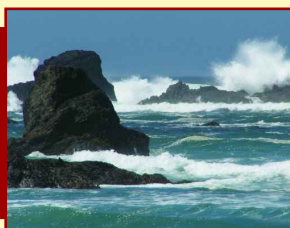


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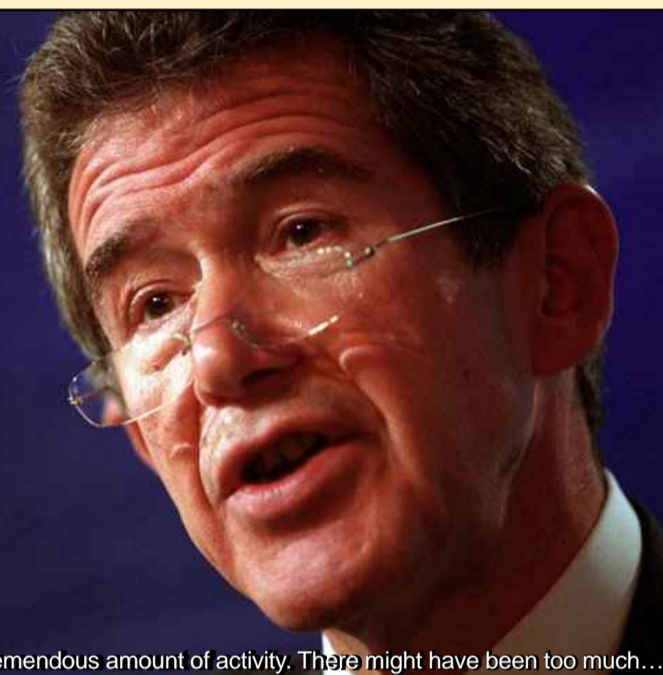
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Financial turmoil and falling oil impacts clean energy

Lord Browne: there has been a tremendous amount of activity. There might have been too much...



A combination of falling oil prices and the credit crunch is beginning to slow growth in the clean energy sector.

by Junior Isles

A new report from New Energy Finance, a market analyst company said that global investment in clean energy companies and new clean energy capacity fell sharply in the third quarter of 2008 compared to the previous quarter. The slowdown in investment is an indication of the effects of the financial crisis and an oil price that has fallen from a high of \$147/barrel in July to less than \$50/barrel in four months.

Venture capital and private equity investment totalled \$4.4 billion in the third quarter, down from \$5.8 billion in the second quarter of 2008.

Clean technology investment has been strong in recent years due to soaring fossil fuel prices and concerns over climate change and energy security. These have made renewables such as wind, in particular, attractive.

As a result of the credit crunch, newer clean technology companies are now finding it difficult to raise financing. Capital raising in the

public markets was down in the third quarter at about \$2.6 billion compared to \$4.9 billion in the second quarter.

Merger and acquisition activity among clean technology companies also fell by 21 per cent to \$2.9 billion in the third quarter.

The financing of new capacity in the clean energy market, however, was down somewhat less – by about 17 per cent compared to the second quarter.

The plunging oil price has also

changed the economics of clean energy. Today's low oil prices have made clean technologies significantly more expensive, relative to fossil fuelled power generation, than they were just a few months ago.

Lord Browne, former chief of BP and now chief executive of Riverstone Holdings, which invests in clean technologies, last month predicted a shake-out in the sector. He told the *Financial Times*: "There has been a

Continued on page 2

China calls for foreign funds to cut emissions

The Chinese government rejected suggestions it could use some of its \$1.9 trillion in foreign exchange reserves to pay for cleaner forms of energy to reduce its greenhouse gas emissions rather than asking developed countries to pay for and provide much of it.

Xie Zhenhua, the vice chairman of China's main economic planning body, said the government is already spending huge amounts to try to cut emissions, but his country is still developing and needs the funds and expertise of wealthier nations.

Xie's comments came at the end of an international conference in Beijing discussing various mechanisms to enable developed countries to honour their commitments to transfer technology – such as fuel cells, nuclear energy and wind and wave power – to poorer nations to combat global

warming.

The G77 of developing nations, along with China, has already suggested that rich countries should put one per cent of their annual GDP into a fund to pay for developing nations' clean energy technology.

Switzerland has also suggested funding technology transfer by levying a "carbon tax" per ton of greenhouse gases produced by countries, with poorer nations paying a lower rate than richer ones.

China has budgeted about 3 trillion yuan (\$440 billion) as part of efforts to reduce energy consumption and pollution in the coming years. Xie said: "China is still developing and we need money in many respects, but despite this we are very willing to invest in efforts to tackle climate change."

He added, a system has to be introduced that encourages developed

countries to pass on technology but also protects companies' patents and intellectual copyright.

Sha Zukang, UN undersecretary general for economic and social affairs, strongly criticized developed countries for failing to fulfil promises of technology transfer. "The transfer of technology is not good enough, to put it mildly. Commitments are repeated hundreds of thousands of times, but these commitments are not honoured," he said.

The executive secretary of the UN Framework Convention on Climate Change, Yvo de Boer, said the process of giving developing countries clean energy technology must be achieved if the world is to have any realistic chance of bringing climate change under control.

"A lot of talk has been about the targets (to reduce greenhouse gas

emissions), but not about the means which will make it possible," he said. "If international technology transfer happens, countries like China will be able to take action which is not affordable to them at the moment," he added.

China said in October that the level of emissions it produces is now level with the United States.

The Chinese government has previously ruled out agreeing to any cap on its emissions in a future climate change pact, saying developed countries should shoulder the biggest cuts while poorer countries attempt to reduce emissions where they can.

China produced a policy document on climate change in October, saying it will attempt to reduce greenhouse gas emissions, but that it needs the help of industrialized countries by giving it clean energy technology.

(Continued from page 1)

tremendous amount of activity. There might have been too much... It's producing a lot of casualties. Maybe some of the more unlikely-to-succeed things will be shut down."

More mature companies have suffered less than newer companies but some are still feeling the effects.

In its latest financial report, wind turbine manufacturer Vestas projected revenue growth of over 25 per cent in 2009 in spite of the credit crisis, which it says will alleviate demand pressure on the wind power industry.

In the report, Vestas said it has no plans to cut its work force, particularly given strong long-term growth prospects, but that it will postpone the hiring of a number of additional employees as a result of the "lower than planned rate of utilization of the organization in 2009." Vestas expects to resume its staffing growth "as soon as the present credit squeeze decreases."

Regarding supply chain issues, the prices for several of its components have peaked, according to Vestas, with the company recovering that cost with higher prices for its product. In 2009, the company anticipates, the number of suppliers, especially from China, will grow, leading to increased competition across the value chain.

Despite the current climate, however, the clean energy sector remains upbeat. Vestas expects annual revenue to be nearly \$7.3 billion for 2008 and \$9.2 billion for 2009.

Michael Liebreich, chief executive of New Energy Finance, predicted investment would return to its previous levels next year. Speaking to the *FT*, he said: "There will be a hiatus of about six months, but then capital will return. The fundamentals of this business still look good."

Unlike the 1980s when a fall in oil prices saw renewables disappear, observers believe that concerns over climate change and the need to move to a low carbon economy will mean that the demand for clean technologies remain.

In October, British prime minister Gordon Brown said the global economic downturn would not affect a government drive to reduce the country's carbon emissions.

Brown told a wind energy conference in London, ministers were committed to meeting a target to produce 15 per cent of the UK's energy supply from renewable sources, such as wind and wave power, by 2020.

Meanwhile, last month, the leaders of the American Wind Energy Association, Geothermal Energy Association, National Hydropower Association and Solar Energy Industries Association released a statement which said that the fast-growing renewable energy sector is poised to help lead the US economic recovery. It said the sector would create millions of new jobs and billions of private investment dollars. However, the new Administration and Congress need to take action to ensure that the renewable industries' growth continues, given the current economic realities, it added.

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FutureGen banking on new president



Mattoon: hoping to go beyond an artist's rendering

Supporters of the scrapped FutureGen project in Mattoon, Illinois are hoping US president-elect Barack Obama will revive the project. Proponents of other clean energy projects are also placing high expectations on the new administration.

Junior Isles

Economic developers and others who back the FutureGen clean coal project that was scrapped earlier this year are hoping that former Illinois Senator Barack Obama, the new US president-elect will get plans to build in Mattoon back on track.

The alliance of power and coal companies that were planning to build FutureGen in Coles County's largest town say that with the election over, now the real work begins. The job is to convince the next president that FutureGen and its mission to capture carbon from coal and store it to cut pollution should be a national priority, Mike Mudd, chief executive of the FutureGen Alliance, said in an interview in late October.

"Obama talked about clean coal during his campaign," Mudd pointed out, and "I think there's a

receptiveness with them to meet with us."

President Bush launched FutureGen in 2003 but his administration backed away from the original project, citing increasing costs. Project supporters still maintain the administration's U-turn was based on politics. The Department of Energy later announced plans to spend \$1.3 billion on carbon capture technology at several sites around the country that are yet to be selected.

Sen. Dick Durbin, the Illinois Democrat who has championed FutureGen, said that he hopes to see money for FutureGen in Obama's first budget, something Congress usually sees in February.

If the project can get back on course shortly thereafter, Mudd says he would like to start building in 2010 and have the plant running by 2013.

In a separate development, ADA-

ES, Inc. said it has started work on a Department of Energy (DOE) CCS project. The project will advance carbon capture technology based around regenerable solid sorbents and equipment. Most competing technologies use liquid solvents such as ammonia and amines to accomplish this task. Solid sorbents offer potential advantages over competing technologies including lower costs and less parasitic energy.

Another clean energy area set to benefit from the new administration is renewables. In his campaign Obama, called for expansion of renewable energy in order to generate jobs and address the environmental challenges that the US faces.

Following the election, members of the wind industry expressed renewed optimism about working with the new President and Congress to put in place the kind of long-term and stable policy

that renewable energy needs. The American Wind Energy Association (AWEA) supports a national renewable electricity standard, a long-term extension of the renewable energy production tax credit, and federal support for investment in transmission lines to tap the nation's vast wind and other renewable energy sources and deliver them to market.

Obama's campaign platform called for the creation of as many as five million new jobs by investing \$150 billion over the next ten years "to catalyze private efforts to build a clean energy future." In addition, he also has called for 10 per cent of the nation's electricity to come from renewable sources by 2012 and 25 per cent by 2025, as well as an economy-wide cap-and-trade programme to cut greenhouse gas emissions by 80 per cent by 2050.

Financial turmoil hits carbon market

- Carbon allowance price hits 18-month low
- Trade volumes still growing

The fall in price for European Union carbon allowances (EUAs) from about €24 in September to around €18-19 in November, a drop in value of about 20 per cent, is a reflection of the global financial crisis.

The price for Certified Emissions Reductions (CERs) also fell from around €20 in September to below €16. CERs are generated by Kyoto Protocol signatories investing in emission cutting projects in developing countries, through the Clean Development Mechanism.

An analysis released by New Carbon Finance in early October had anticipated that the world's carbon markets would reach \$116 billion by the end of this year, based on the consistently high price for EUAs.

The research company's third-quarter report on carbon emissions trading found that the world's carbon markets grew by 81 per cent over the first nine months of the year, reaching \$87 billion. Projecting that to the end of the year yielded the \$116 billion figure.

The significant drop in the price for

carbon emission credits in October, however, may make it difficult for the world carbon markets to break the \$100 billion barrier this year.

But despite the drop in prices, the volume of traded carbon emission credits appears to be growing. New Carbon Finance expected the volume to grow by 31 per cent this year, increasing from 3 billion tons in 2007 to 3.9 billion tons in 2008.

In November, Barclays Capital (BarCap), a unit of Barclays plc, slashed its price forecast for benchmark European carbon emissions prices by 15 per cent.

BarCap analyst, Trevor Sikorski, said in a research note: "A winter storm of bearish factors – economic downturn, falling energy, tight credit and increased EUA issuance – is likely to colour the market for the coming months. The balance of considerations, and a write-down in our (Brent) oil outlook for Q4 08 to \$75/b, has led us to downgrade our EUA forecast for the remainder of the year."

Under current EU proposals, unused

EUAs issued between 2008-2012 can be banked to phase 3 of the EU Emissions Trading Scheme, which runs from 2013-2020. As a result, it is unlikely that the market will see the same over-supply scenario that led to an EUA price collapse in the scheme's first phase (2005-2007).

In early November, the European Environment Committee backed plans to revise key clauses in the landmark climate and energy package just as the financial turmoil and the expected protracted economic slowdown place severe downward pressures on carbon credit demand and pricing.

Over the past month, several EU Member States have sought revisions of the climate and energy package in order to protect some of their key industries.

Central Europe power producer, Czech-based CEZ AS, is pinning hopes on the financial crisis to thwart the approval of the EU's green package, saying it would hurt the region's coal-dependent industry.

Martin Roman, CEZ chairman and

chief executive, said that a "yes" vote on the package from EU members in the region would be "economic suicide".

In October, the seasonally adjusted Eurozone Purchasing Managers Index (PMI) for the manufacturing sector, seen as a leading indicator on the state of the economy, slipped significantly against September levels. There are now very strong signs that European manufacturing is on the decline, which could affect overall emissions and carbon prices. According to Datamonitor, a decrease in European manufacturing would mean lower emissions and a drop in demand for allowances from heavy industry. The company said that while such a downward revision in demand is unlikely to alter market fundamentals, it does imply less price support for carbon credits.

The slowdown in manufacturing was largely responsible for the price of European carbon declining to a new 18-month low in the last week of October.

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GE imagination at work

Risks could tarnish nuclear future

Rising materials costs, a shortage of skilled labour, tight supply chains, new technology and even a new regulatory regime – they all add up to one thing for the emerging US nuclear plant construction market: risk

Siân Crampsie

Utilities in the USA looking to construct new nuclear power plants will have to lure experienced personnel from overseas to execute their projects successfully, according to Standard & Poor's.

The credit ratings agency's latest analysis shows that using new technologies in a market where there has been virtually no nuclear construction for several decades will present the industry with new risks. It warns that new nuclear power plants may need additional financial resources, and are unlikely to start up until 2016 at the earliest.

The report is difficult reading for the utilities planning to construct new nuclear capacity to help improve energy independence in the face of high fossil fuel prices and environmental pressures. It comes as economic conditions continue to worsen and as the country's President-elect Barack Obama – who favours clean coal and renewable energy over nuclear – prepares to take office.

Yet the country's nuclear industry is continuing to prepare for a new wave of construction, with the Nuclear Regulatory Commission now reviewing combined license (COL) applications for 26 new nuclear units.

One of the key risks faced by developers will be the lack of experienced nuclear engineers and construction workers, a factor that will also drive cost escalation, says S&P. This will be complicated by the use of new technologies and construction methods that are untested in the US, and will make nuclear projects more expensive and riskier than conventional power plants.

Labour costs have become a critical new driver for industry inflation, with a 30 per cent nominal increase in average hourly earnings for construction workers since 2001. The situation could worsen, according to S&P, with 45 per cent of the engineering labour force eligible for retirement over the next five years.

The situation is compounded by the strong general global demand for construction labour, especially in the energy industry, and by the specialized skills required for nuclear construction projects.

"The dearth of experienced nuclear engineers and construction workers is a key risk and a driver of cost escalation," notes S&P in its analysis. "With virtually no construction experience in the US since the early 1990s, the degree of training and productivity of workers is uncertain, requiring companies to incorporate additional contingencies in

cost and scheduling budgets."

The report continues by saying that recent nuclear power plant project experience in Japan and France could help US companies overcome some of these challenges. It names Electricité de France (EDF) and Tokyo Electric Power Co (Tepeco) as possible candidates.

While EDF has already announced a commitment to construct four Generation III+ EPR reactors in the USA, the skills gap in the country has not gone unnoticed by French engineering firm Areva, which has committed to making major investments in the country in order to secure its position in the 'renaissance'.

Areva announced in November that it has joined forces with Northrop Grumman Shipbuilding to build a new manufacturing and engineering facility in Virginia to build heavy components for the US EPR. It has also won a contract to manage the Yucca Mountain nuclear fuel repository project in Nevada, and is constructing a state-of-the-art uranium enrichment facility in Idaho.

Northrop Grumman and Areva will together invest \$360 million in the construction of a 27 900 m² facility that will be the first full-scale manufacturing plant in the US dedicated to the supply of heavy components such as reactor vessels and steam generators, according



US nuclear: looking overseas for expertise

to Areva.

The deal will enable the French firm to gain access to a US base of skilled engineers with experience and programme management expertise in building large nuclear and non-nuclear ships for the US Navy. The facility also gives Areva a secure domestic link in its supply chain – another area of risk highlighted by S&P.

"Tight supply chain and long lead times for certain major components will complicate procurement efforts for new nuclear plants," said the S&P report. "Other equipment for which there are especially long lead times include condensers and reactor coolant pumps ... Also, as these are new technologies, the successful delivery and commissioning of the first simulator is also a critical path delivery."

S&P also believes that inflation in building materials costs will affect all nuclear plant developers, and that the nuclear construction industry will be particularly prone to price spurts from transportation bottlenecks and fuel price swings because nuclear units require more material than conventional power units.

The construction risks that nuclear sponsors face will have a considerable impact on engineering, procurement and construction (EPC) contracts, according

to S&P, which does not expect to see any contract that is fully-wrapped with fixed-price, date-certain mechanisms. Recent consolidation in the EPC market also means that contractors can be choosy about the amount of risk that they are willing to accept.

Utilities are therefore having to evaluate alternative risk allocation and contracting approaches.

"A traditional EPC approach is also unlikely for nuclear projects because the development phase is longer than that of traditional projects," noted S&P. "Contractors are unwilling to offer a construction wrap because of cost and schedule uncertainty from commodity cost escalation and shortage of skilled labour, as also increasing supply chain risk, especially for long lead materials."

Once new nuclear units are operational, S&P said that they could require additional financial resources to guard against service interruptions, particularly where new technologies are being used.

"We believe that nuclear power projects will need large amounts of liquidity, unless the industry can maintain its operating track record of the past decade or so, during which capacity factors have risen to more than 90 per cent, fuel outages are fewer and much shorter, and operating and maintenance (O&M) expenses are down," notes S&P.

Tide turns for coal

■ Edwardsport approval upheld
■ Obama pledges clean energy future

The future of coal in the energy mix of the USA looks to be more certain following a pledge by President-elect Barack Obama to make good on election campaign promises on energy.

The last two years have seen numerous coal-fired power plant projects cancelled or put on hold in the USA, but in November Obama made a speech pledging \$15 billion in annual spending to "catalyze private sector efforts to build a clean energy future", including solar, wind, biofuels and clean coal technologies.

Tackling climate change will be a key element of Obama's policy when he takes office in 2009, and while he is reticent towards nuclear, he is strongly in favour of increasing the use of domestic energy resources such as coal and renewable energy. He said he will also prioritise energy efficiency and promote the responsible domestic production of oil and natural gas.

His stance on the use of coal – which accounts for around half of electricity generation in the US – is likely to reinvigorate interest in coal technologies, which has waned due to rising fossil fuel prices and environmental pressures. Growth in renewable energy has boomed, meanwhile.

Indications that coal has a bright future come from the decision by GE to develop a new research centre in Wyoming to accelerate the deployment of integrated gasification combined cycle (IGCC) technology, and a decision by the courts in the state of Indiana to uphold approval of Duke Energy's Edwardsport IGCC plant.

Together with the University of Wyoming, GE will develop the High Plains Gasification Advanced Technology Center that will include a small-scale gasification system to develop IGCC technologies for Powder



President-elect Barack Obama: will catalyze private sector efforts to build a clean energy future

River Basin and other Wyoming coals. The two organizations have stressed that climate change policies must be tailored to incentivise the deployment of low carbon technologies and foster further reductions in costs.

Duke Energy, meanwhile, said that it is pleased to have fought off the court action brought by several environmental groups. The 630 MW Edwardsport project will be the largest of its kind in the country when it is commissioned in 2012.

At least 45 coal plants in development were cancelled or put on hold in 2007, according to the National Energy Technology Laboratory (NETL). Utilities cited rising construction costs and uncertainty over future carbon legislation as the main reasons behind their decisions.

Public opposition to new coal fired projects has also increased.

The International Energy Agency's

most recent *World Energy Outlook* report projects that coal will maintain its share in electricity generation in the US to 2030, but stresses that major investments and revolutionary policies are required to tackle climate change.

Obama is planning to implement a nationwide greenhouse gas emission trading scheme based on a target of reducing US emissions to 1990 levels by 2020 with a mid-century cut of 80 per cent.

"Stopping climate change won't be easy," said Obama in a video-taped speech last month. "But I promise you this: When I am president, any governor who's willing to promote clean energy will have a partner in the White House. Any company that's willing to invest in clean energy will have an ally in Washington. And any nation that's willing to join the cause of combating climate change will have an ally in the United States."

Argentina cuts subsidies

Argentina is planning to ease its precarious financial position by making further cuts in electricity subsidies.

The plans to reduce subsidies to the country's largest consumers will save the government more than \$237 million per year and is a clear sign that the government is willing to curb public spending, say analysts. The move will also help to address the distortion in energy prices and reduce pressure on utilities.

Argentina announced plans in August 2008 to increase electricity prices, which were frozen seven years ago. Its system of subsidies was designed to curb the impact of inflation on consumers but in effect allowed energy demand to continue to rise alongside reliance on energy imports.

The latest cut in subsidies will mean price hikes for around 750 000 residential consumers as well as four per cent of commercial buyers and two per cent of industrial buyers.

Ratings agency Standard & Poor's recently noted Argentina's deteriorating economic and political climate. Soaring inflation has pushed government spending and there are concerns that the government will be unable to service its debt in coming years.

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Vietnam attracts private investment

■ Foreign partners to work with domestic giants on 13 power projects
 ■ State Capital Investment Corporation (SCIC) looks to invest

Syed Ali

Vietnam is attracting significant amounts of foreign investment to fund its booming power and energy sector.

Last month, Deputy Prime Minister Hoang Trung Hai gave the go-ahead for foreign partners to work with domestic giants to undertake 13 power projects that have been "given back" by the country's state power utility - Electricity of Vietnam (EVN).

EVN returned the 13 projects to the government in August because it could not mobilise sufficient capital. The utility said that it had negotiated with many domestic and foreign banks to look for funds for the projects. However, many banks refused to release loans, as they feared that EVN would not be able to repay debts as electricity prices were low and input costs were high.

EVN will now takeover two of the 13 projects, including Duyen Hai 1 (in

the southern Tra Vinh Province) with an expected capacity of 1200 MW, and Vinh Tan No. 2 (in the southern Binh Thuan Province) with an expected capacity of 1200 MW. These projects should start generating power by 2013.

Notably, two of the projects, which have a capacity of 1200 MW each, will be assigned to foreign contractors.

Malaysian Janakusa (JAKS) Resources Bhd will carry out the Duyen Hai No. 2 project in Tra Vinh Province. Estimated to cost \$1.4 billion, the coal fired power plant is expected to be completed by 2015 under a build-operate-own (BOO) contract. The project will be Vietnam's first independent power producer (IPP) project.

JAKS general manager for finance Chee Seong Heng said following official approval from the Vietnamese government, it had until February to submit details, including partners, the power purchase agreement and tariffs.

"We are in a very advanced stage of deciding on the partners, where we will have the controlling stake. We are looking into the fund-raising exercise, which may include a rights issue, and long-term financing for the project," he said.

Another foreign company, China Southern Power Grid Group (CSG), will take-over the Vinh Tan No. 1 project (in Binh Thuan province) which is expected to be completed by 2011-12.

Other projects will be taken over by domestic investors, which include: the National Oil and Gas Group (PetroVietnam); a joint stock company established by EVN, Pacific Corporation and One Energy Co; Lilama; and another joint stock company owned by Lilama, REE and One Energy.

The Deputy Prime Minister asked the Ministry of Industry and Trade and relevant State bodies to get these projects up and running as soon as



Deputy Prime Minister Hoang Trung Hai: gave go-ahead for foreign partners to work with domestic giants

possible.

"If investors are slow in implementing the projects, the Ministry of Industry and Trade will have to suggest replacing them with other investors," he said.

At the same time, the State Capital Investment Corporation (SCIC) is also seeking approval from the government to invest in power projects.

SCIC is proposing to work closely with EVN to invest in additional electricity supplies deemed vital to the country's economic development. Cooperation between the sovereign wealth fund and the national electric utility would be undertaken on the principle that the two public corporations would hold at least 51 per cent of the capital in any electricity projects developed with SCIC funding, ensuring State control of key projects.

SCIC general director Tran Van Ta said that, upon approval of the proposal by the prime minister, SCIC would

invest immediately in some EVN projects which are short of capital disbursement. "We will join these projects in the role of financial investor," Ta said.

At the beginning of November, the Ministry of Industry and Trade announced a plan to build two nuclear power plants in the central province of Ninh Thuan, which will be operational from 2020 to 2022. Phan Minh Tuan, head of the preparation committee for nuclear power, said Ninh Thuan nuclear power plant No.1 would be in Phuoc Dinh Commune, Ninh Phuoc District, covering 540 ha. Its two reactors will be put into commercial operation by 2020 and 2021. The Ninh Thuan plant No. 2 will be built in Vinh Hai Commune, Ninh Hai District, covering 556 ha. Its two reactors will be put into commercial operation by 2021 and 2022. No decision, however, has yet been made on what technologies will be used.

Renewable policy to combat energy shortfall

In an effort to combat power shortfalls, Pakistan is attempting to attract the private sector to help it reach its medium-term targets for power generation from renewables.



Pakistan power: turning to the private sector

Arif Allaudin, Chief Executive Officer of Pakistan's Alternative Energy Development Board (AEDB) said that its plans to produce 5000 MW energy within five to seven years from renewable energy resources will help meet the current energy shortfall.

During a two-day stakeholders' consultative workshop on 'development of medium-term renewable energy policy for Pakistan', jointly organised by AEDB and Asian Development Bank (ADB), Allaudin said the board has been given a target by the government of producing 5 per cent of the country's energy from renewable resources.

He said the country's first 50 MW wind power project is scheduled to be commissioned this month.

In an effort to harness the renewable energy resources, AEDB is encouraging private sector to develop renewable energy power projects and

Allaudin said that tariff issues will be resolved in consultation with stakeholders.

At the end of October, multi-lateral lenders agreed to provide funds to help Pakistan generate over 3000 MW to overcome its power shortages, said deputy chairman of the Planning Commission, Salman Faruqui, in Islamabad.

"Pakistan needs an investment of \$20 billion in the power sector in the next 12 years," the deputy chairman said while speaking at a workshop on development of Integrated Energy Modelling System (IEMS) for Pakistan, organised by the Planning Commission in collaboration with the Asian Development Bank.

He said the World Bank, IFC and Exim Bank had agreed to support development of coal and hydropower resources to enhance the country's power generation capacity.

PLN will need \$60 billion over next 10 years

Indonesian state-owned electricity company, PLN, will need around \$60 billion over the next 10 years to finance development of the electricity projects outside its 10 GW power plant programme.

The company's president, Fahmi Mochtar said PLN will need the funds from next year to build new power plants and transmission and distribution systems, and buy coal.



Fahmi Mochtar: PLN plans to build more power plants

In the ten years, PLN plans to build more power plants with a total capacity of around 57 000 MW, 38 000 km of transmission system and customer service facilities, Fahmi said.

In 2017 coal would account for 63 per cent of fuel used by PLN, he was quoted as saying by the newspaper *Bisnis Indonesia*.

PLN has a 'crash programme' to build coal-fired power plants with a total capacity of 10 000 MW to be completed in 2010 at cost of around \$4.4 billion.

PSALM to ease financial burden on IPP bidders

In light of the global credit crunch, the Philippines Power Sector Assets and Liabilities Management Corp. (PSALM) will remove the upfront-payment requirement for bidders that win the management of independent power producer contracts of state-owned electricity producer National Power Corp. (Napocor). Instead PSALM will require monthly payments.

The first contracts to be placed on the auction block are for the 1200 MW Sual and 700 MW Pagbilao coal fired power plants, both operated by Team Energy Philippines, which PSALM said were chosen to launch the bidding process because they received the most interest from investors.

The Sual plant in the northwestern province of Pangasinan is up for transfer

in 2024 and the Pagbilao plant in the eastern province of Quezon in 2025. Both are under build-operate-transfer contracts with Napocor.

The total generating capacity under IPP contracts to be auctioned totals 6252 MW.

The sector has had to wait years for the launch of the bidding process. Investors interested in bidding for the

right to manage the Sual and Pagbilao contracts submitted letters of interest on November 21. Qualified investors will be allowed to do due-diligence studies on the plants up to February 18, 2009.

A pre-bid conference has been scheduled for December 12, and the bid date has been set for February 20, 2009.

Australia maintains green focus

Australia will forge ahead with a plan to tax carbon pollution from 2010 despite the current economic downturn. A report released in late October by the Treasury Department said targets could be achieved with little impact on Australia's economic growth.

It predicted growth would average 1.1 per cent a year to 2050 if Australia taxed carbon pollution and transformed itself into a low-emission economy, while growth was likely to average 1.2 per cent if it did not.

Treasurer Wayne Swan stood by the report's forecasts, even though most of the calculations were made before the current economic crisis. He said climate change was a "long-term challenge to the nation's prosperity," while the current global economic meltdown was a "substantial" but short-term challenge.

The government will this month release the final details of its plan to cut carbon dioxide emissions and other greenhouse gases (GHG) by 60 per cent by the year 2050. It will announce a short-term GHG reduction target as well as the fee for producing a ton of carbon.

Polluters will be able to trade the permits on a national market as part of an emissions trading scheme. "It is our intention to commence a scheme in 2010," Swan said.

Meanwhile, last month Australia's Energy Minister Martin Ferguson marked the official start of work on the Callide Oxyfuel demonstration project in Biloela, Queensland. An existing power station will be retrofitted with the technology that burns pulverized coal in a mixture of oxygen and recirculated waste gases to create a high concentration of carbon dioxide in the gases exiting the power station's boiler. The carbon dioxide can then be captured for underground storage.

Six partners are collaborating on the A\$206 million project. The Australian federal government will put A\$50 million toward the project, the Queensland state government has committed A\$40 million and the Australian Coal Association's Coal 21 Fund will contribute A\$68 million.

China will slash coal dependence

The Chinese Academy of Engineering (CAE) forecasts in its latest research that the share of coal in the energy mix will fall from its current 66 per cent to 40 per cent by 2050.

Du Xiangwan, deputy head of CAE, reveals that renewable energy is expected to contribute one-third of the country's energy production by that time and coal will play a less important role, although the total consumption of coal will be higher than current level.

CAE believes that the total energy consumption of China will reach 5 billion tons of coal equivalent in 2050, while renewable energy will be equal to 1.7 billion tons. Non-hydropower renewable energy sources, including wind, nuclear, solar, and biomass, will consume 1.27 billion tons of coal equivalent by that time, far higher than 29 million tons in 2006.

Renewables investment central to India's power plans

India is set to make significant investments in technologies that will help combat climate change during the remainder of its Five Year Plan (2007-2012).

According to the Indian Wind Turbine Manufacturers Association (IWTMA), investment in wind power generation will reach Rs1320 billion (\$27 billion) in the next four years. The association said the investment

would push installed capacity of wind power in the country to 22 000 MW by the end of 2012. The current installed capacity of wind power in the country is nearly 9600 MW.

Minister of State for Renewable Energy, Vilas Muttemwar, said: "A total of 216 potential locations have so far been identified in 13 states and union territories which could be considered suitable for installation of

wind turbines."

Meanwhile, in late October the Asian Development Bank (ADB) said it would provide India with a loan of \$800 million to make Himachal Pradesh the country's "hydropower state". An eight-year loan package will help finance the construction of several run-of-river hydropower plants that will have a combined capacity of 808 MW.

Himachal Pradesh has a hydropower potential of 20 415 MW, about 25 per cent of India's total hydropower potential. However, only 6150 MW has been developed.

The ADB said the multi-tranche financing facility, which will be allocated based on the readiness of the project, allows it to engage the state government in a continuous long-term dialogue on its clean energy policies.

ADB and Himachal Pradesh government have identified two projects ready for financing through the first loan tranche of \$150 million, including the construction of the 111 MW Sawra Kuddu hydropower project on the Pabber river in Shimla district, and civil works for the 65 MW Kashang I project located in Kinnaur

district.

Any excess supply from the hydropower development can be exported to other parts of India said the ADB.

India has also been investing in its transmission sector to improve power exchange in the country. In October, the World Bank approved a \$400 million loan to the Power Grid Corporation.

Improving the transmission system will be important to deliver power generated from an increasing installed base to its population, of which more than 40 per cent is without electricity.

The country's goal to increase its power generating capacity to 200 GW by 2012 received a boost with the recent signing of a nuclear accord with the US. The immediate impact of the civilian nuclear agreement will be an increase in nuclear power generation by about 2500 MW by March 2009, according to the Minister of State for Power and Commerce Jairam Ramesh.

The nuclear pact would enable the country to obtain the nuclear fuel needed for its reactors to operate at full capacity, he said.

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France bridges the deep divide

European ministers may yet reach agreement on the European Commission's energy and climate package by the end of the year if a compromise proposed by France succeeds in bringing together the two sides of an increasingly polarised debate.

The proposal by France – which currently holds the rotating presidency of the 27-nation bloc – seeks to allay the fears of coal-dependent economies while still achieving the Commission's aim of a more effective emissions trading scheme (ETS). It also aims to address the issue of carbon 'leakage' and aims to give national governments more say on the use of revenues from carbon allowance auctions.

France hopes that the introduction of temporary exemptions to full auctioning of emission allowances for nations that rely heavily on coal for power generation will encourage Poland and other states in Eastern Europe to sign up to the climate package. It also offers the same concession to countries that are not fully interconnected with Europe's UCTE or Nordpool grid systems.

Countries falling under these proposed rules would be obliged to make investments that are at least the equivalent to the market value of the

free emission allowances received, however, and would have to introduce full auctioning of emission allowances from 2016.

The Commission's climate package targets a 20 per cent reduction in carbon emissions over 1990 levels by 2020. One of its key elements is the strengthening of Europe's ETS by making utilities and other polluting industries pay for their emission allowances.

Poland, Bulgaria, Romania, Hungary and Slovakia are opposed to the climate and energy package because it would result in substantially higher electricity prices for consumers at a time when economies are slowing. Poland relies on coal for over 90 per cent of its power generation and has argued that it made major concessions in the 1990s by closing large numbers of polluting factories.

Poland has formed a coalition with seven other member states – including Italy – that would enable it to veto the climate and energy package. On the other side of the coin are countries such as the Netherlands, France, most Nordic countries and the UK, who all favour the Commission's proposals.

Italy says that the introduction of the

Ministers in Europe are racing to agree on a final climate and energy package, but it remains to be seen whether a new proposal on emission trading will please the 'coalition of the unwilling', writes Siân Crampsie.



climate and energy package and full auctioning of emission allowances would cost its economy €8 billion per year. The Commission contests this figure and Italy has been accused of using the financial crisis as an excuse to delay compliance with climate goals.

The Commission is keen to reach final agreement on the package at a December 11-12 summit of EU heads of state in order to build momentum ahead of next year's UN climate meeting in Copenhagen.

Poland says that making its utilities pay for allowances – currently allocated for free – will result in a 90 per cent increase in electricity prices.

The country's initial reaction to France's compromise proposal has been mixed, however. While Poland's Prime Minister Donald Tusk expressed optimism after a meeting with French President Nicolas Sarkozy, others in the government took a harder line.

It is thought that some factions of the Polish government are concerned that freely-allocated emission allowances will allow utilities to make windfall profits. Mikolaj Dowgielewicz, Poland's minister for European affairs, is reportedly keen on a system that allocates allowances based on

technology benchmarks.

The French Presidency has also proposed giving individual governments more say over the use of revenues from allowance auction, suggesting that only 50 per cent of revenues be pre-allocated to emission reduction investments. The European Parliament wants to see 100 per cent of revenues pre-allocated, with at least half going to emission reduction and climate change adaptation aid.

This proposal may help to pacify Italy's concerns over the cost of implementing the package. The UK last month became the first EU nation to hold an auction for ETS allowances with the government netting revenues of £54 million.

The UK's Climate and Energy Minister Mike O'Brien said: "The EU ETS is central to keeping the price of tackling climate change as low as possible to industry and the economy. We want more auctioning in the future – and are already planning to auction 100 per cent of the allowances needed by the power sector from 2013.

"This auction highlights the importance of using the market to drive down emissions and create incentives for the development of low carbon technology."

The country again made history last

month when it passed legislation to create the world's first legally binding national emissions reduction target. The climate change bill was approved by a clear majority and commits the country to cutting greenhouse gas emissions by 80 per cent by 2050.

But another bone of contention in Europe is financing for carbon capture and storage (CCS) demonstration projects.

The European Parliament has proposed using part of the new entrants' reserve under the ETS to finance demonstration projects of up to 500 million tonnes of CO₂ equivalent. France, however, has proposed bringing this down to 100-200 million tonnes and encouraging the private sector to play a greater role in co-financing projects.

Both the IEA and Eurelectric support the European Parliament's position on CCS financing as they believe that the technology will play a key role in the fight against climate change. The IEA's most recent *World Energy Outlook* report indicates that coal will continue to be a major source of fuel in the power generation sector for many years to come.

RWE boosts geothermal in Germany

RWE Innogy's plans to explore two potential geothermal energy sites in Germany are an indication of the growing importance of this technology in the country.

RWE Innogy, the renewable energy arm of the large German utility, says it is to invest around €34 million in two deep geothermal projects in the Swabian rural district of Oberallgäu. It has received permits for the projects and plans to drill to depths of up to 4000 m to extract energy for power generation.

The projects are the latest in a long



Fritz Vahrenholt: "systematically" developing geothermal

line of recently announced plans to exploit Germany's considerable geothermal potential. A 2003 study put the country's total technical potential for geothermal energy at 300 000 TWh, while over 150 permits have been granted to develop sites in Germany's key geothermal areas.

Interest in geothermal energy in Germany is also being driven by the introduction of a feed-in tariff under the German Renewable Energy Act (EEG).

"We are convinced that deep geothermal energy can make a valuable contribution to supplying heat and electricity in Germany," said Prof. Fritz Vahrenholt, chief executive officer of RWE Innogy. "For that reason, RWE Innogy intends to systematically develop this young form of energy further in our latitudes."

Over the next three years RWE Innogy will investigate the geothermal potential of the two fields in Bavaria, which cover an area of about 100 km². The fields form part of the Bavarian Molasse basin, one of several geological regions in Germany that offer favourable conditions for geothermal energy.

Cernavoda moves forward

- Cernavoda, Belene will boost Southeast Europe
- EPRs, UK nuclear revival face delays

Construction of a new nuclear power plant in Romania could start in 2010 after six European partners reached an agreement with the Romanian government on the structure and ownership of the project.

CEZ, Enel, RWE Power, Electrabel, Iberdrola and ArcelorMittal together with Romanian nuclear company Societatea Nationala Nuclearelectrica SA have given the go-ahead for the creation of a joint venture company to develop Units 3 and 4 of the Cernavoda power plant, the country's most ambitious energy project.

The Czech Republic's CEZ, Enel of Italy, Germany's RWE and Belgium's Electrabel will each hold 9.15 per cent of the project company, while Iberdrola of Spain and Romania's ArcelorMittal will each have a 6.2 per cent stake. The deal was reached during the second round of negotiations after the Romanian government decided in June to increase its stake in the project from 20 to 51 per cent.

The value of the project, which involves construction of two CANDU reactors at the site of the existing

Cernavoda Units 1 and 2, has also doubled to around €4 billion. The first of the two 700 MW units is due to start operating in 2016, according to RWE Power, which sees Romania and Southeast Europe as target markets.

"With a population of over 22 million and an annual economic growth forecast of over five per cent, Romania is among the most attractive growth markets in Southeastern Europe," said Holger Bietz, Head of Regional Development at RWE.

RWE is also a key partner in the construction of the €4 billion, 2000 MW Belene nuclear power plant in Bulgaria, although recent media reports have indicated that the German utility is coming under pressure from environmental groups to pull out of the project.

The Bulgarian government in October named RWE as its strategic partner of choice in the project, but RWE's supervisory board has yet to approve the investment. The project is an important part of plans to replace ageing capacity in the country and will help to boost the region's power sector as a whole.

A consortium of Areva and Siemens in November signed a contract with Russia's Atomstroyexport to supply the main instrumentation and control (I&C) systems for Belene, which is due to start commercial operation in 2014. The plant will consist of two Russian VVER-type pressurized Water Reactors.

Elsewhere in Europe Areva and Siemens have informed Finnish utility TVO that the reactor plant civil construction works for the Olkiluoto 3 nuclear power plant will take several months longer than originally anticipated. The delay will mean that the plant – the world's first EPR-based nuclear power plant – will be commissioned in 2012.

In France, EDF said that it has taken steps to reinforce construction teams at the site of the Flamanville EPR nuclear power plant to ensure that it will start-up in 2012.

The British government has also reiterated its determination to bring new nuclear reactors on-line by 2018 in spite of fears that possible new legal challenges to the programme could cause significant delays.

Nuclear could be a stretch too far for South Africa

Siân Crampsie

South Africa is thought to be re-examining its plans to construct new nuclear power plants in light of the current economic climate.

The country's Department of Minerals and Energy says that the scale of the investment required and the global economic downturn mean that it is unlikely that the country would be able to proceed with a new nuclear build programme as originally envisioned. It is possible that the plans will be scaled back or even postponed, according to media reports.

State-owned power utility Eskom is aiming to come to a decision on two bids for new nuclear power plant before the end of the year. The nuclear programme is a key element of the utility's plans to boost generating capacity and reduce the energy shortages that have plagued the country this year.

Eskom recently secured a \$500 million (R5100 million) loan from the African Development Bank (AfDB) and is continuing to seek further sources of funds for its R343 billion, five-year capital expenditure programme. The difficult international financial markets and the downgrade of Eskom's credit rating earlier this year have made it harder for the utility to secure financing.

Westinghouse Electric and Areva both submitted bids in February 2008 to build around 3000 MW of nuclear capacity in South Africa in response to an invitation from Eskom. Up to 20 000 MW of new nuclear capacity could be built by 2025 under the utility's ambitious plans.

The 20-year loan from the AfDB was a major boost to Eskom's programme, and was secured at an interest rate that is more favourable compared to a commercial financial institution, according to Eskom. The loan is the largest-ever granted by the bank's

private sector arm.

"The loan from the African Development Bank will help to fund our R343 billion, five-year programme," said Fani Zulu, Eskom's spokesman. "The funds have not been earmarked for any specific projects."

Eskom's R343 billion budget for capacity expansion and investment in transmission and distribution infrastructure does not include any nuclear power projects.

In its nuclear bid, Areva has proposed the construction of two EPR units as part of a consortium that brings together South African engineering and construction group Aveng, and Bouygues and EDF of France. Westinghouse has proposed the construction of three AP1000 units. Its response was submitted in cooperation with US Shaw Group and Murray & Roberts Limited of South Africa.

Eskom has also secured funding of €300 million (R3900 million) from the

Eskom is turning to development banks and bilateral lenders to fund its capacity expansion programme, but South Africa's government seems unsure whether new nuclear is affordable in the current climate.



Fani Zulu: funds not earmarked

European Investment Bank, and earlier this year persuaded the South African government to grant early disbursement of a R60 billion loan. It is currently in talks with the World Bank for a major loan.

The utility is hoping that it will gain approval for further tariff increases in order to help fund the construction of new generating capacity, but the current economic climate will make such a move politically difficult. It says that it has so far raised R19 billion of the R30 billion that is required this year.

The capital expenditure programme is aimed at improving South Africa's electricity generation and transmission infrastructure, which has been placed under pressure due to rapid economic expansion and delays in investment. The country suffered massive power shortages at the beginning of 2008 and a power saving programme has been in place ever since.

Eskom's new build programme took a step forward in November when details were released of the companies that have pre-qualified to participate in the utility's multi-site baseload independent power producer (IPP) programme. Up to 4500 MW of new capacity will be developed under this guise, with developers operating the plant and selling output to Eskom under long-term power purchase agreements (PPAs).

The 23 developers named in the programme include AES, Aldwych International, Huaneng Power International, Endesa, International Power, Mitsui & Co., Shenzhen Energy Group, Sumitomo, Union Fenosa and YTL Power International.

South Africa's electricity regulator NERSA earlier this year approved a 13 per cent increase in tariffs but Eskom was then dealt a blow when Moody's downgraded the utility's credit rating to Baa2 from A1.

Afam brings hope to Nigeria

■ Gas and power project is model for the future

■ PHCN reports continued supply problems

Nigeria's power supply situation is again teetering on a knife-edge in spite of successful commissioning of a new natural gas fired power plant by Shell.

The 450 MW Afam VI power plant was brought on line in November but the boost that it gave the power sector was short-lived owing to interrupted gas supplies at two other power plants in the country.

Available capacity towards the end of November stood at 2500 MW, according to local reports, forcing the Power Holding Company of Nigeria (PHCN) to revert to its suspended 12-

hourly rationing programme.

The Shell Petroleum Development Company (SPDC) started commissioning the plant's first turbine in late October and was aiming to finalise performance tests on the unit by the end of November. Commissioning of the plant brought available generating capacity in the country to around 4000 MW.

However, PHCN reported in mid-November that it was losing 800 MW of capacity due to supply disruptions at its Sapele and Egbin thermal power plants.



Losing capacity: Nigeria power supply on a knife-edge

Afam VI is part of the Okolama Gas Plant and associated gas wells and as such is a key project for Nigeria's energy sector. The natural gas element of the \$1.3 billion project will provide gas equivalent to 20 per cent of the current total Nigerian domestic gas supply.

Nigeria is attempting to overcome acute energy shortages that have caused prolonged blackouts across the whole country. Available capacity levels dropped to 2000 MW in July, compared to an installed capacity of around 6 GW.

Problems with gas supplies to power plants is one of the key issues affecting power plant reliability in Nigeria, which has the world's seventh-largest natural gas reserves. The country's government is trying to encourage natural gas development and investment in domestic infrastructure to help overcome the power shortages.

Afam VI is currently operating in simple cycle mode. Shell and its partners aim to convert it to combined cycle operation – adding a further 200 MW of capacity – in the second phase of the project next year.

Dubai enhances green credentials

■ PV plant will be region's largest
■ Legislation for new buildings

In a further sign of the United Arab Emirates' determination to become a leading centre for 'green' technologies, Dubai has announced plans to build a major photovoltaic (PV) manufacturing plant.

The Emirate has also signalled that it is serious about sustainable development through the introduction of new 'green building' legislation – reportedly the first of its kind in the world.

Solar Technologies Free Zone Establishment (FZE) will be the Middle East's largest PV manufacturing plant and will go into operation in 2010 with a capacity of 130 MW/year. It will produce large thin-film solar panels of up to 5.7 m² in size. Construction of the facility has already

begun, and the company says it will boost its annual production capacity to 1 GW by establishing similar facilities in China, Mexico and Bulgaria.

The Dubai Electricity and Water Authority Dubai's will enforce the Emirate's new legislation, which aims to maximise the energy and water efficiency of all new buildings. It specifies the use of high-efficiency lighting systems as well as advanced controls for lighting and air conditioning.

Iraq calls for more finance

Iraq wants to attract more international financial companies to help it finance reconstruction of the country's key infrastructure.

The country has earmarked \$15 billion in its 2009 draft budget – nearly 25 per cent of the total – for rebuilding its energy and oil facilities, but the government believes that this falls far short of the total that is actually required.

An Iraqi government study has put the total required to upgrade its existing infrastructure and build new facilities at \$400 billion. The performance of the country's electricity sector has become a bellwether for assessing the progress made in reconstruction.

According to the government, Iraq's private banks are still suffering from capital shortages in spite of continued government support. Minister for Finance Bayan Jabr was reported as saying that this represents an opportunity for banks in the US, Europe and elsewhere to get involved.

The US-backed government of Prime Minister Nuri al-Maliki is aiming to triple power generation capacity and bring an end to regular power outages by 2012. Power generating capacity currently stands at around 5500 MW.

Efforts to improve the country's power infrastructure and electricity supplies have been hampered by attacks on transmission lines and pipelines. Meeting current levels of electricity demand will require at least \$5.5 billion.

Iraq's government has also recognised the need to wean itself off its oil dependency. Oil revenues account for 90 per cent of the national capital budget, and the recent fall in oil prices forced the country to cut its planned 2009 budget by some \$12 billion.

Enel more cautious

■ Strong results posted ■ New key agreements in Russia

Enel says it may cancel or rethink some projects and investments in response to the slowing economic climate.

The Italian utility has posted strong results for the first nine months of 2008, but expects to reduce capital spending in 2009 and also to continue cutting debt. The company has made a number of key investments in strategically important markets such as Russia in recent months.

Enel had earnings before interest, tax, depreciation and amortization (EBITDA) of €1.3 billion, up almost 69 per cent on the same period last year. The increase was driven mainly by Spanish unit Endesa and by higher volumes and electricity prices in the Italian market.

Enel expects to earmark €-6 billion in capital spending next year, down from €6.5 billion this year. It has also reaffirmed its target of cutting debt to below €50 billion this year.

Enel's debt soared with the purchase last year of Spain's Endesa, and stood at €1.4 billion at the end of September.

Italy's dominant power provider has a strong international expansion strategy and is in particular focussed on Russia, where it sees opportunity

in the rapidly growing and developing energy markets. The company recently signed a memorandum with Inter RAO UES for the joint development of commercial projects and has several other initiatives with key Russian players.

Under its memorandum with Inter RAO, Enel will set up a working group to assess the potential of a variety of power generation projects in Russia and CIS countries. The two companies will also exchange information on energy efficiency, best practice and issues relating to energy security in the region.

Enel's CEO, Fulvio Conti said: "The agreement with Inter RAO UES lays the foundations for joint industrial and commercial initiatives in Russia and neighbouring countries."

Inter RAO handles the export and import of electricity in Russia. The company owns overseas power assets, primarily in the CIS, and manages several electricity stations in Russia.

It controls 8 GW of capacity and plans to increase this figure almost four-fold to 30 GW by 2015.

Enel's activities in Russia also include a memorandum of understanding with RosAtom, the federal atomic agency, to develop the



Fulvio Conti: laying foundations in Russia

electrical system in Russia and Central Eastern Europe, build new nuclear power plants, manage and reinforce the electrical energy transport networks and manage pre-existing nuclear power stations.

It also recently signed an agreement with Gazprom for the joint development of natural gas fields in the Urengoy region of Russia. It already handles a number of operations in Russia, including a stake in RusEnergSbyt, a joint venture with ESN, and a controlling stake in wholesale power generator OGK-5. At home in Italy, Enel signed a

strategic agreement with oil and gas company Eni to develop a carbon capture and storage (CCS) project that includes construction of a pilot plant at Brindisi. The deal brings together the two companies' existing research programmes and aims to make Italy a leading role in CCS technology.

The proposed pilot project will involve the capture of CO₂ from flue gas, underground injection as well as the monitoring of the stability and safety of the deposit. The companies will create a system for the capture and liquefaction of CO₂ at Enel's Brindisi site and for its transport

to the exhausted Stogit field at Cortemaggiore.

Enel is currently completing Italy's first industrial CO₂ capture plant at the Brindisi thermal power station, while Eni has started a project aimed at injecting around 8000 t of CO₂ per year into the Stogit field.

Enel's pilot capture plant will be ready in late 2009 while underground injection is scheduled to start in late 2010. In order to gain experience in the pipeline transport of CO₂, Enel and Eni have also decided to lay a pilot dense-phase CO₂ transport line at the Brindisi site.

Households boost RWE

RWE is aiming to further boost its customer base and profits in the German household sector by extending its range of fixed-price products.

The German utility has announced a new long-term power tariff plan aimed at customers that want to buy electricity from CO₂-free sources. "ProClimate Power 2011" guarantees a fixed price until 2011.

The launch of the new tariff came as RWE posted nine-month profits that were considerably higher than analysts had predicted. Much of its success this year is attributable to increased earnings from households.

In the first nine months of the year, RWE supplied 236 billion kWh of electricity – three per cent more than in the same period last year – while higher electricity prices boosted revenues. The company's operating profit increased by five per cent to €5.8 billion.

RWE has also been able to feed the higher prices through to its customers.

Benchmark power prices in Germany, Europe's largest power market, reached a record €73.17/MWh in the three months through September, more than doubling in a year.



Centrica set for vertical integration

Centrica is forging ahead with its strategy to acquire a 25 per cent stake in nuclear generator British Energy as a means of reducing its exposure to wholesale gas prices.

The UK utility has launched a shareholder rights issue designed to raise £2.2 billion to help fund its strategy, and says it remains in talks with Electricité de France (EDF) about purchasing a stake in British Energy.

Centrica says that the acquisition of additional power generation assets that do not use natural gas will reduce its exposure to movement in UK wholesale gas prices. The company does not produce enough natural gas from its upstream operations to fulfil customer demand and the needs of its gas-fired power generation assets.

Centrica confirmed in August that it was in discussions with EDF over the acquisition of a minority stake in British Energy, which is the UK's largest power generator. In September EDF announced that its £12.5 billion offer for British Energy had been accepted by shareholders.

"Following this rights issue, Centrica will be well-capitalised to fund the potential acquisition of a 25 per cent interest in British Energy," said Centrica Chairman Roger Carr. "Assuming we reach agreement with EDF... the proceeds of the rights issue will be directed towards this opportunity, with the balance of the consideration being funded with additional debt and, possibly, asset sales."

Centrica is also trying to ease its

■ Strategy reduces price exposure ■ EDF talks continue

exposure to price fluctuations through the acquisition of additional upstream gas assets on the UK and Norwegian continental shelves. The imbalance in its operations has, at times, made its UK residential energy supply business uncompetitive.

Based on EDF's offer for British Energy, Centrica estimates that its proposed acquisition of 25 per cent of the nuclear generator would cost around £3.1 billion. The deal would also give Centrica the option of participating in new nuclear build projects in the UK.

British Energy operates eight nuclear power stations and one coal fired power plant, and generates around 19 per cent of electricity in the UK. Its acquisition by EDF has yet to receive regulatory approval.

Finnish pact approved

Metso and Wärtsilä are aiming to capture a significant share of the European market for biomass boilers after their joint venture received regulatory approval.

The European Commission has given the nod to the deal, which will see Metso's Heat & Power business combined with Wärtsilä's Biopower business.

The new joint venture will be called

MW Power Oy and will have consolidated annual pro forma net sales for 2008 of around €130 million. It will be one of the leading providers of small- and medium-scale renewable fuel-based power plants in Europe, offering Metso's fluidized bed combustion technology and Wärtsilä's grate technology.

Metso will own 60 per cent of the company and Wärtsilä the remaining

40 per cent. The venture will allow the companies to take advantage of opportunities in the growing market for biomass-fired power plants in the region.

"Now that we have received the approvals, we can start integration planning. The long-term business drivers are positive for us," said Jorma Lehtoviita, Vice President of Metso's Heat & Power business.

Alstom net profit up 36 per cent in first half



Alstom SA, the French transport and heavy engineering firm, said its net profit rose 36 per cent in the first half of the year due to higher margins from building and servicing power plants.

Alstom reported net profit of €527 million (\$678 million) for the April to September quarter, up from €388 million a year earlier, as higher sales and better contract terms helped lift the profitability of Alstom's power generation and related services operations.

The company said it took in orders worth €5.4 billion during the six-month period, up 20 per cent from a year earlier, which it said lifted its order backlog to two-and-a-half years worth of sales.

The company reiterated its target of lifting its operating margin to around 9 per cent by the end of the financial year ending in March 2010, up from 7.8 per cent at the end of September.

Tenders, Bids & Contracts

Americas

Vestas wins Chile contract

Norwegian renewable energy developer SN Power has awarded Vestas a contract for the supply of equipment and services for the Totoral wind power project in Chile. The project is expected to be the largest of its kind in the country when it is completed in 2009, and will help Chile to reach its renewable energy target.

Vestas will supply 23 of its V90-2MW wind turbine units to the project, located in the region of Coquimbo, around 300 km north of Santiago. The contract includes supply and commissioning of the units as well as a SCADA system.

The Chilean wind market holds great potential, according to Vestas. The country has set a target for non-conventional renewable energy sources to account for ten per cent of energy consumption by 2024.

Delivery of the wind turbines is scheduled to start in April 2009 and the project will be completed in the second quarter of 2009. The wind farm will have an estimated annual production of 100 GWh, enough to satisfy the consumption of around 20 000 Chilean households.

Asia Pacific

Vestas wins China order

China Guangdong Nuclear Wind Power has awarded Vestas an order for 116 of its V52-850kW wind turbines for a project in Inner Mongolia Province, China.

The contract includes the supply and commissioning of the turbines, a SCADA system and a two-year service and maintenance agreement for the project near Xilinguole City. Delivery and commissioning of the turbines is planned for the third quarter of 2009.

Alstom Hydro wins India contract

Andhra Pradesh Power Generation Corporation Ltd. (Apgeco) has awarded Alstom Hydro a €78 million (Rs460 crores) contract for the turnkey supply of hydroelectric equipment to the Lower Jurala hydropower project in India. The contract will reinforce Alstom's leading position in the Indian hydropower market, according to the French engineering firm.

The Lower Jurala hydropower project was conceived to maximize power production by using the discharge of the Priyadarshini Jurala Dam as well as flood discharges during the monsoon period. It will be equipped with six 40 MW bulb turbine generator units and is scheduled to be completed in the next five years.

Alstom Hydro's local unit in Vadodra, India, will be in charge of project execution, including the design, manufacturing, supply, installation, testing and commissioning of the turbines as well as the associated auxiliary and ancillary equipment.

Wärtsilä awarded O&M contract

Finland's Wärtsilä has been awarded an operation and maintenance (O&M) agreement for the Attock Gen Ltd power plant located near Rawalpindi, Pakistan. The contract is the fourth O&M contract secured by Wärtsilä in the country.

The 156 MW power plant, which was supplied and installed by Wärtsilä, will start operating this year. It is equipped with nine Wärtsilä 18V46 generating sets, nine heat recovery boilers and an 11.6 MWe steam turbine.

The Attock Gen plant is located at the Attock Refinery site and will be

connected to the national grid. Wärtsilä says that Pakistan holds huge potential for its O&M contract business and is currently negotiating O&M contracts for around 800 MW of new capacity in the country.

China to manufacture AMSC wind turbines

American Superconductor Corporation (AMSC) has signed an agreement that will allow a major Chinese industrial equipment supplier to manufacture and sell its 2 MW wind turbine in China.

Under the agreement with Shenyang Blower Works (Group) Co. (SBW), AMSC will provide the company with designs for its double-fed induction wind turbine and will also help to localize the supply of all core components for the wind turbines, establish the wind turbine manufacturing line and build and test SBW's first prototype wind turbines.

The deal will allow SBW to become a leading supplier of wind turbines for the Chinese market, which is forecast to grow from an installed capacity of 5.9 GW in 2007 to more than 10 GW in 2008. The company plans to have its first prototype turbines installed and commissioned in 2009 and expects to begin series production in 2010.

After receiving certification, SBW will manufacture the turbines and sell them primarily into the Chinese market. AMSC will provide the full electrical systems for all of SBW's wind turbines.

Europe

Alstom to build CCGT in Spain

A consortium led by Alstom has received full notice to proceed with the construction of a 400 MW combined cycle power plant in Spain under a turnkey contract awarded by Hc Energia.

Under the terms of the contract, Alstom will supply a fully integrated turnkey power plant comprising one KA26-1 single-shaft power train and integrating in-house core plant components consisting of one GT26 gas turbine, one heat recovery steam generator, one STF15c steam turbine and one Topgas turbogenerator.

The turnkey contract, which includes a long-term operation and maintenance contract, was awarded in August 2008.

The new power plant will be located in Soto de Ribera. It represents the eighth GT26 power station built by Alstom in Spain and the fourth with Hc Energia, a subsidiary of Energias de Portugal (EDP).

SPE commissions Trent 60 at Ghent

Belgian utility SPE has commissioned a Trent 60 powered electrical generating plant at the Ham power station in Ghent, making it the most powerful and fuel-efficient plant of its type in the world, according to Rolls-Royce.

The two gas turbines have replaced the diesel engines that were in use at the plant for 40 years and have made a significant improvement to the plant's environmental performance as well as noise and vibration levels, said Rolls-Royce. The British engineering firm has now reached agreement with SPE to build another Trent 60-based power station on an existing SPE site near Liège.

The two Trent 60 units at Ham provide over 100 MW of power during peak times of demand.

Rolls-Royce has now installed 11 Trent gas turbine generating sets at power station sites in Europe, and has an additional 12 units on order.

Toshiba-Westinghouse wins 10-year EDF contract

France's EDF has awarded Toshiba-Westinghouse a ten-year contract to renew stator coils in the generators of more than ten nuclear power plants in the country.

The contract, worth over €100 million, was awarded as part of EDF's on-going programme to retrofit the key components of its 58 commissioned nuclear power plants in France. Toshiba-Westinghouse said that it will apply the experience gained from the contract to future projects around the world.

The manufacture of the stator windings will begin in early 2009 at Toshiba's production facilities in Yokohama, Japan, following initial pre-installation arrangements. It is expected that three or four rewinding operations a year will be conducted for 900 MW and 1300 MW generators, starting in 2010.

Toshiba said that its Japanese technical experts have gained extensive experience in supporting stable operations at numerous sites in Japan, and will provide EDF with technical support for smooth operation of the updated systems.

ESBI to build power plant in Spain

ESB International has announced plans to build a major new gas fired power plant in northern Spain. The move is a significant expansion of its overseas investments. ESBI, a subsidiary of Irish utility ESB, has received approval for the power plant, which will be built near Oviedo, Asturias. Construction work on the 800 MW gas fired facility will start in 2010.

The project is ESBI's second power plant project on the Iberian Peninsula and will require an investment of €500 million. It will consume around 1 billion m³/year of fuel and sell its output into the Spanish wholesale electricity market.

ESBI will be responsible for the construction, operation and ownership of the new power facility through its subsidiary company, Asturias Generacion. The plant, which will be situated on a brownfield site on an industrial complex, will be commissioned in 2012.

"The delivery of this key permit for the Asturias project further advances ESB's reputation for developing and investing in significant power generation projects in the Iberian market," said Pdraig McManus, CEO of ESB. "ESBI's development team is now in discussion with a number of parties in relation to the commercial arrangements for the project."

Metso wins CHP contract

Metso has announced that it is to supply Kuopion Energia Oy with a multi-fuel fired power boiler for a new combined heat and power (CHP) plant in Finland under a contract worth around €67 million.

Metso will supply a 149 MWth circulating fluidized bed (CFB) boiler that will burn peat and forest residues to produce district heat for the city of Kuopio and electricity to the national grid. Start-up of the boiler is scheduled for the end of 2011.

The new boiler will replace the first pulverized peat fired boiler built at Haapaniemi power plant in 1972 by Metso. Kuopion Energia's total investment in the new plant will be €35 million.

I&C for Schwarze Pumpe

Siemens Energy has supplied an SPPA-T3000 instrumentation and control (I&C) system for a pilot power plant at Schwarze Pumpe, Germany under

a contract with Vattenfall.

The Web-based I&C system has been installed at a 30 MW power plant that is demonstrating the oxyfuel process, an advanced clean coal technology. Siemens' I&C technology is also in use at the main Schwarze Pumpe lignite-fired power plant, located near Spremberg, Brandenburg.

For the new pilot plant, Siemens supplied the I&C system as well as connections to the air separation unit, the CO₂ liquefaction facility and the main power plant. The company is also providing support for the entire trial operation.

International

Metso supplies multifuel-fired boiler to Poland

Stora Enso Poland SA has awarded Metso a €50 million contract to supply a boiler for a new power plant at Ostroleka Mill in Ostroleka, 120 km from Warsaw.

Metso will supply a circulating fluidized bed (CFB) boiler capable of burning biomass, paper and fibre rejects, sludge and coal. The new power plant will produce electricity and process steam for the mill, which is a paper and packaging facility comprising a paper and pulp mill, a corrugated board and boxes mill and a sack mill.

Start-up of the boiler is scheduled for the second half of 2010. Metso's contract also includes delivery of a flue gas cleaning system.

Siemens supports IEC expansion plans

The Israel Electric Corp. (IEC) has awarded Siemens Energy a €200 million contract to supply components for three gas turbine power plants. The projects are part of plans by IEC to significantly expand generating capacity over the next few years.

Under the contract, Siemens will supply key components for the 287 MW Ramat Hovav, Hagit and Eskhol power plants. The facilities will initially operate as simple cycle units but will eventually be converted by IEC to combined cycle operation.

The order also includes an option for the supply of components for a fourth power plant.

Siemens will equip each of the plants with an SGT5-4000F gas turbine, an air-cooled generator, exhaust stack and air intake system. The order also covers the instrumentation and control equipment for the turbine-generators, fuel conditioning systems and engineering work.

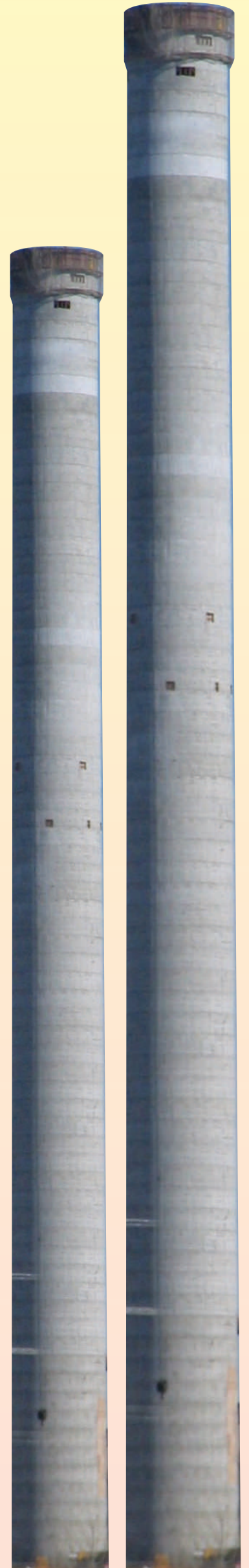
RWE secures Poland wind projects

Germany's RWE Innogy has secured access to three wind power projects in Poland that are all in the early stages of development. The deal follows an announcement by the company in September that it had acquired the rights to develop 300 MW of wind capacity in the country.

RWE has secured a deal to complete development of three wind power projects with a combined capacity of 150 MW in conjunction with a Polish project developer. Each site has a capacity of 50 MW and they are expected to receive official approval from 2011.

In September 2008, RWE Innogy acquired the rights for the development of other wind farms in Poland with a total capacity of around 300 MW. Work on these projects is expected to start in 2010 after authorizations are received.

Roy Schwarzer, division manager for onshore wind at RWE Innogy, said: "The Polish wind market is one of the most attractive in Europe and has huge potential for development."





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Oil

OPEC considers next move as crude prices plummet

■ Further production cuts likely
■ Bleak projections for OPEC member economies

by David Gregory

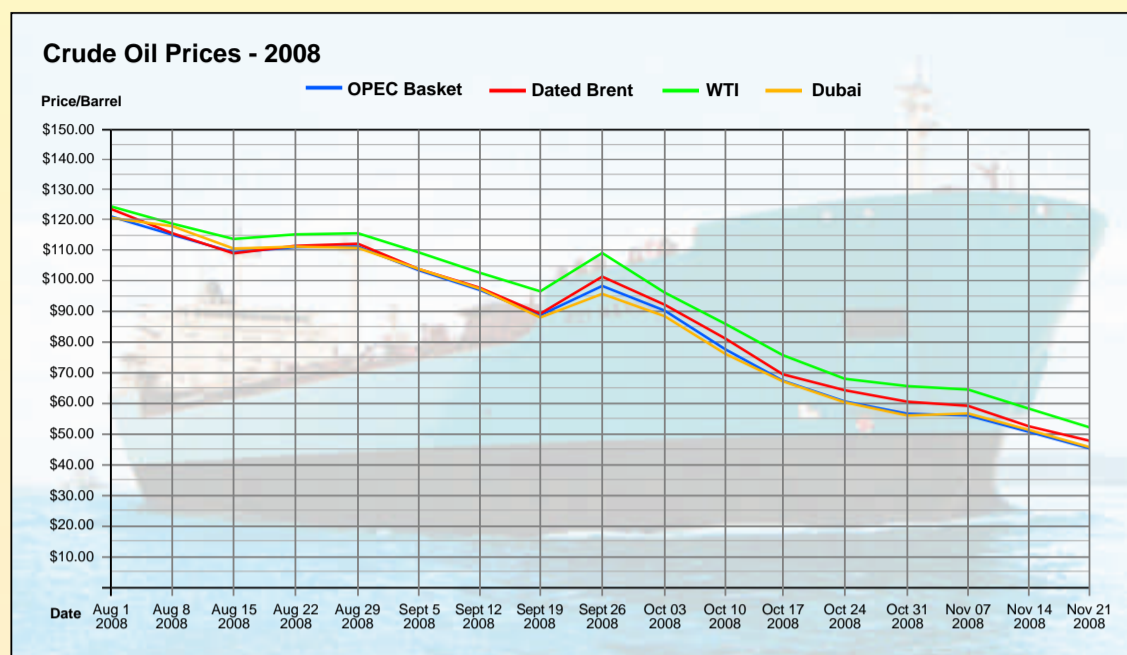
The Organization of Petroleum Exporting Countries (OPEC) is now considering its next move ahead of when it meets in Oran, Algeria, on 17 December. A further cut in oil production is likely to be top of the list as crude oil prices continue their downward trend.

During an extraordinary meeting in Vienna on 24 October, the group, which produces around 40 per cent of the world's oil, announced its intention to reduce aggregate production among 11 members by 1.5 million b/d, effective 1 November. Since then the price of

WTI crude oil has fallen further and has declined in price by two-thirds from its record high of \$147.27/B in mid-July.

While supply was tight six months ago and the market driven by speculation and political events, research organizations are reporting the growth in demand is subsiding globally and may remain slack well into 2009. Even the hijacking of Aramco's fully-laden oil tanker, the *Sirius Star*, by Somali pirates failed to create a stir in the oil market, an event that had it occurred earlier in the year would have caused crude prices to jump.

As the price of crude declines and



the outlook for the global economy looks increasingly gloomy, analysts are beginning to make bleak projections for the economies of OPEC members themselves. Washington-based PFC has calculated that one of OPEC's leading price hawks, Venezuela, would require an average crude oil price of \$99.88/B during 2009 in order to balance its external accounts. Iran would require an average of \$88.33/B, while a price averaging little more than \$50/B would be sufficient for OPEC key producer, Saudi Arabia. Algeria, which holds the presidency of OPEC, and which has used the period of high oil earnings to pay off most of its external debt, could survive on around \$18/B and gas-rich LNG exporter Qatar needs crude oil to average only \$10/B during 2009.

OPEC President Chakib Khelil expressed the concern of OPEC

members over the state of the global economy, especially the worsening of economic conditions in the US and Europe. Speaking prior to an unofficial meeting of OPEC in Cairo in November, Khelil said the data needed to determine the group's future action would probably not be available until the Oran gathering. He added that if OPEC "took new decisions without applying the previous ones, then we would lose our credibility."

Geneva-based PetroLogistics forecast that production among the 11 OPEC members that are obliged to reduce output would amount to 27.8 million b/d during November, compared with 29.05 million b/d in October. PetroLogistics said that while the group did not achieve the targeted reduction of 1.5 million b/d, output did decrease.

Meanwhile, the Centre of Global Energy Studies (CGES) noted in the November issue of its *Monthly Oil*

Report that it took 40 months for oil prices to rise from \$50/B to \$150/B, but just four months for them to fall back again, adding that the decision taken in Vienna in late October had failed to stop the slide in crude oil prices. London-based CGES said the downward price trend would not halt "until real output cuts have been implemented."

"Oil demand forecasts continue to be revised downwards and a year-on-year contraction in global oil demand in 2008 and 2009 is now a very real possibility for the first time in 25 years," CGES said. "The path of oil prices will depend on how, and how quickly, OPEC cuts production in response to the falling demand for its oil."

The research centre said it believes that oil demand growth in Asia, Latin America and the Middle East can no longer offset the continuing decline for oil in the OECD

Gas

Caspian Development Corporation may revive Nabucco

The creation of a new consortium known as the Caspian Development Corporation suggests the EU is serious in its plans to secure energy supply routes from the region that do not transit Russian territory.

by Mark Goetz

As Ukraine enters a new episode with Russia over the price and supply of natural gas, the European Union is attempting to avoid a similar potential predicament in the future with the creation of a new enterprise designed to carry Caspian energy westward.

Announcing an EU Energy Security and Action Plan in Brussels on 13 November, EU Commission President Jose Manuel Barroso urged the creation of a Caspian Development Corporation (CDC), a consortium of European companies that would invest and develop energy sources in the Caspian region and transport them through Turkey to southeast Europe, a route that has been dubbed the 'southern' or 'fourth corridor'.

Gas pipeline projects involving the fourth corridor include the Nabucco Gas Pipeline project, the

Interconnector-Turkey-Greece-Italy pipeline and the Trans Adriatic Pipeline.

The CDC would focus on the upstream development of the region's natural gas resources and aim to provide producing countries with a stable long-term income as well as construct the infrastructure needed for transport. The consortium would give the EU a more connected approach towards investment in the Caspian region and possibly reassure Caspian producers of the EU's political commitment to the region.

The proposal to form the CDC also suggests the EU is serious in its plans to secure energy supply routes from the region that do not transit Russian territory.

EU Energy Commission Andrius Piebalgs said the CDC could be formed before the end of this year or in the early months of 2010.

Companies from all 27 EU members would be eligible for a share in the company.

The formation of the CDC could provide the Nabucco project with the impetus that it has been lacking for some time. The project's inability to secure long-term supplies has left it in limbo despite the fact that the EU and US support the project.

Executives from Austrian oil and gas group, OMV, which leads the project, have embarked on new efforts during the last month to secure gas supplies. Nabucco is designed to carry 31 billion m³ per year (bcm/y) of natural gas across 3300 km from Turkey to Austria. The project, Phase 1 of which is scheduled to come into operation in 2013, is now estimated to cost €7.9 billion. Besides OMV, partners include RWE of Germany, Hungary's MOL, Romania's Transgaz, Bulgaria's Bulgargaz and

Turkey's Botas.

Negotiations for gas supplies have begun with BP, operator of Azerbaijan's huge offshore Shah Deniz gas field. It is set to move into Stage 2 production in 2013 and output could exceed 16 bcm/y. Current output from Shah Deniz, around 8 bcm/y, is shipped through the South Caucasus Pipeline (SCP) through Georgia to Turkey's eastern gas hub at Erzurum and some of that gas is forwarded to Greece through the Interconnector route.

Nabucco partners hope to eventually secure supplies from Turkmenistan, a development that would require the construction of a gas pipeline across the Caspian Sea to link up with the SCP. OMV has also let it be known that talks are proceeding with Shell and its planned development of natural gas resources in Iraq and their subsequent shipment to Turkey.

Earlier this year Russia's gas monopoly Gazprom approached Azerbaijan with a proposition to purchase all of its future gas production at international prices. Gazprom has also signed agreements with Turkmenistan that will boost purchases up to 80 bcm/y in 2010.

Meanwhile, Ukraine is again facing a debacle with Moscow over the price of gas for the new year and the payment of \$2.4 billion for shipments that Kiev has already received. Ukraine currently pays \$179.50 per 1000 m³. Russia is now looking for a price of \$400 per 1000 m³ for shipments beginning in 2009. Furthermore, Moscow is looking at the possibility of legal action against Kiev if the Ukrainian government fails to pay its outstanding debt.

This will further prompt the EU to reconsider its notion that Russia is a reliable source of supply.

Global scenarios for the power sector to 2030

The recently published *2008 World Energy Outlook* takes a detailed look at the policy options for tackling climate change after 2012, when a new global agreement is due to take effect. It examines in detail, through scenario analysis, how different international agreements and national/regional commitments on climate change could affect the evolution of energy markets after 2012.

Maria Argiri

The analysis in the *2008 World Energy Outlook*, launched in mid-November, focuses on three of the most commonly discussed elements of a post-2012 climate framework – cap-and-trade, international sectoral agreements and national policies and measures. A plausible combination of these mechanisms has been modelled in two scenarios: one in which it is agreed to limit the greenhouse-gas concentration in the atmosphere to 550 ppm (in CO₂-equivalent terms) and another in which the concentration is held to 450 ppm. These scenarios are compared against a *Reference Scenario*, which is based on current policies only.

In 2006, global electricity generation reached 19 000 TWh; over 40 per cent came from coal-fired power plants. Carbon dioxide emissions from power plants reached 11 Gt, or 40 per cent of total CO₂ emissions from fossil fuel combustion. Without additional policies, power plant emissions are projected to rise to 18 Gt by 2030.

Under a global agreement to reduce GHG emissions, much of the cut must come from the power sector. In the *550 Policy Scenario*, they reach 13 Gt, while in the *450 Policy Scenario* they fall well below the current level, to about 8 Gt. These reductions come from lower electricity demand (through energy savings) and from greater use of low-carbon technologies (renewables, nuclear power and carbon dioxide capture and storage).

■ The *Reference Scenario*: In the *Reference Scenario*, world electricity generation is projected to grow at an annual rate of 3.2 per cent in the period 2006 to 2015, slowing to 2 per cent per year on average in 2015-2030. It reaches 33 000 TWh by 2030. Most of the projected growth in electricity demand occurs outside the OECD. In the OECD, electricity demand is

projected to rise by just 1.1 per cent per year on average, increasing by less than a third between 2006 and 2030. By contrast, demand in non-OECD countries grows by 146 per cent, at an average annual rate of 3.8 per cent.

The international fossil fuel projections that underpin the *Reference Scenario* have been significantly revised upward in this year's edition of the *World Energy Outlook*. As a result, renewables and nuclear power now appear to be more competitive against coal- or gas-fired generation in many parts of the world. But globally, the dominance of fossil fuels continues.

Coal remains the main fuel for power generation worldwide throughout the period to 2030. On the back of strong growth in non-OECD countries, its share increases from 41 per cent to 44 per cent. The share of natural gas in total generation falls slightly, as a result of higher prices. The share of oil drops to about 2 per cent by 2030, as high oil prices make oil burning extremely expensive.

Nuclear power, constrained by the assumption of unchanged government policies, also loses market share, which drops from 15 per cent in 2006 to 13 per cent by 2015 and further to 10 per cent by 2030, as nuclear power capacity does not increase as rapidly as demand for electricity. Nuclear electricity generation increases from 2793 TWh in 2006 to almost 3460 TWh in 2030.

The share of renewables rises considerably, from 18 per cent in 2006 to 20 per cent in 2015 and 23 per cent in 2030. This results from lower costs as renewable technologies mature, assumed higher fossil-fuel prices, which make renewables relatively more competitive, and strong policy support. The renewables industry has



Maria Argiri: it will be important to minimise policy risk by providing a robust post-2012 framework

the opportunity to exploit this development to eliminate its reliance on subsidies and to bring emerging technologies into the mainstream.

The contribution of carbon dioxide capture and storage in this scenario is negligible.

As noted, global CO₂ emissions from power plants rise to 18 Gt by 2030 in the *Reference Scenario*, nearly 60 per cent higher than in 2006. Our projections indicate a dramatic increase in emissions from power plants in non-OECD countries, which double between 2006 and 2030. These emissions come mainly from coal-fired power plants.

■ The *550 Policy Scenario*: In the *550 Policy Scenario*, global CO₂ emissions from power plants in 2030 are 30 per cent lower than in the *Reference Scenario*. This reduction comes mainly because of greater use of low-carbon technologies and to a lesser extent from lower demand for electricity (which is 9 per cent lower than in the *Reference Scenario* because of greater energy efficiency in industry and buildings). World electricity generation reaches 30 000 TWh in 2030.

By 2030 the share of fossil fuels in the electricity generation mix falls from 66 per cent in the *Reference Scenario* to 55 per cent in the *550 Policy Scenario*, the current share being 67 per cent. The largest fall is in the share of coal, which drops to 32 per cent in 2030 – 12 percentage points lower than in the *Reference Scenario*, despite a growing contribution from CCS. In 2030, the installed capacity of CCS plants amounts to 162 GW worldwide, of which 111 GW (about 70 per cent) is in OECD countries. CO₂ emissions per MWh electricity generated fall from 604 kg in 2006 to 424 kg in 2030.

Renewable energy plays a major role in the global electricity mix, supplying 30 per cent of total electricity in 2030 (up from 23 per cent in the *Reference Scenario*). The biggest increase is in hydropower, biomass and other renewables nearly doubles to 31 per cent by 2030. Nuclear power generation reaches over 4000 TWh in 2030 (533 GW), about 20 per cent more than in the *Reference Scenario*, as a result of licence extension of existing plants over the period 2006-2030 and to the accelerated build-up of new ones.

■ The *450 Policy Scenario*: In the *450 Policy Scenario*, power sector CO₂ emissions fall to 8.3 Gt in 2030, 35 per cent lower than in the *550 Policy*

Scenario and 27 per cent lower than in 2006. This scenario requires a fast decarbonisation of electricity generation: CO₂ emissions fall to 286 kg/MWh. All new fossil fuel plants built in the OECD after 2020 are fitted with CCS. Additional savings come from more efficient use of electricity.

Nuclear power capacity rises to almost 680 GW in 2030 supplying 18 per cent of total electricity. The most dramatic increase is in the use of renewable energy; 40 per cent of electricity generation in 2030 comes from renewable energy sources. CCS capacity rises to 360 GW, supplying 8 per cent of world electricity.

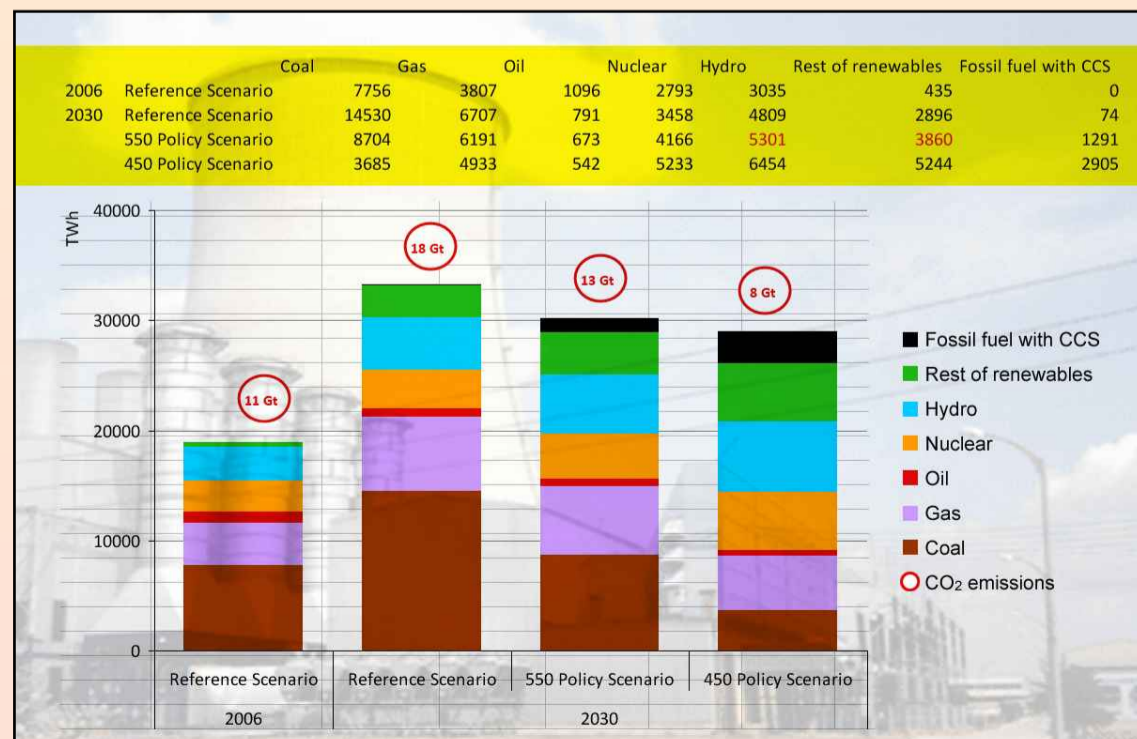
The *2008 World Energy Outlook* also analyses new capacity and investment.

In the *Reference Scenario*, total gross capacity additions amount to 4500 GW over the period 2007-2030, about 190 GW of new capacity per year through to 2030. The total investment needed to bring forth this capacity is \$6.8 trillion. In the *550 Policy Scenario*, total new capacity is over 4700 GW, at a total cost of \$8.2 trillion. New capacity in the *450 Policy Scenario* is substantially higher; it reaches 5700 GW, at a total cost of \$10.6 trillion.

The transition to low-carbon technologies will require a major transformation of the electricity sector. At present, uncertainty about climate policy is one of the greatest risks with which investors in power generation are currently faced. Climate policy will have a significant impact on the absolute and relative costs of different electricity generation options.

However, uncertainty about future climate policy creates great uncertainty about future generating costs and the merits of different investment options. This is likely to lead to delays in investments until greater policy certainty is available. The sooner policy makers can make decisions on climate change mitigation policies, the less risky investments in new power generation will be. Going forward, it will be important to minimise policy risk by providing a comprehensive, robust post-2012 framework, which instils confidence in the energy sector as to the direction of global policy for the foreseeable future, while yet preserving a modicum of flexibility to permit some modification in the light of experience.

Maria Argiri, is Senior Analyst at the International Energy Agency. This article is based on the IEA's "2008 World Energy Outlook".



Comparison of global electricity generation across scenarios, 2006-2030

An integrated tower of power

In November, a project got underway in Spain to develop an integrated solar-gas turbine combined cycle plant. The project brings the possibility of reduced electricity costs and improved dispatch possibilities for solar power, says Junior Isles.

Concentrating solar power (CSP) has been increasingly in the headlines in recent months. This summer, the US Department of Energy announced a new round of funding opportunities for CSP saying that it is ready to invest up to \$60 million over the next five years in projects aimed at commercializing the technology.

Unlike pV solar, CSP offers the opportunity of deploying solar power at utility scale. Essentially, it works in the same way as a solar oven. Tracking 'mirrors' or heliostats, focus the sun's rays onto a vessel containing a heat transfer fluid that is heated to hundreds of degrees Celsius. This heat is then used to power steam turbines in the same way that the heat from burning gas, oil, or coal is currently used.

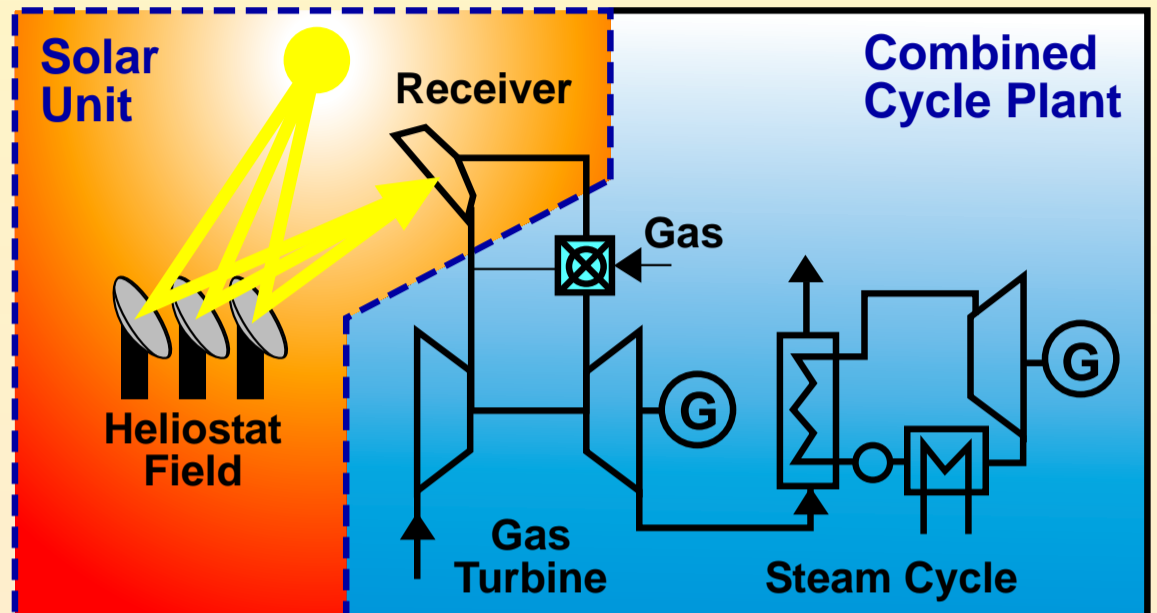
But instead of converting solar energy into steam to produce electricity via a Rankine cycle (steam turbine) cycle there is another way to utilise this heat. When air is heated under pressure, the solar heat can be conducted directly to a gas turbine cycle for air pre-heating.

Spanish company, Abengoa Solar has joined forces with German Aerospace Agency, DLR to develop 'solar power towers' for gas turbines and combined cycles. A project, known as Solugas, will be the first demonstration project to use a commercial-scale gas turbine. The main objective of SoluGas is to demonstrate the performance and cost reduction potential of solar-hybrid gas turbine systems at commercial scale.

A solar tower power plant consists of a tower surrounded by a field of heliostats. These heliostats direct solar radiation onto a receiver located at the top of the tower, which converts the concentrated solar radiation into high temperature heat.

In this latest project located near Seville, Spain, a tower will be constructed for the demonstration plant, which will house the receiver, hot gas piping and gas turbine module. It is not the first solar tower power project at the site. Abengoa Solar built an 11 MW plant with 624 heliostats and a 115 m high tower, which began operation last year. A 20 MW plant is also due to start up next year. These projects, however, use the heat to generate steam to drive a steam turbine.

The incorporation of a highly efficient combined cycle allows the reduction of the collector field. Speaking at the *European Turbine Network* conference in Brussels recently, Dr Reiner Buck of DLR said: "In this case the collector



Solugas solar-hybrid configuration. Heliostats direct the sun's radiation to a receiver to heat air, which is then used for air pre-heating in a gas turbine

field is a field of heliostats which is the most expensive part of a plant. It typically constitutes 50 per cent of the costs of a solar tower power plant. The purpose of solar air pre-heating of the air going to the combustor is that it offers quite a high potential for the reduction of electricity costs from solar compared to other technologies that are currently available."

about 800°C.

After leaving the receiver, the solar heated air is further heated up in the gas turbine combustion chamber with the help of natural gas until it reaches the turbine combustion temperature. The thermal energy is then utilized to produce electricity via the turbine and generator. The combustion system is situated in line with the receiver so that

The purpose of solar air pre-heating of the air going to the combustor, is that it offers quite a high potential for the reduction of electricity costs from solar

In the Solugas project, a field of 140 heliostats, each with an area of about 121 m², will concentrate the solar radiation onto the receiver where the solar energy is absorbed and utilized to heat pressurized air. The hot air is transferred directly into the combustion chamber of a gas turbine located at the top of the tower. The GT is a 4.6 MWe Mercury 50 recuperated gas turbine supplied by Solar Gas Turbines. The combustion and control system of the GT will be adapted to the special requirements of solar-hybrid operation.

In the first stage, for turbine design limitation reasons, the input temperature to the combustion chamber is limited to 650°C. However, the receiver and hot air piping will be prepared for the next step, for operating temperatures of

constant production of electricity can be guaranteed under hybrid operation regardless of weather conditions.

Dr Buck noted: "The amount of sun varies over the course of the day which varies the temperature of the preheated air that is fed to the combustor. This means the fuel fed to the turbine combustor varies significantly."

This solar-thermal approach allows higher conversion efficiencies due to the increase in operating temperature and high performance of combined cycles. Another important advantage is low water consumption of solar-powered gas turbines. Gas turbines at solar plants with heat recovery do not require cooling water, and water demand from hybrid operating combined cycles is reduced by almost a third compared to the needs of a steam cycle solar plant.

The receiver technology has been proven in previous research projects, which Abengoa Solar NT participated in. The first test of such a system was in the Solgate project. This demonstrated the interaction of the solar components with a 230 kW gas turbine. As of October, the plant had accumulated about 150 h. According to DLR, the system has operated as predicted. Testing will continue until February 2009.

After this, the project will be disassembled to make way for the next stage of development known as the 'SolHyCo' project. This will be a solar-hybrid cogeneration unit consisting of a solar receiver, a 100 kWe microturbine, an absorption chiller and water heat exchanger, where the cogeneration unit may be used for power

generation and air conditioning. This system is scheduled for installation in spring 2009.

The Solugas project, started in November and system tests are planned for 2010. Following installation and start-up, the intention is to carry out a demonstration test over 24 months connected to the power grid to validate the efficiency of the components and system performance. "There will be approximately one year of design and one year of installation, after which testing will begin," explained Dr Buck.

As the first MW-scale solar-hybrid turbine system demonstration plant, Solugas is an important step towards commercialization of this technology. The project is being partly financed under the EU's 7th Framework Programme aimed at bringing together technology leaders with specific know-how in different subsystems. The project has an eligible cost of €1.6 million, of which the EU will contribute about €6 million.

The high cost and intermittent nature of solar power has been prohibitive to its widespread commercialization. The main aim of the project is therefore to demonstrate, on a commercial scale, a solar tower using air as working fluid in the receiver, to reach higher temperatures and improve the overall efficiency of the cycle. DLR has performed an analysis of the performance and cost predictions of a combined cycle with four Mercury-50 gas turbines on one tower, for a total electrical output of 28 MWe.

For a maximum solar receiver temperature of 800°C and an annual operation of 4000 h, the unit cost of electricity is estimated at €0.085/kWh. This cost is predicted to fall with increased solar receiver temperature and number of operating hours.

If successful, DLR figures show that the project will help to achieve significant cost reduction for solar electric power generation and help to achieve European targets for electricity generation from renewable energy sources. Further, these developments will go a long way towards making CSP systems more competitive with conventional electricity sources.

Performance and cost predictions

Design Point	800	1000	1000
Max. solar receiver temperature (°C)	800	1000	1000
Heat rate (kJ/kWh)	3556	1580	1580
CO ₂ emissions (kg/kWh)	0.2	0.089	0.089
Solar share (%)	55.6	80.2	80.2
Annual operating hours	4000	4000	6000
Heat rate (kJ/kWh)	5381	4453	5636
CO ₂ emissions (kg/kWh)	0.302	0.250	0.316
Investment cost (€/MWe, millions)	1.25	1.46	1.46
Levelling electricity cost (€/kWh)	0.085	0.086	0.072

Configuration: Combined cycle with 4x Mercury-50 on one tower, 28 MWe
Annuity: 10 %
Fuel: natural gas, €20/MWh
Heliostat: €140/m²



Junior Isles

From Christmas to crisis?

The past few years must have felt like Christmas every day for most players in the power sector. Electricity demand has grown in line with global economies, bearing gifts of new orders for equipment suppliers. But the credit crunch may see Christmas turn to crisis as its chill wind threatens to add to the considerable turbulence that the energy industry experienced in 2008.

If the financial crisis does have an impact, it is the utilities and power companies that are likely to feel the effects first.

In the US, the place where it all began, the early signs are already being seen. Some experts believe the stage is set for widespread consolidation among the more than 250 mid- and large-size utilities and distribution companies over the next 12-18 months.

Two potential mergers were announced in October – Warren Buffet's bid for Constellation Energy and Exelon's proposed takeover of NRG Energy. Analysts say Reliant Energy, Dynegy, Calpine, AES and Mirant are likely to be next.

The outcome of these potential deals and final fate of many companies will be determined by the availability of finance.

In November, NRG Energy, rejected as "risky" and "opportunistic" the unsolicited \$6.2 billion merger bid by Exelon to create the US's largest power producer. With the bid coming as the credit crisis hit the equity and debt markets, the deal faced difficulties in financing.

Bankers said that NRG has about \$8 billion debt, which upon a change in control must be financed. They said Exelon would like NRG to help it refinance since Exelon does not have the money to do the deal.

The crisis should have less effect on companies that have greater liquidity. Bruce Williamson, chief executive officer of Dynegy recently noted that his company had \$2 billion of liquidity, including \$855 million cash and no significant debt maturities until 2011. He said that the credit crisis should therefore not affect his company.

It is a sentiment that has been echoed in Europe. In announcing its latest

financial results, Lars Josefsson, CEO of Swedish utility, Vattenfall, said: "The turmoil in the financial markets has led to greater uncertainty in the general operating environment. However, it has not affected Vattenfall's earnings. Our liquidity situation remains favourable, and we do not have any immediate borrowing needs. We have strict and clear rules for managing liquidity, financing and credit risks."

In any event, Europe will not see the same level of consolidation that may be looming in the US. As a result of deregulation, there has already been a significant amount of consolidation over the last decade and now only a handful of large players remain.

Energy companies will make more careful assessments of where they invest, with the riskier projects likely to fall away

Buoyed by high energy prices, there is little evidence that the credit crisis has had an impact on any of its energy giants.

EDF said its operations to date have not been significantly hit by the financial crisis. The company maintained its objective of organic growth in earnings before interest, taxes, depreciation and amortization of around 3 per cent for the full year.

Meanwhile, Vattenfall reported consolidated net sales of SEK37.02 billion for the third quarter of 2008, a 17.2 per cent increase compared to SEK31.59 billion for the same period of 2007.

Nevertheless, some European companies will start to restructure their operations and begin to pull in the reins.

Fulvio Conti, chief executive officer of Italy's Enel, reaffirmed the company's target of cutting its debt to below €50 billion this year. Its debt had soared with the purchase of Endesa and was €51.4 billion at September 30th. Enel's board also approved the launch of the sale process for its natural gas network in a debt-cutting move. An agreement is expected early next year, Conti said. Enel also could list its renewable energy unit next year but

if market conditions are unfavourable it could seek private investors to take a minority stake, he said.

Enel had earnings before interest, tax, depreciation and amortisation (EBITDA) of €1.3 billion, up almost 69 per cent. Enel forecast 2008 EBITDA of more than €4 billion, up from €1.02 billion last year, and expects EBITDA next year to be higher than this.

However, the company will be cancelling or rethinking some projects in response to a slowing economic climate. It expects to earmark €5-6 billion in capital spending next year, down from €6.5 billion seen this year, executives said. "If economies are slowing down, there is no reason to

accelerate investments," said Conti.

It is likely that energy companies will make more careful assessments of where they invest, with the riskier projects and markets likely to fall by the wayside.

Independent power producer projects are also more likely to be affected than utility projects and the projects that are less fundamentally and economically sound may disappear.

At the CEPSI conference in Macau, Colin Tam, CEO of developer, AEI Asia Ltd, said: "We are at the lowest point in 41 years. There will be a recession in 2009 bringing fundamental changes in the energy market."

As a seasoned player in the Asian IPP market, Tam is no stranger to risk and crisis. He believes that "unpredictable market forces will create new risks for the power generation sector". While he believes that Asia is facing shortages caused by a shortage of fuel supply or lack of installed capacity, he said the "risk-reward formula is inadequate to create the climate for new investment". He added: "A return on investment of 8-10 per cent was not enough before the financial crisis and will be even less attractive with the financial crisis."

The extent of the impact of the

financial crisis on the energy sector is anyone's guess, but certainly much will depend on how long the crisis lasts.

For many equipment manufacturers, the slowdown will at first have little effect since their order books are full. With large order backlogs, if anything it will give them the chance to catch their breath. However, their sub-suppliers and sub-contractors will be hit first and the large OEMs will have to ensure that their terms of credit do not push these smaller companies into bankruptcy.

If the financial crisis deepens and becomes more protracted, then the large equipment manufacturers may also face problems. It is unlikely that a full order book will allow them to ride out a crisis that extends beyond the next 12-18 months.

Although it is too early to assess the full likely impact, the good news is that the fundamentals of the energy sector remain sound. While any GDP slowdown will have a corresponding impact on power demand, albeit with a lag, people will not stop using electricity.

The US has an ageing distribution infrastructure and still has a need for new capacity. China is still installing 1 GW of new capacity a week and the IEA's latest *World Energy Outlook* predicts that world electricity generation, in its *Reference Scenario*, is projected to grow at an annual rate of 3.2 per cent in the period 2006 to 2015.

Those that have been around long enough, will know that the power industry goes through cycles. The last big downturn was in 2002-03; but it was not long before it rebounded stronger than ever.

This means that money will still flow into the sector. Observers believe that private capital will fill the gap developing from companies' lack of access to the public equity and debt markets on which the power industry traditionally depends.

So although the long-term future is certain, I am doubtful whether anyone this Christmas will be singing *Silent Night* with any true conviction. All is neither calm nor bright.



"What do you mean you're all cancelling...?"