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THE ENERGY INDUSTRY TIMES

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Disputes continue over carbon cuts

Christiana Figueres: "high-level political attention" is needed

As global leaders continue to make little progress on an international agreement to replace the Kyoto Protocol, the EU's attempt to introduce tougher carbon emission targets has also now been blocked. **Junior Isles**

World political leaders must step into climate negotiations in the next few months to unlock disputes over reducing greenhouse gas emissions.

At the end of a two-week negotiating session among more than 180 countries last month, the UN's top climate chief Christiana Figueres said it will take "high-level political attention" to resolve mutual demands between industrial countries treaty-bound to reduce carbon emissions and countries who now have no legal obligations on

fighting global warming.

Developing countries insist that the nearly 40 countries bound to specific reduction targets by the 1997 Kyoto Protocol renew and expand their commitments when they expire in 2012. But the wealthy countries say they want the rest of the world to show willingness to accept legal obligations, if not now at least in the future.

With the next major climate change conference scheduled for Durban, South Africa, near the end of the year,

Figueres says even if delegations resolve the Kyoto dispute in Durban, there will be no time for countries to ratify an extension, leaving a "regulatory gap". Countries must find a way to bridge that gap between the expired commitment period and the one that succeeds it, she said.

If the European Union also pulls out of Kyoto, it could spell the death of the 14-year-old pact, the only international treaty limiting CO₂ emissions. "The EU needs to see a

signal of progress toward an internationally binding legal agreement by other countries," said Jurgen Lefevere of the European Commission.

But even in Europe problems are beginning to emerge with plans to make deeper emission cuts within the 27-member bloc.

Poland has moved to block a proposal to toughen the EU's current

Continued on page 2

Energy majors focus on solar

International oil majors are putting an increasing focus on expanding their presence in the solar power market.

French oil producer Total SA has completed its \$1.3 billion takeover of solar power company SunPower Corp., boosting the oil giant's renewable energy presence.

Total said it closed the deal, buying 60 per cent of SunPower shares with an all-cash tender.

"Today marks a new stride forward for Total in the solar power industry," Total Gas & Power President Philippe Bousseau said in a statement.

SunPower CEO, Tom Werner, said the sale will help SunPower expand by boosting its market access and research and development programme.

SunPower designs and delivers solar electricity systems for businesses and homes.

Meanwhile, BP Solar International, Inc., a designer, manufacturer and marketer of solar energy products, has launched the BP Solar Associate Developer Program, or ADP, which it says combines the strength and experience of BP with solar developers in strategic markets.

The BP Solar ADP is designed to leverage the local reputation, relationships and expertise of small to medium sized developers and adds BP's financial strength and project development experience to more adeptly navigate the development process and thereby bring more

projects to fruition.

"BP Solar continues to build a strong pipeline of projects in strategic markets in the US and around the world," said BP Solar CEO Mike Petrucci. "This development model allows us to invest in promising projects – leveraging local knowledge and expertise of our partners – while creating the flexibility to maximise returns for all parties."

BP Solar already has over 100 MW secured through ADP in California and is working with several other developers in other US solar markets, as well as Central and South America, Australia, and Asia. The company expects to launch the ADP in Southern and Eastern Europe, the Middle East and Africa this summer.

Interest in solar power has been gaining momentum as costs continue to fall. In parts of the US, the cost of solar power is nearing that of other types of energy at peak times, and analysts and experts expect global demand for it to take off. Solar power costs have fallen by about 60 per cent in the past five years due to technological advances, manufacturing efficiency and reduced profit margins.

Experts from the IEEE say solar photovoltaic (PV) systems have the potential to be the most economical form of generating electricity, even compared to traditional fossil fuels, within the next 10 years.

It says to achieve this cost parity,

the global industry must continue to improve the efficiency of solar PV cell technologies and create economies of scale to further decrease manufacturing costs.

"Solar PV will be a game changer," said James Prendergast, IEEE Senior Member and Executive Director. "No other alternative source has the same potential. As the cost of electricity from solar continues to decrease compared to traditional energy sources we will see tremendous market adoption, and I suspect it will be a growth limited only by supply. I fundamentally believe that solar PV will become one of the key elements of the solution to our near- and long-term energy challenges."

(Continued from page 1)

goal of reducing carbon emissions by 20 per cent by 2020. At least seven countries had backed higher targets before an EU ministerial meeting last month.

The UK had pushed for a 30 per cent cut. Officials said all 27 members, except Poland, supported a compromise target of 25 per cent. The officials acknowledged that the figure was not a binding commitment, but a suggested milestone in a long-term roadmap to reduce emissions at least 80 per cent by 2050.

The EU was hoping that the meeting would lock-in progress before Poland's six-month EU presidency begins this month.

The news comes at a time when energy-related global carbon dioxide emissions have hit an all time high. According to the latest estimates from the International Energy Agency, after a drop in 2009 as a result of the global financial crisis, emissions in 2010 are estimated to have climbed to a record 30.6 Gt – a 5 per cent jump from the previous record year of 2008.

Carbon emissions from electricity generation climbed to a record in 2010, led by coal fired power plants, as growth accelerated in emerging economies. Worryingly, the IEA estimates 80 per cent of projected CO₂ emissions from the power sector in 2020 are already locked in, as they will come from power plants currently in place or under construction.

However, it noted that the electricity sector can contribute almost 50 per cent of the emissions reductions needed to hold the rise in global temperatures below 2°C, through steps such as improved energy efficiency, greater renewable power generation and the increased roll-out of electric cars.

As the "largest and fastest-growing" source of carbon dioxide, the IEA argues that the electricity sector will play a central role in meeting climate goals. Bo Diczfalussy, director of sustainable energy policy and technology at the IEA, said a shift to low-carbon electricity supply is achievable, but warned it will involve "significant challenges".

The report also notes that existing electricity market structures "may not be optimal for decarbonisation", and says policies that address investor risk "may be needed as part of a least-cost response".

"A key question for policymakers will be whether to use targeted measures to ensure capital cost recovery for low-carbon investments, or whether to introduce (or modify) market-wide policies such as capacity payments that cover all generation," the report says.

The IEA said carbon pricing remains "a cornerstone policy" in climate change mitigation strategies, which can encourage a shift to low-carbon electricity through fuel-switching in existing plants, affecting the economics of new plants and encouraging the retirement of older, high emissions plants.

Chinese wind turbine manufacturers under pressure

■ Manufacturers forced to install LV ride-through technology
■ Subsidies stopped after WTO complaint

Junior Isles

China's wind turbine manufacturers are likely to come under increasing pressure as a result of the government's plan to issue stringent national standards for wind turbine manufacturers, and a decision to stop subsidising domestic manufacturers of wind turbine components.

Following incidents where a total of 1346 wind turbines were disconnected from the power grid on April 17 in Gansu and Hebei provinces, stringent national standards are being drawn up that require all installed wind turbines to be equipped with low-voltage ride-

through (LVRT) capability to ensure stable connection to the power grid.

It costs Yuan10 000-500 000 (\$1550-\$77 500) to upgrade a single wind turbine by installing LVRT, depending on the turbine model, said experts from Denmark-based Vestas Wind Systems, a leading international wind turbine manufacturer.

"Some turbine models merely need software upgrading, while others require much more than that," said Shi Haifeng, an expert with the Finland-based The Switch, a leading supplier of wind turbine components.

"This will put considerable pressure on wind turbine makers and wind farm

operators to upgrade China's 34 000 wind turbines," said Li Yinghua, deputy director of the security regulatory bureau under the State Electricity Regulatory Commission (SERC).

At present, most of China's installed wind turbines do not have the LVRT capability and domestic manufacturers are upgrading their machines in the wake of the recent incidents in Gansu and Hebei provinces.

The State Grid, China's largest power distributor, issued the current standards in practice for wind power operators in 2009, but these were not enforced nationally.

The industry received an earlier blow when China agreed to stop subsidising domestic manufacturers of wind energy turbine components after the United States filed a complaint with the World Trade Organisation (WTO), alleging the subsidies illegally shut out foreign competition.

The subsidies, valued at between \$6 million and \$22 million, were challenged by the United Steelworkers Union. It was one of several complaints US trade officials have made about Chinese support for its exporters, which Washington says unfairly boosts China's massive surplus in bilateral trade.

Nuclear defeat will boost Italy's renewables

A referendum in Italy, which saw 95 per cent of voters reject the re-introduction of nuclear power generation, may signal a potential shift toward renewable energy.

The referendum – in which the electorate also rejected the privatisation of municipal water supplies and legislation that protects the prime minister from prosecution – attracted a turnout of around 57 per cent. This was 7 per cent more than the turnout required to make the results legally binding.

Prime minister Silvio Berlusconi, who was attempting to revive the country's nuclear programme after it was dropped nearly 25 years ago following the Chernobyl disaster, said: "We must probably say goodbye to the possibility of nuclear power stations and we must strongly commit ourselves to renewable energy."

Berlusconi's government had made

a last-ditch attempt to have the vote scrapped but Italy's constitutional court, known as the Consulta, unanimously approved the referendum, in a decision welcomed by environmental groups.

While the outcome of the vote may be good news for renewable energy in the long run, with solar subject to regulatory uncertainty it is likely that gas will meet most of the need for additional capacity in the short- to medium-term.

Berlusconi's statement, coupled with a Pew Environmental Group Report at the end of March should provide a strong measure of comfort to investors in Italy and around the world who have been considering green technology strategies. Pew's research indicates that in 2010, world investment in the clean energy sector increased to \$243 billion, representing a 30 per cent growth rate over the previous year.



kissing goodbye to nuclear:
Italian PM Silvio Berlusconi

Islamic funding could play important role in energy

Delegates at a recent Bahrain Association of Banks (BAB) roundtable in Bahrain heard that Islamic finance could play an important role in raising around \$10 trillion in project finance needed between now and 2030 to fund energy and infrastructure globally.

Nicholas Polley, a finance lawyer at international law firm Charles Russell LLP, told the meeting that some \$7.2 trillion will be needed for energy projects along with a further \$2.8 trillion for infrastructure projects. He said that Islamic finance could

play an important role in this with funding for a project or asset that had to be constructed using a Sharia-compliant Istisna vehicle.

Polley said for a project that has already been completed, an Ijara leasing structure arrangement should be used.

In the GCC alone in the medium-term, project finance would need to raise around \$1 trillion according to Developed Solutions principal consultant, Riyad Al Dughaiter. He noted that the GCC is looking at mega projects in housing, hospitals and

other infrastructure from power, water and oil and gas to airports and railways to meet the demand of a young, rapidly growing population.

"Given the size of spending, this will not be achieved by bank-syndicated lending at a time when in the wake of the financial crisis regional and global banks have a lesser appetite for lending. Projects will have to tap into alternative sources of funding such as capital markets, sovereign funds, public-private partnership and Islamic funding sources and as a centre for

the Islamic financial industry, Bahrain can have a strong role here," he said.

Instrata Capital director Patrick Townsend, a fund manager specialising in infrastructure investment in the Middle East and North Africa region, said there was a shortage of debt finance in the region but no shortage of equity. "The cost of debt has risen but the cost of equity has fallen," he said.

"The high oil price is allowing governments to develop infrastructure projects which will create jobs for their nationals," he added.

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Exports signal end for gas glut

Siân Crampsie

Natural gas prices in the USA could rise over the next few years if producers are allowed to export the commodity overseas.

A supply glut and the effects of the recession have caused the price of natural gas to tumble over the last few years but recent analyses indicate that it could almost double to \$8 per million Btu if producers tap markets in Europe and Asia.

A rise in natural gas prices would be good news for the USA's renewable energy industry, which has expressed concerns over the potential for natural gas to compete with cleaner renewable technologies in the power generation market.

There is also concern in the US power industry that natural gas could dent investment in new nuclear power

power projects.

Natural gas prices in the US have risen three per cent in 2011 so far, reaching \$4.80/million Btu in mid-June.

In May, the US Department of Energy approved a plan for Houston-based Cheniere Energy to export liquefied natural gas overseas from a planned terminal in Louisiana. Under the first ever approval for the overseas export of US-produced gas from the lower 48 states, Cheniere will export 2.2 billion cubic feet per day from the Sabine Pass terminal, which could start operations in 2015.

Two other permits for the export of natural gas have been submitted to the DOE: one from Freeport LNG Expansion and Liquefaction to export 1.4 billion cubic feet of natural gas per day from a terminal port near Freeport, Texas; and a second from Lake Charles



- First export license granted
- Report advocates a switch to gas

Exports to export 2.0 billion cubic feet a day from its Lake Charles, La., facility.

In its export application, Cheniere Energy said that natural gas prices in the United States would increase by up to 11.6 per cent when the Sabine terminal begins exports.

A report in the *Pittsburgh Tribune Review* newspaper said that the two export applications pending with the DOE, combined with the license granted to Cheniere, represent 8.4 per cent of US natural gas production. Other companies – including Sempra Energy and Dominion Resources – are also considering export markets for natural gas.

Natural gas prices in markets such as China, India, other parts of Asia and Europe are more closely linked to oil prices and can be up to three times higher than prices in the USA.

Exporting natural gas to these markets would reduce the supply glut in the USA, boost prices and encourage more investment in production, say proponents.

Others have expressed concerns over the impact of exporting domestic resources on energy security. The manufacturing sector is also concerned about the impact that increased prices would have on the USA's economy.

A recent report from the Massachusetts Institute of Technology said that the increasing supplies of natural gas in the USA had given manufacturers a competitive advantage. It suggested that power generators could cut emissions of greenhouse gases and comply with proposed pollution limits from the Environmental Protection Agency by switching from coal to gas-fired boilers.

Brazil tests smart grid gear

International energy and technology companies are eyeing Brazil's potential as a key market for smart grid technology.

Trilliant and AES Eletropaulo have announced plans to collaborate on a smart grid R&D project in Sao Paulo, while Enel and Endesa have embarked on a groundbreaking project to install and test smart meters in Brazil's Fortaleza area.

In Sao Paulo, AES Eletropaulo is hoping to improve system monitoring and data management by using GE smart meters and Trilliant's wireless communications technology. It says that the project will demonstrate the benefits of smart grid technology such as giving consumers better control over their energy use and improving grid reliability.

"We want to prove the benefits of smart grid architecture with this project and soon expand the solution throughout our distribution system," said Richard Van Erven, director of technology services at AES Eletropaulo.

Endesa's Brazilian subsidiary, Coelce, has installed 100 digital electricity meters at customer sites, echoing similar projects carried out

in Europe by Enel.

The two European utilities want to test Enel's remote management system and say that the project will make a valuable contribution to the development of smart grids in Latin America.

Brazil is the first country in Latin America to begin developing a regulatory framework for remote management.

Sentinel clears financing hurdle

US power developers have raised financing for two key projects, signalling the return of investors to both the conventional and renewable power markets.

Competitive Power Ventures, Inc. (CPV), GE Energy Financial Services and Diamond Generating Corporation (DGC) announced last month that they have closed the largest project financing in the US thermal power industry this year.

In addition, renewable energy developer Terra-Gen Power has raised \$631 million in financing for the largest

wind farm in the US.

CPV, GE and DGC are co-owners of the planned \$900 million Sentinel power plant in California, which will provide peaking power as well as support for nearby wind farms. The 800 MW gas-fired facility is scheduled to enter commercial operation in mid-2013.

Some 23 banks – working with lead arrangers MUFG, Royal Bank of Scotland, ING, Natixis and Sumitomo Mitsui Banking Corp. – agreed to provide credit facilities of nearly \$800 million for construction and other

capital needs. With almost \$2 billion of commitments received from lenders, interest in the project was so high that the syndicated loan was 2.4 times oversubscribed, says GE.

Also in California, the construction of two 150 MW wind projects at Terra-Gen's Alta wind farm will push the facility's total capacity above 1 GW. Financing for the project includes a seven-year construction and term loan, a bridge loan to the investment tax credit cash grant from the US Department of Treasury, and ancillary credit facilities, according to Terra-Gen.



Alabama reaches CCS milestones

US research and development efforts in the carbon capture and storage (CCS) field have taken significant steps forward recently with the commissioning of two key projects.

The US Department of Energy (DOE) has announced the successful start-up of a facility in Alabama that is designed to test post-combustion CCS technologies, while Southern Company said that its 25 MW CCS demonstration facility – also in Alabama – has started operating.

The DOE's Post-Combustion Carbon Capture Center (PC4) was installed at the Alabama Power Gaston power plant Unit 5, an 880 MW supercritical pulverised coal unit. The slipstream test facility will test a number of technologies at different scales, including new solvents, sorbents and membranes.

Southern Company's CCS facility is the world's largest for a coal-fired generating plant, and will capture approximately 150 000 tons of carbon dioxide (CO₂) annually for permanent underground storage in a deep saline geologic formation.

"This is a significant milestone in our continuing efforts to research, develop and implement 21st century coal technologies," said Southern Company Chairman, President and CEO Thomas A. Fanning. "Because coal is a low-cost and abundant natural resource, it is important for Southern Company and the industry to preserve coal as a fuel source."

PC4 is part of the DOE's wider National Carbon Capture Centre (NCCC) project, which is designed to speed development of a variety of CCS technologies.

Initial testing at the PC4 began recently when researchers used a solvent called monoethanolamine (MEA) to capture carbon dioxide (CO₂) from a slipstream of flue gas from the plant. To date, the MEA solvent has exceeded the expected 90 per cent CO₂ capture, and the unit is now in steady operation capturing about 10 tons of CO₂ per day.

Data from these initial tests will be used as a baseline to evaluate the performance of emerging CO₂ capture technologies.

Report highlights the dark side of the sun

The USA's electrical grid is becoming increasingly vulnerable to solar activity, a new report says.

Components of the country's network are becoming increasingly intricate and complex, says Standard & Poor's, and this, coupled with the strong likelihood of catastrophic cascading failures.

According to a recent article in *Scientific American*, there is a one in 20 chance of a solar super-storm in the next 15 years. Such storms cause fluctuations in the earth's geomagnetic field, which in turn damage electrical equipment such as transformers, and cause harmonics and reactive power.

The sun goes through cycles of high and low activity, with the next period of maximum activity expected in 2013-2014.

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Japan counts cost of Fukushima

As Japan counts the cost of the disaster at the Fukushima Daiichi nuclear power plant, some believe that Asia will remain the key region for growth in new nuclear build. **Syed Ali**

The cost of scrapping the Fukushima Daiichi nuclear power plant as well as compensating evacuees could total up to Yen20 trillion (\$250 billion) over the next decade, according to an estimate by private

think tank, the Japan Center for Economic Research (JPCER). But despite the massive costs, a number of Asian countries plan to continue pursuit of their nuclear ambitions. In a presentation to the

government, JPCER said the cost of scrapping all six reactors at the Fukushima complex, crippled by an earthquake and tsunami on March 11th could be up to Yen15 trillion. It said compensating people who have been evacuated from areas located within 20 km from the plant could reach around Yen630 billion.

The plant's owner, Tokyo Electric Power, has already said it expects to lose Yen570 billion (\$7 billion) in the coming year. The net loss for the business year ending next March does not include compensation to people affected by the disaster.

Yet despite the blow to the sector, some experts argue that nuclear power still makes sense for Asia, especially China.

Yun Zhou, a Harvard post-doctoral fellow in nuclear security, told the *New York Times*: "China should be doing what it has been doing. With its population, with its economy, China needs to use nuclear power. And it's better for its power security. The key issue is whether it can

maintain the safety record."

China, which already has 13 reactor units in operation, is proceeding with plans to build 28 more, while readying for comprehensive inspections and assessments of nuclear plants. Yun said China has placed a high priority on safety, "but if you have 70 or 80 plants, that's a different story."

Taiwan also plans to continue with construction of its fourth nuclear plant, although start up will be delayed while safety measures are improved.

Chen Yi-bin, director of the council's Department of Nuclear Regulation, said the facility is unlikely to go online at the end of next year as planned. January 2014 has been mooted as a more likely start date.

Meanwhile, Michael Angwin, CEO of the Australian Uranium Association, told an International Uranium Conference in Perth last month that Australia should try to get its first electricity generating nuclear reactor up by 2022.

Thailand focuses on low carbon technologies

Thailand boosted its green credentials as state utility Electricity Generating Authority of Thailand (Egat) announced plans to use advanced clean coal technology. Independent power producer Ratchaburi Electricity Generating Holding Plc also said that its 100 MW of renewables projects will be operational ahead of time.

Egat is looking to convert its ageing Mae Moh coal fired plant to an integrated gasification combined cycle gas turbine (IGCC) plant.

The company aims to replace units 4 and 7 of its lignite-fired power generator with an IGCC plant of 600 MW. It has asked the Institute of Energy Economics of Japan to do a feasibility study on the project.

Egat, which announced in May that it is spending Baht 66 billion (\$2.15 billion) to build three 800 MW gas-fired power plants, has been trying to diversify its fuel sources for electricity generation. Natural gas now accounts for 72 per cent of electricity production.

Thailand is making progress in increasing the share of renewables in the generation mix. Ratchaburi recently said it expects to complete its 100 MW renewable energy programme ahead of the original 2016 target and will explore more solar and wind opportunities both at home and abroad.

"We had planned to have 100 MW worth of renewable energy projects by 2016. But now it looks like these projects will be up and running well ahead of that target, so now we're planning additional projects," said Ratchaburi president Noppol Milinhanggoon.

Through its joint venture with Yanhee Solar Power, Thailand's largest private power producer will spend Baht5 billion this year to develop eight solar farms with a combined capacity of 34.25 MW. The first 3 MW unit began operation last month.

S. Korea to invest in energy storage

South Korea will invest Won6.4 trillion (\$5.94 billion) by 2020 in developing its energy storage industry.

The government will spend Won2 trillion in research and development (R&D) and invest 4.4 trillion won in building up infrastructure in the next 10 years in cooperation with private companies, the Ministry of Knowledge Economy said in a statement. The plan is aimed at nurturing an indigenous market for energy storage systems.

Energy storage facilities will be of greater significance down the road as variable renewable sources such as wind and solar are expected to meet a greater portion of total power demand.

The ministry said energy storage is a technology for balancing supply and demand when renewables exceed 10 per cent of total electricity production.



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Conservation and emissions plan presents challenge

China's combined plan for improving energy conservation and reducing emissions could present a big challenge according to Han Wenke, head of the Energy Research Institute of the National Development and Reform Commission (NDRC).

In the national development plan for 2011-2015, China plans to reduce energy consumption per GDP unit by 16 per cent by 2015 from 2010. Han said, however, the plan would be difficult for China to meet since there is no longer much scope for closing down outdated capacity in 2011-2015 following the elimination of a large amount of small thermal power generating capacity and production capacity in high energy-consuming industry in 2006-2010.

According to statistics by the NDRC

and the National Bureau of Statistics, China's energy consumption per GDP unit decreased by 19.1 per cent by the end of 2010 from 2005, fulfilling the energy conservation target for 2006-2010. However, to achieve the target, electricity use was ruthlessly rationed in parts of the country.

Jiang Kejun, a researcher at Energy Research Institute of the NDRC said that China's carbon emission will peak in 2025 and also noted that its power industry will face "grim challenges" in energy conservation and emission reduction.

China made two separate plans for energy conservation and emission reduction during 2006-2010 but combined them into a single plan for 2011-2015, which is soon to be released.

The NDRC is now drafting a special plan, likely to come out next month (August), that outlines specific implementation measures for the combined energy conservation and emission reduction plan. It will be submitted to the State Council after soliciting public opinions.

China plans to pilot carbon trading in six provinces during 2011-2015, including Beijing, Chongqing, Shanghai, Tianjin, Hubei and Guangdong.

However, there is as yet no plan to set up a national carbon trade market since there are no set carbon emission reduction targets for provinces and regions. Also, the scale of national carbon trading will depend on how much potential China has for carbon emission reduction after fixing the



Han Wenke:
head of the
Energy
Research
Institute
of the
NDRC

targeted total energy consumption volume for 2011-2015.

In Chongqing alone, energy consumption in 2010 totalled 62.5 billion kWh. According to China Guodian Corp., power consumption in the province is expected to grow at an annual average rate of 12.1 per cent over the next five years.

Zhu Yongpeng, general manager of China Guodian Corp., one of the country's largest state-owned power companies said: "Chongqing's fast economic growth has brought great opportunities for the development of energy."

In a statement, China Guodian Corp. said it is planning to invest Yuan 20 billion (\$3 billion) in the development of energy programmes in the province over the next five years.

Asset sell-off to resume

The Philippines is to resume the sale of the remaining power generation assets and contracted capacities, promising that the bidding programme would resume this month.

Despite opposition from certain members of Congress, Energy Secretary Jose Rene D. Almendras has assured energy stakeholders that there would be no further delays in the bidding programme. The programme is expected to kick-off with the independent power producer administrator (IPPA) contract for the 149 MW Naga power facility.

The IPPA contract for the 640 MW Unified Leyte geothermal complex would likewise be pursued within the third quarter despite a pending House bill seeking the deferment of the auction, according to Almendras.

The government's Power Sector Assets and Liabilities Management Corp. (PSALM) had eight to nine contracts, between state utility Napocor and IPPs, to transfer to private-sector IPPAs.

Under the Electric Power Industry Reform Act, the transfer of the management and control of at least 70 per cent of the total output of power plants under contract with Napocor to IPPAs is one of the conditions for implementation of retail competition and open access.

IPPAs are qualified independent entities that will administer, conserve and manage the contracted energy output of Napocor's IPP contracts, including selling the energy production and/or offering ancillary services.

The total capacity of all IPP contracts to be bid out is 6252 MW.

India to double use of renewables

India is aiming to double the level of renewable power in the country to represent 10 per cent of the total generation mix by 2015.

At a recent conference organised by the Confederation of Indian Industry (CII) and Ministry of New and Renewable Energy (MNRE), Pramod Deo, chairperson, Central Electricity Regulatory Commission said: "Promoting increased use of green power is for our own energy security."

He added: "There is a general apprehension that green power is costly. The costs are going to be flattened in the next five years. Regarding tariffs, all state regulatory commissions should take [the] CRC tariff as [the] guiding tariff. From the point of view of sellers, operational issues like connectivity should be addressed."

Notably, S. Chandrasekhar, Chairman, CII-Karnataka State Council said Karnataka will add another

6000 MW capacity in the next two years with the passing of a new energy policy last year.

According to a report by KPMG India, India's solar power generation capacity will reach 68 000 MW by 2021-22, triple the government's target and accounting for around 7 per cent of the country's total installed capacity by that year.

KPMG expects the tariff for solar power to decline 5-7 per cent every

year due to factors such as technological innovation, economies of scale, and the emergence of low-cost equipment production centres. It also predicts the cost of generation from thermal plants will increase 4-5 per cent every year due to increases in fuel costs and the capital costs of greenfield projects. The report adds that the cost of generating solar power will be on a par with that of conventional thermal electricity by 2019-20.

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Spotlight thrown on German policy

Siân Crampsie

Germany's decision to close its nuclear power plants early has angered utilities but has left its European neighbours looking for opportunity.

Nuclear operators in the country have launched legal actions against the government and announced plans for winning compensation, while France, Poland and Russia say that they will be able to increase energy exports to Germany in order to help it replace its nuclear capacity.

Vattenfall said that it expects "fair treatment and compensation" for the financial losses that it will incur as a result of the move by Germany, while E.On announced that it "expects to receive due compensation for the financial damages associated with these decisions".

Vattenfall has shares in three nuclear power plants in Germany, two of which will close with immediate effect,

and one by 2021. The closures will negatively impact Vattenfall's operating profit for the second quarter of the year by about SEK10 billion (€1.15 billion), said the Swedish firm.

E.On said that it expects financial damages to amount to billions of euros. It has also announced plans to take legal action against the nuclear fuel rod tax, which was introduced this year and which the German government wants to keep in place.

The German government said in early June that the closure of three of the country's 17 nuclear power plants would be brought forward to 2015, 2017 and 2019 instead of 2021.

The country's seven oldest plants are to remain closed following the moratorium on operation that was imposed after the earthquake and tsunami struck Japan in March.

The government announced in May that all of its nuclear power plants would be off-line by 2022 at the latest.

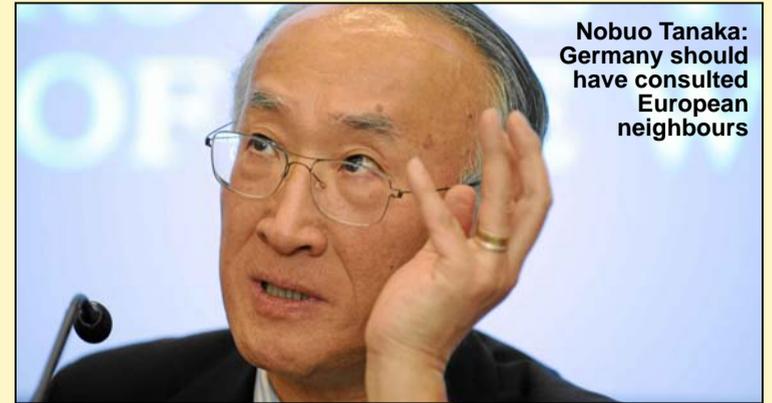
The policy has raised questions about the impact of nuclear plant closure on Germany's energy sector and its economy, as well as on the wider European energy system.

Nobuo Tanaka, Executive Director of the International Energy Agency (IEA), said last month that Germany's decision would have implications for other countries in Europe, particularly in terms of energy and carbon prices. He suggested that Germany should have consulted its European neighbours before making its decision.

"One country's decision could compromise the security and sustainability of energy in the whole of Europe," said Tanaka.

The French government has also called for the European Commission to organise a ministerial meeting to discuss the effects of Germany's decision to phase out nuclear energy.

France is likely to gain from Germany's decision, however, as it



Nobuo Tanaka:
Germany should have consulted European neighbours

- Utilities plan for financial compensation
- Wider implications for Europe

will be required to increase exports of electricity to its neighbour. In April, German electricity imports from France rose by 43 per cent and cost Germany an additional €60 million.

Russian gas firm Gazprom also says that it sees opportunity in Germany's decision. In addition to increasing gas supplies to Germany, Gazprom said it would investigate opportunities to construct new gas-fired power plants in the country.

Poland's Prime Minister Donald Tusk said that Germany's decision would put coal-fired generation "back on the agenda".

German Chancellor Angela Merkel has acknowledged that the nuclear phase-out will result in greater use of coal-fired generation in Germany. However it wants to create incentives for the development of small, decentralised power stations, as well as major investment in renewable energy.

In all, the German government says the country needs 10 GW of new generating capacity by 2020. It has earmarked energy efficiency measures to cut energy use by 10 per cent by 2020, and wants the proportion of energy generated by renewable resources to rise from 17 per cent today to 35 per cent in 2020.

Natural gas will play a key role, not only in bridging the gap between nuclear and renewables, but also by serving as a back-up to the intermittent nature of renewable energy generation.

The implication, says analysts, is that Germany will not meet its ambitious climate change targets. Deutsche Bank expects emissions by the country's power sector to increase by 370 million tonnes between 2011 and 2020.

Electricity prices will also rise because of the investment that will be needed in generating capacity as well as grid reinforcements.

FIT changes shake clean-tech confidence

Uncertainty surrounding electricity market reform, coupled with recent changes to feed-in tariff (FIT) schemes, is shaking investor confidence in the UK's green energy sector.

UK business lobby group CBI says that while the country's government has set the wheels in motion in a number of key green energy policy areas, it risks failing to achieve emission reduction targets because

investor confidence remains low.

The CBI's statement was echoed by Ernst & Young's latest quarterly clean-tech sector survey, which indicates that clean-tech executives and financiers are not optimistic about levels of investment and growth.

According to the CBI, the UK has fallen from 5th to 13th in a global ranking of low-carbon investment. It blames unexpected changes to the

Carbon Reduction Commitment (CRC) energy efficiency scheme, FITs and the North Sea oil and gas tax.

In June the UK government moved forward with plans to cut FITs for large solar installations. It made the policy change after an emergency review after realising that demand for the subsidy would outstrip available funding.

"Without urgent intervention, the

scheme would have been completely overwhelmed within a very short period of time," said Gregory Barker, Minister for Energy and Climate Change, in a written statement.

The UK's Solar Trade Association (STA) said that the change to the FIT scheme would "effectively kill the UK solar industry for all installations over 50 kW in size". It believes that the UK will lose major manufacturing opportunities to

countries such as China, Japan and Germany, which are moving solar to the heart of energy policy.

The CBI has praised the government for moving forward with the Green Investment Bank, however.

The government said last month that the bank would start operating in April 2012, with offshore wind, waste and non-domestic energy efficiency at the heart of its initial targets.

Commission, EIB seed energy efficiency fund



The European Energy Efficiency Fund is to be seeded with €205 million of capital from the European Commission, the European Investment Bank (EIB) and Deutsche Bank.

The EEEF is designed to provide direct financing for energy efficiency projects around the EU. It is part of a

new European Energy Efficiency Facility (EEE-F) being launched by the European Commission using unallocated funds from the EU's European Energy Programme for Recovery.

The European Commission is providing initial funding of

€25 million, the EIB €75 million and Deutsche Bank €5 million.

Some 70 per cent of the fund's financing will be directed towards energy efficiency projects such as smart metering and building energy efficiency investments, particularly in urban areas. Projects must achieve at least 20 per

cent primary energy savings and investments will be made in proven technologies only.

Around 30 per cent of projects financed will be in the renewable energy sector.

The fund will be managed by Deutsche Bank.

Eurotunnel link JV established

France is to gain a second electricity interconnector with the UK after Groupe Eurotunnel and Star Capital Partners established a joint venture to develop the link.

Studies conducted by the two companies show that a twin cable 500 MW direct current (DC) interconnector could be installed inside the service tunnel of the Channel Tunnel.

The proposed project – known as ElecLink – would increase cross-Channel capacity by 25 per cent to 2500 MW.

Eurotunnel and Star say that a new interconnector would help to improve security of energy supplies in Europe, as well as underline the role of the Channel Tunnel as a strategic European asset.

The joint venture will be 49 per cent owned by Eurotunnel and 51 per cent by Star. The investment required to execute the project amounts to €250 million.

Ukraine loses out to new pipelines

Ukraine is a key transit route for Russian natural gas supplies to Europe, but will lose this status – and revenues – when new pipelines open.

Siân Crampsie

Ukraine has expressed concerns over Russia's plans to divert some of its natural gas exports to the new Nord Stream pipeline.

Ukraine serves as a key transit route for exports of Russian natural gas to Europe but Russian gas firm Gazprom says that it will redirect around 20 billion m³ of the fuel to the new pipeline.

Ukraine, which has in recent years had a difficult relationship with Russia over gas prices and supplies, will lose some of the revenues that it earns for transiting the gas. The reduction in volumes is equivalent to around one-fifth of the Russian gas that Ukraine transits.

The change is concerning for

Ukraine, but the opening of new supply routes from Russia will help to improve Europe's security of supply.

Gazprom is a key partner in the Nord Stream pipeline, which will transport up to 63 billion m³/year of gas to central and southern Europe. Gazprom owns 51 per cent of the project.

Russia is also planning to build a second major pipeline, South Stream, which would also bypass Ukraine to transport up to 63 billion m³ under the Black Sea to central and southern Europe.

Nord Stream will become fully operational in late 2012. First gas supplies from South Stream are scheduled for 2015.

Last year Ukraine transited 95.4

billion m³ of Russian gas to Europe. According to a 2010 transit agreement between Ukraine and Russia, Ukraine is to transit 112 billion m³ of Russian gas over the next five years.

Russia last month also stepped up the pressure on Belarus in an attempt to secure payment on \$54 million of unpaid bills.

Russia has cut electricity supplies to Belarus by over 50 per cent and said it would cut off supplies altogether if the money had not been paid by mid-June.

Imports of electricity from Russia account for around 12 per cent of Belarus' needs. The Russian government says that its decision to cut supplies is purely commercial and not politically motivated.

Belarus owes Russia \$54 million in outstanding bills for deliveries in March and April.

Local reports in June indicated that Belarus has also stopped importing electricity from Ukraine, possibly because of a shortage of foreign currency.

Alstom is continuing its push into the Russian power market with the signing of two agreements to produce and engineer equipment for high voltage electricity transmission systems. It has joined forces with KER Ltd. to study the creation of a joint venture for engineering and project execution in the high voltage direct current (HVDC) sector. It has also signed an MOU with Soyuz Holding to manufacture Alstom's high voltage switchgear products.



ACWA moves in on Jordan firm

Saudi Arabian independent power firm ACWA Power International is making good on its regional expansion plans with the purchase of a stake in Jordan's largest power generator.

ACWA Power has agreed a deal with Jordan Dubai Capital (JDC) to buy its 65 per cent stake in Enara Energy Investments, which owns a 51 per cent stake in Jordan's Central Electricity Generating Company (CEGCO).

The transaction values the 51 per

cent CEGCO stake at \$144 million. It will boost ACWA Power's generating portfolio and is "a culmination of a longstanding endeavour" by the company to establish a presence in Jordan, according to ACWA's Chairman, Mohammad Abunayyan.

ACWA specialises in the development and operation of privately financed power and desalination projects, and last year expanded from its Saudi Arabian base into Oman with the acquisition of the

Barka 1 IWPP. "The stable investment climate of the Hashemite Kingdom of Jordan and the socio-economic growth potentials give us a perfect platform to build our regional growth ambitions," said Abunayyan.

CEGCO is the largest power generator in Jordan with seven power generation sites across the country that generate about 1700 MW from a mixed portfolio by technology and fuel type. It is 40 per cent owned by the Jordanian government and meets around 59 per cent of the country's

electricity demand.

Jordan faces rapidly growing electricity demand and imports around 97 per cent of its energy needs. Last month the country's energy minister, Khaled Toukan, said that the Jordan Atomic Energy Commission (JAEC) is in the final stages of reviewing bids from three shortlisted nuclear vendors vying to build the country's first nuclear power plant.

JAEC is reviewing technology bids from Canada's AECL, Russia's

Atomstroyexport, and a joint venture of Areva and Mitsubishi Heavy Industries.

JAEC expects to start building a 750-1100 MWe nuclear power plant in 2013 for operation by 2020 and a second one for operation by 2025. Longer-term, four nuclear reactors are envisaged.

The first will be built near Balaama, some 40 km northeast of Amman. Environmentalists have stepped up protests against the country's nuclear programme in recent months.

Uganda pledges hydro, renewables focus

■ Bujagali poised for commissioning
■ Mini-hydro projects on track

Uganda is hoping to start construction of a new 600 MW hydropower plant this year.

The east African nation is suffering from acute power shortages and wants to increase its generating capacity by developing its hydropower and renewable energy potential.

Speaking in his state of the nation address last month, Ugandan President Yoweri Museveni said that

the process of finding a construction contractor for the Karuma hydropower project had already begun and that the project would be funded by the government.

He also said that work on the construction of the 250 MW Bujagali hydropower project dam, powerhouse and its associated transmission line in eastern Uganda is nearly complete.

Commissioning of the first 50 MW turbine is on course for October, with



Yoweri Museveni: focusing on renewables

commissioning of the full 250 MW plant scheduled for April 2012, said Museveni. Uganda has an installed capacity of 820 MW.

According to Museveni, the government is to focus on the

development of renewable energy projects and rural electrification schemes over the next five years. A number of mini-hydro schemes are scheduled to be commissioned this year.

Iraq boosts gas supplies

Iraq is planning to increase supplies of natural gas in order to prop up its power generating sector.

The country's government has signed a deal with neighbouring Iran to import natural gas and has approved \$100 million of funding for the construction of a gas pipeline from Iran.

The five-year plan with Iran will let Iraq buy 25 million m³ of natural gas each day to feed two power plants in the northeastern suburbs of Baghdad. The gas will be supplied via a new pipeline that should be completed by the end of 2012.

The new pipeline will run parallel to an existing crude oil pipeline.

The gas import deal will help Iraq to maintain production at its power plants. The country currently produces around 7000 MW – equivalent to half of actual demand – and power cuts are still frequent.

Iraq is also attempting to increase production of natural gas from its domestic reserves.

Last month Shell and its partner Mitsubishi Corp. said that they were preparing to begin a delayed \$12.5 million project in Iraq to capture gas that is being flared from oil fields in southern Iraq.

In November 2010 the Iraqi government awarded three licenses in its first auction of gas concessions since the US-led invasion of 2003.

Wärtsilä strengthens fuel cell strategy

Finland's Wärtsilä sees a strong future in solid oxide fuel cell technology.



Erkkko Fontell: providing clean and efficient power solutions

Wärtsilä is targeting the commercialisation of fuel cell products for the power generation and marine market sectors through a new agreement with Versa Power Systems (VPS).

The two companies are to cooperate in the development and integration of VPS's solid oxide fuel cell (SOFC) products into Wärtsilä products.

Finland-based Wärtsilä has been active in developing and testing SOFC technology for over a decade and considers fuel cell technology to be "one of the most exciting" future energy technologies.

"VPS is leading the development of large SOFC stacks, and the company's capabilities support Wärtsilä's strategy of developing large SOFC systems

for the distributed power and marine markets," said Erkkko Fontell, Director, Fuel Cells, Wärtsilä. "The agreement with VPS strengthens Wärtsilä's ability to provide its customers with clean and highly efficient power solutions.

"Demand is developing rapidly and the commercial potential for such products is very promising."

Wärtsilä says that the agreement with VPS will have no impact on its existing cooperation with Topsoe Fuel Cell of Denmark. "This co-operation with VPS supports the commercialisation of fuel cell products by strengthening the development and supply partnerships," said Wärtsilä in a statement.

Alstom reorganises after period of strong growth

- Joubert fills Deputy CEO role
- New focus for renewable, thermal generation

Siân Crampsie

A major reorganisation of Alstom's business units will enable the company to achieve its performance objectives and take advantage of its recent period of strong growth, says the company's Chairman and CEO Patrick Kron.

Alstom's Board has approved the restructuring, proposed by Kron, which will see the creation of the position of

Deputy CEO, and the split of the company's existing three sectors into four. The changes will allow the company to focus on the operational objectives of key sectors such as renewable energy, while keeping track of larger, strategic objectives and issues.

The Deputy CEO position will be filled by Philippe Joubert, who is credited with the successful recovery

and development of the company's power sector division. The company's power sector will now be split into a thermal power sector and a renewable power sector, led by Philippe Cochet and Jérôme Péresse, respectively.

The split of the current power sector into two will allow the functioning of both entities to be simplified and to better address their specific markets, says Alstom.

Alstom's existing sectors covering the grid and the transport sectors will remain in place, but will have new Presidents.

Joubert will be responsible for assisting Kron in strategy, group development, sustainable development and the supervision of the international network.

The changes are due to take effect on July 4, 2011.

GE opens manufacturing centre

- New hub serves Middle East, Africa, Europe
- New office in Turkmenistan

GE Energy has celebrated the opening of its newest energy technology centre, which it says will bring it closer to its customers in the Middle East.

The 10 000 m² manufacturing technology centre in Dammam, Saudi Arabia will serve the Middle East region, Europe and Africa with advanced energy technology services and manufacturing. It will help GE to capitalise on growth opportunities in

the Middle East's energy sector, especially key markets such as Saudi Arabia and the UAE.

GE is also planning to invest an additional \$150 million in the creation of a Saudi manufacturing hub of equipment for the energy industry, bringing the firm's total investment in the new centre to \$250 million.

The core capabilities of the manufacturing technology centre

include the manufacture of high technology equipment supporting the power generation, electrification and oil & gas industries such as critical components for gas turbines, control units and motors. It will also have service and repair capabilities, says GE.

GE also announced in May that it had opened its first office in Turkmenistan in order to support the

continuing development of its business there. The office, located in the capital, Ashgabat, will have initial staff of commercial and technical engineers.

"The new office illustrates our localisation strategy for Eastern Europe and the CIS and will enable us to quickly respond to local customers' needs," said Joe Carelli, managing director for GE Energy in the Caspian region.

Samsung plans solar focus

Electronics giant Samsung is to boost investment in its solar and energy storage businesses as part of a strategy to tap the world's green energy markets.

Samsung has announced plans to invest \$5.5 billion in the development of solar technology and production by 2020. It wants to increase spending on R&D with the aim of increasing the efficiency of its solar cells as well as the cost of photovoltaic modules.

Samsung wants to complement its push in the solar market by manufacturing and marketing inverters and energy storage systems.

The company currently produces 130 MW of monocrystalline and thin film photovoltaic modules per year. It is planning to increase this to 300 MW by 2012, 1 GW by 2013, 3 GW by 2015 and 10 GW by 2020.

It says it is considering whether to open up new production facilities in order to meet these goals.

In the energy storage arena, Samsung is planning to offer a range of rechargeable batteries for photovoltaic plants in the residential and utility sectors.

Atomic Anne steps down

Anne Lauvergeon's departure from Areva has raised concerns over the future direction of the French nuclear champion.

Lauvergeon, 51, is to be replaced by Areva board member Luc Oursel and her exit is seen as a signal that the French government wants to gain more control over the company.

Ms Lauvergeon – known as 'Atomic Anne' – had resisted moves to merge with state-owned utility EDF and in recent months conducted a bitter and public feud with EDF chief Henri Proglio. Her contract with Areva was due for renewal at the end of June but President Nicolas Sarkozy's government said that she would be leaving after ten years of service.

While credited with turning around the fortunes of Areva over the last decade, Lauvergeon has also been criticised for the cost overruns and delays at the EPR nuclear power plant project in Finland, and for losing a bid to build new reactors in Abu Dhabi.

The departure of Lauvergeon could pave the way for the French government to restructure the debt-laden company, and could also result in a greater role for Proglio in the export of French nuclear technology.

Areva's European Works Council has called for Oursel to clarify the company's strategy as soon as possible.

Oursel is currently the firm's Chief Operating Officer (COO) and ran Areva's nuclear engineering department for four years. One of his main tasks will be to restore the group's finances, an assignment that may trigger a restructuring of the company or further equity sales.

Tenders, Bids & Contracts

Americas

Suzlon bags Canadian order

Suzlon Wind Energy Corp has taken its first order from North America for its S9X wind turbines.

The order was placed by Sprott Power Corp., which will install 15 of Suzlon's S97-2.1 MW units at a site in Amherst, Nova Scotia, Canada. The project is due to be commissioned in early 2012.

The S9X family of wind turbines has been developed specifically for low to moderate wind speeds and is an evolution of Suzlon's S88 wind turbine. The new blade designs, with 95 m and 97 m rotor diameters, provide a larger swept area for more power production at lower wind speeds.

Cleaning systems reduce costs

Xcel Energy and Southern Minnesota Municipal Power Agency (SMMPA) have contracted GE Energy to supply online impulse cleaning systems for a 900 MW generating unit.

Under the contract GE will provide its Powerwave+ Impulse cleaning system, which uses high-energy impulse technology to clean boiler surfaces. It estimates that the project will save Xcel and SMMPA around \$20 million over the next six years by eliminating tube erosion and helping to prevent a major boiler tube replacement project.

"The installation of this technology will decrease the number of unplanned outages in the affected section of the boiler and provide greater value for our customers," said Aaron Brixius, Xcel Energy project manager.

Alstom wins Brazilian wind farm deal

Alstom signed a contract worth nearly €200 million to build and service three wind farms in Brazil for Brasventos S.A., a special purpose company owned by J. Malucelli Energia, Eletrobras Eletronorte and Eletrobras Furnas.

The scope of the order – Alstom's largest in the wind sector in Brazil to date – includes the supply, installation, commissioning and long-term servicing of Alstom's ECO 86 wind turbines. The wind farms will be located in Rio Grande do Norte State and have a forecasted production of 580 000 MWh per year.

Vestas to supply Blacksprings Ridge

Greengate Power Corporation has agreed a turbine supply and long-term service and maintenance agreements with Vestas for the 300 MW Blacksprings Ridge I wind power project in Canada.

Greengate is expecting to begin construction on Blacksprings Ridge I in 2012, with a target commercial operation date of 2013. Upon completion, Blacksprings Ridge I is expected to be Canada's largest operating wind energy project.

Under the terms of the turbine supply agreements, Vestas will supply 166 of its V90-1.8 MW wind turbines for Blacksprings Ridge I. It will also provide ten years of service and maintenance at a predetermined cost.

Asia Pacific

L&T places Siemens order

Indian firm Larsen & Toubro has placed an order with Siemens Energy for the supply of the power train for the Dhuvanan Phase III combined cycle power plant.

Delivery of the components is scheduled for the summer of 2012, with commissioning planned for the end of 2013. Siemens is supplying a

SCC5-PAC 4000F (1S) power train, comprising an SGT5-4000F gas turbine, an SST5-3000 steam turbine and an SGen5-2000H hydrogen-cooled generator, plus the SPPA-T3000 instrumentation and control system.

The 375 MW single-shaft power plant will supply electricity to the region around Vadadora city in Gujarat state, India.

Nalco places order for CDM project

India's National Aluminium Company Limited (Nalco) has placed an order with Suzlon Energy Limited for the construction, operation and maintenance of a new wind farm in Andhra Pradesh state.

The order comprises 24 units of Suzlon's S88-2.1MW wind turbines. The order marks Nalco's entry to the wind power sector, and the firm says that it will register the project under the UN's Clean Development Mechanism (CDM).

Energy from the wind facility will be sold to the state electricity grid company. The project is due to be commissioned in early 2012.

Firms agree JV for geothermal project

International Power, PT Supreme Energy and Marubeni Corporation have entered into a joint venture agreement for the development of the Rantau Dedap geothermal project located in South Sumatra Province, Indonesia.

The 220 MW project is part of the Indonesian government's second 10 000 MW accelerated electricity development programme and will help to meet growing energy demand.

The agreement between the three companies follows the appointment of Supreme Energy as the winner of the concession tender and the award of the geothermal mining license.

Kimanis orders 6FA technology

Malaysian energy firm Kimanis Power Sdn Bhd has placed an order with GE for the supply of three Frame 6FA gas turbines, associated generators and services for a 300 MW combined cycle power plant in Sabah state.

The Kimanis power plant will consist of three combined cycle blocks of approximately 100 MW each, and will make an important contribution to helping the Malaysian state meet growing energy demand. The plant's configuration will enhance its operational flexibility, reliability and availability, says GE.

In addition to supplying equipment, GE has signed a contractual service agreement (CSA) with Kimanis Power to support the plant for 18 years.

Ormat secures Ngatamariki geothermal contract

New Zealand's Mighty River Power Limited has signed two key contracts with Ormat Technologies for the development of the Ngatamariki geothermal power project.

Ormat is to supply the equipment for the project as well as be responsible for its engineering, procurement and construction (EPC). The EPC contract is the largest in Ormat's history.

The new power plant is a key part of plans by Mighty River Power to expand its geothermal power output, which currently accounts for around one-third of the state-owned company's generation. The new plant will comprise four air-cooled Ormat energy converters and will allow 100 per cent geothermal fluid re-injection.

Europe

Eneco awards project contracts

Dutch energy firm Eneco has awarded the turbine contract for the Lochluichart wind farm in Scotland to Siemens.

Under the contract, Siemens will supply 17 of its 3 MW turbine units to the project, which is being developed by Eneco on the Lochluichart Estate near Inverness. Eneco says it is also finalising a contract with engineering firm Jones Brothers for the supply of balance of plant services such as cabling and electrical work.

The wind farm is due to enter operation in 2013.

Industrial plant opts for high efficiency

Italy's Termica Colleferro S.p.A has selected GE's LM2500+ G4 DLE aeroderivative gas turbine technology for a 40 MW combined cycle cogeneration power plant in the industrial district of Colleferro, near Rome.

The new plant will replace an existing installation at the production facilities of Avio Group's Space Division and will also supply energy for a heating system serving nearby industrial facilities.

Under its €10.5 million contract, GE will provide the gas turbine plus a steam turbine and related equipment. Once it is operational, the plant will be able to produce 300 GWh/year of electric energy and 110 GWh/year of thermal energy.

Fortum plans biofuel plants

Finnish firm Fortum is investing €160 million in two new biofuel-fired combined heat and power plants.

The two plants will be built in Jarvenpaa, Finland, and Jelgava, Latvia, and will start commercial operation in 2013. Both plants will use local fuels such as wood chips and forest industry by-products.

The Jarvenpaa plant will produce around about 280 GWh of heat and about 130 GWh of electricity per year. The Jelgava plant will have an annual production of around 230 GWh of heat and 110 GWh of electricity.

Alstom wins Salamonde contract

Alstom, in consortium with Portuguese engineering company Ensulmeci, has been awarded a contract by Portuguese utility EDP (Energias de Portugal) to supply and install a new power generation unit at the Salamonde dam in Portugal, 30 km from the city of Braga.

Under the €55 million contract, Alstom will supply and install one 207 MW Francis reversible pump turbine, a 244 MVA motor-generator, butterfly valve and other hydro mechanical equipment. It will also supply the mechanical and electrical balance of plant.

Salamonde's two existing units, for which Alstom supplied part of the hydro mechanical equipment and carried out a retrofit of the generators during the 1980s, were installed in the 1950s and have an output of 21 MW each. The commissioning of unit 3 in 2015 will bring total power output of the Salamonde dam up to 250 MW.

GE wins contracts for four new wind farms

Stena Renewable Wind Energy Company of Göteborg, Sweden has signed a contract with GE to deploy 40 of GE's 2.5-100 wind turbines for installation at four new wind farms in the southern Swedish municipalities of

Laholm, Boxholm and Mjölby.

The four projects represent a total investment of 1.2 billion Swedish crowns (about €130 million) for Stena, which currently operates 22 wind turbines in the central Sweden municipalities of Ludvika and Härnösand. The new projects will be supported through Sweden's existing green certificate support system that gives producers of renewable electricity set payments for every MWh of energy they produce.

Centrax agrees packaging deal

Centrax Gas Turbines has expanded its range of power generation products in an agreement with Siemens to package two of Siemens gas turbines product ranges.

Under the agreement both the Siemens SGT-300 and SGT-400 gas turbines will be packaged at the Centrax UK plant in Newton Abbot. Centrax will initially market the packages for the industrial power generation and cogeneration markets in the UK, France, Italy, the Netherlands and Belgium.

Metso to build 140 MW bio-gasification plant

Metso has won a contract to build a bio-gasification plant in Vaasa, Finland, that will enable an adjacent coal fired power plant to reduce carbon dioxide emissions.

The bio-gasification plant will use mainly forest residues for fuel and will produce biogas that will be co-fired in a 565 MW coal fired power plant owned and operated by Vaskiluodon Voima Oy.

The bio-gasification plant will enable Vaskiluodon Voima to replace 25-40 per cent of the coal it now uses with renewable energy, reducing carbon dioxide emissions by about 230 000 tons per year.

Vaskiluodon Voima's total investment is approximately €40 million, of which Metso's delivery represents more than half. The new bio-gasification plant will be taken into operation in December 2012.

International

Lanco bids for Iraq projects

Lanco Infratech says it is bidding to develop power projects in markets such as Iraq and Bangladesh.

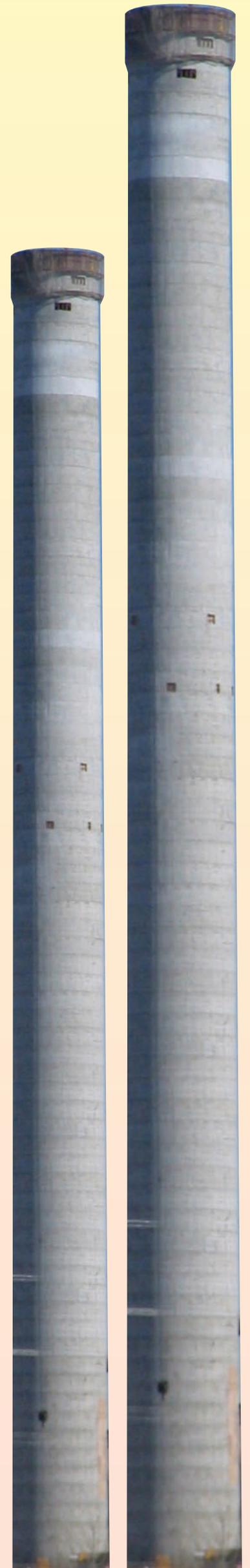
The Indian energy and construction company has bid for an engineering, procurement and construction contract to set up a 240 MW gas-based project at Azab in Iraq valued at \$81 million. It has also placed a bid to develop a 660 MW imported coal-based project in Chittagong, Bangladesh, to be run on a build, own and operate basis.

Lanco says that scarcity of fuels for power projects in its home market is hindering the development of projects there.

Siberian plant ramps up efficiency

PJSC EnergoMashinostroitelny Alliance (EM Alliance) has reached an agreement to use GE's highly reliable and energy-efficient aeroderivative gas turbine technology to update and expand the Omskaya TETs-3 power plant in the Siberian city of Omsk.

Under the terms of the agreement, GE will supply two 32 MW LM2500+G4 gas turbines, which will run on natural gas in combined cycle configuration. The units are to be delivered in March 2012, and the 90 MW power plant is expected to begin commercial operation in November 2012.



Delivering policy objectives

A recent report from the International Energy Agency says there are strong potential synergies between cogeneration and renewables, and that using the two together can result in powerful low-carbon energy solutions that complement each other. However, strong policy support will be needed if they are to reach their full low-carbon potential.

David Flin

According to the International Energy Agency (IEA), an energy revolution is required to achieve a 50 per cent reduction in global CO₂ emissions relative to current levels by 2050, which it regards as a necessary condition to limit a long-term global rise in temperature to a maximum of 3°C.

In this respect, renewable energy is generally viewed as an important plank in energy policy throughout the world, and projections show that this trend is likely to continue as countries transition to a low-carbon economy. However, transitions take time, especially when they are on the scale needed to re-invent the global energy system. Even though the share of renewables will rise in the coming decades, fossil fuels will still play an important role, and for that reason, it is important to use these fuels as efficiently as possible.

In a report entitled: "Cogeneration and Renewables" the IEA states that cogeneration, or combined heat and power, is a proven, energy-efficient technology that can also accelerate the integration of renewable energy technologies.

In many instances, cogeneration and renewables complement each other. Several renewable technologies, including biomass, geothermal and concentrating solar power (CSP), can be operated in cogeneration mode. Cogeneration can assist in balancing electricity production from variable renewables such as wind. Some balancing technologies will inevitably be fossil fuel-based, and by increasing the efficiency of fossil-based technologies, cogeneration represents a low-carbon balancing solution.

Much of the attention of energy policy focuses on electricity and transport, and heat is largely overlooked, despite the fact that its demand dominates all other energy uses. Heat represents a sizable part of final energy consumption, both globally and in OECD countries.

Unlike electricity, heat cannot be transported efficiently over large distances. As a result, it has to be generated close to where it is consumed. Demand for heating in buildings and industry varies widely; industrial heat demand does not always require high temperatures, but is known for having a wide diversity with respect to temperature levels needed for many different types of industrial processes. Meeting heat demand involves being able to meet both quantity and quality of heat. The characteristics of the heat demand and supply can significantly influence the financial viability of heat-generation technologies.

The size and variety of the heat demand demonstrates the value of cogeneration systems. Often, the heat component of cogeneration is thought of as having less value than the electricity component, which is not always the case. The value of the available heat is frequently underestimated.

Several renewable primary energy sources generate electricity via prior thermal generation. These technologies can, therefore, enjoy a double low-carbon benefit. First, the use of renewables has obvious low-carbon credentials. Second, by operating in cogeneration mode, these benefits are brought to heat production. These technologies include: biomass, geothermal, and concentrating solar power.

	World	OECD countries
Heat (%)	47	37
Electricity (%)	17	21
Transport (%)	27	32
Other (%)	9	10

In an electricity system, a dynamic balance must constantly be achieved between demand and supply. Several renewable technologies are inherently variable, creating variability in their supply to power systems, and this can cause them to be viewed as a less attractive option.

However, variability is not a new challenge in power system balancing, and under the right conditions, cogeneration systems coupled with renewable electricity systems can assist in balancing.

A cogeneration plant used to support variable electricity demand and supply will have consequent fluctuations in its heat supply. Fluctuations in heat supply can be smoothed out by the use of heat storage techniques, eventually supported by highly efficient boilers. Münster and Lund stated in a report from Aalborg University in 2007 that "storing heat is simple but storing electricity is still difficult and expensive."

In fact, the ease of storing heat depends greatly on the form in which heat is stored and the length of time for which it is stored. It is relatively straightforward to store low-grade heat (up to 100°C) for up to 48 hours. Storing at higher temperatures or for longer periods is more complex. However, many applications can benefit from low grade heat; 30 per

there is a possibility of adjusting electricity production by adjusting heat production, or adjusting the power to heat ratio based on electricity demand. The overall supply of high temperature heat could be kept stable by using heat storage or by using high efficiency auxiliary boilers.

By combining electricity generation with heat generation, cogeneration increases flexibility in the energy system. When a system is larger, there is more chance that a deficit in one part of the system can be balanced by a surplus elsewhere. The fundamental characteristic that makes cogeneration a viable candidate for supporting variable supply renewable electricity is the link that it provides between electricity and heat.

Tokyo Gas and Osaka Gas is testing this flexibility within the Smart Energy Network demonstration project, launched in May 2010. The project aims to demonstrate the potential for optimisation of heat and electricity production and consumption, beginning on a small scale within a localised community. One system interchanges both heat and electricity produced by cogeneration among several buildings, while the second system will only interchange electricity. The partner companies

There are several effective policy tools that can be applied to support cogeneration. The three main factors highlighted by the IEA are: **ns** A cogeneration strategy at the national level, covering technology development, incentives where needed, grid interconnection, and outreach/awareness, among other initiatives, with a government department or agency to implement the strategy.

nA strategic approach to infrastructure planning to match supply and demand.

nTargeted implementation levels to meet different needs at the national, state or provincial, and local levels.

While renewable energy is likely to be the long-term goal of energy policy, it suffers from well-known barriers to its deployment, such as high upfront capital costs, unknown savings over time due to fluctuating fossil fuel prices and competition from other well-established technologies that enjoy economies of scale. As a result, a transition technology will be of major benefit, and cogeneration has the advantage of being able to contribute to renewable power deployment, and to renewable heat.

Currently, renewables for heat energy currently receives little policy attention, and there should be more policy focus on renewable heat, concentrating on ways to better allocate and distribute any additional costs in order to make it independent of government budgets. This might be complicated in the heat market due to the more heterogeneous delivery of heat and the heterogeneity of fuels used for heat production.

An advantage of renewable heat produced by cogeneration technologies is that the scale is sufficiently large to make it economically viable to measure the heat produced. This allows for the introduction of an incentive for the production of renewable heat, such as in a renewable energy feed-in tariff scheme, based on the assessment of generated heat output.

Cogeneration can reduce the carbon footprint of some technologies that will inevitably be needed to balance fluctuations in electricity production due to the variable nature of some renewable energy sources. Since cogeneration offers well-established energy efficiency and carbon mitigation credentials, it should be a preferred solution.

Combining cogeneration plants with heat accumulators can be a viable option to provide an energy-efficient low-carbon back-up for renewables

cent of total industrial heat demand in 32 European countries is for low grade heat below 100°C.

Combining cogeneration plants with heat accumulators can be a viable option to provide an energy-efficient low-carbon back-up for renewables.

Cogeneration produces both electricity and heat and this should allow other innovative solutions to be found. For example, heat generation from a cogeneration plant can affect its level of electricity generation, especially when the heat supplied is high pressure, high temperature heat. More high temperature heat production can equate to less electricity generated, and vice versa. Circumstances vary, but the fact that heat and electricity generation are coupled means that

expect the project will: "Promote the introduction of photovoltaic power generation by supplementing photovoltaic power – whose output fluctuates depending on the weather – with cogeneration.

The IEA report clearly indicates that there are strong potential synergies between cogeneration and renewables, and that using the two together can result in powerful low-carbon energy solutions that complement each other. However, strong policy support will be needed if they are to reach their full low-carbon potential. Energy efficiency is one of the most powerful tools that can be used to meet energy-related challenges, and it is available now if there is sufficient support from policy makers to make it a reality.

Seismic possibilities

Geothermal energy is a much under-utilised source of energy; but with the right policy incentives, government support and research into new technologies, its use for heat and power could be dramatically increased.

Junior Isles

With the current problems plaguing nuclear power, some governments around the world are putting a sharper focus on renewables and energy efficiency as a way of meeting electricity demand, while meeting targets for greenhouse gas emissions. Although much of the attention has been on wind and solar, geothermal is one renewable energy source that could play a much greater role in meeting these dual goals.

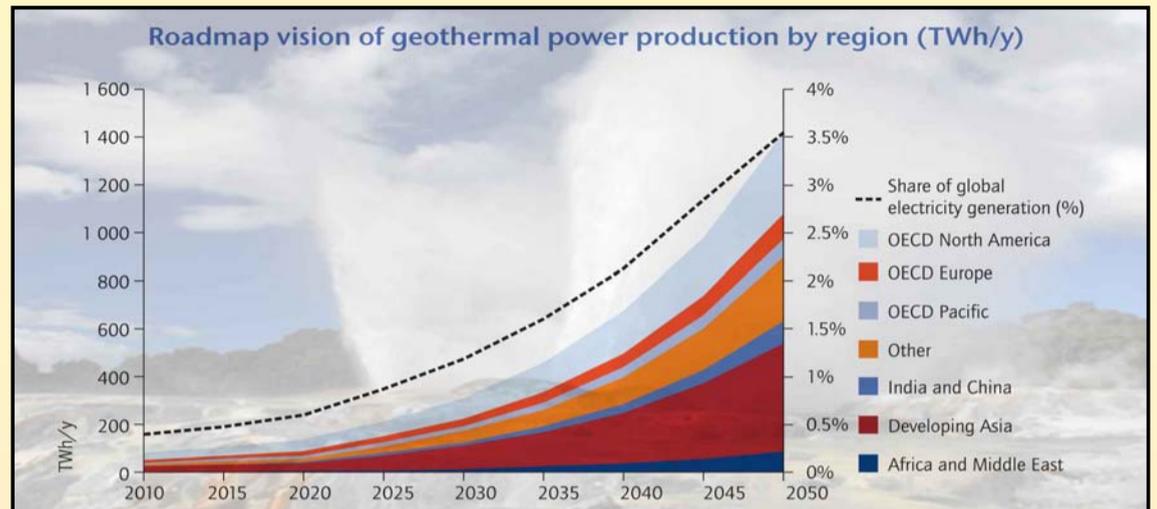
Compared to wind and solar, geothermal energy has the advantage of being able to provide base load power production and can also be used in combined heat and power plants or in heat-only applications.

According to a recent report launched by the International Energy Agency (IEA), geothermal currently accounts for just 0.3 per cent of annual global electricity production and 0.2 per cent of heat. It notes, however, that the introduction of incentive schemes to develop technologies that are not yet commercially available could see these figures increase by more than 10-fold by 2050. In a recent report titled: *Technology Roadmap: Geothermal heat and power*, it says that geothermal energy could account for 3.5 per cent of global electricity production and 3.9 per cent of heat production by the outlook period.

Geothermal energy is stored in rock and in trapped vapour or liquids, such as water or brines. Electricity generation usually requires geothermal resources temperatures of more than 100°C. A wider range of temperatures can be used for heating. Even the modest temperatures found at shallower depths can be used to extract or store heat for heating and cooling by means of ground source heat pumps.

According to the IEA, in 2009 global geothermal power capacity was 10.7 GW and generated approximately 67.2 TWh. Geothermal electricity provides a significant share of total electricity demand in Iceland (25 per cent), Kenya and the Philippines (17 per cent each), and Costa Rica (13 per cent). In absolute terms, the US produced the most electricity from geothermal sources in 2009 – 16 603 GWh/yr from an installed base of 3093 MW. China showed the highest use of geothermal heat (excluding heat pumps).

Until recently, geothermal energy production was most common in areas where geological conditions permit fluids to transfer heat from the Earth to the surface in self-flowing wells at high temperatures i.e. 100°C to 300°C. These conditions are typically found near tectonic plate boundaries and are often associated with volcanoes and seismic activity, as the crust is highly fractured and therefore permeable to fluids, resulting in heat sources being readily



available.

The Pacific Ocean basin or so-called "Ring of Fire" is a notable region where there have been significant geothermal developments.

Earlier this year The World Wildlife Fund (WWF) Philippines joined forces with Energy Development Corp. (EDC), the Philippines' biggest geothermal energy producer, to accelerate development of power generation from geothermal sources in Asia through the landmark "Ring of Fire" Project.

The initiative hopes to exploit the huge geothermal resources in the Pacific Ocean basin to increase installed geothermal capacity in the region by more than 150 per cent in the next five years, and 300 per cent by 2020.

Meanwhile neighbouring Indonesia, which holds approximately 40 per cent of the world's conventional geothermal reserves, is also moving to increase the amount of geothermal in its energy mix.

Following the recent Fukushima nuclear disaster, the Indonesian government plans to prioritise the use of new and renewable energy, especially geothermal, hydro and bio fuels, over nuclear. The government is now revising its proportion of new and renewable energy utilisation from the previous target of 17 per cent to 25 per cent by 2025. Geothermal capacity is planned to increase to 2000 MW in 2012 and reach 5000 MW in 2014. The country's geothermal potential is around 29 000 MW.

While geothermal energy has been concentrated in areas of naturally occurring water or steam, and sufficient rock permeability, the vast majority of geothermal energy within drilling reach (up to 5 km with current technology) is in relatively dry and low-permeability rock. Heat stored in this rock is commonly referred to as hot rock resources, and is found all over the world.

Currently, technologies that allow energy to be tapped from hot rock resources are still in the demonstration phase and require innovation and experience to become commercially viable. Of the various hot-rock geothermal technologies, the best known is enhanced geothermal systems (EGS).

The IEA report suggests that governments should provide sustained and significant research, development and demonstration resources to plan and develop at least 50 EGS pilot plants during the next decade.

EGS technology is centred on engineering and creating large heat exchange areas in hot rock. The process involves enhancing permeability by opening pre-existing fractures and/or creating new fractures. Heat is extracted by pumping a transfer medium, typically water, down a borehole into the hot fractured rock and then pumping the heated fluid up another borehole to a power plant, from where it is pumped back down to repeat the cycle.

EGS has been under development since the 1970s on very low permeability rocks, and is also known as hot dry rock technology. On the surface, the heat transfer medium (usually hot water) is used in a binary or flash plant to generate electricity and/or used for heating applications.

As of 2011, 20 EGS projects were either under development or under discussion in several EU countries. Of the current projects worldwide, the pilot project at Soultz-sous-Forêts, France, is in the most advanced stage and has currently commissioned the first power plant (1.5 MWe). This will provide a valuable database of information.

EGS research and testing is also under way in the US and Australia. The US has included large EGS research design and development components in its recent clean energy initiatives as part of a revived national geothermal programme.

In Australia, 50 companies held about 400 geothermal exploration licences in 2010. The government has awarded grants totalling around \$205 million to support deep drilling and demonstration geothermal projects. The world's largest EGS project under development, the 25 MWe Cooper Basin plant, has the potential to generate an estimated 5-10 GWe.

In China, there are plans to test EGS in three regions – the northeast (volcanic rocks), the southwest (volcanic rocks) and the southeast (granite).

Meanwhile, India is believed to have abundant hot rock resources because of a large volume of heat-generating granites throughout the country.

However, it is not yet possible to assess investment costs for EGS because it is still at the experimental stage. For today's geothermal electricity, development costs

vary considerably as they depend on a wide range of conditions such as resource temperature and pressure, reservoir depth and permeability, size of development, number and type of plant etc. Costs are also affected by the price of commodities. According to the IEA, in 2008 the capital cost of a greenfield geothermal development for power generation was \$2000-4000/kWe.

Levelised generation costs also vary widely. The IEA calculates average production costs for hydrothermal high temperature flash plants have been calculated to range from \$50-80/MWh. Estimated EGS production costs range from 100/MWh (for a 300°C resource at 4 km depth) to 190/MWh (150°C resource at 5 km) in the US. European estimates are somewhat higher at 250-300/MWh.

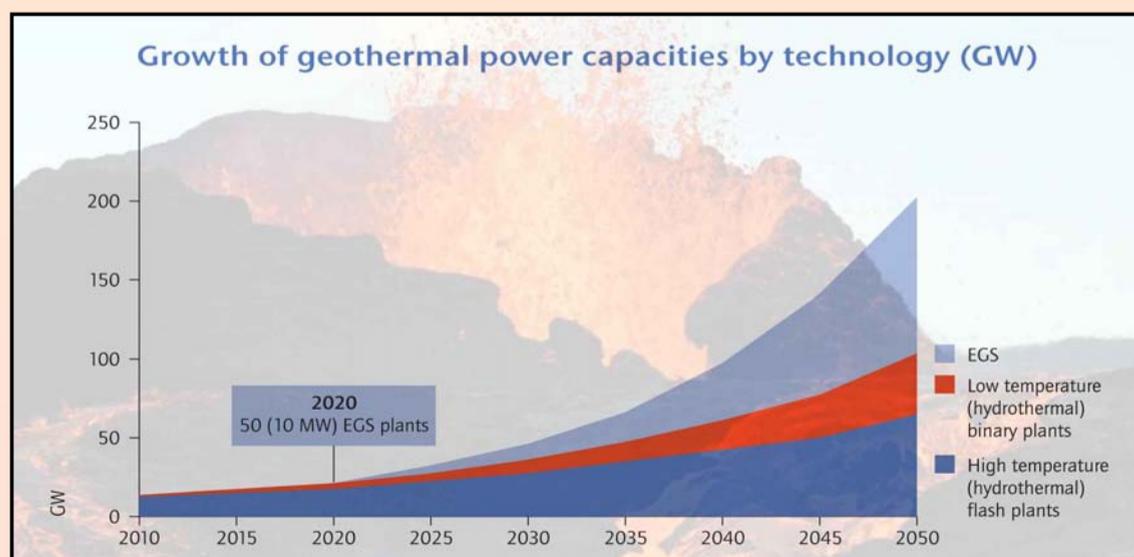
With the possibility of utilising low and medium temperature heat resources, the IEA says that governments should reconsider current geothermal potential and establish medium term targets for (nearly) mature technologies and long term targets for advanced technologies such as EGS.

While feed-in tariffs and premiums already exist in several European countries for geothermal electricity, the IEA says there will need to be clear, long term, effective and predictable economic incentives for technologies that are not yet commercially viable. These might include feed-in tariffs, feed-in premiums, renewable portfolio standards, fiscal incentives and investment subsidies.

In addition the report stresses that publicly available databases should be developed, which could be used to assess, access and exploit geothermal resources throughout the world. Milou Beerepoot, the report's author and senior analyst at the IEA wrote: "This requires cooperation among geothermal industry groupings, national authorities and research institutes."

A third proposed area of action outlined in the report focuses on overcoming the barrier of obtaining permits. "Many countries that lack specific laws for geothermal resources currently process geothermal permits under mining laws that were conceived with objectives other than renewable energy production," wrote Beerepoot. "Permitting procedures can consist of numerous steps, resulting in long lead times. The lack of regulation for geothermal energy is inhibiting the effective exploitation."

For geothermal energy for heat and power to claim its share of the coming energy revolution, the IEA report concludes that concerted action is needed by scientists, industry, governments, financing institutions and the public. Its roadmap is intended to help drive these necessary developments.



Oil

Crude price slides after IEA stock release

■ Emergency stock released for only third time in history
 ■ Opec meeting “worst in 16 years”

David Gregory

The Paris-based International Energy Agency's decision on June 23 to release 60 million barrels of oil stocks caused the price of West Texas Intermediate (WTI) crude to fall more than \$4.00 to settle at \$91.02/b later that day, while Brent fell by \$6.95 to \$107.26/b. The IEA's 28 members will release 2 million b/d of crude oil and products over a 30-day period. After that, the IEA will decide on whether further action is necessary. Of this amount, the US will release 1 million b/d from its Strategic Petroleum Reserve (SPR).

This is only the third time in its history that the IEA has taken the decision to release its emergency stocks. It follows the Opec meeting in Vienna on June 8 where the organisation's hardliners refused to accept a proposal to increase production in an effort to replace the crude oil that has come off the market

since the outbreak of civil war in Libya and also to meet projections of rising demand for crude oil.

Rising crude oil prices and retail prices have brought concern to the US and Europe on whether energy cost might harm global economic recovery. Media reports said close consultations had been made over a period of time between IEA members, key oil producers like Saudi Arabia, and major non-IEA consumer countries.

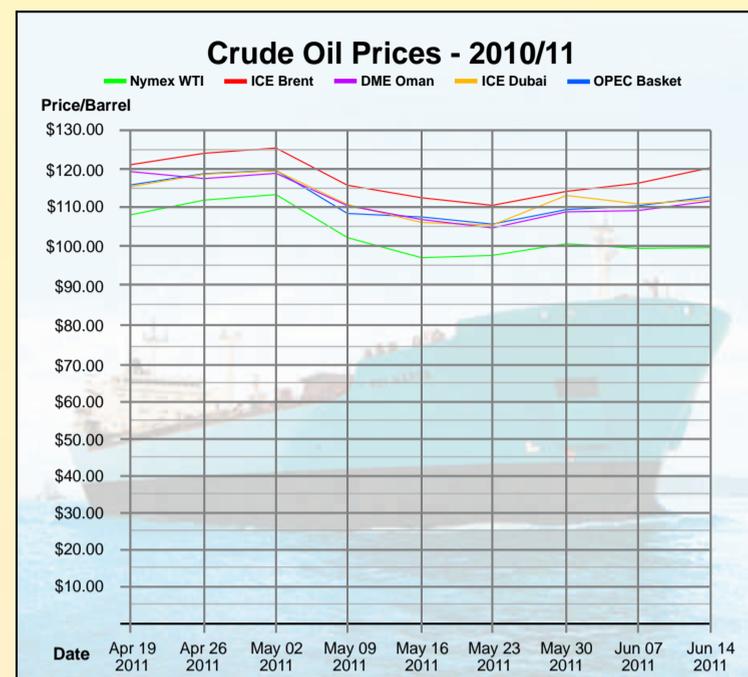
Crude oil prices had been falling but there was no real indication that they would continue to do so. Analysts have argued for some time that Opec needed to deliver more oil to the market to reduce the strain that high prices are creating for consumers in almost all retail sectors.

Opec's disastrous meeting in Vienna made clear that strong differences exist within the organisation. Key producer Saudi Arabia led other Gulf members

in an attempt to raise the official production ceiling by 1.5 million b/d but Iran, Algeria, Libya, Angola, Ecuador and Venezuela refused to budge. Saudi Minister of Petroleum Ali al-Naimi left the meeting saying it was the worst meeting he had had with Opec during his 16 years as minister.

Opec's official production ceiling is 24.845 million b/d, set in December 2008, when the global economic recession was in full swing. With producers now exceeding that by more than 4 million b/d, the figure has essentially become irrelevant.

According to Opec's own estimates demand for Opec crude will increase to 30.5 million b/d during the fourth quarter of this year. The group is estimated to have produced 29.1 million b/d in May. According to the latest issue of Opec's Monthly Oil Market Report (MOMR), the call on Opec crude for the second quarter of this



year is 28.81 million b/d. This will rise by 2.1 million b/d to 30.91 million b/d during the third quarter of 2011.

Several days after the meeting Opec Secretary General Abdullah al-Badri, who is Libyan, voiced his support for the Saudi proposal saying that if a shortage of 2 million b/d does materialise in the third and fourth quarters then the price of oil would certainly go up.

Since the Opec meeting, Saudi Arabia and other Gulf producers Kuwait and the UAE have promised that they will do what they can to meet the demands of their customers. But the IEA cited the fact that it could take some time before the new crude would move into the market, giving that as another reason for its decision to release stocks.

Opec's spare capacity is estimated at a little more than 4 million b/d, most of which is held by Saudi Arabia, and much of that is Arab Heavy, not the

grade that the market prefers. The hardline members of Opec are seen as not having any extra capacity, thus their reluctance to endorse a production increase.

Meeting future demand is a problem that is likely to become more complicated in the years ahead, as the latest edition of the International Energy Agency's Medium Term Oil and Gas Markets 2011 report points out. The Paris-based agency forecast that demand for crude oil will increase by 7.2 million b/d between 2010-16, up from 88.0 million b/d in 2010 to 95.3 million b/d in 2016. Most of the growth in demand during this period will come from the non-OECD countries, it said. The IEA forecast that the call on Opec crude would rise from 30.0 million b/d in 2010 to 32.5 million b/d in 2016. Non-Opec supply is to rise during that time from 52.7 million b/d to 55.4 million b/d.

Gas

Golden age of gas a real possibility

The world could be on the verge of a 'Golden Age of Gas,' according to the International Energy Agency (IEA), although this would not mean that the planet could sit back from the action needed to combat climate change.

Mark Goetz

In a special report released by the IEA on June 6, entitled: 'Are We Entering a Golden Age of Gas?' the Paris-based agency looks at a scenario in which natural gas use might increase by more than 50 per cent over 2010 and meet more than 25 per cent of global energy demand by 2035. In the Golden Age of Gas Scenario (GAS), global primary natural gas demand increases from 3.1 trillion m³ (tcm) in 2008 to 5.1 tcm in 2035, an increase of 62 per cent. This reflects an average rate of increase in gas demand of nearly 2 per cent per year. The IEA said that under its GAS scenario, natural gas sees the strongest demand growth of all energy sources in absolute terms.

The IEA usually bases its projections on its New Policies Scenario in the *World Energy Outlook 2010*. The GAS scenario incorporates a combination of new assumptions that underpin a

more positive future outlook for gas, it said in the new publication. These assumptions include the implementation by China of an ambitious policy for gas use, lower growth of nuclear power and more use of natural gas in road transport. It said that ample gas availability – much of it unconventional – keeps average gas prices below the levels assumed in *WEO 2010*.

Under the gas scenario, China's natural gas demand alone arises from about the level of Germany in 2010 to match that of the entire EU in 2035, the IEA said in its statement announcing the release of the report. "To meet the growth in demand, by 2035 annual gas production must increase by 1.8 tcm, about three times the current production of Russia," it said, adding: "Conventional natural gas will continue to make up the greater part of global production, but unconventional gas becomes

increasingly important, meeting more than 40 per cent of the increase in demand."

Natural gas is vast and widely dispersed over the world, the IEA said, adding that conventional recoverable resources are equivalent to more than 120 years of current global consumption. Total recoverable resources could sustain today's production for over 250 years, it added. The report stated that all major regions have recoverable resources equal to at least 75 years of current consumption.

Unconventional sources of gas, particularly shale gas, are estimated to be as large as conventional resources. The IEA reported that unconventional gas now makes up about 60 per cent of marketed gas in the US.

It also pointed out that while natural gas can replace other fossil fuels, and that as a result it can lead to lower

emissions of greenhouse gases and local pollutants, its scenario shows carbon emissions consistent with a long-term temperature rise of over 3.5°C.

Speaking at the launch in London, Fatih Birol, the IEA's Chief Economist noted: "A strong penetration of gas alone is not enough to reach our climate goals. Replacing nuclear power with gas is not good from a climate change point of view. It is a cleaner fossil fuel but is not completely innocent – it does emit CO₂."

A path towards a temperature rise of no more than 2°C would still require a greater shift to low-carbon energy sources, increased energy efficiency and deployment of new technologies including carbon capture and storage (CCS), which could reduce emissions from gas-fired plants.

Natural gas is an attractive fuel for those countries undergoing rapid growth in energy demand such as

China, India and the Middle East. These regions, the IEA said, will for the most part determine the extent to which natural gas use expands over the next 25 years.

According to the GAS scenario, trade in natural gas between the main regions more than doubles, with the increase of 620 billion m³ split evenly between pipeline gas and liquefied natural gas (LNG). It said that while natural gas markets are becoming more global and regional prices are expected to show signs of increased convergence, the market does not truly globalise.

North America will remain largely self-sufficient and is therefore likely to be essentially isolated from inter-regional trade, according to the IEA. China, meanwhile, will grow to become one of the largest importers of natural gas globally, as Russia and the Caspian region increasingly export both west and east.

Joining the over 60s club

With the dust still settling following Siemens and GE's announcements of combined cycle plants that offer efficiencies 60-61 per cent and above with improved flexibility, Alstom now claims to have a plant capable of delivering similar levels of performance and flexibility.

Junior Isles

In a recent report, the International Energy Agency (IEA) explored the potential for a "golden age" of gas. The report titled: "Are We Entering a Golden Age of Gas?" presents a scenario in which global use of gas rises by more than 50 per cent from 2010 levels and accounts for more than a quarter of global energy demand by 2035.

Global natural gas resources are vast, widely dispersed geographically and can help improve energy security. The IEA says all major geographical regions have recoverable natural gas resources equal to at least 75 years of current consumption but notes that timely and successful development of these resources depends on a complex set of factors, including government policy choices, technological capability and market conditions.

At a press conference in London, the IEA also noted that due to a gas glut, gas prices remain low and are unlikely to begin to rise in the EU until around 2015. Low prices combined with the ability of gas fired plants to complement the intermittency of wind and solar means gas is likely to be the fuel of choice for generators, at least in the immediate to mid-term.

Accordingly, gas turbine manufacturers have been moving to develop gas turbine combined cycle plants that have a high electrical efficiency combined with the ability to operate in a flexible manner to compensate for the variability of wind and solar.

In May, Siemens announced that its Irsching 4 plant had achieved an efficiency of more than 60 per cent with high flexibility. This was followed by the news that GE is introducing a plant known as FlexEfficiency 50, which promises an efficiency of more than 61 per cent, while being able to ramp up or down at a rate of more than 50 MW per minute.

Now Alstom has announced an upgrade of its KA26 combined cycle plant. According to Alstom, this 'next generation' KA26 combined cycle plant can produce more than 500 MW of power and is capable of an efficiency of more than 61 per cent at ISO ambient conditions with direct cooling. Alstom notes the engine has undergone validation at its Test Power Plant in Birr, Switzerland. This facility is a fully operating, grid-connected power plant owned by Alstom to perform full scale testing under real load conditions before releasing engines to market. Alstom says validation at the facility

means the engine is "ready and a reality today".

A new feature, it says, is the ability to reach full load under hot start conditions (after an 8-hour shutdown) in 30 minutes and the capability of delivering more than 350 MW to the grid in less than 15 mins. Alstom says this can be done without the addition of any extra plant equipment such as heaters.

Commenting on the thinking behind the plant upgrade, Mark Coxon, Senior Vice President of Alstom's gas business said: "There is an increasing amount of wind being brought onto the worldwide power generation market. Gas is a global market and is not limited to any one region... interestingly its use [for power generation] corresponds to areas where there is also a significant amount of renewables, particularly wind."

Like other industry players, Alstom sees a need for combined cycle plants to be increasingly flexible while being highly efficient. "Unfortunately, Mother Nature is not always predictable. In Germany there was a huge drop in output when the wind stopped blowing one day in February 2009 - around 12 GW was lost in just 18 hours. We have to be able to respond to provide power very quickly in response to any drop-off in power from renewables," said Coxon.

Alstom believes its GT26 has some unique design features that give it an advantage in terms of operational flexibility. It uses a technology known as sequential combustion, which allows greater flexibility by essentially separating the emissions aspects of the design from elements that impact power and efficiency. This allows Alstom to provide a plant that can be 'parked' at 20 per cent load while still meeting emissions requirements.

Alstom's sequential combustion system uses an EV (EnVironmental) burner in a first, annular combustor followed by the SEV (Sequential EnVironmental) burner in the second combustion stage. Integrating the concept of dry low NOx EV-burner and sequential combustion into a single shaft resulted in the GT24/GT26 - an advanced GT technology with high power density and low emissions.

Since its introduction in the 1990s, there have been three performance increases largely through compressor upgrades and a stepped increase in the turbine inlet temperature of the low-pressure (LP) turbine.

With the increase in wind generation,



All four stages of the LP turbine contain new 3-D blades with optimised profiles and cooling schemes

there is a growing need for combined cycle plants to start and stop quickly and cycle up and down. Because of the requirement for high operational flexibility, Alstom has focused its latest upgrade on delivering higher efficiency at part load.

According to Alstom, the latest GT26 upgrade contains evolutionary modifications on the compressors; SEV (second stage) combustor; and the LP turbine.

The compressor is still a 22-stage design, but is a new development for higher mass flow and therefore more power. The compression ratio has been only slightly increased from the present value of 33:1. Michael Ladwig, Director of Marketing and Product Management within Alstom's gas power plant business said: "Sequential combustion systems need a higher compression ratio compared to other heavy duty gas turbines, although not as high as in aircraft engines, which have compression ratios of up to 40. But you will see that other [heavy duty gas turbine] manufacturers are also increasing their compression ratios. With compressor efficiencies already at a high level, the name of the game was optimising the compressor for better part load efficiency. The difference is no longer in the overall efficiency. If you compare the compressors of other manufacturers with ours, the difference is in part load."

One element is the increase in the number of variable guide vanes from three to four for better control of the mass flow. The outer diameter of the

compressor has also been slightly increased to match the mass flow increase. The compressor was validated in a scaled test rig first prior to operation in a full scale engine.

The higher mass flow means more air is fed to the burner, which would have resulted in flame instability and higher emissions. The SEV burner has therefore been modified to ensure better mixing of the fuel with the airflow to achieve lower emissions over a wide operating range and fuel gas composition. SEV burner modifications have been tested in a high-pressure test rig under engine conditions prior implementation into the next generation GT26 engine.

The new LP turbine has been modified to provide higher component efficiency and the ability to support even greater flexibility. To achieve this, all four turbine stages contain new 3-D blades with optimised profiles and cooling schemes. Seals have been improved to reduce leakage. Alstom says the new LP turbine also features a switchable operating concept that allows the operator to switch on-line between a so-called power optimised operation mode and a mode which allows operation for a longer time between maintenance inspections.

According to the validation, process, Alstom had to validate the LP turbine ahead of all the other components. The new LP turbine was therefore tested at the Castejón power plant in Spain owned by HC Energía, which is owned by Energias de Portugal (EDP). Installed since November 2009, as of June this year the turbine has accumulated more than 8000 operating hours. The successful operation means that the LP turbine can now be commercially offered as a retrofit package which will increase the output of the existing KA26 single-shaft combined cycle power plants by 13.5 MW and efficiency by 0.7 percentage points.

The installation at a plant in Spain represents a good example of why combined cycle plants have to be much more flexible than before. Last year Spain set a new record when on one day 51 per cent of the country's power was produced by wind. Here, combined cycle plants can typically run today for just 200-300 hours a year at full load. With plants operating at part load for most of the time, high part load efficiency is becoming increasingly important.

And with the big three manufacturers all now striving for greater flexibility while delivering high efficiency, it will be interesting to see where the next developments will come from to push the boundaries even further.

Working with renewables

The ability of this latest generation of combined cycle plants to help drive and support renewables is quickly being realised by the power market.

Following the introduction of its FlexEfficiency 50 power plant last month, GE has announced its first customer. The plant to be located in Turkey, will be used at a new Integrated Renewables Combined Cycle (IRCC) plant being developed by MetCap Energy Investments, a Turkish project developer.

The innovative project will integrate the new 9FB gas turbine, a steam turbine, a generator, 22 MW of GE wind turbines and 50 MW of concentrated solar thermal tower technology. The solar technology will be provided by California-based eSolar, a company with which GE recently signed an investment and licensing agreement.

"The addition of eSolar's high temperature tower technology to our FlexEfficiency combined cycle power plant is an important step forward for our industry... At MetCap's site conditions, we will achieve 69 per cent plant efficiency, and this technology provides the capability to deliver efficiency greater than 70 per cent at *Gas Turbine World* conditions," said Browning

The power plant will be located in Karaman, Turkey, and will be rated at 530 MW at site conditions. It is scheduled to enter commercial operation in 2015.

The Turkey installation could be closely followed by other projects in China. Harbin Electric Co., Ltd. (HE) has signed a memorandum of understanding (MOU) under which it plans to purchase four 9FB gas turbines from GE before the end of 2013, including two that will incorporate FlexEfficiency 50 technology. The purchases are subject to HE being awarded projects, most likely for district heating applications in China.



Junior Isles

Time to rock the boat?

That's what you get when politicians take charge of things they know little about – a wreck," joked Lars G. Josefsson, outgoing President of Eurelectric and former President and CEO of Vattenfall, at a welcome reception at the Vasa Museum in Stockholm, Sweden. Yet many a true word is spoken in jest.

On the eve of the Annual Eurelectric conference, Mr Josefsson was inferring that the European Commission should take heed of the industry's voice in its effort to develop an energy strategy for Europe that meets its goals of providing low carbon, sustainable and secure electricity supply in the most economic way.

Certainly politicians would be well advised to work in close partnership with industry on this mission – arguably, shaping the electricity sector is somewhat more complicated than building a 17th century boat.

At least Günter Oettinger, the EU Energy Commissioner seems to be making the right noises. Speaking at the conference, he said: "The transition to a low carbon economy will not be easy. In their submission to the February European Council, Eurelectric described today's situation as [being at] an 'unprecedented crossroads'. We need to choose the right direction together. The industry has a key role to help the EU deliver its goals to satisfy European demand for more electricity while attacking climate and fuel security concerns."

As the voice of Europe's electric utility sector, Eurelectric argues that it is imperative to focus on implementing a functioning internal market. Fulvio Conti, incoming President of Eurelectric and CEO of Enel said: "One of the priorities should be meeting the full integration of the market. Without such a step, we will not be able to work in an integrated environment."

The Commission seems to agree, at least in principle. It has set a timetable to complete the internal energy market by 2014. Oettinger noted that in the last year there has been significant coupling of markets in Belgium, France, Germany, Luxembourg and

the Netherlands with the Nordic regional markets.

He added: "The European Council has set 2014 as the deadline for completing the internal market and it's my interest and others on the European Council to realise this conclusion. We have three years to realise an internal market for everyone."

But despite his conviction, most are not convinced of the Commission's ability to make this happen. An electronic vote at the conference showed that most delegates did not believe this was possible. And it is not strictly because of the tremendous investment needed in infrastructure. Equally challenging is EU politics – 27 member states with politicians all protecting their own national interest.

This is where the European Commission has to take a firm stance, not just perhaps in driving a single internal market but maybe going even further by planning its fuel mix as a bloc.

"The future EU energy mix should be decided according to geo-climatic conditions and cross-border energy flows"

To individual member states, it may seem an absurd idea and may no doubt be extremely difficult to realise, but it is by no means a mission impossible. Indeed it would be the logical conclusion to what Brussels has already started. A target has been set for renewables – although based on no scientific reasoning – but why stop there? If the idea is to set some kind of energy strategy that will deliver the EU's goals then surely there should be a plan for all fuels.

Most will argue that once there is a single internal market and a reasonable price for carbon, the market will sort out the fuel mix. That may help deliver low carbon generation but will do little to ensure fuel diversification and probably even less to deliver low cost electricity.

The European Commission may find it both uncomfortable and difficult to act in the same way as say, China, wherein it is able to dictate an energy

mix policy; but perhaps it should.

Matias Alonso, Global Managing Director, Utilities Industry Group, Accenture said: "The future EU energy mix should be decided according to geo-climatic conditions and cross-border energy flows."

No doubt implementing this will be easier said than done, especially if such a long-term energy mix objective has to be agreed by member states. Alonso noted: "Capacity and production planning would need to be coordinated between member states. New rules might be needed and the EU will have to lead coordination among policymakers. Member states would have to refine their energy mix and legislation according to EU objectives."

The idea, however, is not without its supporters. Tomasz Zadroga, Vice President of Eurelectric and President and CEO, PGE-Polska Grupa Energetyczna said: "We need a common regulation for the next 10, 20 or 50 years. Based on current

impact. For example, instead of awarding EU funding for CCS projects in countries where coal is not a major player, perhaps the bulk of funding should go to developing projects in countries that have extensive coal resources, such as Poland and Germany.

Similarly, renewable projects would be sited where they make most sense. As Alonso put it: "There's a clear mismatch between natural resource availability and installed capacity. The most installed wind capacity is in Spain, which is not the place for wind. The most installed capacity of solar is in Germany. I understand this is not the best place for sun – I see a lot of German people in the south of Spain looking for the sun."

Oettinger agreed: "Among the things we need to explore together [with Eurelectric] include... the electricity mix, including gas and renewables... and resource efficiency. We have to think beyond national markets. With regards to emissions, the power industry has no choice but to rethink its fuel basis."

Sweden's King Gustavus Adolphus in his effort to build one of the grandest, most impressive warships of its time, decided to add another level of guns to the *Vasa*. He was also in a hurry for the ship to join the Baltic fleet for the Thirty Years' War. The result was a vessel that was so top-heavy, it barely made it out of the harbour before sinking.

The King's subordinates and shipbuilders knew of the ship's instability before it set sail but lacked the courage to bring it to the King's attention.

Unlike King Gustavus' subordinates, I am sure that EU member state politicians will have no problems raising objections to a pan-European energy mix with Mr Oettinger. But 'King' Günter, empowered by Commission president José Manuel Barroso, must have a touch of the King Gustavus in terms of acting with strength and speed – although he would do well to take advice from his shipbuilders i.e. the electricity industry itself.

