amended "Renewable Energy Law". National targets have also been proposed for non-fossil fuel use, CO₂ emissions and reducing energy consumption.

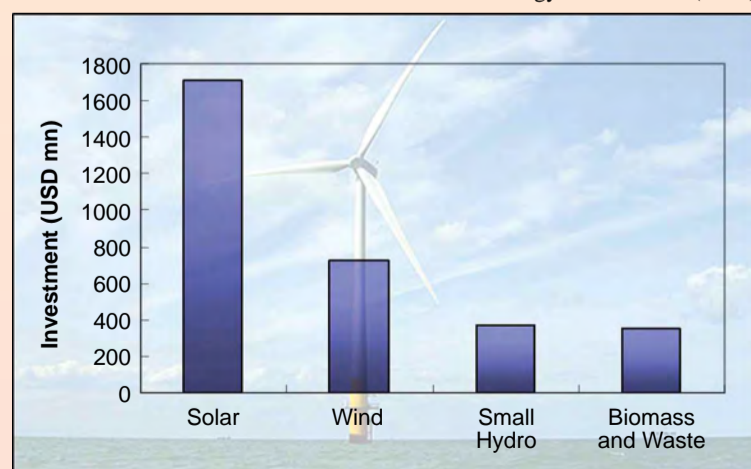
However, authorities face the massive challenge of rapid economic growth requiring enormous amounts of energy, of which fossil fuels currently make up 90 per cent. Some 83 per cent of the energy for one of the primary sources, electric power, is from coal fired plants. This is despite a sharp growth in wind generation capacity; a staggering 14.1 GW was added in 2009 representing a 127 per cent year-on-year growth.

China faces many other challenges in addition to seeking to diversify its over-reliance on fossil fuels for its energy requirements, whilst maintaining a sustainable economic and social development. For example, high uncertainty over the continuance of the Clean Development Mechanism (CDM) post-2012 raises serious question marks about future potential carbon revenues for renewable energy (RE) projects such as wind farms.

Another challenge is the location of RE resources. The bulk of RE resources rich regions are in the north or northwest where there is limited electricity demand and a lack power infrastructure. This has meant that around 25 per cent of wind capacity was still not grid-connected by 2010.

Also authorities have tried to promote the growth of solar generation but the still high price per kWh compared to conventional and even wind generation is a daunting consideration. For example, the very low price (\$160/MWh) for the first solar concession in Dunhuang (Gansu) was still 60 per cent higher than that from coal-fired plants.

Meanwhile, there have been enormous efforts on the clean energy policy front. New agencies have been created to better coordinate the formulation of energy strategy and development planning. The National Energy Administration (NEA) was formed in 2008, while the beginning of the year saw the creation of the National Energy Commission (NEC)



VC/PE investment in Chinese low carbon energy (2005 - Aug. 2010)
Source: Bloomberg New Energy Finance

Item	2005 Actual	2010 Target	2020 Target
CO ₂ Emission Reduction per unit of GDP from the 2005 level	—	—	40 per cent-45 per cent
Energy consumption reduction per unit of GDP from the 2005 level	—	20 per cent	—
RE contribution in total energy consumption	7 per cent	10 per cent	15 per cent
Hydro (GW)	117.0	190.0	300.0
Nuclear (GW)	7.0	12.0	70.0 - 86.0 (40)
Wind (Total) (GW)	1.3	10.0	150.0 (30)
Offshore Wind	—	—	30.0 (n.a.)
Solar PV (GW)	0.1	0.3	20.0 (1.8)
Biomass Power (GW)	2.0	5.5	30.0 (n.a.)

China's mid- to long-term targets in mitigating climate change

Note: The 70-86 GW nuclear, 150 GW wind (total), 30 GW offshore wind and 20GW solar PV targets are being discussed by Chinese policy makers; the figures in brackets in the last column are the original 2020 targets set before
Source: National Development and Reform Commission, and other sources

in January 2010.

China has already set a series of mid- to long-term targets to address the climate change issue. Thus far, the 2020 targets for some RE sources are still being refined, most likely on the upside. It is likely that further policies will be introduced and higher targets set under the Twelfth Five-Year Plan (2011-2015).

At the moment, hydro and nuclear dominate low carbon power generation, although wind and solar continue to achieve higher annual compound growth rates compared to

The government has set an aggressive target of at least 150 MW from CSP by 2015. The NEA plans to launch the first concession bidding for a utility scale (50 MW) CSP project in Inner Mongolia in the third quarter of 2010, although progress on the project is slow.

A key factor that could influence the development of CSP may be the CNY/kWh, which will be much higher than the bidding prices in the second round of solar PV concession projects. Given technology maturity, capital cost requirement and China's

CNY980/MWh (\$144/MWh), almost double that of onshore wind projects. In May 2010, the first offshore wind concession was launched, including two near-shore projects with installed capacity of 300 MW each and two inter-tidal projects with a capacity of 200 MW.

With the rich offshore wind resources and government subsidies, offshore wind should continue to grow rapidly. However, due to a lack of Intellectual Properties for large scale wind turbine manufacturing, lack of offshore wind farm installation, operation and maintenance experience, as well as the high capital cost of offshore wind projects, it will be some time before offshore wind projects are commercially competitive.

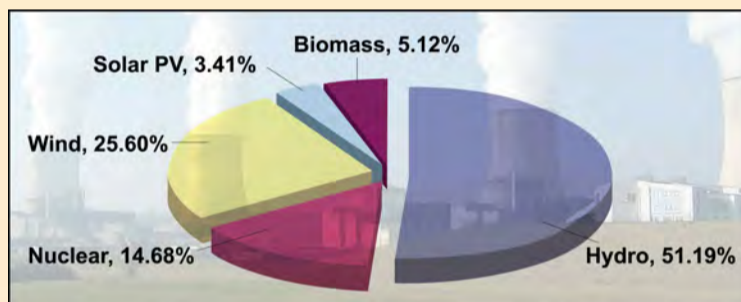
Building a low carbon future will call for significant financing. To accelerate technology and project development, government subsidies and venture capital (VC) and private equity (PE) investments are essential. Even during the global financial crisis in 2008, low carbon projects investments still saw high-speed development in China, partly thanks to the enabling government policies and the CNY4 trillion (around \$586 million) stimulus package.

With regards to carbon markets, China is one of the major CDM players in the carbon markets. About 2632 CDM projects had been approved by the NDRC as of September 25th this year, of which 917 projects had been registered mainly in hydro and wind.

Today, China has already set up three environmental exchange platforms for future emission trading: the Shanghai Environment and Energy Exchange (SEEE), the Tianjin Climate Exchange (TCX), and the China Beijing Environment Exchanged (CBEEEX). Currently, China is drafting criteria to facilitate the VERs market development, and also considering extending CDM approval beyond 2012.

China is also considering the feasibility of carbon tax and cap-and-trade platform to reduce GHG emissions. In February 2010, a small-scale energy intensity trading project was launched at the TCX, where two parties bought CEAs from three heat suppliers with the possibly amounting to 11 500 tonnes of CO₂. However, it still has a long way to go in terms of building a large scale and mature cap-and-trade platform.

Giuseppe 'Joseph' Jacobelli is Group Director, Carbon Ventures, and Dr Jian Liang is Senior Associate, Low Carbon Tech, Carbon Ventures, CLP Holdings Ltd.



The combination of low carbon generation capacity in 2020 (targets)
Source: National Development and Reform Commission, and other sources

hydro and nuclear. It is projected that their contribution in the whole portfolio by 2020 will be significantly higher.

A series of policies and programmes to facilitate projected solar development have already been rolled out. Two examples, the "Gold Sun" programme and "Building Integrated Photovoltaics [BIPV]" programme are mainly for small to medium-scale project development while the concession bidding is mainly for utility-scale project development.

The first concession for solar PV began in 2009. The 10 MW Dunhuang PV project was finally set at CNY1090/MWh (\$160/MWh), though the lowest bidding price was CNY690/MWh (\$101/MWh). In August 2010, the NEA opened the second concession bidding for 280 MW. Thirteen projects ranging from 10 MW to 30 MW in six provinces were included. The lowest bidding prices for all projects was below CNY1000/MWh (\$147/MWh). Most project developers have said these projects are unlikely to deliver reasonable project returns. Compared to feed-in tariffs (FiTs) in other regions in Asia Pacific, these prices are extremely low and unattractive.

The other popular form of solar, concentrated solar thermal power generation (CSP), is still at an early stage of development in China. The first solar thermal pilot, a 1 MW plant based on heliostat-tower technology, should be commissioned in Beijing before the end of this year.

FiT policy, CSP project development is likely to be slower than solar PV project development. However, as the technology develops and mass production of the key components is executed domestically, CSP should have a high application potential in future.

Looking at wind power, through 2006 to 2009, the cumulative installed onshore wind capacity increased from 2.6 GW to 25.5 GW, an annual growth of about 114 per cent. The new installed capacity in 2009 was 14.1 GW, the highest in the world. Based on Bloomberg NEF data, the total installed wind capacity may reach 41 GW in 2010, much higher than the previous 10 GW target for 2010.

However, grid connection remains a key hurdle. As of May 2010, around 6.3 GW had not been grid connected i.e. 22.5 per cent of total capacity. Authorities have been implementing an ultra high voltage grid, kicking off the development of a strong "smart" grid to enhance the electric power infrastructure. However, the required investment is huge and it may take many years to build new facilities. Grid connection will remain an obstacle to wind project developers in the near term.

Currently the offshore wind project development in China is still at an early stage. However, there are plans to install 5 GW by 2015, increasing to 30 GW by 2020. The first utility scale (102 MW) offshore wind demo project was commissioned in mid-2010 generating electricity at

Reducing carbon intensity

China has pledged to make continued improvements in energy efficiency and has set challenging targets for carbon intensity. However it faces an uphill struggle against the coal-based energy engine that is driving its economy.

Siân Crampsie

Missing government targets is not an option in China. As the country reaches the end of its current Five Year Plan (FYP), extreme measures have been taken in some areas to ensure that goals set out for energy efficiency and emissions will be met.

According to some reports, electricity has been cut to homes and businesses for hours at a time, while in August the government ordered the shutdown of over 2000 polluting industrial plants by the end of September in order to curb energy use.

The measures are an indication of the seriousness with which China views the targets, and the difficulty that it has in meeting them.

In the current 11th FYP, running from 2006 to the end of 2010, the Chinese government pledged to reduce energy intensity – the amount of energy that is used to generate each unit of GDP – by 20 per cent from 2005 levels. It also laid out targets for sulphur dioxide (SO₂) emissions.

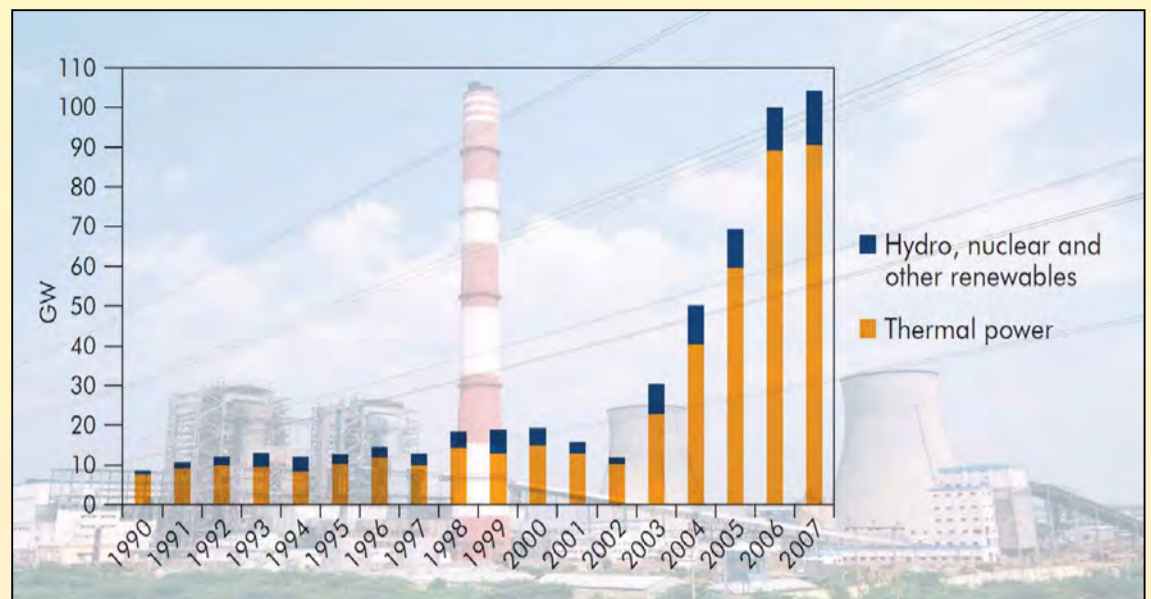
Targets for the 12th FYP, which is due to be approved in the coming weeks, are likely to be more stringent, while China has also set challenging targets for carbon emissions and renewable energy to be met by 2020.

China made good progress on energy efficiency throughout the 11th FYP period with an improvement of 14.4 per cent between 2006 and the end of 2009. However, government spending on major infrastructure projects in early 2010 to ward off the worst effects of the economic recession have somewhat derailed earlier efforts and it is now unclear whether the 20 per cent energy intensity target will be met.

There are also now question marks over whether China can hit the targets set for carbon intensity (emissions of carbon per unit of GDP) and renewable energy for 2020, especially in view of its continued strong economic growth and heavy reliance on coal. The government announced in late 2009 that it would reduce its carbon intensity by 40-45 per cent over 2005 levels by 2020. It has also pledged to ensure that non-fossil energy sources will supply 20 per cent of total primary energy supply by 2020.

Since 1990, China's economy has grown four-fold and energy use has doubled. It has also become the world's fastest-growing energy consumer while energy-related carbon dioxide (CO₂) emissions have doubled since 2000.

These trends are largely due to the fact that China's economy is heavily biased towards goods manufacturing and export and that coal is the most widely used energy source in the



Commissioning of new generating capacity in China

Source: IEA

country. Coal accounts for 65 per cent of total primary energy supply (TPES) and more than half of all coal supplies are used in power generation. The transition to a low carbon energy system will require "significant decarbonisation" of China's power generation sector, says the IEA.

While largely responsible for China's strong economic growth in recent years, the industrial sector represents the largest share of total energy use in China, and accounts for 70 per cent of electricity demand in the country. Industrial energy consumption has doubled since 2000, according to the IEA.

In 2007, with CO₂ emissions of 6.2 gigatonnes (Gt), China became the world's largest CO₂ emitter, overtaking the USA for the first time. China's CO₂ intensity per unit of GDP is one of the world's highest at 0.62 gCO₂/\$1000 GDP on a purchasing power parity basis.

Recognising the impact of its economic growth on energy consumption and emissions, the Chinese government began setting targets for energy efficiency in the 1980s. Each successive FYP has incorporated more stringent targets, with a variety of policies and programmes implemented by central government to achieve them.

Recent policies to improve energy efficiency have leaned heavily on programmes to close old and inefficient industrial and power plants. Targets for plant closures set for the 11th FYP have been met ahead of time and this, combined with investment

in new, larger facilities, has resulted in process efficiencies rising very quickly. According to the IEA, process efficiencies have, in some cases, reached levels typical of plants in OECD countries.

In the power sector, where coal accounts for around 80 per cent of electricity generation, 60 GW of capacity was closed between 2006 and 2009. This avoided the release of nearly 139 million t of CO₂, according to the IEA. At the end of July 2010, the Chinese government said that 70.77 GW of small-scale, outdated coal-fired power plants had been shut down during the 11th FYP, avoiding the release of 164 million t of CO₂ and 1.4 million t SO₂.

Now, the approval for investments in new coal-fired plant in China is dependent on the closure of smaller facilities of less than 200 MW capacity. The country also has a policy of building no new plant with capacities less than 300 MW and the use of supercritical or ultra-supercritical technologies is encouraged.

Another key initiative undertaken in China is the Top-1000 programme, under which the country's largest energy-consuming power plants and factories signed agreements to improve energy performance and gain access to supporting measures. Another cluster of energy efficiency initiatives, termed the Ten Key Projects, has also provided a large proportion of energy savings achieved in recent years.

According to the IEA, the impact of these programmes on energy efficiency has been immense, with energy intensity in China improving by 5.8 per cent per year between 1990 and 2007. Analysis by the IEA also shows that the largest contribution to energy savings was made by the manufacturing sector, which improved by three per cent per year over the same period.

But China is also aiming to improve its carbon intensity by addressing the fuel mix in power generation. In 2007 total installed power capacity in China reached 718 GW, with 556 GW of this based on coal-fired plant. Over the last 20 years, China has been adding new generating capacity at an unprecedented rate, much of it coal-fired, in order to keep pace with economic growth.

The country's drive for energy efficiency and use of larger, more efficient power generating units has resulted in an improvement in coal consumption per kWh of energy

produced. Other policies will result in large increases in nuclear and renewable energy capacity.

Official targets for installed capacity call for 70 GW of nuclear power, and over 300 GW of renewable installed capacity, including 100 GW of wind and 1.8 GW of solar, by 2020. China in 2007 had 8.8 GW of installed nuclear power, 148 GW of hydropower and less than 1 GW of other renewables. Data from the Global Wind Energy Council put China's installed wind energy capacity at nearly 26 GW at the end of 2009.

Renewable energy is developing fast in China due to the implementation of a renewable energy law in 2005 that provides financial incentives such as tax breaks and subsidies for renewable energy technologies. In 2009, \$35 billion was invested in renewable energy technologies in China, and in the second quarter of 2010 the country overtook the USA to take top spot in an Ernst & Young index of the most attractive countries for renewable energy investment.

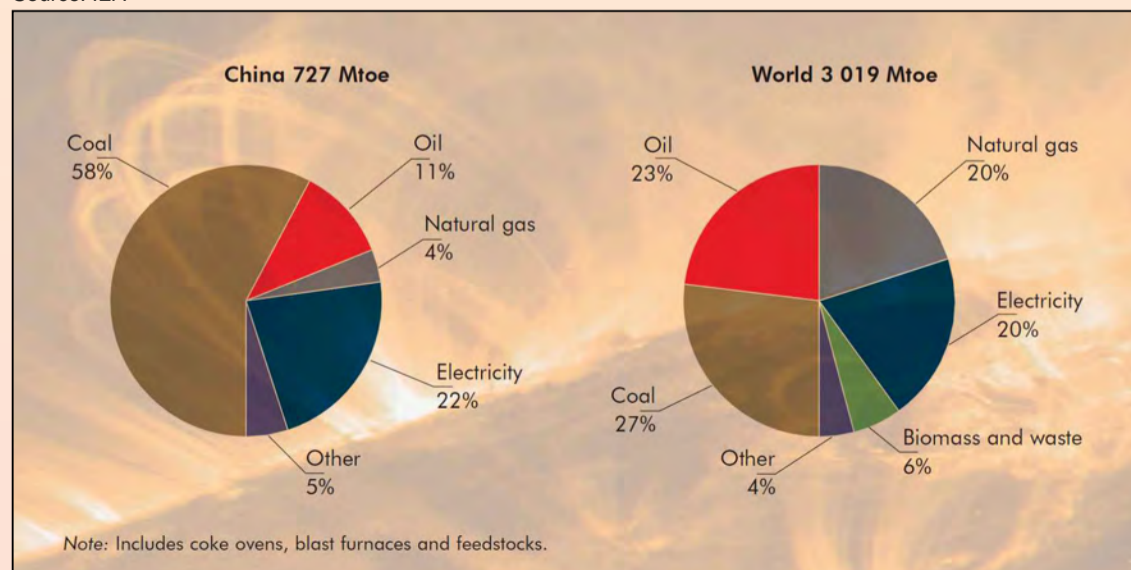
China's latest proposal to address improvements in carbon intensity is the creation of an emissions trading scheme (ETS) during the next FYP. Although details are yet to emerge, it is possible that the scheme would only target carbon-intensive sectors such as coal-fired power generation and manufacturing, and incentivise emitters to invest in clean technologies by capping emissions and putting a price on carbon.

Such a scheme – if properly implemented and structured – could lead to significant reductions in carbon emissions and would please observers who believe that China has already made all the "easy" gains that it can in energy efficiency improvements.

Other projects aimed at improving carbon intensity in China include efforts to develop and commercialise carbon capture and storage (CCS) such as the GreenGen project and a number of other international collaborative research and development projects. The IEA says that CCS needs to play a crucial role in reducing carbon emissions in China, but a recent brief from the World Resources Institute (WRI) notes that – like many countries – a comprehensive regulatory framework on CCS has not yet been developed in China but will be required for effective deployment of CCS technology on a commercial scale.

Industrial final energy mix in China and the world, 2007

Source: IEA





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Oil

Opec satisfied with oil price but remains wary

- Demand expectations stable
- Opec remains wary of action

David Gregory

The Organisation of Petroleum Exporting Countries (Opec) celebrated its 50th anniversary in September with crude oil prices in the \$70-80/b range, right where some Opec members have called for them to be on numerous occasions.

During the depths of the global economic downturn, when crude oil prices fell below \$40/b, Opec ministers were making the case that in all fairness for the sake of investment in crude production projects and the economic welfare of Opec member states, the price of crude oil needed to be in \$70-80/b – a range acceptable to both producers and consumers.

The price of West Texas Intermediate (WTI) crude began the year above \$80/b and except for a few days in May has stayed above \$70/b throughout the first nine months of 2010. The market is well supplied,

inventories remain high and Opec has some 5 million b/d in spare capacity. While analysts see the economy recovering at a decelerated rate, and data for key economic indicators continues to fluctuate, the current price range should be satisfactory to Opec, and non-Opec oil producers.

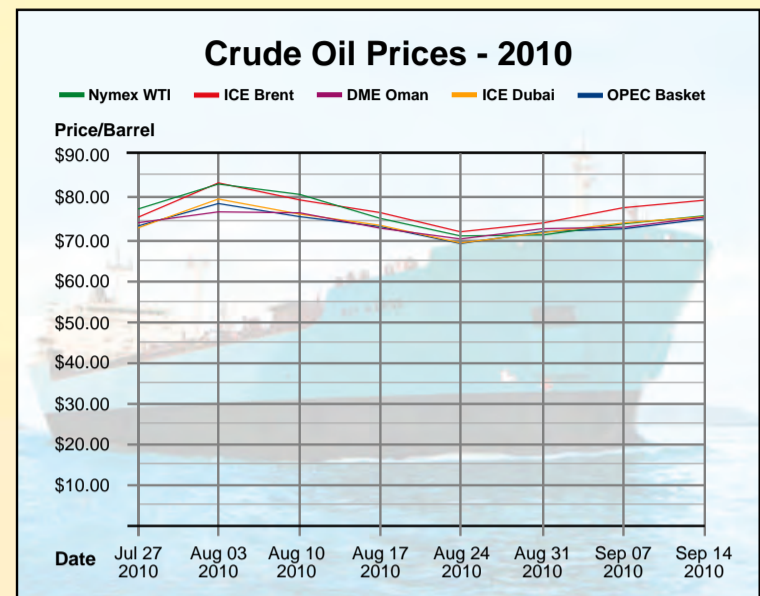
However, as Opec prepares for its next ministerial conference in Vienna on 14 October the media cannot help but ask if any changes can be expected in the organisation's policy.

So far, many see no reason to adjust policy, which calls for a total production of 24.845 million b/d from the Opec-11 (excluding Iraq). Compliance with this target has slipped considerably since it was first agreed in late 2008, with Opec-11 output averaging 26.88 million b/d in August, while total Opec output averaged 29.241 million b/d.

However, higher prices do appeal to some. Algeria's new Minister of Energy and Mines Yusuf Youfsi, who

this summer replaced long-serving Chakib Khelil, said recently that he thought crude oil prices "could be better," and Libya's top oil official, Shukri Ghanem, chairman of the country's National Oil Company (NOC), said crude oil production targets should remain unchanged and that emphasis should be given to closer compliance with production targets. But Mr. Ghanem added that Opec should seek a price of \$100/b.

In its latest *Oil Market Report*, published on 10 September, the Paris-based International Energy Agency (IEA) said its oil demand expectations for 2010 "have been stable at 86.1-86.6 million b/d for the last 11 months. Demand growth of 1.9 million b/d for 2010 has also been steady" during several *OMRs*. It added that OECD demand is not as weak as previously forecast, while non-OECD demand is not as strong." The agency said global oil demand is projected at 86.6 million b/d in 2010 and 87.9 million



b/d in 2011, an increase in demand of 1.9 million b/d and 1.3 million b/d year-on-year respectively.

The IEA said Global supply fell by 250 000 b/d during August to 86.8 million b/d, largely due to lower output by Opec, but added that year-on-year global output is up by 2.0 million b/d. Opec supply was down 60 000 b/d according to the IEA, averaging 29.2 million b/d in August, while non-Opec supply declined by 200 000 b/d in August to 52.4 million b/d.

In the September issue of its *Short-Term Energy Outlook*, the US Energy Information Administration (EIA) said WTI averaged around \$77/b in August and expects it to average the same for the fourth quarter of this year. It projected that WTI would average \$84/b by the end of 2011.

Having seen a remarkable 50 years and finding its way through numerous crises, wars, periods of powerlessness and times of too much influence on

the world economy, Opec, for now, appears to be in a comfortable position. The group is expected to earn some \$625 billion during 2010, which is near its 2007 earnings while producing 1 million b/d less.

But things rarely go smoothly in the oil market for lengthy periods, and for now Opec is wary of rocking the boat of economic recovery. It is well aware that crude price increases might stymie the recovery and send prices plummeting again.

"The remainder of this year and the first half of next year will be very difficult," Opec Secretary General Abdullah al-Badri said recently, adding: "We have to be very careful of any action taken by anybody."

For the time being, this 'perfect' oil price range is fine for everyone involved. It may take another year or so, but ultimately the world economy will recover, inventories will recede, demand will pick up and spare capacity will start to decline.

Gas

China seeks out gas supplies

China is seeking gas supplies from overseas as well as looking to exploit its own unconventional gas resources in order to satisfy spiralling energy demand.

Mark Goetz

In its ever-broadening pursuit of energy, vital for the realisation of its economic potential, China is turning to its neighbours in Asia for supplies of natural gas. In late September China National Petroleum Corporation (CNPC) held negotiations with Russia's Gazprom on gas supplies that are due to start arriving in 2015 and eventually reach 30 billion m³ per year (bcm/y).

A statement released by Gazprom on September 22 said the two sides "agreed on key indicators and parameters" of future Russian natural gas supplies to China as stipulated by a memorandum of understanding signed by the two in 2009. Gazprom said a further document pertaining to the basic terms and conditions for natural gas suppliers would be signed shortly and taken as the basis for a future contract.

The two sides have yet to agree on

a price, which is usually the sticking issue. Gazprom said it does not expect to reach an agreement on price before the middle of 2011. A visit to Beijing by Russian President Dmitry Medvedev in late September is expected to result in a document outlining the core terms of supply, such as volumes, cut-off points and take-or-pay terms.

China is reported to be seeking a price of \$120 per 1000 m³ for the gas supplied by Gazprom, the same as it pays for natural gas shipments from Turkmenistan at the Turkmen-Uzbek border. But Russia is said to be looking for nearly double this amount.

The private Russian firm Lukoil has reached an agreement with China to supply 15 bcm/y of natural gas from its operations in Uzbekistan beginning in 2014. The price has yet to be agreed, but it could be close to the arrangement that CNPC has with Ashgabat. Lukoil is a member of the consortium developing Uzbekistan's Kandym-

Khauzak-Shady-Kungrad project near the Aral Sea. Production from that license is so far only about 3 bcm/y and what Lukoil produces is sold to the Uzbek state gas company and then to Gazprom. Lukoil has been holding back on further investment in the field, but the new agreement with China is expected to move development forward.

Lukoil's Uzbek production to China would be shipped through the Trans-Asian Gas Pipeline (TAGP), built by CNPC to carry 40 bcm/y of Turkmen gas to China. Beijing has also been in negotiations with Kazakhstan for gas supplies that would also travel via the TAGP.

Initial shipments from southern Turkmenistan began in December 2009 and as of July, CNPC had received some 2 bcm of Turkmen gas. Ashgabat announced in late September that the capacity of the pipeline had been increased to 24.5 million m³/day, around 9 bcm/y, and should reach 15 bcm by the end of this year and full capacity by the end of 2011.

China is also seeking to develop its own gas resources in order to reduce its dependence on imports. The so-called 'shale gas revolution' in the US has sparked the interest of many countries and led China to examine its

own unconventional gas resources.

According to a study recently carried out by global consulting firm Wood Mackenzie, China's coal bed methane (CBM) resources will eventually provide China with one-third of its unconventional gas supply. The report said state-owned PetroChina is seeking international partnerships to acquire the technical expertise to exploit its CBM reserves.

Wood Mackenzie said CBM "holds huge potential in meeting the country's long-term gas supply needs, making up the second largest domestic unconventional gas supply to shale and accounting for 14 per cent of total domestic supply by 2030." It added that the major basins of Qinshui, Ordos and Junggar are believed to hold CBM resources of 664 trillion cubic feet (tcf), of which Wood Mackenzie

estimated 260 tcf could be recovered.

A recent article in *Asia Times*, referring to projections made by the US Energy Information Administration (EIA), said China's energy consumption will grow by 133 per cent between 2007 and 2035 – from 78 quadrillion British thermal units (BTUs) to 182 quadrillion BTUs. "Think about it this way," the *Asia Times* said, "the 104 quadrillion BTUs that China will somehow have to add to its energy supply over the next quarter-century equals the total energy consumption of Europe and the Middle East in 2007. Finding and funnelling so much oil, natural gas, and other fuels to China is undoubtedly going to be the single greatest economic and industrial challenge facing Beijing – and that challenge lays the possibility of real friction and conflict."

Powering its economy: China will need access to more gas



Focusing on solar hybrids

Reducing the intermittency of solar is crucial to its increased use. Integrating solar technology with a conventional fossil fuel plant can alleviate the problem while boosting the efficiency of the thermal plant.

Dave Ugolini and Justin Zachary, Ph.D.

The intermittent nature of renewable energy sources can be overcome by the use of some form of storage. However, large-scale energy storage has many unresolved technical and cost issues. A viable alternative to alleviate the situation is the integration of renewable sources such as concentrated solar thermal power (CSP) with combined cycles or steam cycles, resulting in reduced capital cost and continuous power supply.

Conventional combined cycles achieve the highest thermal efficiency of any fossil fuel based power generation system. Their emissions footprint including CO₂ is also substantially lower than coal fired plants. By including an additional source of heat such as solar energy in an integrated solar combined cycle (ISCC), the efficiency of the system is further dramatically increased.

Hybrids involving conventional coal fired plants are also possible in regions with reasonably good solar conditions. For these plants, where the steam pressures and temperatures are higher than for ISCC, the type of solar conversion technology used (e.g., linear Fresnel, parabolic trough or tower) will dictate how solar is integrated into the plant.

CSP systems require several components to produce electricity – a concentrator, receiver, storage or transportation system and a power conversion device.

Several different technologies are available.

The parabolic trough is considered to be the most proven technology for CSP. It has been demonstrated on a relatively large scale. In the current financing environment this advantage could bring projects to execution faster than other competitive CSP technologies.

The parabolic trough is basically a very large curved mirror designed to concentrate the solar energy and reflect it onto a linear focus. A receiver tube is located at the focal point of the parabolic mirror. Flowing inside the tube is a conventional heat transfer fluid (HTF), which absorbs the energy from the concentrated sunlight. Several receivers are connected into a loop, with many loops required to produce the necessary heat to bring a large amount of HTF to the maximum temperature allowable.

The hot HTF goes into a steam generator, a heat exchanger where the HTF heat is transmitted to water in the first section to be converted into steam and then transmitted to steam in the second section to generate superheated steam. From this point on, the power block converting the steam into electricity contains conventional power plant components: steam turbine, heat sink, feed water heaters, condensate and boiler feed pumps.

The main disadvantages of trough technology are related to firstly the maximum HTF temperature, which dictates relative cycle efficiency and secondly, the complexity of having an additional heat exchanger between the Rankine cycle working fluid and the fluid heated by the sun.

Another technology is the linear Fresnel solar collector, a line focus system similar to the parabolic trough. Unlike troughs, it uses an array of nearly flat reflectors to concentrate sunlight. The receiver is one or more tubes located above the mirrors. These are metal tubes with an absorbent coating, similar to trough technology. Water or a mixture of water and steam flows within the tubes. At the end the water and steam are separated and



BrightSource Luz Power Tower technology: Bechtel will partner with BrightSource on construction of the Ivanpah project in the Mojave desert. It will be the world's largest power tower project

saturated steam is produced either for process heat or to generate electricity using a conventional Rankine cycle power block. Major efforts are currently under way to increase the final superheated steam temperature, thus improving the efficiency of the cycle.

In principle there are advantages to this system, notably the direct generation of steam without the use of the intermediate HTF. But there are also disadvantages such as lower power cycle efficiency due to lower steam temperature. The technology is also less mature than troughs, with only recent relatively small-scale commercial developments.

In another concept known as the Solar Tower, a boiler on top of a tall tower receives concentrated solar radiation from a field of heliostats, which are two-axis tracking mirrors. The heat transfer media could be water or steam, molten salt, liquid sodium or compressed air. In the more conventional arrangement, the working fluid is water. The water temperature is higher than in line-focus systems. The power tower can be connected to molten salt storage, thus allowing the system to extend operating hours or increase capacity during periods when power is most valuable.

The main advantage of this technology is the ability to provide high temperature superheated steam. The design requires accurate aiming and control capabilities for the solar field heliostats in order to maximise efficiency and avoid potential damage to the receiver on top of the tower. Large scale power tower projects in the final design stage may soon enter the execution phase.

The CSP technology selected determines the thermal output and thus the different options for interface with a conventional fossil-fired plant.

ISCC plants have been under discussion for many years. Several plants are proposed, in development, or under construction, the largest being the Palmdale project in California. This plant uses trough technology and has a total power output of 617 MWe with the solar contribution being 62 MWe.

Several questions must be answered when planning to integrate steam generated by solar energy into a combined cycle: What solar technology should be used? How much solar energy should be integrated into the combined cycle? Where is the best place in the steam cycle to inject the solar generated steam?

There is no simple answer to these questions. A detailed economic analysis must be performed to determine the levelised cost of electricity for the specific site location under consideration. This analysis must look at different MWth solar inputs to the combined cycle and different solar technologies that generate differing steam conditions.

Capital costs, operation and maintenance costs, performance data, and operating scenarios must be assessed. In the current capital market environment, financing requirements are highly uncertain. It is likely that the price of the installed solar field will come down through economies of scale and increased manufacturing and installation productivity.

Site data must be examined to quantify the energy contribution of the solar facility as well as to define the performance characteristics of the combined cycle.

To analyse a proposed plant configuration, its performance characteristics must be defined. A conceptual design must be established and a cycle performance model developed.

An advantage of solar thermal energy over some other forms of renewable energy is that it produces energy when it is most needed – in the peak times of the day and the year. So “Time of Delivery” pricing, where energy payments vary with time of day, can greatly help a solar facility. For example, some power purchase agreements of US utility PG&E include time of delivery pricing that values energy produced during “super-peak” periods (from June - September between 12:00 and 20:00 Monday through Friday) at rates almost double the rates of any other time of year. The pricing structure must obviously be included in the economic analysis to assess the viability of any hybrid solar plant configuration.

Many of the same issues confronted when trying to integrate solar technology with a combined cycle are present when trying to integrate solar with Rankine cycles. The same type of analysis needs to be done to determine the best system for the specific application.

However, a major difference between a Rankine steam cycle and combined cycle is that the efficiency of Rankine steam cycle is lower. This means that it can be very advantageous to use solar energy to displace fossil fuel energy,

thus dramatically increasing the cycle efficiency and reducing the carbon footprint of the plant. Since boiler efficiency typically increases slightly as boiler load is reduced, an extra benefit is achieved if solar energy is used to reduce boiler load to save fuel.

Although there are possibilities for integrating solar with steam cycles, most integration applications to date have focused on ISCC. The ISCC offers advantages for both the combined cycle as well as solar plant.

When compared with a solar standalone plant, there are many benefits for the ISCC. The capital cost of a separate steam turbine in a standalone plant is much higher than the incremental cost of increasing the size of the combined cycle steam turbine. The annual electricity production is increased due to the fact that the steam turbine is already in operation, avoiding lost time for startup. During solar operation the steam produced by the solar heat source offsets the loss of power typical for CC when the ambient temperature is higher.

Other solar technologies are currently coming on line. Integrating these technologies into proven conventional fossil plants is a means of increasing the renewable energy portion of energy supply while minimising the effect of the intermittent nature of the solar energy supply.

The addition of concentrated thermal solar systems to new and existing combined cycle plants also offers significant improvements either for cycle efficiency or to increase power output of the plant. Sizing the most optimum solar field is a site-specific task, which must consider the grid requirements and operational profile of the steam cycle components at night or during periods when the solar energy is not available.

Renewable energy sources continue to make inroads into the electricity supply market. More and more countries are mandating that a portion of new generation must be renewable. Several areas of the US and other parts of the world have high levels of sunlight that allow the use of solar technology.

As these trends continue, it is expected that the number ISCC projects around the world will continue to grow.

Dave Ugolini is Senior Principal Engineer at Bechtel Power Corporation. Dr Justin Zachary is the company's Technology Manager.

Converting Claus

Increasing plant efficiency is an approach that many utilities see as central to their efforts to cut greenhouse gas emissions. Dutch utility, Essent, is in the process of repowering its existing Claus B unit to a highly efficient combined cycle power plant known as Claus C. **Junior Isles**

Essent is the largest energy company in the Netherlands. The utility, which was bought by RWE in 2009, also operates in Belgium.

Its efforts to reduce greenhouse gas emissions were highlighted earlier this year when it opened the first commercial fast-charge station for electric vehicles in Europe. According to the company, its long-term plan is to achieve CO₂-free power generation by 2050. In the nearer term, its goal is to have sustainable energy account for 25 per cent of all its energy production by 2020.

However, the company acknowledges that in the meantime it will be unable to meet its current energy needs without the use of fossil fuels. Increasing the efficiency of its existing power plants, thereby increasing the amount of power generated from the same amount of fuel, is therefore high on the agenda.

Accordingly, Essent is in the process of converting its Claus steam power plant to a high efficiency combined cycle power plant. The conversion is being carried out by Alstom under a contract signed in June 2008, which will see the efficiency of the existing Claus B unit increase from around 38 per cent to more than 58 per cent.

The Claus power plant consists of two identical gas fired steam generating units, which came on stream in 1977 and 1978 respectively. Each unit has a generating capacity of 640 MW.

In 1993 and 1994 respectively, the units were converted to start/stop units to respond as effectively and efficiently as possible to the daily fluctuations in electricity demand.

Claus is a strategically important plant for Essent and is ideal for repowering. The units are approaching the end of their normal operating life. Also, located in Maasbracht in the southeast of the Netherlands, it is close enough to supply power to both Germany and Belgium through short connections and even further away to France if

necessary. Gas is also already available since it is a brownfield site.

Thomas Gross, Alstom's project director within its Thermal Systems unit, responsible for the new Claus C plant, commented: "Since it was an existing plant, the permitting process went smoothly."

The conversion will see the capacity of the 640 MW Claus B unit increased to more than 1300 MW through the addition of three Alstom GT26 gas turbines and a retrofitted steam turbine.

According to Alstom, one aspect of its offer that was attractive to Essent was the proposal to re-use much of the existing plant.

"Much of the existing infrastructure is being refurbished and re-used. We are re-using a huge section of the existing steam turbine building and electrical building, and the direct cooling facilities such as the main cooling water pumps and the cooling tower. According to the customer, re-using the steam turbine building and its facilities provides savings of 15-20 per cent compared to a totally new combined cycle power plant building," said Gross.

Notably, it is the first time that Alstom will be providing a 3 + 1 configuration for a KA26 combined cycle power plant. In this set-up, three gas turbines each exhaust into its own heat recovery steam generator (HRSG) to generate steam that is then fed to a single steam turbine.

The hot exhaust gas leaves the



turbine with a capacity of 640 MW. The steam that could be generated from the thermal output of three GT26 turbines could drive a steam turbine of about 500 MW."

This means the steam turbine has to be retrofitted to reduce the steam

An artist impression of the completed Claus C unit and its current status (inset)

design of the steam turbine. We are only re-using the external casing of the LP modules," said Gross.

The new steam turbine will consist of a high pressure (HP) section, medium pressure (MP) section and three low pressure (LP) sections that

challenges required a great deal of "professionalism and serious interface handling" with Essent.

The scope of the project has been split into re-used and new systems where Alstom is responsible for new systems, and Essent for all remaining re-used systems.

Work is currently progressing smoothly. Retrofit of the steam turbine is currently being finalised. "We are about to align the steam turbine shaft with the existing generator. The installation of the steam piping in the existing building is progressing well. The new control room will soon be installed," said Gross.

All three gas turbines and their associated generators and HRSGs are physically in place and mechanical completion is scheduled for the end of the year.

Cold commissioning has already begun and first backfeed is expected at the end of this month (October). Final commissioning followed by full commercial operation is planned for October next year.

During commercial operation, Claus C is expected to meet daytime demand. It is therefore designed to make daily starts and stops – starting up in the morning and shutting down late evening. However, it is also capable of operating in base load when there is demand.

An additional feature of the plant is that it has been designed for future easy implementation of Alstom's Low Load Concept, which is a direct result of the sequential combustion system of the GT26. This allows the operator to run the gas turbine at loads of less than 25 per cent while maintaining low NO_x and CO emissions.

Claus C is expected to produce 104 per cent more power than the original plant, i.e. more than 1300 MW compared to 640 MW. However, due to the huge increase in efficiency, the fuel consumption will only increase by 35 per cent. According to Alstom, this will reduce CO₂ emissions by 40 per cent with respect to a comparable base of equal power, thus

Claus C will more than double power output for just a 35 per cent increase in fuel. This will cut CO₂ emissions by 40 per cent compared to a steam plant of equal output

turbine at a temperature of more than 600°C and enters into a horizontal triple-pressure HRSG.

Gross explains: "The plant design was driven by the capacity of the steam turbine. We had to see what was the necessary thermal output from the gas turbines to drive a steam

turbine load. The internals of the steam turbine are being completely retrofitted to meet the specific requirements for Claus C. The retrofit includes the replacement of rotors, blades, vane carriers etc. The generator will also receive a new rotor. "We are doing a complete new

will drive the generator.

Retrofit of the steam turbine to reduce the steam turbine load was necessary in order to optimise the entire combined cycle plant. Gross noted: "We have experience of the 3-on-1 configuration at plants that use smaller GT13E2 gas turbines but this is the first with a GT26."

The use of three gas turbines will result in a very flexible plant since it can be operated with one, two or all three gas turbines. It will also mean high plant availability since the plant will not need to completely shut down for maintenance.

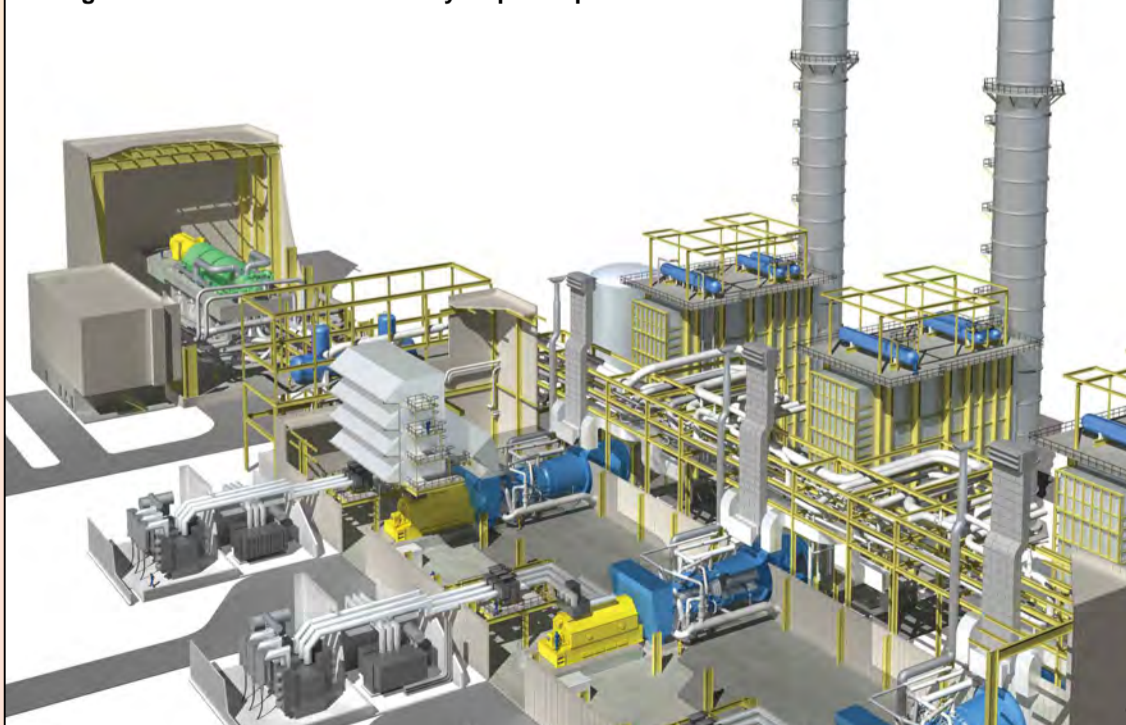
Gross is confident that Alstom's experience with the configuration on smaller plants will stand it in good stead but notes that they will be paying close attention during plant commissioning, particularly to the existing equipment.

The repowering project, which is more than 80 per cent complete, has had its challenges. "Integrating items like the existing hybrid main cooling water system, including the cooling water pumps, three condensers (retubed with titanium) the gas receiving station and the existing generator to the new configuration is quite a challenge. The existing systems are being integrated with the new plant and will be controlled by a common Alspa distributed control system," said Gross.

"It will also be a challenge to bring in the new steam header into the existing steam turbine building," he added.

According to Alstom, these

A 3D CAD drawing of Claus C. It is the first to use a 3 + 1 configuration for a KA26 combined cycle power plant





Junior Isles

The good, the bad and the strange

This was no spaghetti western. We were after all in Montreal, Canada for the World Energy Congress and security ensured there was not a bandit in sight. Yet it did have its moments.

Gas was a hot topic of discussion and although cited as a reason for market uncertainty, the gas story and in particular unconventional gas sources, generally seems to be a good one.

Unconventional gas was one of the first subjects addressed in the opening address by Daniel Yergin, Chairman of energy market research group IHS Cambridge Energy Research Associates. Yergin spoke of the "shale gale", the storm of shale gas that has come so quickly.

He said: "Shale gas has really come and changed things. The shale gas revolution probably counts as the biggest energy innovation since the beginning of the 21st century."

Europe's largest energy company, GDF Suez explained what it could mean for the industry. According to Dirk Beeuwsaert, Executive Vice President in charge of Europe & International, said 60 per cent of the company's electricity generation comes from natural gas and the increasing amount of gas resources is an important development. "The shale gas revolution is an important one. The presence of shale gas was unthinkable just a few years ago but it is now becoming a reality...it's a natural resource that will play a bigger and bigger role in the future and will be more in the mind of decision makers."

With fossil fuelled generation likely to be in the mix for some time to come, shale gas is certainly good news for power generators needing mid-term options on the way to a longer term renewable future. As Dr Johannes Teyssen, Chairman of E.On AG, put it: "We have to build a bridge from the old world to the new world. You can't expedite transition just because you wish to."

Fatih Birol, chief economist at the International Energy Agency (IEA)

was also positive about what shale gas means for the future, although he noted not everyone would be a winner. He cautioned: "We have heard that the picture is rosy, which I understand, but there will be some losers."

Last year, the IEA said a gas glut was coming, which would have an impact on prices. "The question now," said Birol, "is not whether we were right or not [on prices] but how long this glut will continue. We believe it will continue longer than some of us thought a year ago. We have seen some key gas exporters lose market share and they will continue to lose market share if the gas glut continues for some time to come. It's uncertain how these exporters will react in terms of their investment decisions, especially in the upstream sector."

He also said it should not be taken for granted that the shale gas boom will hit other key markets outside the US, such as Europe and China. Indeed unconventional gas is being

"We have heard that the picture is rosy, which I understand, but there will be some losers"

seen as central to China's plans to increase its gas fired power generating capacity. If China does utilise its own unconventional gas, Birol believes that global natural gas demand growth will be much less pronounced since there would be natural gas in the market that would otherwise have been consumed by China.

China featured in a number of keynote speeches, mostly in a positive light. Lester Brown, President of the Earth Policy Institute said that although "we worry about China's coal plants, last year it brought 12 GW of wind capacity on line compared to 10 GW in the US".

It seems the China effect is becoming increasingly unavoidable in any discussion about the world energy landscape and the global economy.

Birol said that China's policies and economy would have an impact on every country's energy sector. "China

is thinking of expanding coal production at Shenyang to fuel its power plants. If this happens it will become a coal exporter, which will have a significant impact on coal prices. And if coal gas comes into the picture, it could lead to lower [global] gas prices."

He also noted the significance of the fact that a large portion of global growth in energy demand comes from the emerging economies. "China's economy is fuelled by energy; there is no problem that China uses a lot of energy and will continue to use a lot of energy in the future. It is thanks to the global Chinese economy that the impact of the financial crisis was not felt so badly."

However, he said that the question now is whether emerging economies such as China and India would be able to perform solidly in the last two quarters or whether they will be affected through trade links with the sluggish economies of the OECD

countries. "This is an uncertainty we have not seen much of before," said Birol.

There are many different views on the economic recovery, which makes it tough for decision makers and the uncertain economic climate is bad news for potential investors.

James Turley, Chairman and CEO, Ernst & Young, US, said that work carried out by his consulting firm about one year ago saw the recovery being a "LUV" recovery – largely 'L'-shaped in Europe, 'U'-shaped in the US and a strong 'V'-shape in the emerging markets. "I think this is what we are experiencing and as energy demand tracks economic activity, it means that demand growth in the emerging countries will be ten times that in OECD countries. Enormous financial commitments are needed to meet this demand growth."

Turley said, however, there were risks to the recovery. "There is a risk in many parts of the world that entrepreneurs might stay on the sidelines; they might not put their capital at risk. In many parts of the

world, entrepreneurs are looking around and seeing increased regulatory risk and are just not willing to make some of the most necessary long term investments such as hiring individuals."

With regards to finance, Turley believes the money is there but noted that energy investments are some of the longest term investments in any industrial sector, which presents a problem in an era of short term thinking. "The mismatch between the short term thinking, short term return on investments, and the long tail issues in the sector, are a challenge. When you think about the financing mechanisms in many parts of the sector, historically joint ventures have been used. Assets have been pooled to mitigate risks but people are now stepping back and asking whether that risk mitigation is really there."

While ongoing economic uncertainty is bad news for the sector, the energy market is by no means a stranger to uncertainty. As Birol noted: "Energy markets always work with uncertainties; uncertainty is not strange for the market. Today, however, the level of uncertainty is unprecedented."

Uncertainty may not be strange to the industry but the industry does have its share of strange individuals. I had a brief (although still too long) encounter at the exhibition, which ran alongside the Congress.

One entrepreneur, who I wished had stayed on the sidelines, was a Canadian-based Russian salesman who seized the opportunity to spend five minutes at the *TEI Times* booth.

He attempted to explain a new power generating unit which needed no fuel but "worked on gravity". A unit no larger than our exhibit table could, according to this gentleman, provide enough power for 100 000 homes.

Unsurprisingly, subsequent 'literature' emailed to me revealed few details. It showed what looked like a homemade device of some sort, which incidentally was plugged in to a power socket – so much for his promise of "free energy". This 'entrepreneur' also promised us commission on any units he sold to contacts that we could provide him with.

It seems that no matter how tight security is, some modern-day bandits will still slip through the net.

