Tearing down barriers
The EU unveils plans to remove barriers to a common energy market. *Page 2*

Flexible future
TEIT speaks to GE's Paul Browning about flexible generation. *Page 12*

Final Word
Junior Isles weighs up the price of ambition. *Page 16*

December 2010 • Volume 3 • No 10 • Published monthly • ISSN 1757-7365 www.teitimes.com

THE ENERGY INDUSTRY TIMES

IN BRIEF

China moves to nuke independence
The handover of documents from Westinghouse and greater control of its own uranium resources are helping China to improve its nuclear independence.
Page 6

E.On delivers new strategic focus
Europe's competitive energy markets and growth markets outside Europe will be the focus of E.On's future efforts.
Page 10

Energy Outlook: Nuclear damage or a new era?
US suppliers may feel the spear of India's new Civil Liability for Nuclear Damage Act 2010.
Page 14

Technology: Building tomorrow's power plant today
A UK project hopes to combine fuel cells, gasification and carbon capture.
Page 15

Tough road ahead for climate negotiators

Nobuo Tanaka

Carbon dioxide emissions are approaching record levels, putting growing pressure on world leaders to accelerate efforts for unified action on global emissions reduction, writes **Junior Isles**

Climate change negotiators went into UN-led climate change meetings in Mexico with the knowledge that global carbon dioxide (CO_2) emissions were likely to hit record levels in 2010.

A week before the start of the COP16 meeting in Cancun, an annual study from the Global Carbon Project, led by the UK's University of Exeter in partnership with the University of East Anglia and other global institutions, forecasted that if economic growth proceeds as expected, global fossil fuel emissions would increase by more than 3 per cent this year. The study also forecasts that emissions growth rates will approach the high levels observed through 2000 to 2008.

Overall in 2009, global CO_2 emissions were 1.3 per cent below the record 2008 figures. This is less than half the drop predicted a year ago.

"The 2009 drop in CO_2 emissions is less than half that anticipated a year ago," said the study's main author Pierre Friedlingstein.

"This is because the drop in world gross domestic product was less than anticipated and the carbon intensity of world GDP, which is the amount of CO_2 released per unit of GDP, improved by only 0.7 per cent in 2009 – well below its long-term average of 1.7 per cent per year," he added.

The poor improvements in carbon intensity were caused by an increased share of fossil-fuel produced carbon dioxide emissions from emerging economies with a relatively high carbon intensity and an increasing reliance on coal, the study said.

The study claimed a substantial increase in emissions in 2009 from emerging economies heavily reliant on coal such as China and India offset the fall in emissions from developed economies such as Europe, the US

Continued on page 2

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(Continued from page 1)

and Japan due to the global financial crisis.

It said that emissions in the US, UK and Japan fell 6.9 per cent, 8.6 per cent and 11.8 per cent respectively in 2009. However, emissions in China, India and South Korea grew 8 per cent, 6.2 per cent and 1.4 per cent, respectively.

The study makes grim reading for world leaders but could help crystallize the need for concrete progress in Cancun and further climate change meetings before the expiry of the Kyoto Protocol in 2012.

The level of effort and commitment needed by industry and political leaders in tackling climate change was quantified in the recent *World Energy Outlook 2010* (WEO 2010) published by the International Energy Agency (IEA).

The Outlook stated that $5.7 trillion must be invested in renewables by 2035, even under the IEA's more conservative forecast – which would still result in global warming of 3.5°C. In 2009, $115 billion was invested in renewables, by comparison.

Renewables would make up nearly one third of the global electricity supply in 2035 under the IEA's New Policies Scenario, up from 19 per cent in 2008 – this assumes that governments fulfil the policy promises made at Copenhagen. To meet the IEA's more ambitious 450 Scenario target (i.e. to limit the concentration of GHG emissions to 450 ppm), renewables will need to make up 45 per cent of the electricity supply and 20 per cent of the heat supply in 2035.

Government subsidies will need to continue to rise in order to deliver these increases, the IEA says. Public spending to support renewables reached $57 billion last year – the first time such a calculation has been produced. This is up from $41 billion in 2007 and $44 billion in 2008.

It said, however, that subsidies for renewable electricity and biofuels could nearly quadruple to $205 billion by 2035 if governments implement broad policy commitments and plans to cut emissions and phase out fossil fuel subsidies.

Around two thirds of the support from now until 2035 would go to electricity generated from renewables. The remainder would go to biofuels. The amount does not include the additional "significant" costs of integrating renewables, such as wind and solar energy, into networks.

Meanwhile, a new study published in mid-October by the Global Wind Energy Council and Greenpeace International reports that wind could meet 12 per cent of global power demand by 2020, and up to 22 per cent by 2030.

The 1000 GW of wind power capacity projected to be installed by 2020 would preclude the emission of as much as 1.5 billion tons of CO_2 every year said the report. By 2030, a total of 34 billion tons of CO_2 would be avoided with 2300 GW of wind power capacity.

EU promises to remove energy barriers

- €1000 billion needed over next 10 years
- Improving links would help renewables compete

Gunther Oettinger: European Energy Commissioner

Junior Isles

European Energy Commissioner Gunther Oettinger has called for €1000 billion in new investment over the next 10 years to finance the connection of oil and gas pipelines and enhance the EU's electricity grid. The plan, unveiled in a strategy paper, is aimed at removing the barriers that have thwarted the goal of a common European energy market.

The bulk of the investment needed for building new connections and adapting pipelines would come from the private sector.

Oettinger complained that the EU's pipeline networks were "still operating within the borders of the principalities of the 19th century".

Policy makers argue that opening the networks and improving links would allow renewable sources of energy, such as solar and wind to better compete with traditional generators. It would also help make it easier for member states to share supplies in the event of another cut-off of Russian gas such as that which occurred in 2009.

At a meeting in early November, Oettinger and Georgian Prime Minister Nika Gilauri held a meeting to discuss Georgia's potential in the development of energy transit routes.

As gas markets in southern and central EU member states are isolated, the European Commission suggested developing a transit project to end EU countries' isolation in terms of energy.

According to the commission, the project should aim at improving wholesale competition and establishing a physical connection between the two regions.

Commissioner Oettinger said Nabucco, a gas pipeline from Central Asia that bypasses Russia, complies with the EU criteria and has been considered a priority to open a southern corridor. He also considered LNG as an additional and important project as well.

"Nabucco is a very important project and it will soon be realised," Georgian Prime Minister Nika Gilauri said, adding that development of further projects could play a significant role for Eastern Europe, Romania, Bulgaria, Hungary and Ukraine.

The EU has failed to realise its ambitions for energy integration partly due to the reluctance of member states to embrace EU laws that open their national energy companies to increased competition.

In terms of removing market barriers, Oettinger promised to be more confrontational with European leaders, who will focus entirely on energy policy at a special summit meeting in February.

Oettinger said: "We will be asking heads of state: 'Do you really want this, or is this just something for speeches?'"

Auction to finance clean-tech projects

- NER allowances auction to raise €4.5 billion
- EC trying to "engineer higher carbon prices"

The European Commission's plan to auction 300 million EU allowances (EUAs) – worth about €4.5 billion ($6.2 billion) at today's prices – will help finance renewable energy and carbon capture and storage (CCS) projects.

The European Investment Bank (EIB) is collaborating with the Commission in the NER300 programme, so called because it will auction 300 million EUAs from the new entrants' reserve (NER), a pool of credits for new installations that join the EU Emissions Trading Scheme (ETS).

National governments and private businesses would be expected to match the EU funding, bringing the total expected financing to €9 billion.

"Through using revenues from selling of CO_2 allowances, around €4.5 billion will be available for innovative renewable energy technologies and CCS," said Climate Action Commissioner Connie Hedegaard. "With project sponsors and member states contributions this will sum up to €9 billion. This can give a needed boost for keeping the EU in the frontrunner position when it comes to climate-friendly technologies."

The EUAs will be from Phase III (2013-20) of the ETS but the EIB will sell them before the phase begins. The Commission did not say when sales would start. Issuing Phase III allowances also depends on a technical fix to the registry system, the completion date for which is unclear.

"The issue of the timing of such large volumes of liquidity into the market will be important for price behaviour," said Barclays Capital analyst Trevor Sikorski in a note.

The Commission has previously said it will auction some Phase III allowances before the start of the phase, to demonstrate that the system is working.

European power companies are likely to be major bidders in such auctions, as they will have to buy all of their allowances in Phase III. The industry previously requested that 100 million-300 million Phase III EUAs should be auctioned ahead of 2013.

At least 42 projects are due to receive funding, with a minimum of one in each of the EU's 27 member states. Applications are expected from a range of businesses and consortia across the bloc.

The NER300 programme will finance eight CCS projects and 34 renewable energy projects split across bioenergy (9), concentrated solar power (5), solar photovoltaic (3), wind (6), geothermal (4), ocean power (3), hydroelectric (1) and smart grids (3).

Companies interested in making proposals have three months to submit bids.

In the meantime, Sikorski said the European Commission "is using all the levers in its control" to engineer a higher carbon price.

At the end of October, the European Commission raised the 2013 cap for greenhouse gas emissions under the EU Emissions Trading Scheme (ETS) by 5.6 per cent from 1.93 Gt to just under 2.04 Gt. The increase takes into account additional installations joining the ETS and the scheme's extension to include nitrous oxide (N_2O) and perfluorocarbons emissions. Currently the ETS covers only CO_2 emissions as well as N_2O from certain installations in the Netherlands and Austria.

Sikorski said that his company is forecasting EU allowance (EUA) prices to rise to €28 ($39) in 2012, despite the fact that there will be more EUAs in circulation than likely carbon emissions over the second phase of the EU Emissions Trading Scheme (ETS), from 2008 to 2012.

The immediate cause of the run up in prices from current levels of around €15/tonne will be due to utilities buying heavily from next year to hedge forward power sales covering 2013 and beyond, before the corresponding allowances are auctioned by EU governments.

Utilities tend to hedge around 50 per cent of their power sales two years in advance, and 90 per cent one year ahead. "It's going to be a shock to the system," Sikorski said. "They will have to pay industrial [emitters] more to get them to sell their surpluses."

Business leaders call for focus on energy efficiency

Business leaders at last month's G20 Business Summit, a prelude to the G20 Seoul Summit, issued a 20-point statement that included an urge for G20 countries to improve energy efficiency.

The business summit brought together the heads of some 120 of the world's leading companies from 34 developed and developing countries, with combined total sales of over $4 trillion annually.

Jean-Pascal Tricoire, CEO of Schneider Electric, a global leader in energy management said if the world wants to reduce carbon emissions, energy efficiency is a must.

As a convene of the working group on energy efficiency for the G20 Business Summit, Tricoire said his group believes that improving energy efficiency is the best way to ensure energy security, limit greenhouse gas emissions, and insulate economies from the volatility of energy prices.

With global energy demand set to double before 2050, energy efficiency is becoming a top priority. However, there are challenges and obstacles to promote energy efficiency.

According to an IEA report, global energy demand is forecast to increase about 40 per cent between 2007 to 2030 as a result of urbanisation and industrialisation.

Growth still depends on primary energy consumption in some developing countries. Coordinated actions and large investment are needed in energy efficiency to reduce energy usage, said a discussion report by the working group.

"Energy efficiency does not mean big investment. It could be a small investment," said Tricoire.

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*Source: World Energy Outlook 2009, IEA/OECD

Venezuela passes nuclear law

President Chavez: preparing for post oil era

Venezuela is planning to boost its electricity generating sector through the use of nuclear and renewable energy.

The South American country – which earlier this year suffered from severe power shortages – has signed agreements with Portugal covering the development of renewable energy, while its national assembly has approved a bill to construct and operate a nuclear power plant.

Venezuelan President Hugo Chavez said during a recent trip to Portugal that his country had to prepare "for the post-oil era", and that wind farms would initially be developed at four sites.

The country is currently heavily reliant on hydropower and its oil sector. It announced in October that it would boost the output of its largest hydropower plant by 795 MW through a modernisation programme financed by the Inter-American Development Bank (IDB).

It is also planning to build up to 4000 MW of nuclear capacity and recently signed a nuclear agreement with Russia.

At the 10.2 GW Guri hydropower complex, which provides around 45 per cent of Venezuela's electricity needs, a $1.3 billion modernisation project will replace six turbogenerators in order to extend the plant's life and increase its output.

The IDB has approved a $700 million loan for the project, which is due to be completed in 2016.

Mexico, Argentina and Brazil are the only Latin American countries developing nuclear energy, while Bolivia and Chile have expressed their interest in the area.

Bolivian president Evo Morales said recently that he had secured backing from Iran to help his country develop a nuclear power plant.

California votes for cap and trade

Solar projects approved
Carbon trading system will underpin clean energy investment

The US state of California is moving quickly forward with plans to rapidly expand its renewable energy sector with the approval of more solar power projects by both state and federal agencies.

The state – seen as one of the most progressive in the US with regards to clean technology and environmental regulation – is also set to introduce an emissions trading programme in early 2012.

The California Energy Commission (CEC) has approved the 664 MW Calico solar thermal project, its seventh since September, while the US Department of the Interior (DOI) has approved the 250 MW Genesis solar thermal project, its sixth in California since October.

The CEC has now licensed 3492 MW of solar power in the California desert since August. The projects are being developed under an initiative pioneered by California and the DOI that aims to help renewable energy companies navigate the approval process.

California has released details of its proposed cap and trade greenhouse gas market, which would impose mandatory emission limits on around 600 polluters in the state. The trading system would help the state reach its target to cut greenhouse gas emissions to 1990 levels by 2020.

California's air board – a nine-member body appointed by the governor – is scheduled to vote on the rules on December 16th. If it approves them, as expected, California will become the first state in the USA with mandatory limits on emissions from a wide variety of industries.

Other policies that will help California reach its greenhouse gas goal include new energy efficiency standards on appliances and building construction, and an existing renewables portfolio standard.

The survival of California's proposed climate legislation through the USA's mid-term elections – in which the state's voters chose pro-cap and trade democrat candidate Jerry Brown for their next governor – bodes well for the state's plans to attract investment in renewable energy projects such as Calico and Genesis.

However President Barack Obama's loss of control over the House of Representatives in the mid-terms means that the future of federal carbon trading plans are extremely bleak.

Obama has pledged to work with his opponents in Congress to find common ground on energy issues and to find other ways of tackling climate change. However, the continued uncertainty over future regulations governing greenhouse gas emissions and renewable energy is bad news for investors.

The American Wind Energy Association (AWEA) said in November that the US wind industry had its slowest quarter since 2007 from July to September, when 395 MW of new wind capacity was added, down from 1584 MW in the same quarter of 2009.

The main reason for the drop is policy uncertainty, which is causing utilities to delay plans for new projects, says AWEA.

These sentiments have been echoed in a new report published by VB Research, which says that start-up funding for clean energy companies around the world slumped in the last quarter.

In research carried out for law firm Taylor Wessing, VB Research found that investment by venture capital firms in clean technology and renewable energy companies has fallen from €4.3 billion to €3.5 billion ($5.5 billion) since the second quarter.

The Environmental Protection Agency (EPA) is planning to use existing legislation – namely the Clean Air Act – to control greenhouse gases, but this move is facing legal challenges.

Power to Atlantic provinces

Atlantic Canada provinces should finally be able to develop the Lower Churchill Falls hydropower project, and gain access to northeastern US markets without help from Quebec.

Siân Crampsie

The premiers of Nova Scotia and Newfoundland and Labrador have hailed a new era of cooperation in Atlantic Canada after a C$6.2 billion deal was reached to develop the Lower Churchill hydropower project.

Nalcor Energy, the Crown utility of Newfoundland and Labrador, and Emera Inc., which owns Nova Scotia Power, have announced plans to develop generating capacity at Muskrat Falls, Labrador, and transmit the electricity via subsea cable to Nova Scotia and the island of Newfoundland.

The project will boost the two provinces' economies and create new opportunities for cooperation in the energy market, said Danny Williams and Darrell Dexter, the premiers of Newfoundland and Labrador and Nova Scotia, respectively.

It will also boost their independence and reduce the "geographic stranglehold" that Quebec has held over them, said Williams, who has been battling Quebec Premier Jean Charest for years over Hydro-Québec's refusal to transmit power from the Lower Churchill project through its existing transmission grid to markets in Ontario and the United States.

"Today, we are saying that Quebec will no longer determine the fate of Newfoundland and Labrador, and one of the most attractive clean energy projects in North America," said Williams.

Under the agreement, Nalcor will build the first phase of the Lower Churchill project by establishing a C$2.9 billion, 800 MW generating facility at Muskrat Falls in Labrador.

Emera will provide C$600 million for the C$2.1 billion transmission link between Labrador and Newfoundland, and will completely fund the C$1.2 billion link between Newfoundland and Nova Scotia.

Nova Scotia will receive 20 per cent of the power generated at Muskrat Falls for 35 years.

Newfoundland and Nova Scotia have asked for C$375 million in federal infrastructure assistance for the subsea transmission cables, a move that is likely to anger Quebec.

In addition to project permits for the project, Canada's federal government will have to reach agreement with Labrador Innu, who have vowed to block development of the project unless their land claims are settled.

Fuel cells march forward

Fuel cell developers in the US are moving forward with key projects in spite of the difficult power market environment.

Last month Canadian firm Ballard announced that it had started a 1 MW mobile fuel cell system demonstration project in Eastlake, Ohio, USA, while Connecticut-based Fuel Cell Energy announced a contract with the US Department of Defense (DOD) to install a fuel cell power plant at a base in California.

Another Fuel Cell Energy project to install 4.5 MW of generating capacity in San Diego has received a $23.5 million investment from the New Energy Capital Cleantech Infrastructure Fund (NECCIF).

For the next five years, Ballard is planning to carry out performance tests on what is thought to be the world's largest proton exchange membrane hydrogen-powered fuel cell at FirstEnergy Generation Corp.'s Eastlake power plant in Ohio. The performance and operating data will be evaluated in collaboration with the Electric Power Research Institute (EPRI).

"Finding new sources of clean, renewable peaking energy is important for meeting our customers' energy needs and helping us meet increasingly stringent environmental requirements," said Gary R. Leidich, executive vice president and president of FirstEnergy Generation. "This fuel cell system has the added benefit of being mobile, so it can provide peaking power when and where it's needed."

Fuel Cell Energy specialises in molten carbonate fuel cells and its project to install three fuel cells totalling 4.5 MW of capacity at sites owned by the University of California San Diego (UCSD) and the City of San Diego is the largest integrated fuel cell project in the USA. The fuel cells will run on renewable biogas sources from wasted methane gas at the City of San Diego wastewater treatment plant.

Fuel Cell Energy is also planning to relocate, install and service a DFC300 fuel cell power plant at US Army Camp Parks Reserve Forces Training Area in Dublin, California.

San Diego: will host the USA's largest integrated fuel cell project

China moves toward nuclear independence

The transfer of intellectual property from Westinghouse and the greater control of its own uranium resources are helping China to improve its nuclear independence, **says Syed Ali.**

China took a significant step last month in becoming more self-sufficient in nuclear power generation.

In late November, Westinghouse Electric transferred more than 75 000 documents to its Chinese customers, mainly government-run State Nuclear Power Technology Corp., as the initial part of a technology transfer agreement.

The documents relate to the construction of the four Third Generation AP1000 reactors that Westinghouse, owned by Japan's Toshiba, is building in the country.

Westinghouse, like other international companies, has had to enter into technology transfer agreements in order to win contracts to build reactors in China's booming nuclear power market.

In a mid- and long-term development plan for the nuclear power industry approved in October 2007 by China's Cabinet, the State Council said it aims to increase the country's nuclear power capacity to 40 000 MW by 2020. The nation plans at least 60 new reactors by this date.

By the end of September, China had an installed nuclear power capacity of 9190 MW, with 27 730 MW under construction. With the acceleration of construction, the National Energy Administration (NEA) predicts that the 2020 goal might be achieved in 2015. Accordingly, nuclear installed capacity could hit 70 000-80 000 MW by the year 2020.

Foreign companies have become increasingly critical of China's demands for technology transfer in return for winning contracts.

In other industries, companies have transferred technology to Chinese companies only to see them quickly become competitors. It is a risk, however, that they are being forced to take.

Jack Allen, president of Westinghouse for Asia said: "We don't expect that we will walk away at the completion of these units and not participate in the [nuclear] programme, but there are no guarantees."

Rajesh Panjwani, an analyst at CLSA Asia-Pacific Markets in Hong Kong, commented: "It seems entirely reasonable to me to say that the company will get a lot more out of China. Westinghouse has been selling nuclear technology in Korea for almost 20 years and it still needs Westinghouse's assistance."

He added: "This is very complex technology to master. This is a case of Westinghouse deciding to get involved in the biggest nuclear power market in the world and also assuming that it will take China some considerable time to fully master this technology."

At the same time, China is also diversifying its sources of uranium to meet the rising demand in the nuclear power industry.

Speaking at the China Mining Conference and Expo in Tianjin last month, Lu Xiaoming, director of the Nuclear Fuel Division of the China Atomic Energy Authority said: "Exploration and exploitation of domestic uranium will be prioritised for the country's mid- and long-term development of nuclear power.

"We should rely on our own resources to acquire uranium. We will intensify our geological survey efforts to have a clear understanding of uranium resources, and bring technical innovation to the exploration and exploitation of uranium for greater efficiency."

China is looking to overseas uranium resources and will invest in, and deepen cooperation with, countries in the field of uranium, said Lu.

Chen Yuehui, deputy president of China Uranium Corp. Ltd. (CUCL), said his company is spearheading the search for uranium in Australia, Canada and African countries. CUCL is a subsidiary of China National Nuclear Corp., China's biggest operator of nuclear power plants.

"By the year 2015, we shall have completed construction of two overseas uranium mines. They will have an annual production capacity of up to 2500 tonnes and control uranium resources of 100 000 tonnes," Chen said.

China: gaining western technology

Japan may allow utilities to emit more CO_2

■ No upper limit for electricity generators ■ Households may have to cut electricity use

The Japanese government is leaning toward introducing an emissions trading scheme (ETS) that would treat utility companies as exceptions and allow them to increase emissions if they generate more electricity.

According to sources close to the matter the Ministry of the Environment is considering not setting an upper limit for the total amount of CO_2 emissions from electric power companies.

Instead, the ministry would oblige utility firms to limit emissions per a certain volume of electricity produced, meaning that the system would allow them to emit more if they generate more.

The government has apparently taken into consideration utility firms' roles in supplying electricity. However, observers said it would make it more likely that households would be required to sharply cut emissions as Japan has set a target of cutting its greenhouse gas emissions by 25 per cent from 1990 levels by 2020.

For companies in other sectors, the government plans to set upper limits for emission volumes through consultations with them, taking into account their track records in cutting emissions and energy-saving technologies that they could introduce in the future. Since companies will be able to consult with the government in advance on how much they should cut emissions, their reduction limits would be seen as less of an imposition, the observers said.

Indonesia explores CBM-to-power

Indonesia is exploring the use of coal methane gas as a way of ending the use of diesel fuel as the primary fuel source to operate its power plants.

Indonesia's leading coal bed methane (CBM) company, Ephindo, signed a memorandum of understanding (MOU) with GE last month to develop a pilot power plant that will tap into the country's vast reserves of coal methane gas to produce electricity using cleaner burning power generation technology. The project is the first of its kind in the country.

Total energy demand in Indonesia is growing at 7 per cent per year, and currently up to 40 per cent of power generation in the country comes from diesel fuel. With the third largest CBM reserves in the world, the Indonesian government plans to focus more on using these resources to reduce the country's dependence on subsidised fuel.

"Indonesia has been a net importer of oil since 2004, and although it is currently the world's third largest exporter of liquefied natural gas, conventional domestic gas supply is projected to decrease by 2020. Therefore, the Indonesian government is encouraging investors in commercialisation of CBM to power," said Sammy Hamzah, CEO of Ephindo.

GE will finance and develop the 1 MW pilot plant, which will be located at the Sangata field in East Kalimantan, Indonesia. It will feature GE's Jenbacher J320 gas engine technology, which has been successfully used in CBM-to-power markets around the world. If the pilot plant is proven commercially viable, the project could be expanded when the 21 CBM production-sharing contracts go into operation in the future. The production-sharing contracts are spread across four main areas in Sumatra and Kalimantan.

The four-well pilot drilling programme was expected to begin by the end of November and commercial operation is scheduled for the third quarter of 2011. Eventually, it is expected that this CBM-to-power project will be connected to PLN's (Indonesia's state-owned power company) grid to improve rural electrification in remote areas.

CBM gas occurs naturally within coal deposits and is composed largely of methane, the principal component of natural gas. Compared to natural gas, CBM burns more efficiently and delivers considerable cost savings in extraction. Potential Indonesian reserves of CBM are estimated at 450 trillion cubic feet, almost three times the country's current reserves of natural gas.

Vietnam seals nuclear deal

Vietnam has signed an agreement with Japan to build two civil nuclear reactors in Vietnam. Japan will also cooperate with the Vietnamese government on the exploration and refining of rare earth minerals.

The nuclear reactor deal was sealed during a meeting between Naoto Kan, the Japanese Prime Minister, and Nguyen Tan Dung, his Vietnamese counterpart, after a summit of Asian leaders in Hanoi.

The deal is the first significant order for the Kan administration since it embarked on a policy of supporting exports of Japanese technologies overseas.

The Japanese nuclear project will be located in Ninh Thuan province, in southern Vietnam. It is the first order for the International Nuclear Energy Development of Japan Co. a public-private venture established in October to help export Japanese nuclear technology.

The two countries are working towards the early signing of a treaty between the two countries that sets a legal framework for peaceful use and transfer of nuclear power-related technologies, materials and equipment.

The Japanese and Vietnamese premiers also agreed during the talks that they will promote joint exploration and refining of rare earth minerals – resources vital for making products such as wind turbines, car batteries and radar systems.

Japan's move to cooperate with Vietnam on developing rare earths is part of its effort to move away from its heavy reliance on China, which accounts for more than 90 per cent of the global production of rare earth metals

This dominance has become an increasing concern as China has steadily reduced export quotas for the minerals.

Philippines sees critical two years ahead

The Philippines government says that the next two years will be critical as it attempts to plug its power gap.

Energy Secretary Rene D. Almendras said at the recent Infrastructure Philippines 2010 Conference that while the estimated 2000 MW of additional capacity committed by both local and foreign investors will meet the country's power shortfall from 2013 onwards, the power supply situation would be problematic until 2012.

The government noted that the time needed to build a power plant project is about 24 months, depending on the technology to be deployed, and if financial closing and permitting processes are included, the entire completion period could be three to five years.

"We are assured of power supply by 2013 and even for 2015 to 2016, but we are working on quick solutions in the next two years," said Almendras.

Between 2013 and 2014, the 600 MW capacity of GN Power will start shoring up supply in the Luzon grid, while the other power commitments may come on stream between 2014 and 2016.

The government is expecting Pesos348.5 billion ($7.9 billion) worth of investments in the power sector under the Public Private Partnership (PPP) programme.

Board of Investments (BOI) managing head Cristino L. Panlilio said that for 2012 and beyond, they are considering 43 new projects in the power sector.

Likewise, Panlilio said that there are already 28 projects that require P263.5 billion in investments that are up for competitive selection. He said that for 2012, 73 projects have been identified for PPP.

The country's immediate problems will be eased by the news that a new coal fired power plant will enter commercial operation early next year.

The joint venture of Korea Electric Power Co. (Kepco) and SPC Power Corp. says it has just completed the first generating unit of its coal-fired power plant in Cebu. In a statement, KSPC said that it has synchronised the first 100 MW unit of the company's 200 MW coal plant in Barangay Colon, Naga in the said province.

Commercial operation of Unit 1 is scheduled in February and Unit 2 in May 2011.

Meanwhile, last month plans were announced for the expansion of two large coal fired plants. TeaM Energy Corp. will expand the 1200 MW Sual and 735 MW Pagbilao plants in Pangasinan and Quezon by 600 MW and 400 MW, respectively. TeaM Energy operates the two coal plants under a build-operate-transfer agreement with the government that will last until 2025.

The expansion of the facilities, however, is still subject to a feasibility study that would be undertaken by Tokyo Electric Power Co. (Tepco), one of TeaM Energy's owners.

Conal Holdings Corp. also said it will start construction of its $450 million coal fired power plant in the first quarter of 2011 to plug the chronic power supply deficit expected to hit Mindanao by 2014.

Joseph C. Nocos, Conal Holdings vice-president, said the company was in the permit process for the 200 MW coal power plant in Maasim, Sarangani, adding the firm was also moving into the detailed design and engineering phase of the project.

The Philippines power sector was given a further boost with the announcement in late October that distribution utility Manila Electric Co. (Meralco) moved closer to returning to the power generation business after finalising plans to form a new subsidiary that will install 1500 MW of capacity by 2016.

Macao and NZ promote competition

Macao competitive bidding after 2015
NZ establishes Electricity Authority

Both New Zealand and Macao are looking to promote competition in their power markets.

The government of Macao Special Administrative Region (SAR) plans to bring new operators into its power generation market in 2015 at the earliest.

Companhia de Electricidade de Macau (CEM), a private utility company, is currently the exclusive supplier to the power generation market. The company signed a new power supply contract with the SAR government at the beginning of November, extending its concession by 15 years starting from December 1, 2010.

While existing power generation capacity is able to meet power demands until 2015, new demand arising after 2015 will be met through competitive bidding, said the SAR's Office for the Development of the Energy Sector.

The terms in the new contract also specifically provide for the introduction of renewable energy. The concessionaire is now required to support local renewable energy development, especially solar power.

Meanwhile, the establishment of New Zealand's Electricity Authority marks a milestone in the government's reforms of the electricity sector.

As of November 1, the Electricity Authority replaced the Electricity Commission and is now responsible for promoting competition, reliable supply and efficient operation of the New Zealand electricity market.

Energy and Resources Minister Gerry Brownlee said: "It is less than a year since the government agreed to the measures to be implemented to improve electricity market performance. The establishment of the Electricity Authority is one aspect of the changes made to improve governance. Other measures, which the Electricity Authority is responsible for advancing, are directed at improving costs, competition and security of supply."

The Electricity Industry Bill was introduced into Parliament in December 2009 to implement most of the recommendations of the review. Now, the Electricity Industry Act 2010 comes into force in its entirety.

Ports spending attracts turbine makers

The UK government's decision to spend £60 million on upgrading its ports has been applauded by the wind industry, but the business sector says it still needs to do more to keep investment flowing – and the lights on.

Siân Crampsie

Three major wind turbine manufacturers have confirmed plans to invest hundreds of millions of pounds in the UK's wind energy industry.

Siemens, GE and Gamesa will between them spend over £200 million ($320 million) in the next few years to establish manufacturing and research centres around the UK.

The news is a major boost to the UK's plans to become a world-leading industrial centre for the wind energy industry, and came after the country's government said that it would go ahead with a £60 million investment in the UK's ports to upgrade them and make them suitable for handling large offshore wind turbines.

In line with that announcement, energy regulator Ofgem opened its second tender round for the provision of transmission links between 2.8 GW of offshore wind farms and the mainland.

The high-voltage projects will connect six major offshore wind farms to the grid and are worth a combined £1.9 billion. Companies will be able to compete in the tender for the right to own and operate the links for the next 20 years.

A competitive tender will ensure that the cost of the links is kept to a minimum, said Ofgem.

These latest developments have been applauded by the renewables industry, which feared that government cutbacks would affect government plans to upgrade the UK's ports, but business lobbying organisation the Confederation of British Industry (CBI) warned that the government still needs to do more to continue attracting investment.

Speaking at the CBI Climate Change Summit in London, Richard Lambert, CBI Director-General, said that companies had put climate change issues at the heart of their businesses and were ready to make the investments needed in the UK's energy infrastructure, but need a clear framework of policies and commitment from the government.

He said that the government's job was in "providing the incentives, setting the regulations, supporting the infrastructure for green growth", which would allow businesses to get on with "designing and marketing their products and services within a consistent policy framework".

Richard Lambert, CBI Director-General urged the UK government to work with business

Lambert urged the government to accelerate energy market and planning reform, and to work with business to deliver some of its big new ideas, such as the Green Investment Bank, in an effective fashion.

"We are going to have to raise our game substantially in the next few years," said Lambert. "The risk to our future energy supplies, unless properly addressed, will seriously undermine the attractions of the UK as a place to invest.

"Enormous sums of private capital that could support our nuclear and offshore wind programmes and re-energise our manufacturing sector will shift to other, more welcoming parts, of the world."

Ofgem has estimated that a total of £200 billion of investment is needed in the UK's energy infrastructure over the next decade – £32 billion of it on the transmission network and much of the rest on replacing the country's ageing power plants.

The regulator said that its first tender for the provision of £1.1 billion worth of transmission links to offshore wind farms attracted almost £4 billion of interest.

The winning bidders of the first round will be announced in mid-2011.

Commission wins in golden share case

The Portuguese state can no longer own a "golden" share in privatised utility EDP because it contravenes European law, Europe's highest court has ruled.

The European Court of Justice has declared that the "special rights" granted to the Portuguese state through the golden share constitute an "unjustified restriction on the free movement of capital".

The ruling came down in favour of the European Commission, which has been trying to crack down on the practise of golden shares held by governments in former state owned companies.

In July the Court delivered a similar verdict in declaring government golden shares in former state telecomms company Portugal Telecom illegal.

In its ruling the Court said that because the golden share in EDP gave Portugal the right of veto over a large number of important resolutions, potential investors might be discouraged in making investments in the firm. Portugal had therefore "failed to fulfil its obligations in respect of the free movement of capital", one of the four founding principles of the 27-nation bloc.

The Portuguese state privatised EDP in several phases between 1997 and 2006 but held on to a golden share in order to retain some level of control over the company. It argued in court that the golden share could be justified because of the need to ensure energy security in the event of a crisis such as war or terrorism.

Energy efficiency will save billions, says Greek PM

- Major renovation programme planned
- Greece and Turkey join forces in climate change initiative

The Greek government has announced further measures aimed at both greening and growing its economy.

The measures centre on improving energy in the residential, commercial and public sectors and will save as much as €9 billion by 2020.

The ambitious plan – known as "Building the Future" – was unveiled by Greek Prime Minister George Papandreou and Greek Environment, Energy and Climate Change Minister Tina Birbili last month. It follows on from the government's announcement in October that it wanted to attract billions of euros in investment for the renewable energy sector.

According to Papandreou, Greek households are among the biggest energy consumers in Europe, using as much as three times the amount of energy as households in some parts of northern Europe.

Householders on low incomes also tend to live in old buildings that are less energy efficient.

The Building the Future plan therefore aims to offer Greek households a series of incentives to renovate old buildings, windows and roofs, and improve energy efficiency. Incentives will include low-interest loans and fast-track application procedures.

Environmental campaign group Greenpeace said that the plan was "probably the most ambitious programme for the energy upgrading of buildings in Europe".

Greece is hoping to attract around €45 billion of green energy investment over the next five years.

The government hopes that the plan will bring economic growth, boost employment and help to make Greece and the wider Mediterranean a major renewable energy hub.


PM Papandreou: attracting green investment

Greece in October hosted the launch of the Mediterranean Climate Change Initiative, a political and projects-based programme that is supported by the European Investment Bank.

Speaking at the launch event, Papandreou said that the initiative would promote dialogue between governments, scientists and companies and would make better use of climate change initiatives already underway in the region.

"The region of the Mediterranean… is particularly vulnerable to temperature rise and we are facing real dangers," said Papandreou. "This threat, this major problem, binds us together."

He added: "Two core beliefs have led me and my dear friend Tayyip [Erdogan, Turkish Prime Minister] to launch a Mediterranean Climate Change Initiative.

"The first is that we have much to gain by collaboration, whether in sharing our expertise, sharing the risks implicit in exploring new solutions, or developing a strong, united voice in the international arena.

"The second is that we can no longer speak of economic prosperity and climate security as opposites, as polar opposites. I am convinced that adopting a new, low-carbon development model provides a unique opportunity to jointly address the financial and energy and climate crises."

"Crown jewel" tidal project awarded

One of the world's largest tidal energy projects is set to be developed off the coast of Scotland after the UK's Crown Estate awarded a lease agreement to a consortium owned by Morgan Stanley, International Power and Atlantis Resources Corporation.

The Inner Sound tidal project is known as the "crown jewel" of tidal projects in Scotland's Pentland Firth and could generate up to 400 MW from a stretch of high flowing water between the Island of Stroma and the mainland of Caithness in northern Scotland.

The MeyGen consortium has been granted the exclusive right to take the project forward and take up a 25-year operational lease. It says it will take a phased approach to the project, starting with the deployment of a limited turbine array to assess the environmental impact of the tidal turbines and inform the detailed planning for future phases.

Completion of the final phase is scheduled for 2020, when up to 400 turbines from Atlantis Resources Corporation will have been installed.

Atlantis owns a ten per cent stake in MeyGen, while International Power and Morgan Stanley both own 45 per cent.

"The MeyGen project will be seen as a flagship marine power project," said Dan Pearson, CEO of MeyGen. "In cooperation with the local community, The Crown Estate and all levels of government, we are committed to making tidal power a success not only for our shareholders, but for Scotland as well."

The Pentland Firth and water surrounding the Orkney Islands are the first areas to be made available for commercial scale development of wave and tidal energy in the UK. With potential generating capacity totalling 1600 MW, including the Inner Sound site, these projects constitute the largest planned development of wave and tidal energy worldwide.

Nigeria shapes up for investors

Brazil could fund Mambilla
Nigeria taps Indian expertise

Nigeria is considering plans to offer investors a 10-15 year tax-free period in order to boost its ailing power sector.

The country's government is also continuing to look abroad for expertise in the construction of major power projects as it seeks to rapidly expand its generation base.

In a statement issued at the end of a forum in Abuja organised by Nigeria's Ministry of Power in partnership with the embassies of Finland, Sweden and Norway, the government said that 'pioneer' status could be granted to companies that make large-scale investments in the power sector.

The main benefit of the status would be a 10-15 year tax-free period that would enable investors to realise their returns more quickly.

The statement from the government also recommended the formulation and enactment of effective policy and legislation in order to boost investor confidence.

Nigeria has suffered from power shortages for several years due to rising electricity demand and a lack of investment in existing and new infrastructure. President Goodluck Jonathan has made development of the power sector a priority in his tenure.

Projects that could benefit from the proposed policy include the Mambilla hydropower project, which Brazil is planning to fund and build, according to Nigerian officials.

The 2600 MW Mambilla project, located in Gembu, Taraba state, would have the largest capacity of any dam in Africa but its development has been hampered by the controversy surrounding the corruption in Nigeria's previous administrations.

In 2006 the China ExIm Bank offered $1 billion to finance Mambilla and a contract was awarded to Chinese firm Gezhouba to build the project. No work has actually been carried out at the project site, according to International Rivers, a pressure group that campaigns against large-scale hydropower projects.


President Goodluck Jonathan: making power sector development a priority

Nigeria and Brazil have been examining ways of cooperating in the power sector under the Nigeria-Brazil Energy Partnership.

Indian firms are also reported to be interested in emulating China's strategy in Africa and Nigerian officials said last month that Indian companies such as Bharat Heavy Electricals Ltd. (BHEL) have been invited to set up and operate power projects.

In 2009 BHEL signed a Memorandum of Understanding (MOU) to help Nigeria establish three new coal-fired power plants.

Kenya ventures into carbon trading

Kenya hopes to attract investment by becoming the first African nation to establish a carbon exchange, writes **Siân Crampsie.**

Kenya is hoping to become a major carbon trading hub for Africa and has started the process of establishing a trading scheme in Nairobi.

The country's government has released a draft climate change bill that would establish a carbon market as well as set targets for energy efficiency and prevent destructive land use practises.

The government hopes that the legislation will open up investment in renewable energy and forestry projects.

Kenya's government estimates that its largest forest, the Mau, has the potential to earn the country close to $2 billion a year over the next 15 years, according to the *BBC*.

The draft Climate Change Bill 2010 proposes that six months after it becomes an Act, the government will establish a National Clean Energy Development Mechanism Authority to give directions on trading of carbon emission reductions. The market – the first of its kind in Africa – would enable all African countries to sell and trade their carbon credits.

Carbon trading consultancy firm Bea International is helping Kenya to set up the exchange. The market is expected to be open for business by mid-2011.

Database sheds light on gasification plants

The use of gasification technology worldwide is growing and capacity could reach more than 112 GW by 2016, according to a new analysis from the US Department of Energy (DOE).

The DOE's Office of Fossil Energy's National Energy Technology Laboratory (NETL) has compiled a database of existing and planned gasification plants, which are expected to become a popular choice for future coal-fired power plants.

The database reveals that the worldwide gasification capacity has continued to grow for the past several decades and is now at 70 817 MWth of syngas output at 144 operating plants with a total of 412 gasifiers.

The database also shows that 11 plants, with 17 gasifiers, are presently under construction, and an additional 37 plants, with 76 gasifiers, are in the planning stages to become operational between 2011 and 2016. The majority of these plants – 40 of 48 – will use coal as the feedstock.

The additional planned capacity from all new 2011-2016 plants is 51 288 MWth, an increase of more than 72 per cent. If this growth is realised, worldwide capacity by 2016 will be 112 106 MWth of syngas capacity from 192 plants and 505 gasifiers.

Gasification is increasingly being viewed as a "clean" means of converting coal and other carbon feedstocks into hydrogen and carbon monoxide, which are in turn used to create a variety of value-added products, including electricity.

Increased focus on global warming could drive the uptake of the technology, says the DOE, especially in the power industry.

Gasification plants are now operating in 29 countries, with 37 per cent of capacity situated in Asia or Australia. China and the USA are expected to lead the growth of the industry over the next six years.

China has seven gasification plants under construction and ten in the planning stages, while North America is currently building two plants – both IGCC – and is planning a further 16 for operation by 2016.

Thirteen additional plants are planned in other parts of the world, 11 of which will use coal.

Russia seeks Icelandic cooperation

Russia is hoping to boost the supplies of geothermal energy with the help of Iceland.

The two countries are in talks over the development of large-scale geothermal projects in the Russian Far East region of Kamchatka in order to underpin industrial growth in the region.

Several working meetings have already been conducted on the proposal and the two sides are working on drawing up an intergovernmental agreement, according to Russian Energy Minister Sergei Shmatko.

Russia is also improving ties with other major energy partners, including China, and recently expressed concerns about the European Union's desire to reduce its reliance on Russia for its energy supplies.

Speaking at an EU-Russia energy conference in Brussels, Shmatko was quoted by *Bloomberg* as saying: "Unfortunately in the area of energy, if you look at the situation between Russia and the EU partners, there's a certain lack of trust here and there.

"We see too much of this sort of policy diversification in Europe," he added.

The EU relies on Russia for about 25 per cent of its natural gas and supply disruptions over the last few years – caused by disputes between Russia and its neighbours – have raised concerns in the 27-nation bloc about security of supply.

Russia could provide "good and economically viable" supplies, according to Shmatko.

Russia last month signed agreements with China to expand cooperation in oil, gas, coal and nuclear power.

Nuclear for oil: France and Libya deepen ties

France could help Libya to build a nuclear power plant after the two countries signed a declaration of intent to establish a strategic partnership in a number of fields.

The agreement means that the two countries will hold talks with the ultimate aim of the signing of an accord by the Libyan Nuclear Energy Authority and the French Atomic Energy Agency.

Such an accord would facilitate the creation of nuclear legislation in Libya as well as the implementation of the studies required for the construction of nuclear capacity.

Other areas discussed by the two countries include the oil and gas sector, banking and renewable energy.

French firms are keen to gain access to Libya's massive unexploited oil reserves.

GE to address China's "pressing needs"

Investment push in China, Brazil
John Rice to head global ops

Siân Crampsie

GE has announced a plan for aggressive investment and expansion in China and Brazil to take advantage of the opportunities in these two rapidly growing markets.

The US conglomerate is to sink more than $2 billion over the next two years into a range of markets in China, as well as $500 million in its operations in Brazil.

Many of the investments will be made through technology partnerships, and will help to address both countries' pressing infrastructure needs, says GE.

The company has also named John Rice as head of global operations, a role that will focus on GE's business in high growth markets such as China, India, the Middle East and Brazil.

Rice has been a GE vice chairman since 2005 and in his 32-year GE career has held the helms of GE's energy, transport and technology infrastructure businesses.

GE sees huge potential in markets such as China, India and Brazil and says that its investments will help it to keep pace with its customers' demands in these markets.

"China is one of the world's fastest growing areas with a tremendous need for infrastructure," said Dan Heintzelman, president and CEO, GE Energy Services.

He added: "Currently, China is experiencing one of the largest rural to urban migrations in history and is expected to become a predominantly urban society by 2020, when urbanisation rates reach at least 50 per cent.

"This shift means significant changes to the electric distribution needs for a country boasting one of the world's largest populations. Doing this in a sustainable manner will be a challenge we will help provide solutions for."

GE's plans for China include $500 million on research and development and new customer innovation centres, and more than $1.5 billion to be spent on new joint ventures with Chinese state-owned enterprises in high-technology sectors such as electricity grid infrastructure and transport. It has signed a number of joint venture agreements with State Grid Corporation of China (SGCC), China's top power distributor and one of the world's largest utilities, to modernise China's power grids.

"To support current energy needs and future growth, China is rapidly expanding its use of renewable energy sources, which rely heavily on smart grid technologies to optimise their effectiveness," said Hai-An Zhu, general manager for GE's Digital Energy business in China. "These solutions will provide the region with a new supply of additional power, helping minimise the need for large investment in transmission networks while improving reliability and reducing pollution."

GE will build customer innovation centres in six cities to enable it to improve product development, engineering, sourcing support and delivery in the west, north, central and south China markets.

Rice: focused on high growth markets

The deals follow closely after those signed in India recently.

In Brazil, GE is to invest $100 million in a new global research centre that will focus on advanced technologies for the oil and gas, renewable energy, mining, rail and aviation industries. It also plans to invest $400 million over the next three years in technology, training, new product development, new plant and equipment and human capital.

These investments include $200 million for new wind turbine and aeroderivative product development and increased plant capacity for GE's Energy and Oil and Gas businesses.

"Brazil presents tremendous opportunity for growth and increased collaboration with our customers," said Mark Little, Senior Vice President of GE Global Research.

E.On delivers new strategic focus

Assets sales will cut debt
Business growth outside Europe

E.On CEO Johannes Teyssen is looking to be "more international"

Europe's competitive energy markets and growth markets outside Europe will be the focus of E.On's future efforts as the German utility giant attempts to enhance efficiency, boost profits and cut debts.

The company says that it is planning to raise €15 billion by the end of 2013 from asset sales and is also expecting to achieve €600 million worth of efficiency enhancements in its business over the same period.

About half of the proceeds will be used to pay down debt.

Under the new strategy, E.On will enhance its efforts to leverage synergies across its businesses in Europe's converging energy markets. At the same time, it will seek to implement new build projects in Russia, and expand its renewable energy portfolio in North America.

CEO Johannes Teyssen expects E.On's businesses outside Europe to deliver one-quarter of its total earnings by 2015, and said at the announcement that he wants the company to become an international energy specialist.

"E.On will become more focused and at the same time more international," said Teyssen. "In Europe, we're going to concentrate on what we can do best and on areas where we see the biggest opportunities for profitable growth. Outside Europe, we're going to achieve additional business growth by deploying our expertise in areas where we're a true outperformer."

The company has not said which areas of the business it will sell.

In a recent report in the *Financial Times* it was rumoured that E.On may sell its $4.5 billion stake in Russian gas group Gazprom to Russian state-owned bank, VEB. The report stated that a source close to negotiations between E.On and VEB told *Reuters* that talks over the 3.5 per cent stake have taken place, confirming an earlier report.

E.On has pointed to "considerable business challenges" in the years ahead from a planned German nuclear fuel tax, full auctioning of European Union carbon allowances, a changed gas market environment and narrower wholesale margins.

These, it said, "will put considerable pressure on E.On's earnings".

Exelon half way to 2020 goal

US utility Exelon is underpinning its 'Exelon 2020' climate change strategy with investments of nearly $5 billion.

The company says that it is already half way to achieving its goal to reduce, offset or displace more than 15 million metric tons of greenhouse gas (GHG) emissions per year by 2020.

The $5 billion of investments will take place between 2010 and 2015 and will be made in projects such as energy efficiency and smart grid programmes, economic renewable energy investments, and increased output at its nuclear plants.

The projects will be located in Pennsylvania and Illinois, where the majority of its customers are based, but also in other US states.

"We are committed to a clean and secure energy supply at the lowest cost to the communities and customers we serve and the markets in which we operate," said , chairman and CEO of Exelon. "Exelon 2020 is a roadmap for advancing market-driven innovation and economic options."

Key initiatives implemented so far under the Exelon 2020 strategy include energy efficiency programmes, an increase of 100 MW in the output of the company's nuclear plants, smart grid initiatives in Chicago and Philadelphia, and investments in renewable energy projects.

Exelon has also retired four fossil fuel fired power plants with a combined capacity of 933 MW.

"We are committed to a clean and secure energy supply at the lowest cost to the communities and customers we serve and the markets in which we operate," said Chairman and CEO of Exelon, John Rowe.

"The question facing the United States is not whether it should reduce air pollution and carbon emissions, but how to do so affordably, especially in light of current economic conditions. The pending suite of [Environmental Protection Agency] regulations will help drive the transition to a cleaner energy future."

Vestas cuts 3000 jobs

Vestas is to cut around 14 per cent of its workforce because of excess capacity and a reduction in the volume of orders.

The Danish wind turbine manufacturer is to shed 3000 jobs, one-third of which will be from its Danish operations. It said that uncertainty in Europe's renewable energy markets was at the heart of the problem.

The company is to close four production facilities in Denmark and one in Sweden.

At the same time, strong business in North America has enabled Vestas to create around 3000 jobs in that market.

Vestas' problems point to deeper difficulties in Denmark's huge wind power industry, where more than 38 per cent of Danish wind power equipment manufacturers cannot make ends meet, according to new analysis by the Danish wind power industry association and Deloitte.

According to their analysis, operating margins among suppliers to the wind power industry have fallen from 21 per cent in 2008 to five per cent in 2009.

In October, Skykon, one of Vestas' major component suppliers, suspended payments to its creditors.

Americas

Kallpa Generacion converts to combined cycle

A steam turbine from GE is to be used to convert the Kallpa Generacion power plant in Chilca, Peru into combined cycle operation.

Under contracts totaling more than $40 million, GE will provide a 207D-11 steam turbine, maintenance services and spare parts for the project, which is being executed by Posco Engineering and Construction as the lead contractor.

Conversion to combined cycle will increase both the efficiency and output of the Kallpa Generacion plant, which is located 60 km south of Lima and is Peru's largest thermoelectric plant.

The steam turbine will join three gas turbines at the site and will bring output to 850 MW.

John Deere orders Vestas units

John Deere Wind Energy has placed an order with Vestas for 50 wind turbines for the Michigan Wind II project near Minden City, Michigan, USA.

The order is for Vestas' V100-1.8MW units and includes delivery and commissioning along with a ten-year service and maintenance agreement. Delivery and commissioning are scheduled for 2011.

Brazil orders first LMS100

GE has announced its first order for the LMS100 aeroderivative gas turbine in Brazil.

The company has won an order from Bertin Energia for the supply of two LMS100s as well as three TM2500+ machines and one TM2500 aeroderivative unit for the 300 MW Jose de Alencar power plant in Ceará state, Brazil.

The $90 million contract was announced in November, just a week after GE said it would invest $500 million in Brazil to build a research centre and expand its operations in the country.

The Jose de Alencar power plant will be built in a greenfield area in Fortaleza and will use the LMS100 in simple cycle, powered by natural gas. The LMS100 offers high efficiency and low maintenance costs, says GE, and will also complement Brazil's hydropower-dominant energy mix.

Vestas lands Horse Butte deal

Vestas has received an order to supply 32 of its V100-1.8MW wind turbines for the Horse Butte wind power project near Idaho Falls, USA.

The 57.6 MW order represents Vestas' first in the USA for its V100-1.8MW unit. The contract includes delivery and commissioning along with up to a six-year service and maintenance agreement.

The project is being developed by Utah Associated Municipal Power Systems. Commissioning is expected for the second half of 2011.

Wind turbines for Wintering Hills

Suncor Energy has placed an order with GE for the supply of GE's 1.6 MW wind turbines for one of the largest wind power projects in the province of Alberta, Canada.

The 88 MW Wintering Hills project will use 55 of the GE units, which make use of a range of product features – including 82.5 m blades – to maximise power output while providing superior control flexibility and increased reliability with decreased maintenance requirements.

The Wintering Hills project is located near Drumheller, approximately 125 km northeast of Calgary, and is owned jointly by Suncor (70 per cent) and Teck Resources (30 per cent).

SunPower joins Iberdrola for PV project

Iberdrola Renovables has signed up SunPower Corp to help it build the 30 MW San Luis Valley Solar Ranch in Colorado, USA.

The photovoltaic (PV) power plant is to be built on 216 acres of private, former agricultural land and is expected to be fully operational by the end of 2011. It will use SunPower E19 solar panels mounted on SunPower Tracker systems, which tilt the solar panels towards the sun.

The plant will be owned and operated by Iberdrola Renovables.

Asia Pacific

Alstom wins India, Vietnam contracts

Alstom has strengthened its environmental control systems (ECS) business in Asia by winning contracts worth more than €40 million in India and Vietnam.

In India, the French-Swiss engineering firm will supply four 300 MW units of seawater FGD (SWFGD) for the Ratnagiri power plant, which is owned and operated by JSW Energy Ltd. In Vietnam, Shanghai Electric (SEC) has awarded Alstom an engineering and procurement contract for a SWFGD system for the 1244 MW Vinh Tan 2 power plant.

Wind turbines for Tuppadahalli

Tuppadahalli Energy India Pvt Ltd has placed an order with Vestas for 34 wind turbines for a project in the state of Karnataka, south India.

The contract includes the supply and commissioning of Vestas V82-1.65MW wind turbine units, a SCADA system and a seven-year service and maintenance agreement. Delivery is scheduled for the fourth quarter of 2010.

Tuppadahalli Energy is a Special Purpose Vehicle created by Acciona Energy India for the project.

ESP upgrade

Shanghai, China-based Baoshan Iron & Steel Co. Ltd. (BaoSteel) has awarded Alstom a contract to upgrade the electrostatic precipitators (ESP) of units 1 and 2 of its captive power plant.

The contract scope includes design, supply of materials and equipment as well as technical advisory services during installation and commissioning of the ESP upgrade. The contract also includes supply of switched integrated rectifiers (SIR), Alstom's high-frequency power supply, which optimises the energisation and performance of the ESPs.

The existing ESPs at the plant have been in service since 1980 and the upgrade will reduce particulate emissions from over 400 mg/Nm^3 to 100 mg/Nm^3.

Europe

Centrax will reduce hospital CO_2

Centrax is to supply the gas turbine generator set at the heart of a new energy centre at a major health campus in Scotland, where it will reduce the hospital's carbon dioxide (CO_2) emissions by nearly 20 per cent.

The combined heat and power centre at Aberdeen Royal Infirmary's Foresterhill site will feature a natural gas-fuelled Centrax generator set powered by a Rolls-Royce 501-KB7 gas turbine and combined with a waste heat recovery boiler. There will also be a biomass boiler fired by woodchips and three dual fuel boilers running on gas and light oil.

The Centrax package will produce 5.5 MW of electricity plus 12 tonnes of steam per hour.

"This new energy centre will not only replace our old high-maintenance boiler plant but will also provide a modern and flexible system suitable for what is one of the largest single health campuses in Europe," reports Gary Mortimer, Estates Manager for National Health Service Grampian Estates.

"It will provide extra energy needed for current and future developments at Foresterhill and bring a 17 per cent reduction in present CO_2 emissions, equating to some 4500 tonnes per year."

Belchatow modernisation

Alstom has signed two contracts worth a combined €140 million with PGE Gornictwo i Energetyka Konwencjonalna S.A. to modernise six units of the Belchatow power plant in Poland.

Under the first contract Alstom will retrofit the turbine island equipment on units seven to 12 at Belchatow, increasing each unit's output by 20 MW and boosting cycle efficiency by 2.4 per cent. The second contract entails retrofitting the units' existing electrostatic precipitators (ESPs).

Bomhus buys biomass boiler

Sweden's Bomhus Energi has placed an order worth €50 million with Metso for a new biomass power boiler and a flue gas cleaning and condensation system for a new cogeneration plant.

The new plant will be built on the site of a pulp mill that is owned and operated by Korsnaes AB, and will supply steam an electricity to Korsnaes as well as district heat to the town of Gaevle.

The plant will start up in early 2013.

GE offers technical support

UK-based utility SSE Generation has signed a service agreement with GE covering its fleet of GE wind turbines in operation across the UK and Ireland.

SSE has 127 GE wind turbines in operation in the UK and Ireland and says that the agreement gives it the flexibility to customise the technical support services that it needs. Service scope will be split between GE and SSE's own service teams depending upon the respective team's regional capability.

"With the expansion of the onshore wind generation fleet we needed new ideas and strategies to manage our fleet while continuing to manage safety, long term integrity and costs," said Jeremy Williamson, Onshore Wind Generation Manager of SSE Generation.

All of the wind turbines covered under the new service agreement are GE 1.5 MW units. The agreement includes GE's specialised technology for remote monitoring, trouble-shooting and support as well as routine maintenance. In addition, SSE will benefit from GE's wind turbine upgrades, parts, and access to state-of-the-art training from GE's Energy Learning Center.

Siemens wins offshore grid contract

German firm Siemens has won a contract from Dutch grid operator Tennet to provide maintenance services for two offshore grid connections in the North Sea.

The contracts are for an initial period of five years and are Siemens' first for offshore grid connection maintenance services within Germany. They will cover the HelWin 1 and BorWin2 connections, which are being built by Siemens.

The two connections provide transfer capacity to the German mainland for several offshore wind farms in the North Sea. The services covered by the contract include preparing the maintenance schedules, coordinating and executing inspections, preventive maintenances and repairs, and providing the related logistics and spare parts management services.

Siemens will establish a service base in Lower Saxony close to the coastline for the offshore and onshore converter stations, a move that will enable it to further expand its operation and maintenance service portfolio for electricity transmission grids.

International

Wärtsilä wins Syria O&M

Al Badia Cement JSC has awarded Wärtsilä an operations and maintenance (O&M) contract for a captive power plant at the site of a cement factory in the Abu Al Shamat area, Syria.

Under the three-year contract Wärtsilä will be responsible for operating and maintaining the power plant, which will be the sole source of electrical power to the new cement works facility. It consists of five Wärtsilä 20V32 and one Wärtsilä 9L32 generating sets, and produces a total output of more than 45 MW.

SNC Lavalin to build Tunisia plant

Canada's SNC Lavalin and Ansaldo Energia of Italy are to build a new combined cycle power plant in Tunisia after being awarded an engineering, procurement and construction contract by Société tunisienne de l'éléctricité et de gaz (STEG).

Under the €240 million contract, the two companies will build the greenfield 420 MW plant in Sousse, on the Bay of Hammamet. Work on the new thermal power plant will begin before the end of the year, with completion expected 30 months later.

The contract also includes a 12-year long term service agreement (LTSA).

Najaf rehabilitation

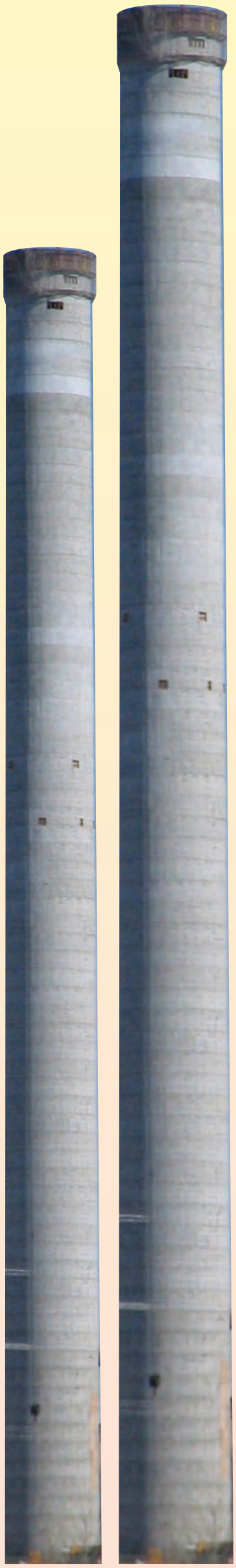
Alstom has signed a contract worth over €20 million with the Ministry of Electricity in Iraq for the rehabilitation of Najaf power station.

The deal represents Alstom's first Iraqi rehabilitation contract in a decade and involves the fast-track rehabilitation of unit 1 of the Najaf power station, situated 160 km south of Baghdad.

The project scope includes the delivery of a new compressor, noble parts for the gas turbine and combustion chamber, a completely new control system, major electrical components and a step-up transformer. Alstom is also responsible for erection and commissioning of the unit.

The rehabilitated unit will be reconnected to the Iraqi electricity network in time for the summer of 2011. Summer temperatures in Iraqi can be above 50°C in the shade, creating enormous need for electricity.

Najaf is a gas-fired power plant consisting of three GT13D gas turbines and with an overall output of 180 MW. It was built by Alstom in 1977 and has been out of service for five years.



A flexible future

Utilities are increasingly calling for flexible thermal plants to complement their increasing renewable portfolios. *TEI Times* speaks to GE's **Paul Browning** about flexible generation and gets a glimpse of what the company has in the pipeline to meet the market's needs.

Paul Browning has been the Vice President of GE Energy's Thermal Products Business for seven months, but with a long history in the turbomachinery business and a background in metallurgy and materials science, he has a good grasp of the technical challenges and developments at the forefront of today's thermal power generation business.

With responsibility for the worldwide business plan and execution of GE's heavy-duty industrial gas turbine, steam turbine, generator and controls, and gasification product lines, Browning sees the impact of intermittency as one of the main challenges.

"The increased penetration of renewables on the electrical grid means that utilities are looking for flexible operation. They need their fossil power plants to be able to dispatch when the wind is not blowing or the sun is not shining," he says.

Although the US and western Europe have felt the greatest impact of wind on the grid, the issue is global. With the lifetime of a power plant being 30 years, thermal plants built in almost any part of the world will need to have the flexibility to take advantage of the opportunities and cope with challenges presented by intermittent renewable generation.

For example on a hot day, when there is typically no wind, high electricity demand due to air conditioning load can push up power prices. In this scenario, a utility that is ready to respond with fast start-up generation can be very profitable in some US states. Alternatively, on a day where there is lower demand but there is a lot of wind, a utility may still want to keep some spinning reserve in case there is a sudden change in weather but does not want the cost of keeping turbines spinning. Here the ability to turn down plant load would be beneficial.

There are a few options for providing flexible 'wind firming' generation. In the past, utilities have used simple cycle peaking gas turbines or even reciprocating engines to provide fast start power. While there will continue to be a role for such installations, their capital cost per kilowatt can be high compared to a combined cycle gas turbine (CCGT) plant. Operating costs can also be higher since their fuel efficiency is lower. Utilities would therefore prefer to do the job using a CCGT.

"We have seen a very strong desire from many of our customers to give them a combined cycle gas turbine power plant that has much better flexibility than in the past," says Browning.

He believes there are a couple of new ways of thinking when looking at ways of optimising flexibility in CCGT plant.

The first focuses on block size. Over the last few decades, the trend has been towards increasingly large power plants but this is a view that perhaps now has to be reconsidered.

Browning notes: "You get economies of scale as you go larger, which reduces cost of electricity. A larger gas turbine also has better baseload efficiency. But as we put in the flexibility constraint, we are finding that there is an optimum power plant size. In the 50 Hz market, it's about 500 MW, while in the 60 Hz world where there tends to be a 2-on-1 (2 gas turbines + 1 steam turbine) configuration, it's about 650 MW. This seems to be the best compromise between block size and flexibility."

The other area of focus for GE engineers centres on how to measure efficiency. In the past it was calculated from the amount of megawatts produced and the amount of fuel needed at full load to produce those megawatts. In a flexible operating mode, the calculation is not so straightforward.

Browning explains: "In flexible operation, you spend some time at full load but you also spend a lot of time at part load, or in a turndown condition. A lot of time is also spent starting and stopping. How much fuel is used during the start-stop cycle becomes an important contributor. If you only count the number of profitable megawatt-hours, we have found that in a modern 60 per cent efficiency combined cycle plant you lose about 4-5 per cent in efficiency when operating in a flexible mode."

GE says its next generation of products will have good baseload efficiency while recovering a good part of this 4-5 per cent in efficiency that is typically lost in flexible operation.

In today's market, operating flexibility means: the ability to start and stop rapidly; good fuel efficiency at part load; and the ability to turndown to very low levels so utilities can maintain spinning reserve at a lower cost. When ramping up and down in load it also important that gas turbines are able to maintain emissions compliance.

Providing plants with these capabilities creates technical challenges. GE believes, however, that these challenges "fit squarely" with where its strengths are. "We are the only heavy duty gas turbine business that has an aviation business at its core. All of our gas turbine products have been derived from our early experience in aviation," says Browning.

He explains the relevance of this: "An aircraft engine has a very cyclic duty. Its overhaul intervals are determined more by starts, than hours since the last overhaul. This means that over the years we have had to develop very reliable technology to handle this cyclic duty, much of which is transferable to our heavy duty gas turbines."

The technology coming from the aviation sector is, as Browning puts it, "not easy stuff to do" and GE therefore draws off experience from its investments in commercial and military aircraft engine technology.

Browning: there are a couple of new ways of thinking when looking at optimising CCGT flexibility

The company has been introducing alloys used in aviation into land-based gas turbines. These exhibit cyclic capability at elevated temperatures and according to Browning will enable both high baseload efficiency and cyclic capability.

He adds: "We started this 20 years ago, bringing aviation alloys into the rotor, buckets, nozzles and other hot gas path components of our F-Class turbines. But these are large parts, and with the most advanced alloys containing 3 per cent Rhenium, at one point GE was consuming 50 per cent of the world's Rhenium in its aviation and land-based gas turbines."

GE has been investing in a low-Rhenium version of the aviation alloy so that it can be used more extensively in its land-based gas turbines at a lower cost.

Another area of development is in what Browning calls 'Model-based' controls, originally developed for the vertical take-off joint-strike fighter aircraft. "A lot of the same capabilities needed for these aircraft are the same as those needed to run a combined cycle power plant in a very cyclic mode."

GE believes the use of new materials and controls will result in significant advances. "Ten years ago, 60 per cent turndown was state-of-the-art. Our existing 7FA.05 gas turbine can get down to 37 per cent of baseload output. Our next generation of products will be able to go quite a bit lower," says Browning.

In terms of start capability, he says the same machine can achieve 75 per cent (about 160 MW) of its full power in about 10 minutes. Again, he said ten years ago this would have taken 50-60 minutes. "Currently we can achieve a ramp rate of 17 MW/min and it's an area in which we will be making more progress in our next generation of products. We will also be ensuring we maintain emissions compliance while improving ramp rates and turndown level. Today we guarantee the same NOx level at 37 per cent turndown as at full load, i.e. 15 ppm. The next generation of turbines are targeted to do even better."

The company is also working on advanced sealing technologies for both its gas and steam turbines. This is important during transient operation, where both flexible operation and fuel efficiency are needed.

Some of these technologies will also be included in future steam turbines, heat recovery steam generators and the entire balance-of-plant.

Browning comments: "A lot of the technologies and design strategies developed to provide cyclic capability for a gas turbine are applicable to a boiler. We are working with some of our keys suppliers to help them develop the HRSG or boiler that we need for the future. We have been doing research in the field of heat transfer which will help in the area of transient operation."

With gas prices likely to remain relatively low for the next 10 years or more, at least in the US, CCGTs will become even more attractive.

Fuel flexibility is being improved so that gas turbines can burn natural gas with a wider Wobbe index, heavy fuel oils and other forms of liquid fuel that are important to utilities in regions like the Middle East.

Fuel flexibility will also be an important driver for integrated gasification combined cycle (IGCC) plants. IGCC plants have the ability to generate electricity from the gasification of feedstocks such as petroleum coke, biomass and more importantly coal.

GE believes that IGCC plants fitted with carbon capture will be important in reducing emissions from coal fired plants in the future. The lack of operating flexibility of these plants could, however, present a dilemma for utilities caught between the need to cut CO_2 emissions while retaining operational flexibility.

Yet Browning does not believe the dilemma is insurmountable. "After the gasifier, an IGCC project is the same as a CCGT plant. So the real question comes down to the gasifier. Firstly, we believe our gasifier will have the ability to provide starts and stops, and operate in a much more flexible way than today's pulverised coal plant. If we want to take flexibility even further, it's not hard to imagine having some sort of gas storage capacity between the gasifier and the power island that would basically disconnect the two and allow the plant to be run as a CCGT plant."

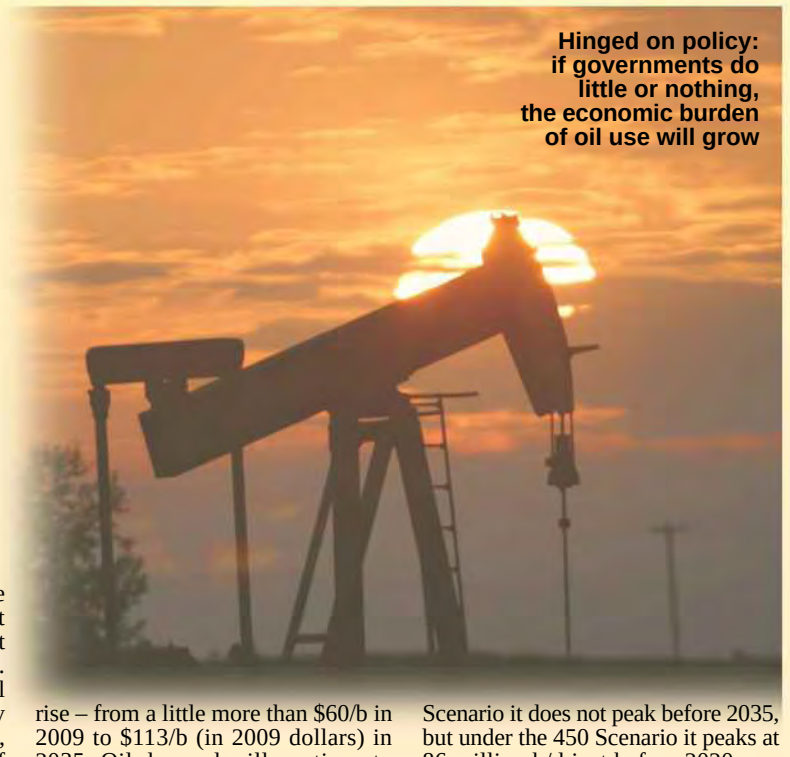
GE remains very bullish about IGCC projects of the future being flexible while offering the ability to cut emissions. The company is equally confident that the technologies used to increase flexibility in CCGT plants can also be applied to the steam turbines used in standard and supercritical coal fired plants, concentrated solar thermal plants, or even nuclear plants.

"We have a new emphasis on this area with new [steam turbine] products, and will be re-entering many of those markets in 2011," concludes Browning.

Next year will be an interesting year.

Oil

Government action key to energy future



Hinged on policy: if governments do little or nothing, the economic burden of oil use will grow

David Gregory

The energy world is facing "unprecedented uncertainty," the *World Economic Outlook 2010* tells us in its opening sentence. Released by the International Energy Agency (IEA) on November 9, the *WEO* paints a serious picture for the years 2010-2035, pointing out that "world energy outlook to 2035 hinges critically on government policy action, and how that action affects technology, the price of energy services and end-user behaviour."

"The global economic crisis of 2008-2009 threw energy markets around the world into turmoil and the pace at which the global economy recovers holds the key to energy prospects for the next several years," the *WEO* says. "But it will be governments, and how they respond to the twin challenges of climate change and energy security, that will shape the future of energy in the longer term," it adds.

In the *WEO*, the IEA reports that research it conducted in association with other international organisations at the request of G-20 leaders shows that removing fossil-fuel consumption subsidies, which totaled $312 billion in 2009, could make a big contribution to meeting energy-security and environmental goals, including mitigating carbon dioxide (CO_2) and other emissions.

For forecasting energy demand and supply for the next quarter century, the IEA casts three scenarios: one based on new policies, another on current policies and a third called the 450 Scenario, which refers to the situation if greenhouse gases released into the atmosphere amounted to only 450 parts per million of CO_2 equivalent.

New policies, if implemented, would have a "real impact" on energy demand and related CO_2 emissions, the *WEO* says. In the New Policies Scenario, world primary energy demand increases by 36 per cent between 2008 and 2035, from around 12.3 billion tons of oil equivalent (btoe) to a little more than 16.7 btoe – a rate of 1.2 per cent per year, the report states. Under the Current Policies Scenario, the growth in demand rises by 1.4 per cent per year, and in the 450 Scenario it increases by only 0.7 per cent.

Fossil fuels – oil, coal and natural gas – remain the dominant energy sources in 2035 in all three scenarios, the *WEO* states, though their share of the overall primary fuel mix varies markedly. And, it adds, emerging economies like China and India will drive the increase in global energy demand.

The oil price needed to balance oil markets is set to rise, reflecting the growing insensitivity of both demand and supply to price, the *WEO* says, adding: "The growing concentration of oil use in transport and a shift of demand towards subsidised markets are limiting the scope for higher prices to choke off demand through switching to alternative fuels. And constraints on investment mean that higher prices lead to only modest increases in production."

Under the New Policies Scenario, the price of crude oil will continue to rise – from a little more than $60/b in 2009 to $113/b (in 2009 dollars) in 2035. Oil demand will continue to grow, reaching about 99 million b/d in 2035 – 15 million b/d more than in 2009. It also points out that all the net growth in oil demand comes from non-OECD countries, with nearly half coming from China alone, mainly driven by rising use of transport fuels. Meanwhile, demand in the OECD falls by more than 6 million b/d.

By 2020, crude oil production reaches a plateau of around 68-69 million b/d under the New Policies Scenario and never regains its peak of 70 million b/d of 2006. Production of natural gas liquids (NGLs) and unconventional oil grows strongly, the report says.

Peak oil production will be determined by factors affecting both demand and supply, according to the *WEO*. Under the New Policies Scenario it does not peak before 2035, but under the 450 Scenario it peaks at 86 million b/d just before 2020 as a result of weaker demand, and falls briskly thereafter.

"The message is clear," the *WEO* states, "if governments act more vigorously than currently planned to encourage more efficient use of oil and the development of alternatives, then demand for oil might begin to ease soon and, as a result, we might see a fairly early peak in oil production. That peak would not be caused by resource constraints. But if governments do nothing or little more than at present, then demand will continue to increase, supply costs will rise, the economic burden of oil use will grow, vulnerability to supply disruptions will increase and the global environment will suffer serious damage."

Gas

Golden age for gas

The IEA's latest *World Energy Outlook* says China could lead us into a golden age for gas and predicts the current glut of global supply could persist for longer than many expect.

Mark Goetz

Global demand for natural gas is set to resume its rise on a long-term upward trajectory beginning in 2010, according the *World Energy Outlook 2010*.

In this latest *WEO*, the IEA has introduced three scenarios in order to map out what international energy demand might look like between now and 2035. Its New Policies Scenario reflects data on the assumption that governments implement policy changes in order to address climate change. The Current Policies Scenario assumes no change from what governments are doing now. And the 450 Scenario looks at the impact of taking steps to implement policies that limit greenhouse gases in the atmosphere to 450 parts per million (ppm) – a measure believed needed to prevent the Earth's temperature from rising more than 2ºC.

The report states that natural gas is the only fossil fuel for which demand is higher in 2035 than in 2008 in all scenarios.

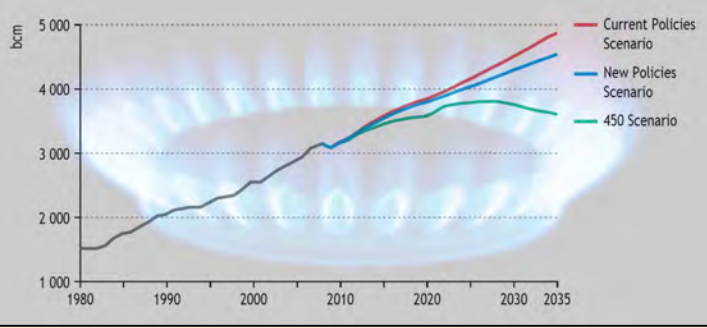
In the New Policies Scenario, global demand grows to 4.5 trillion cubic meters (tcm) in 2035. This is a rise of 1.4 tcm, or 44 per cent, over 2008 – an average increase of 1.4 per cent per year. In the Current Policies Scenario, gas demand growth increases by 1.6 per cent annually to 4.9 tcm, compared to 3.1 tcm in 2008. And in the 450 Scenario, growth in gas demand rises by an average of 0.5 per cent per year to 3.6 tcm in 2035, up by 15 per cent from 2008.

There is only a modest difference in gas demand growth rates across the three scenarios in the period to 2015, with global demand in every case recovering steadily following a drop in demand in 2009 – the biggest since the 1970s, the *WEO* says. But it adds that there are signs that demand is already starting to rebound, with OECD demand in the first quarter of 2010 up by an estimated 7 per cent on the same quarter a year earlier. Demand rose by about 5 per cent during the second quarter of 2010, the report says.

"On the assumption that the global economic recovery continues, demand is projected to resume its long-term upward path," the *WEO* states. "It grows by 12 per cent between 2008 and 2015 in the New Policies Scenario – compared with 13 per cent in the Current Policies Scenario and 10 per cent in the 450 Scenario."

Non-OECD countries drive gas demand growth over the next quarter century, according to the report, accounting for 84 per cent of the increase in demand between 2008 and 2035 under the New Policies Scenario. China's demand growth averages 6 per cent annually in 2008-2035. China's demand for gas reaches nearly 400 billion cubic meters (bcm) per year in the later part of the period forecast. It accounts for 22 per cent of the increase in global demand during this time. China's power sector accounts for almost half of total gas use in the country by 2035.

World primary natural gas demand scenario



Under the New Policies Scenario, the Middle East sees an increase in gas demand almost as big as China's in absolute terms. This, says the report, is driven by rising needs for power generation and in heavy industry, and as a feedstock for petrochemicals. Demand for the Middle East is put at 608 bcm in 2035. India's demand grows nearly as fast as China's, at 5.4 per cent per year, but reaches only 180 bcm in 25 years.

The power sector is to remain as the leading contributor to gas-demand growth in most regions, according to the *WEO*. But it adds that the rate of growth in gas-fired generation in the coming decades is very uncertain for several reasons, among them being fuel prices.

Despite rising prices, natural gas used mainly in combined cycle gas turbines (CCGTs) is expected to remain the preferred option for new power stations in many parts of the world, the report says.

Supplies of natural gas remain abundant and are easily large enough to meet the projected increase in global demand. The biggest uncertainty for supply over the next quarter century, the report says, is whether sufficient and timely investment will be made in developing those resources and how much their exploitation will cost. Proven reserves of natural gas stood at 184 tcm at the end of 2008 – enough to meet 42 years of demand under the New Policies Scenario.

The *WEO* projects global gas production in 2035 ranges from 3.6 tcm to 4.9 tcm across the three scenarios, corresponding to demand in each case.

Nuclear damage or a new era?

India's new Civil Liability for Nuclear Damage Act 2010 seeks to establish a legal regime for compensating victims in the event of a nuclear accident but US suppliers may feel the spear of the Indian democratic lawmaking process.

Vishvjeet Kanwarpal

On August 26, 2010, after months of political debate, lobbying and negotiation and 18 official amendments, the Congress led UPA government successfully shepherded the Civil Liability for Nuclear Damage Bill, 2010, through the Lok Sabha with the support of the BJP.

"This Bill is a completion of a journey to end the nuclear apartheid, which the world had imposed on India in the year 1974," Prime Minister Manmohan Singh said.

The Civil Liability for Nuclear Damage Act 2010 provides for: civil liability for nuclear damage and prompt compensation to the victims of a nuclear incident through a no-fault liability regime channeling liability to the operator; appointment of Claims Commissioner; and establishment of a Nuclear Damage Claims Commission.

There are four international instruments for nuclear liability: the 1960 Paris Convention; 1963 Vienna Convention; 1997 Protocol to Amend Vienna Convention and the 1997 Convention on Supplementary Compensation for Nuclear Damage (CSC).

On October 27, 2010, India signed the CSC, which seeks to establish a uniform global legal regime for the compensation of victims in the event of a nuclear accident.

Prior to the Act, the obligation of an operator of a nuclear facility in India was limited to obtaining insurance cover for damage to life, property and the environment outside the nuclear plant, to the tune of only Rs 50 Crore (about $11 million) under the Public Liability Insurance Act, 1991.

The Act has set a total liability for the operator at $320 million, while the government would be liable for an additional $220 million. The Act represents the most stringent liability law when compared to 28 other countries with similar legislation. The nuclear Liability Act binds the operator and supplier under contractual liabilities.

The time limit for compensation claims regarding damage to property is 10 years and for personal injury to any person is 20 years. In the event of a nuclear accident, suppliers of equipment, raw materials, and services can be held liable for 80 years after the construction of a plant (beyond the recourse already available through the courts).

Countries such as the US, UK, Canada, France, Germany, Japan, China and Russia have similar nuclear liability laws that affix liability exclusively to operators but do not provide a right to recourse against suppliers.

In effect, under the Act, any direct or indirect defects – patent or latent – that lead to a nuclear incident will allow the operator compensatory claim against the supplier after the operator has paid compensation for nuclear damage to the victims. This structure was proposed to ensure speedy delivery of compensation to victims by the operator, which in turn would expeditiously claim damages against the liable suppliers.

However the only 'operator' in the Indian context is NPCIL (Nuclear Power Corporation of India Ltd.). India's Atomic Energy Act 1962 prescribes that only a company in which a minimum of 51 per cent of the paid-up share capital is held by the Central Government can operate nuclear stations. This condition however tacitly enables the prospect of joint ventures between NPCIL and Public Sector Undertakings (PSUs) and Private Companies and Government and Private companies, provided the Government holds the majority stake.

Much of the political passion regarding the liability clauses was driven by the Bhopal gas tragedy victims' protracted journey to justice and compensation. The political forces in India were adamant that foreign and private suppliers would not escape their liability lightly. However, it is noteworthy that more than 60 per cent of suppliers in a nuclear plant are projected to be Indian suppliers.

Indian apex industry chambers such as FICCI (Federation of Indian Chambers of Commerce and Industry) & CII (Confederation of Indian Industry) and leading private sector nuclear players, including Larsen and Toubro (L&T), had expressed serious reservations regarding the framing of supplier liability in the critical Clause 17 (b) of the Bill. Deep reservations were also expressed regarding the magnitude and tenure of the liability.

It was suggested that the supplier liability clause would "keep away domestic and foreign suppliers" and in turn jeopardise India's envisaged ambitious nuclear capacity addition programme.

Suppliers have argued that it would be difficult to obtain insurance to back such onerous contracts. Additionally, the cost of nuclear power generation would increase with increased liability and associated insurance cover required. The net impact would be on the operator and the consumer.

The proposed liability could also increase the risk of the supplier to unacceptable levels wherein companies could go bankrupt in the event of a nuclear accident claim.

Russia, which had a "special supplier status", with India regarding the nuclear sector will also be impacted by the Act when Russia becomes a member of the World Trade Organisation (WTO). Indian laws cannot discriminate between WTO member countries.

However, despite objections and vigorous lobbying efforts at diluting Clause 17, the Bill has been passed and the industry is coming to terms with it. The rewards of the Indian market may well outweigh the perceived liabilities and risks of doing nuclear business with India.

Vishvjeet Kanwarpal: companies could go bankrupt in the event of a nuclear accident claim

NPCIL has aggressive plans to increase nuclear capacity from the present 4560 MWe to 63 000 MWe by 2032. This spells a $150 billion investment potential in the next 10-20 years in the Indian civil nuclear power market.

Beyond indigenous technology, NPCIL plans are focused on imported light water reactor (LWR)-based capacity of 40 000 MWe by 2020. India plans to add ten 1000 MWe LWRs, eight 700 MWe pressurised heavy water reactors (PHWRs), three 500 MWe fast breeder reactors (FBRs) and one 300 MWe advanced heavy water (Thorium) by 2032.

For five nuclear project sites, NPCIL is exploring Toshiba-Westinghouse's AP1000 reactors, GE-Hitachi's ABWR reactor, Areva's 1650 MWe European Pressurised Reactors (EPR) and the Russian VVER reactors.

India has identified sites in the coastal states of Tamil Nadu, Andhra Pradesh, West Bengal, Maharashtra, Karnataka, Orissa and other states for developing nuclear power plants. Each site is proposed to have generation capacity ranging from 6000-10 000 MW. A JV between NPCIL and NTPC Ltd aims at setting up a 2000 MW nuclear power project. Several Public Sector Undertakings (PSUs) are firming up plans to take stakes in NPCIL nuclear projects. These include IndianOil, National Aluminium Company and others. The Government directives regarding the NPCIL-PSU JVs are awaited.

Private-sector players in the Indian power sector, including Tata Power, Reliance Power, GMR, GVK, Lanco and others, could explore a joint venture (JV) with NPCIL to participate in the nuclear power sector.

International players active in the Indian nuclear market include Areva SA (France), Rosenergoatom (Russia), GE-Hitachi (US-Japanese) and Westinghouse-Mitsubishi (US-Japanese).

The insurance industry is also gearing up to address the requirements of the unprecedented new liability law.

General Insurance Corporation (GIC) plans to establish a corpus domestically to meet the limit of liability at Rs 1500 crore ($320 million) per operator per event. The Insurance Regulatory and Development Authority (IRDA) will form the necessary guidelines for covering nuclear accidents.

In October 2010, NPCIL announced that it would also set up a corpus of Rs 1500 crore to address liabilities arising from nuclear disasters from its cash surplus of Rs 12 000 crore. However, this would be contingent on Department of Atomic Energy rules and norms under the Civil Nuclear Liabilities Act.

NPCIL has informed the central government it was not in favour of nuclear insurance wherein foreign re-insurers would be brought in by Indian firms and be entitled to inspect the nuclear projects.

Now that the law has been passed, the international nuclear players appear to have factored it in their outlook.

NPCIL's groundbreaking technical agreement with Areva for supplying two EPRs of 1650 MW each for a proposed 10 000 MW project in Maharashtra is likely to be finalised soon. The focus has been on the indigenisation of manufacturing, design and manpower to reduce the cost per MW and net cost of generation down to Rs. 4 per kWh. NPCIL has received commitments worth $6.5 billion from BNP, Credit Agricole, Societe Generale, Natixis and HSBC. State-owned Bharat Heavy Electricals Ltd (BHEL) is associated with 80 per cent of the heavy equipment for India's indigenous nuclear power programme. It plans to setup a JV with Nuclear Power Corporation of India Ltd and Alstom Ltd. Alstom would be technology partner in the joint venture. The joint venture would not only manufacture nuclear power equipment but also bid for construction of civil nuclear power plants.

L&T, India's largest private engineering company, is targeting annual revenues of $1.5-2 billion from the nuclear business in another three years. L&T has complete solutions for the turbine island and balance-of-plant work related to nuclear reactors, and plans to invest in building capabilities. In addition, L&T has established links with key advanced reactor manufacturers – GE Hitachi and Toshiba Westinghouse of the US, Atomstroyexport of Russia, and Atomic Energy of Canada as well as Rolls-Royce.

Russia has progressed quickly in the Indian nuclear market by moving ahead with plans for additional units at the Koodankulam plant.

It is ironic that the US, which spearheaded the end of the Indian nuclear apartheid, should be the country to feel the spear of the Indian democratic lawmaking process.

American corporations such as GE and Westinghouse have stated their inability to supply nuclear equipment to India unless "they are fully insulated from all liability claims in the event of an accident". Two sites, one in Andhra Pradesh and another in Gujarat, have been designated for participation for reactor consortiums: GE-Hitachi and Toshiba-Westinghouse. Whether these sites will lie vacant remains to be seen.

Vishvjeet Kanwarpal is CEO, Global InfraSys (P) Ltd. and Asia Consulting Group (P) Ltd.

Country	Nuclear liability law, currently in force	Strict Liability	Channeling of liability exclusively to operator	Right of recourse against supplier	Operator's insurance amount	State guarantee/ cover	Additional State Compensation	Supplementary amount from international fund	Legal Liability Limit
China	1986: Gua Han 2007: Amended	Yes	Yes	No	RMB 300 Mn	Upto RMB 800 Mn	Upto RMB 800 Mn	No	RMB 1.1. Bn
Canada	1976: N-Liability Act	Yes	Yes	No	C$ 75 Mn	Upto C$75 Mn	Upto Parliament	No	C$ 75 Mn
France	1968: Act on 3rd Party Liability in the field of Nuclear Energy 1990: Amended	Yes	Yes	No	¤9.15 Mn	¤91.5 Mn	Upto 175 Mn	125 Mn SDR	300 Mn SDRs
Germany	1985: Atomgesetz 2007: Amended	Yes	Yes	No	¤256 Mn insurance + ¤2.244 Mn	¤2.5 Bn	No	125 Mn SDR	Unlimited
Japan	1961: Act on Compensation for Nuclear Damage 2009: Last Amended	Yes	Yes	No	Yen 120 Mn	Indemnity Agreement	Upto Parliament	No	Unlimited
Republic of Korea	1969: Act on Compensation for Nuclear Damage 2001: Last Amended	Yes	Yes	No	50 Bn Won	Upto 300 Mn SDRs	Upto Parliament	No	300 Mn SDRs
Russia Federation	None 1963 Vienna Convention	Yes	Yes	No	No Amount specified	Upto Operators Limit	Upto Operators Limit	No	No Amount specified
United Kingdom	1965 Nuclear Installation Act 1983: Amended	Yes	Yes	No	£ 140 Mn	Upto Operators Limit	Upto 175 Mn SDRs	125 Mn SDR	300 Mn SDRs
United States	1957: Price Anderson Act 2005: Amended	Yes	Yes	No	US$ 12.50 Bn	Upto Parliament	No	If CSC is in force	US$ 12.59 Bn
India	Civil Liability N-Damage Bill, 2010-likely to be enacted soon	Yes	Liability to Suppliers & Consultant	Yes if defect in equipment	INR 1500 crore	Upto INR 1550 crore	No Provision so Far	Depend on India ratifying CSC	Total Liability capped at Rs 2050 crore

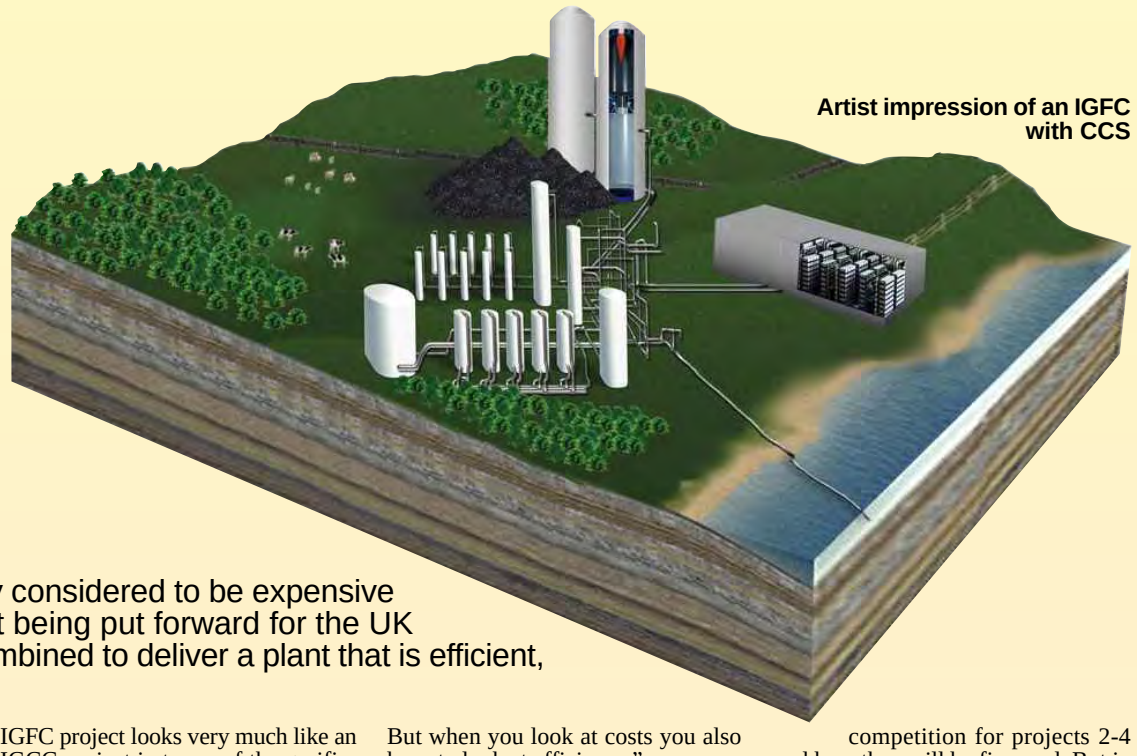
Yes | No | No Amount specified | Upto Operators Limit | Upto Parliament | No Provision so Far | Unlimited | Depend on India ratifying CSC

Note: Mn: Million, Bn: Billion, SDR: Special Drawing Rights

Source: Confederation of Indian Industry

A comparison of nuclear liability laws

Building tomorrow's power plant today



Artist impression of an IGFC with CCS

Fuel cells, gasification and carbon capture are all widely considered to be expensive technologies of the future. Yet the proposer of a project being put forward for the UK CCS competition believes all three can be effectively combined to deliver a plant that is efficient, clean and economic. **Junior Isles**

Alisa Murphy believes that now is the time to start building the power plants of the future; and she aims to practice what she preaches. As the Director of UK-based B9 Coal, Ms Murphy is pulling together a consortium that plans to develop a project that will "put the UK at the forefront of carbon capture technology".

The consortium of major industrial partners, will propose a 500 MW project for the UK Department of Energy and Climate Change (DECC) carbon capture and storage (CCS) competition.

Notably, the project would showcase the use of fuel cells operating on syngas derived from coal gasification – a power system that many would consider to be one for the future rather than the present.

Murphy stressed, however: "We believe the way to get CCS adopted is to make it commercially attractive, and by promoting technologies that are equipped for our future energy needs rather than looking backwards at retrofitting old and dirty technology."

B9 Coal was formed in 2009 with the specific aim of ensuring penetration of alkaline fuel cells (AFCs) developed by AFC Energy into the power generation market. Murphy explained: "AFC Energy wants to remain focused on the technology and not be distracted by very large scale integration projects that require different skill-sets, time and energy. B9 Coal was formed to take care of what we think is the largest market for AFC's fuel cell – power generation from coal and gas. This includes large scale power projects with carbon capture."

B9 Coal sees fuel cells as a "pull-through" technology for CCS. Murphy said: "While there's a place for retrofitting old coal plants, the main focus should be on building power station projects for the future. Coal will continue to play a significant role in the power generation mix for some time to come so we have to do something about the emissions. So if you can marry it with a power generation technology that has low capital cost, high efficiency and is scalable, it will help with the adoption of CCS since you are not asking people to do something that will result in the loss of efficiency. You can build a plant that doesn't have the energy penalty and get carbon capture at the same time."

The project being put forward for the DECC competition is a 500 MW plant at a potential site owned by Rio Tinto Alcan at Lynemouth in Northumberland. The project would replace an existing coal fired station that provides power for the aluminium smelter at the site.

The project that B9 Coal is pioneering is somewhat unique and if selected for funding would represent a departure from the UK's current focus on post-combustion capture technology. Known as an IGFC (integrated gasification fuel cell) project, it does not involve combustion – although in terms of defining CCS projects, some would place it under the banner of pre-combustion technology.

When asked if this could be a problem for B9, Murphy said: "The government's focus on post-combustion has caused a lot of controversy. I can understand the argument that we have a large number of coal fired power stations and have to do something about the emissions from them. The government hasn't yet come forward with their requirements for projects 2-4 but my feeling is that there will be more of an emphasis on showing a more diverse range of technologies. This is important so that we can explore the technologies in order to know what the best technologies are. The government has talked a lot about showing global leadership on CCS… it can't do this if there's a continued focus on post-combustion."

From an engineering perspective, an IGFC project looks very much like an IGCC project in terms of the gasifier and the gas clean up process. The syngas is cleaned and cooled and goes into a water-gas shift. However, the key difference is that there is an additional stage because pure hydrogen is needed for the fuel cell.

The AFCs require hydrogen with a purity of 99.95 per cent, as opposed to the 90 per cent purity seen in IGCC plants after the clean up process. Therefore a pressure swing absorber (PSA) is included to absorb the remainder of the carbon dioxide under high pressure and separate it from the hydrogen stream. The hydrogen will then be fed to the fuel cell while the CO_2 will be compressed so that is ready for transport and storage.

B9 Coal's Lynemouth project will use a surface gasification process where coal is reacted at high temperature with a controlled amount of oxygen to produce syngas. "It is fairly standard technology," noted Murphy.

Building a 500 MW project based purely on fuel cells is unusual. Murphy commented: "People are surprised by this because no other fuel cell companies are talking about large scale industrial power generation but that is what makes AFC Energy's technology unique. The modular nature means that if you can build one megawatt, you can build hundreds of megawatts. They are very easy to manufacture and it is a very simple modular scale up. It is just a case of how many can be installed in the given space."

With each fuel cell cartridge delivering about 10 kW, Murphy estimates that the 500 MW project would require about 2 acres (8100 m^2) of land.

An alkaline fuel cell converts oxygen (from the air) and hydrogen (from a supply) into electrical energy and heat. It is chemically comparable to a battery that will provide electric power continuously, as long as it is fed with hydrogen and air. The only by-products are demineralised water and heat, both of which have a commercial value. Excluding water, an alkaline fuel cell is a zero emission device.

In AFC Energy's fuel cell, the electrolyte is an alkaline liquid: in this case, potassium hydroxide (KOH). This is a very cheap electrolyte, akin to an industrial bleach. It has a very high electrical conductivity that helps an AFC to have the highest electrochemical efficiency of all types of fuel cell – 60 per cent electrical efficiency.

This is one of the main advantages that Murphy cites compared to gas turbines. She also says capital costs are lower. Target costs are £400 000/MW. But when you look at costs you also have to look at efficiency."

Perhaps more important, however, are the maintenance costs and the benefit of having no moving parts. She commented: "Maintenance costs are significantly lower due to the ease of maintenance. Each individual fuel cell cartridge is monitored. If there is a problem with even an individual plate within a cartridge, that cartridge can be isolated and switched off and replaced. The target is a 12-month cycle for cartridge maintenance but the commercial offering is a 3-month cycle. However, you never have to power down the station for maintenance. Because each cartridge is individually controlled there isn't the possibility for something to go wrong with the entire system… this is something utilities find very appealing."

The ability to switch individual cartridges on and off also means, according to Murphy, that such a plant has the load following capability that is becoming increasingly important. "In the future we will have to find ways to meet peak demand and have generation that can match the renewable portfolio. You can load follow by switching off banks or simply passing less hydrogen through the system," she noted.

Looking still further ahead Murphy also believes that the technology is ideal for the transition to a hydrogen economy. "As options for hydrogen storage are developed there is fantastic potential for operating peak load models. Hydrogen could be stored and fed to the fuel cell plant, which could then be operated to match demand. The fuel cells will operate at 60 per cent electrical efficiency no matter how much hydrogen is passed through them."

The UK CCS competition stipulates that the minimum plant size has to be 350 MW. The proposed Lynemouth project surpasses this requirement, having been sized to provide enough power for the smelter with sufficient left over for export to the grid.

DECC is yet to release details for the competition for projects 2-4 and how they will be financed. But in any event, B9 Coal intends to seek funding through the EU's NER300 mechanism and will be putting together a special purpose vehicle with various partners who not only have the relevant expertise but could also provide funding. Special equity partners will also be brought in.

This approach is absolutely necessary for the proposed Lynemouth project. The UK CCS competition calls for the demonstration of an end-to-end CCS solution. This will require the involvement of major multi-national companies with expertise in areas such as industrial gas supply, pipelines, storage, engineering and regulation. "These are large projects and you really need a consortium with the relevant expertise," said Murphy.

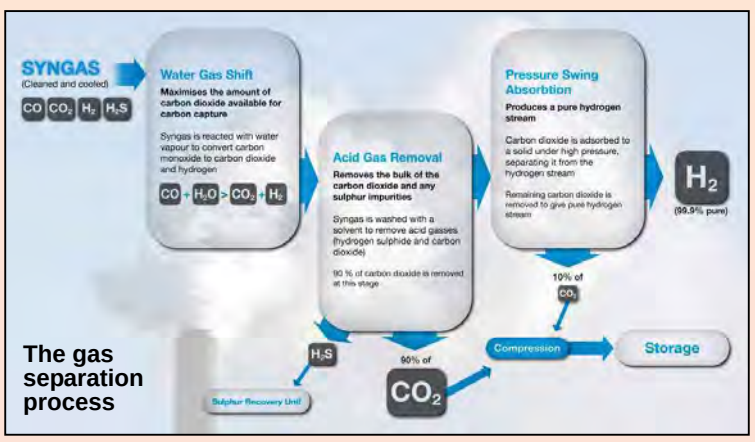
With most of the partners already in place and pre-FEED (front end engineering design) work under way, B9 Coal is now waiting for DECC to issue its requirements.

However, Murphy noted: "This is just one project for us; we are not looking to own and operate a plant and project manage the whole thing. We see ourselves as a developer that will develop a pipeline of projects with the fuel cell at the centre, bringing together companies to take advantage of the opportunities."

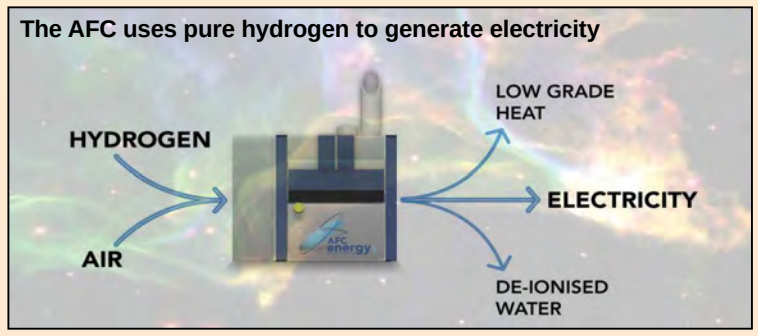
In the early stages, B9 Coal sees opportunities for projects that could involve electricity generation from a combination of small turbines and fuel cells.

Already there are plans to install 330 MW of fuel cell capacity at the Hatfield project owned by Powerfuel Power Ltd. These fuel cells will be installed alongside the IGCC plant that Powerfuel is building. The timeframe of this project, like Lynemouth, is looking at completion by around 2015.

The start-up of such projects in as little as five years would be a tremendous achievement and go a long way to making the power plant of the future very much a reality of the present.



The gas separation process



Junior Isles

The price of ambition

Some say ambition comes at a high price; but sometimes a lack of it can be even costlier. According to the latest *World Energy Outlook* from the International Energy Agency, a lack of ambition and the resulting failure in Copenhagen might not just cost us dearly in terms of climate change but will also have a high financial price.

The official message in the recently published *WEO 2010* is that even if the commitments under the Copenhagen Accord were fully implemented, the emissions reductions that would be needed after 2020 would cost more than if more ambitious targets had been pledged earlier.

One of the few but key things agreed at last year's COP15 meeting in Copenhagen, was that global temperature increase brought on by increased level of greenhouse gases must be limited to 2ºC – the amount that many scientists believe is the limit to avoid catastrophic climate change.

To achieve this, the IEA says that the concentration of greenhouse gases in the atmosphere has to be limited to 450 ppm CO_2 equivalent.

However, this 450 ppm scenario is becoming increasingly difficult to achieve. *WEO 2010* paints a disturbing picture.

The IEA's New Policies Scenario, which takes into account commitments made in Copenhagen, forecasts that the concentration of greenhouse gases is projected to stabilise at the equivalent of 650 parts per million (ppm). This, it says, will lead to a global temperature increase of 3.5ºC above pre-industrial levels.

The organisation outlined a scenario of what needs to be done in the energy sector to restrict the temperature rise to the 2ºC limit. The bottom line is that it will now be a lot more expensive than it could have been.

During last month's press conference in London to mark the launch of the *WEO 2010*, Fatih Birol, Chief Economist at the IEA and one of the chief authors of the book said: "The lack of ambition in the pledges [will] cost the energy sector about an additional $1 trillion."

In this year's Outlook, the additional spending on low-carbon energy technologies (business investment and consumer spending) amounts to $18 trillion (in year-2009 dollars) more than in the Current Policies Scenario in the period 2010-2035, and about $13.5 trillion more than in the New Policies Scenario. The additional spending compared with the Current Policies Scenario to 2030 is $11.6 trillion – about $1 trillion more than the IEA estimated last year.

While the task will now be much more expensive, it is not impossible but finding the political will is the hard part.

According to the IEA, reaching the 2ºC goal requires a "phenomenal policy push" by governments around the world. An indicator of just how big a push is needed is the rate of decline of carbon intensity – this is the amount of CO_2 emitted per dollar of GDP – required in the 450 Scenario.

According to the IEA, intensity would have to fall in 2008-2020 at twice the rate of 1990-2008. Between 2020 and 2035, the rate would have to be almost four times faster.

Birol commented: "What was agreed in Copenhagen needs to be fulfilled in 2020 and much stronger action is needed after that.

"We believe Copenhagen was a failure in terms of not providing a legally binding agreement. [Also] When you look at the pledges from more than 100 countries, some of them are very vague. Some countries give a range and the difference between the optimistic and pessimistic interpretations of these values is 3.9 Gt of CO_2. This equals the total reduction of all OECD countries put together. In addition to a legally binding agreement, there is therefore also a need for transparency in those pledges."

WEO 2010 stated that it is vital that these pledges are interpreted in the strongest way possible and that much stronger commitments are adopted and acted upon after 2020, if not before, otherwise the 2ºC goal "would be out of reach for good".

Going into climate talks at Cancun, the general feeling was that there was almost no chance of walking away with a global legally binding agreement.

Yet the industry should not be hung up on this. After all, there is little evidence that Kyoto reduced greenhouse gas emissions to any demonstrable degree even in the industrialised countries that ratified it. Instead, it makes sense to focus on implementing and building on what has already been agreed.

Countries can determine how the financing from developed countries to developing countries can be used most effectively. Birol said that one area they could work on in Cancun and beyond, is how this financing can foster more sustainable electricity generation in developing countries.

"By sustainable electricity generation I mean renewables, nuclear and fossil generation that uses carbon capture and storage. One area is how this financing, which was dedicated to Clean Development Mechanisms for the developing countries, can be reformed and used in the most effective way," he said.

> If Cancun succeeds in giving a significant message that there is an agreement on its way, it would at least give a signal… that climate change must play a role in investment decisions

At the moment much of the wind seems to have gone out of the sails in addressing climate change. The run up to Cancun was markedly low-key compared to Copenhagen last year. Speaking on the sidelines of the London press conference, Birol said: "There is no momentum now in terms of addressing climate change. After the results of Copenhagen, which were not great, there is almost a time of anaesthesia in discussing the issues."

If Cancun succeeds in giving a significant message to the world that there is an agreement on its way, it would at least give a signal to companies looking to build new power plants that climate change must play a role in their investment decisions.

The two major players that can obviously make the greatest impact in achieving the goal are China and the US. But it is unlikely that these countries will be singing from the same hymn sheet any time soon.

As Birol put it: "Looking at the recent discussions, it would not be wrong to say that the wind is not blowing in the right direction in this respect."

But whether China and the US can agree with each other and the rest of the world on a climate deal should neither be here nor there. The global power industry should still continue to use the best available technology while developing new technologies to address emissions.

At the moment, with the global gas glut, which the IEA believes will last for at least another 10 years, it is likely that power companies will continue to build combined cycle plants. This will allow them to address the issues of emissions and operating flexibility in the cheapest possible way.

"In all our scenarios," said Birol, "we expect gas use to grow." He added: "Gas turbine combined cycle plants make a lot of sense in terms of economics. Gas is very cheap, especially LNG. It is not capital intensive compared to some other power generation technologies and is also much more environmentally friendly compared to other fossil fuels."

Yet the use of gas could cut both ways in terms of its net effect on global CO_2 reduction. It will put pressure on the uptake of renewables as well as slow the commercialisation of important technologies like CCS.

Birol believes that gas will replace coal for power generation in the US and China but confirmed that in Europe it would "have a negative effect on the growth of renewables and postpone the appetite for CCS".

The IEA has not quantified the net effect of gas on CO_2 emissions but plans to publish a special edition of the WEO in June 2011 that will look at all aspects of stronger gas penetration.

It will be an interesting publication in helping power generators decide whether the price of today's short-term ambitions will be worth it in the long run.