

THE ENERGY INDUSTRY TIMES

April 2015 • Volume 8 • No 2 • Published monthly • ISSN 1757-7365

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Carbon prices must rise

WWF’s Anderson says ministers are “applauding themselves” but should be aiming for much more



As the EU submits its carbon emissions target to the UN in the run-up to Paris, new research claims carbon prices must rise significantly to avoid climate change. **Junior Isles**

As nations prepare to submit pledges on carbon emissions, a new study by international researchers claims that carbon prices should be increased by up to 200 per cent to avoid dangerous levels of climate change.

Research conducted by the Universities of Exeter, Zurich, Stanford and Chicago concluded that the cost of CO₂ emissions now should be increased by between 50 and 200 per cent and setting a correspondingly high tax would trigger a reduction in emissions and limit the impacts of climate change.

According to the researchers, the

likelihood of human activities taking the climate system past a tipping point increases from 2.5 per cent in 2050 to almost 50 per cent in 2200.

Professor Tim Lenton, from the University of Exeter, said: “Our results support recent suggestions that the costs of carbon emissions used to inform policy are being underestimated. We are calling on policymakers to respond to the prospect of triggering future climate tipping points by applying the brakes now and putting a high price on carbon emissions before it’s too late.”

The research findings came as EU

environment ministers submitted the EU’s commitment towards the Paris agreement on climate change – known as Intended Nationally Determined Contribution (INDC).

In early March the EU pledged to cut its greenhouse gas emissions by at least 40 per cent by 2030 relative to 1990 levels. The EU is the second party to submit a climate target to the UN, after Switzerland. Only a handful of other countries were expected to meet an end-of-March deadline to submit targets.

The EU target, however, has been heavily criticised by environmental

lobbyists. Jason Anderson, Head of EU Climate and Energy Policy at WWF European Policy Office, said: “Ministers are applauding themselves for submitting their climate commitment before the deadline, but they should be aiming for much more than that... The EU needs to get its act together. Its leaders may be used to settling for weak compromises because of internal battles, but the outside world will show little understanding – they rightly expect Europe to stand on the high ground it claims at every UN conference, and not just to

Continued on Page 2

Coal boom ‘going bust’ says report

For every new coal plant built worldwide, two have been shelved or cancelled since 2010, according to a new report.

The report, ‘Boom and Bust: Tracking The Global Coal Plant Pipeline’ by US environmental organisation Sierra Club and research group CoalSwarm says this rate is significantly higher in places like Europe, South Asia, Latin America, and Africa, and has reached a six-to-one cancellation rate in India since 2012.

In China coal use declined in 2014, the first drop for 14 years, while at the same time the economy grew by 7.3 per cent. From 2003 to 2014, the amount of coal-fired generating capacity retired in the US and the EU exceeded new capacity by 22 per cent, claimed the report.

The report comes in the midst major restructuring by several European utilities that are re-organising their businesses in a shift from fossil fuels to renewables.

Last month Enel, the Italian energy giant, pledged to phase-out its investments in coal. In a joint statement released with Greenpeace, Enel outlined its target to achieve “carbon neutrality” before 2050.

The statement also said the company will promote an industrial strategy focused on boosting investment in renewable sources, energy efficiency, smart grids and storage systems, as well as “gradually phasing out further investment in coal”.

The company said that it shared the concern on climate change expressed by many scientists and is focused on the target of keeping the global tem-

perature rise below 2°C.

Kumi Naidoo, the international executive director at Greenpeace, has said he will write to the top 20 energy chief executives outlining the change in the group’s relationship with Enel to spur further action.

In 2014 Enel announced plans to close 13 GW of its fossil fuel capacity in Italy by 2020 and the company also cancelled two planned coal plants in Italy and Chile.

Enel’s CEO, Francesco Starace said: “The direction of future growth is in alternative energy sources – not fossil fuels.”

In March RWE Germany’s second largest utility warned of a “crisis” in fossil fuel power generation. It noted that up to 45 per cent of its fossil fuel power stations are no longer making money.

The company, which recently predicted a sharp fall in underlying earnings this year, has said it will invest about €1 billion a year from 2015 in renewables, with an emphasis on wind farms. In March, it bought a minority stake in solar group Conergy, hoping to expand its foothold in the embattled solar industry after having missed the trend for years.

Meanwhile, E.On, Germany’s biggest utility by market value, is preparing to split the group in two, spinning off fossil fuel and nuclear power generation into a new group.

E.On’s CEO Johannes Tysen recently said that the “preparations are making good progress”. E.On will provide more details on the plan in the second quarter, by which time it hopes to have set up management teams for both new companies.

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point up to it from below.”

All countries are supposed to present targets for a new global climate agreement that governments plan to adopt in Paris in December.

Hopes of limiting a rise in global temperature received a boost when the International Energy Agency (IEA) revealed last month that, for the first time in 40 years, annual global emissions of carbon dioxide did not rise in 2014 even though the global economy grew.

World leaders agreed nearly four years ago that global warming should be limited to no more than 2°C to avoid potentially dangerous climate change. The IEA's findings indicate that the 2°C target might be more achievable than thought.



Birol: findings are "a real surprise"

IEA chief economist, Fatih Birol, recently named as the agency's next executive director, said the findings are "a real surprise".

The agency says there have only been three times in four decades when emissions fell or stopped rising: after the oil price shock and US recession in the early 1980s; in 1992 after the collapse of the former Soviet Union; and in 2009 during the global financial crisis.

The IEA says emissions stayed flat predominantly because of shifts in energy use in the world's three biggest carbon dioxide emitters: China, the US and the EU.

China has imposed energy efficiency standards on industry, reduced coal consumption and increased its use of hydroelectricity, wind power and solar electricity.

Wealthier countries, many of which started promoting low carbon technologies much earlier, have also installed more renewable power and boosted energy efficiency. Some have also shifted from coal to gas. Most notably, the shale gas revolution in the US has brought down the price of gas putting economic pressure on already environmentally challenged coal fired plant.

Meanwhile, the future use of coal in the EU has once again come under fire. Last month a Greenpeace investigation claimed that new pollution limits for coal-fired power plants currently being discussed by the European Union are significantly weaker than those in place in China.

Greenpeace also said it uncovered evidence that the UK and other EU governments have put representatives of some of the worst polluting industries in charge of drawing up the new air pollution rules.

Commenting on the findings, Greenpeace UK energy campaigner Lawrence Carter said: "This is a classic case of the fox guarding the henhouse. By leaving the big polluters to write new air pollution rules, EU and UK ministers are guilty of a collective dereliction of duty."

The news comes in the wake of a report by the European Environment Agency, warning that hundreds of thousands of people could die prematurely in the EU over the next two decades if member states fail to tackle air pollution.

Energy deals to re-launch Egypt's economy

- Heavy investment in coal, gas and renewables
- Siemens secures 4.4 GW combined cycle plant

| Junior Isles

Several major deals signed at the recent Egypt Economic Development Conference (EEDC) look set to re-launch Egypt's economy following four years of political and economic turmoil.

The deals will bring billions of dollars to the country's upstream natural gas production and power generation sectors, which are in crisis due to a lack of investment in recent years.

Power generation capacity has been unable to keep pace with rising demand in recent years, leading to frequent blackouts. Falling natural gas production, which affects both power generation and industry, has made matters worse.

Several of the projects will help Egypt reduce its dependence on gas for power generation.

Tharwa Investments, a leading player in the asset management services sector, signed an agreement with Egypt's government to build the

world's largest coal-fired power plant, with a capacity of 6000 MW and costing \$11 billion.

An agreement for another huge coal fired plant was also reached at the conference between Orascom Construction Industries (OCI) and the International Petroleum Investment Company (IPIC). The deal will see construction of a 3000 MW station on the Red Sea coast, costing nearly \$3 billion for the project's first stage.

A non-binding framework agreement was signed between Masdar, ACWA Power and the Egyptian Electricity Holding Company (EEHC). The companies signed a Memorandum of Understanding (MoU) to explore developing up to 4 GW of renewable and natural gas power generation projects worth \$9.4 billion.

Masdar, Abu Dhabi's renewable energy company, would lead development of renewable energy projects in partnership with ACWA Power of Saudi Arabia. According to the MoU,

the partners will evaluate 2 GW of renewable energy projects, including 1.5 GW of solar and 500 MW of wind. The first project that would be considered is a 200 MW solar photovoltaic plant.

The framework agreement also calls for development of 2.2 GW of combined cycle natural gas generation led by ACWA Power.

Siemens will also benefit from the government's drive to attract investment in its energy sector.

The German company announced agreements that could amount to as much as €10 billion (\$10.5 billion) and boost the country's electricity generation capacity by up to a third by 2020.

Siemens and the Egyptian government reached firm agreements to build a 4.4 GW combined cycle power plant, based on its advanced H-technology gas turbines, and install 2 GW of wind power capacity. Siemens will also build a factory in Egypt to manufacture

wind turbine rotor blades, creating up to 1000 jobs.

Under two further MoUs signed at the conference in Sharm el-Sheikh, Siemens will propose to build additional combined cycle power plants with a capacity of up to 6.6 GW and ten substations to provide reliable power supply. The new deal came days after Siemens announced a contract to supply four gas turbines to the Attaka Power Plant near Suez City.

On the sidelines of the conference GE announced that it is investing in a new \$200 million multi-modal manufacturing, engineering, services and training centre in Egypt which will focus on various industries including power generation, renewables, water, oil & gas, aviation and rail transportation.

With demand growing at an annual 10 to 12 per cent, according to estimates Egypt's power generating capacity must be scaled up to 50 GW by 2025, nearly double today's capacity.

Think-tank calls UK energy policy a "disaster"

The Centre for Policy Studies says renewable energy is far more costly than thought and the current UK energy policy is on course to be "the most expensive domestic policy disaster in modern British history". The UK think-tank added that the government can either have renewable energy or the current market, but not both.

The report said that government policies "aim to hide the full costs of intermittent renewables, which as a result are systematically understated". It added that renewable energy requires a higher level of plant-level costs compared to fossil fuels alongside needing "massive amounts of

extra generating capacity to provide cover for intermittent generation when the wind doesn't blow and the sun doesn't shine".

The UK will need 22 GW of capacity using fossil fuels to replace existing older coal and nuclear plants, but the Centre for Policy Studies said the UK would need 50 GW of power capacity from renewables to replace the same existing stations, more than double that of fossil fuels, to deal with the intermittency problem.

Including capacity to cover for intermittency and extra grid infrastructure, the annualised capital cost of renewables is approximately £9 billion (\$13.5 billion), according to the

Centre's report, whilst using gas would cost only £3 billion a year at current wholesale prices, implying an annual net cost of £6 billion per year for renewables.

In response, the Department for Energy and Climate Change (DECC) said: "The report by the Centre for Policy Studies ignores the reality of the energy market. It wrongly suggests that we can ditch renewables for gas, with no explanation of where we would source that from. It also appears to suggest that we should row back on the tremendous gains we have made in the fight on climate change. Given the dire consequences of global warming this is not an option."

DECC added that the UK has "some of the best" wind, wave and tidal resources in Europe and exploiting these resources will make a strong contribution to future needs for secure and affordable low carbon energy.

The government demonstrated its support for renewables in its recent budget by moving to the first phase of commercial negotiations on a Contract for Difference with the developer of a proposed £1 billion tidal lagoon at Swansea Bay.

The proposed six-mile horseshoe shaped sea wall scheme in Swansea Bay could generate around 500 GWh per year, enough to power almost 120 000 homes.

Jordan, Hungary deals show Russian nuclear strength

Two major deals signed last month highlight Russia's role as a key player in the international nuclear power sector.

At the end of March Russia signed an agreement with Jordan worth \$10 billion that sets the legal basis for building the kingdom's first nuclear power plant.

The deal, signed with Russia's state-owned nuclear firm Rosatom, envisages the construction of a two-unit power plant with a total capacity of 2000 MW at Amra in the north of the kingdom by 2022.

Commenting on the need for the nuclear plant, Khalid Toukan, head of the Jordanian Atomic Energy Commission said: "As you know, we lost the oil from Iraq, natural gas from Egypt, and the country has been bleeding and

losing on average, \$3 billion every year." Jordan lacks any local energy sources and imports 96 per cent of its electricity.

Sergey Kiriyenko, the CEO of Rosatom, noted that cooperation with Jordan would also open the door for future nuclear fuel supply deals.

"The nuclear power plant is the embodiment of a strategic partnership," Kiriyenko said.

Russia, especially keen to tap lucrative new markets for its nuclear technology and know-how as it battles western economic sanctions imposed over the Ukraine crisis, will meet 49 per cent of the project's costs.

Rosatom's investment programme, sourced from Russia's state budget, allows it to spend about \$300-350 billion per year to build nuclear plants

in Russia and abroad. The availability of financing is proving attractive to several countries looking to build new nuclear plants.

In February, Moscow and Cairo signed a memorandum of understanding to build Egypt's first nuclear power plant during a visit to that country by Russian President Vladimir Putin.

Earlier this year Rosatom also signed an agreement to build two reactors at the Paks power plant in Hungary. Details of the deal were not announced and new legislation approved by the Hungarian government last month will keep those details secret for 30 years.

What is known of the deal is that it includes a loan from Russia of €10 billion (\$11.1 billion) to cover an estimated 80 per cent of the construction

costs. Hungarian companies are to carry out 40 per cent of the work.

Hungary's decision to award most of contracts to Rosatom without a public competition prompted the European Commission to launch a probe into whether the deal violated public procurement and state aid rules.

While Brussels said it was not challenging the expansion of the facility itself, it is seeking changes to the fuel supply deal. Last month the Commission backed the Euratom Supply Agency's (ESA's) move to block the fuel supply contract.

The current deal stipulates that only Russian fuel can be used in the new nuclear plant. According to EU sources, the ESA's decision found that this was against the principles of diversification in fuel supply contracts.



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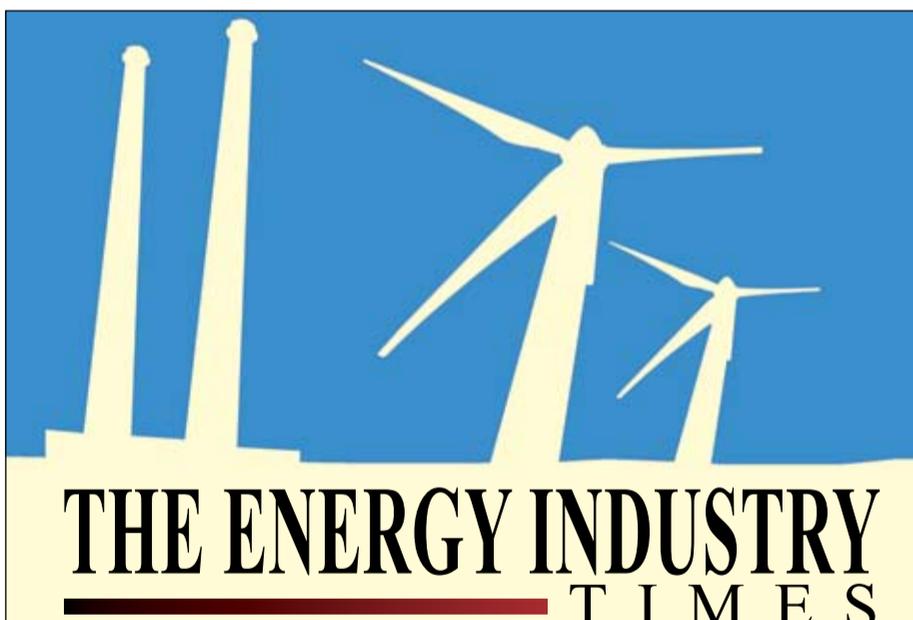
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Carbon tax proposed for NY state

■ Obama issues new executive order ■ Tax proposal to raise revenue, address climate change

Siân Crampsie

Sustainable energy lobbyists are garnering support among the political and business communities for a carbon tax system in New York state, USA.

The Network for Sustainable Financial Markets (NSFM) and the Citizens' Climate Lobby for New York City have joined forces to promote their proposal, which would reduce incentives to use fossil fuels by levying a sales tax on fossil fuels produced or distributed in New York state.

Revenues from the tax would be repaid to consumers through tax income

refunds, says NSFM.

The proposal is not the first of its kind in the USA, although no states have yet implemented a carbon tax system. It comes amid a growing momentum for climate change initiatives in the country.

In mid-March President Barack Obama ordered the federal government to cut its greenhouse gas (GHG) emissions by 40 per cent. Earlier in 2015, in his State of the Union address, Obama reaffirmed his commitment to tackling climate change and making the USA a leader in international efforts on reducing GHG emissions.

As well as pledging a cut in the federal government's emissions, Obama's latest executive order also directs the government to increase the use of renewable energy sources to 30 per cent of the federal government's consumption.

He said that US taxpayers could save up to \$18 billion in electricity costs by reducing GHGs 40 per cent over the next decade, compared to 2008 levels.

"These are ambitious goals, but we know they're achievable goals," Obama said.

The White House also said that some

of the federal government's major suppliers, including GE and Honeywell, would also make announcements on voluntary commitments to cut their own greenhouse gas emission levels.

According to NSFM, a carbon tax gradually imposed on crude oil and gasoline in New York State, at a rate equivalent to \$30 per metric ton of carbon dioxide emitted, would generate revenue while addressing climate change.

The tax would provide approximately over \$3.3 billion a year in new net state tax receipts, to be remitted back

to households and corporations via tax refunds.

The carbon tax policy would complement the existing Regional Greenhouse Gas Initiative, which has reduced power plant CO₂ emissions through a cap-and-trade system.

British Columbia in Canada set a precedent for a carbon tax in North America.

The BC tax began at C\$10/tonne (\$7.9/t) of carbon dioxide emitted and has increased by C\$5/t annually to C\$30/t. The BC carbon tax is revenue neutral, so that carbon tax revenues are returned through tax cuts.

IDO supports Caribbean states

Caribbean islands are hoping to strengthen their energy systems with the support of the United Nations Industrial Development Organization (IDO).

IDO is studying the energy sector challenges faced by Barbados, Grenada, Antigua and Barbuda and Dominica and is aiming to help the countries to implement more resilient and sustainable energy systems. The countries are dependent on oil imports for power generation, making electricity costs high and vulnerable to oil price volatility.

It has partnered with the Swedish Energy Agency for the initiative, which could also result in the creation of a Caribbean Center for Renewable Energy and Energy Efficiency.

Barbados' Prime Minister Freundel Stuart said that he wants the country

to become "the most environmentally advanced green country in Latin America and the Caribbean".

However, a recent report from Baringa Partners LLP, prepared for the UK's Foreign and Commonwealth Office (FCO), says that renewable energy will pose challenges to the utility business model in the Caribbean and that regulatory changes should be made in the region.

The Baringa report indicates that overly ambitious renewables targets are being set in the Caribbean in order to reduce the region's dependence on imported oil.

These targets will place pressure on utilities in the Caribbean, as in other small island nations with high electricity costs, and there are potential regulatory changes that could ease the pressure on utilities.

Block Island kicks off offshore wind vision

The Block Island offshore wind farm is poised to become the USA's first commercial offshore wind farm.

Alstom has announced that it has received formal notice to proceed from the project's developers, Deepwater Wind, which recently announced that it had fully financed the project. The French firm said that Block Island would highlight "both the commercial and technological viability of offshore wind in the US".

Alstom will provide five of its Haliade 150 6-MW wind turbines to the 30 MW project and will also provide 15 years of operations and maintenance support. Installation of the foundations is due to start three miles off the southeast coast of Block Island in Rhode Island in summer 2015, with commissioning following in 2016.

Deepwater Wind announced financial close of the project in early March, saying it was "ecstatic" to have reached this milestone. Alstom has already completed fabrication in Denmark of all 15 blades for the project, while Gulf Island Fabrication has started work on the wind farm's five

steel jacket foundations.

"We are on the cusp of bringing offshore wind from theory to reality in the US," said Deepwater Wind CEO Jeffrey Grybowski. "We've brought together some of the best American and European expertise to build an outstanding project and finance team. We're poised to launch a new American clean-tech industry, and it all starts here with our work on the Block Island wind farm."

In March the US Department of Energy (DOE) released a report into the US wind industry indicating that the country could install a total of 86 GW of offshore wind capacity by 2050, alongside some 400 GW onshore capacity.

DOE said in its 'Windvision' report that in 2013, wind energy in the US reduced direct power sector carbon dioxide emissions by 115 million metric tons and reduced power sector water consumption by 36.5 billion gallons.

President Barack Obama has made growth in the wind sector a key element of his climate action plan.



California leads solar growth

■ ITC underpins 30 per cent growth in solar installations
■ California nears 10 GW installed capacity

Siân Crampsie

California is poised to become the first US state to reach an installed solar photovoltaic (PV) capacity of 10 GW.

In 2014, California added 4316 MW of solar electric capacity, bringing total installed capacity in the state to 9977 MW. Much of the growth – 3395 MW – was due to the utility-scale sector, according to the Solar Energy Industries Association (SEIA), which last month released its Solar Market Insight 2014.

SEIA says that 2014 was a record-breaking year for the US solar industry, which now employs more people than tech giants Google, Apple, Facebook and Twitter combined.

The record growth in installed capacity in 2014 of 6201 MW across the country is largely down to the solar investment tax credit (ITC), said Rhone Resch, SEIA President and

CEO. "Since the ITC was passed in 2006, more than 150 000 solar jobs have been created in America, and \$66 billion has been invested in solar installations nationwide," said Resch. "We now have 20 GW of installed solar capacity – enough to power 4 million US homes – and we're helping to reduce harmful carbon emissions by 20 million metric tons a year."

"By any measurement, the ITC has been a huge success for both our economy and environment."

Solar accounted for 32 per cent of the USA's new generating capacity in 2014, beating both wind energy and coal for the second year in a row. Only natural gas constituted a greater share of new generating capacity.

In 2014, for the first time in history, each of the three major US market segments – utility, commercial and residential – installed more than 1 GW of PV capacity.

In the utility scale segment, 2014

saw 3.9 GW of PV capacity commissioned and there is a further 14 GW of projects currently under contract. Key projects include the 550 MW Desert Sunlight project completed by First Solar in California.

Some 767 MW of concentrating solar power (CSP) came on-line in 2014, says SEIA.

GTM Research forecasts that the US PV market will grow 31 per cent in 2015, adding 8.1 GW of new capacity. The utility-scale segment is expected to account for 59 per cent of additions.

"Solar PV was a \$13.4 billion market in the US in 2014, up from just \$3 billion in 2009," said Shayle Kann, Senior Vice President at GTM Research. "And this growth should continue throughout 2015 thanks to falling solar costs, business model innovation, an attractive political and regulatory environment and increased availability of low-cost capital."

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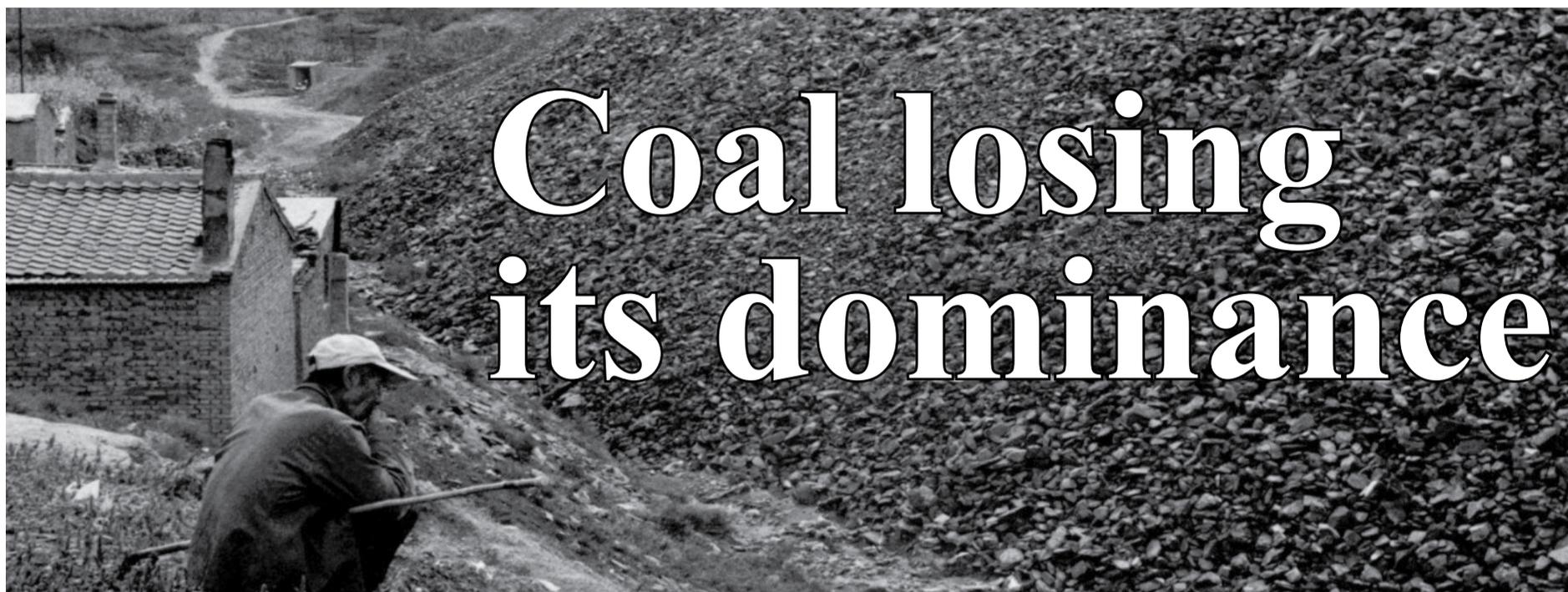
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Coal losing its dominance

■ Price gap between gas and coal narrows ■ China continues to cut coal use

Syed Ali

Coal is losing its dominance in Asia's power sector as it comes under pressure from the need to combat emissions and the increasing popularity of gas and renewables.

A recent report by Wood Mackenzie says downward pressure on gas prices as well as individual market conditions in Asia are creating conditions in which gas might compete with coal in the region.

According to Wood Mackenzie, Asia will need 2000 GW of new capacity through 2030 and notes that "it is likely gas will account for a higher proportion of this new power generation".

Graham Tyler, Research Director for Asia Gas & Power at Wood Mackenzie said: "While gas-coal competition is more commonplace in the US and Europe, in Asia, this is a new dynamic as coal and gas prices have not been

at close enough levels for this to be a consideration.

"Spot LNG prices have fallen to around \$7 per million British thermal units (mmbtu) in recent months and we do not forecast any sustained price recovery above \$10/mmbtu with over a 100 million tonnes per annum (Mtpa) of new LNG expected to be operational by 2020. This looming supply glut will create an environment where coal versus gas competition in Asia is a real possibility."

It also noted that benchmark thermal coal prices in the seaborne market are trading below the marginal cost of supply for many producers, and therefore are unlikely to fall significantly lower in the future.

With coal prices not expected to fall more dramatically and gas prices expected to see renewed softening after this summer, Wood Mackenzie says that the price differential between gas

and coal will be one to watch.

However, as there is not a single gas price across Asia, other factors will come into play. In China, air quality is a key issue and gas-fired power generation is subsidised in some provinces. China is also introducing a national carbon trading scheme; and other markets are also implementing or looking at carbon initiatives. "These factors all make gas the more attractive option," Tyler commented.

Just last month in its continuing effort to cut air pollution, Beijing closed down another large coal fired plant and replaced it with a gas fired station. The city previously had four coal-fired power plants. The first was closed last July and the last will be closed next year.

Under a new mid-term energy policy released at the latest National People's Congress at the start of March, China is to lift its use of non-

fossil fuels such as renewable and nuclear energy sources to 15 per cent of the total by 2020. If achieved, this could cut coal use by an estimated 160 million tonnes a year by 2020.

Meanwhile India, one of Asia's biggest coal users, recently said it will double tax on coal production as a way of showing the nation's commitment to tackling climate change and reaching a solid agreement at the COP 21 Paris Summit at the end of this year.

Also in early March, the government's Economic Survey, published just ahead of the budget, said India's renewable energy industry is likely to generate business opportunities worth \$160 billion in the next five years.

The government has embarked on a high-profile "solar mission" to deliver up to 100 GW of solar power by 2020, as part of 175 GW of clean energy it aims to install by 2022.

Last month China also announced

plans to boost its solar capacity. According to the National Energy Administration the 2015 target will be increased by 20 per cent to 17.8 GW. NEA officials cited the need to "stabilise and expand the solar application market," as the reason for the move.

China's wind market, meanwhile, has grown at an astounding rate. According to new research by market research firm CCM, installed wind power capacity recorded a CAGR of 58 per cent from 2007-2013. However, the production capacity of Chinese wind turbine manufacturers has grown even more quickly and is now at least double the country's demand for new turbines.

Michelle Li, CCM's energy market analyst, commented: "Severe overcapacity in China's wind power industry is likely to lead to a large-scale market consolidation over the next few years, and many turbine manufacturers will be bought out or go out of business."

Thailand calls for power plant delays

Significant overcapacity and slowing demand has prompted Thailand's government to call for a delay in several private power projects.

Syed Ali

Thailand's Energy Regulatory Commission (ERC) is in talks with several private power producers that received licences to develop plants, urging them to postpone commercial operations until 2022 due to lower than anticipated demand.

According to commissioner Kraisi Karnasuta, the ERC is negotiating with those companies that were granted licences but have yet to start their projects since the ERC predicts power demand over the next five or six years will be lower than expected.

The major power producers likely to renegotiate are those whose plants are scheduled to begin operating during the 2017-21 period including the Electricity Generation Authority of Thailand (Egat), Gulf Power Co and National Power Supply Co.

Thailand's power capacity reserve

is now 42 per cent, far above the international average of 15-20 per cent, meaning Thailand's operating cost for capacity reserves will increase.

Mr Kraisi blamed the global economic slowdown and political unrest for falling power demand, which was previously estimated to rise by 4-5 per cent a year.

At the end of February Ratchaburi Electricity Generating Holding Plc (Ratchaburi), Thailand's largest private power producer, had said it plans to spend Baht13 billion (\$400 million) to increase power production capacity at home and abroad this year.

Of this, Baht8 billion has already been used for existing projects, while Baht5 billion will be spent on new projects, chief executive Phongdit Photchana said.

New capacity will not save Philippines from power outages

According to the Department of Energy the Philippines has 27 committed power projects with a total capacity of 2281 MW set to be commissioned before the term of President Aquino ends next year, all of which are vital to meet growing power needs.

However, despite the amount of potential new capacity in the pipeline, the Philippines is unlikely to avoid impending rotating power outages this summer.

Therma South Inc. (TSI), the Aboitiz Power Corp. subsidiary, recently said full commercial operation of its 645 MW coal-fired power plant at Davao City is expected by mid-April.

DMCI Holdings of the Consunji Group also said it expects the first 150 MW expansion of its Calaca coal-fired power plant in Batangas to be ready by the summer of 2015.

Energy World Corp. (EWC), an Australian listed energy company, said last

month it is aiming to have the first 200 MW unit of its gas-fired power plant in Quezon ready by the middle of the year.

Meanwhile, Meralco PowerGen (MGen), the power generation arm of power distributor Manila Electric Co. (Meralco), is awaiting the green light from the Energy Regulatory Commission (ERC) for its 455 MW coal-fired power plant in Quezon. Meralco is hoping to have the project ready by the summer of 2018.

MGen also said last month that it is in discussions for a \$2 billion natural gas facility in the Philippines to be built together with a Japanese partner.

Metro Pacific Investment Corp. (MPIC) and Meralco chairman Manuel V. Pangilinan said his group is currently in talks with Osaka Gas for the possible construction of a natural gas-fired power plant that will have a generating capacity of 1200-1500 MW.

The company is also looking for partners for several coal projects in the pipeline.

The Philippines' government has been looking to attract private participation in its power sector to not only meet rising power demand, but also to reduce public debt.

The government, through the Power Sector Assets and Liabilities Management Corp. (PSALM), has so far raised \$19.9 billion from the privatisation of state-owned power assets, according to the latest status report on the implementation of the Electric Power Industry Reform Act (EPIRA) of 2001.

PSALM still needs to sell several power plants with a total capacity of 1600 to 1700 MW and expects to raise \$3.2 billion to \$3.4 billion more from the sale of the remaining assets, which are lined up for privatisation up to 2017.

EU builds on international links

With increasing renewable energy capacity and a drive to improve security of supply, interconnector capacity in Europe is expanding.

| Siân Crampsie

Electricity interconnections between European countries are increasing in response to European policy and greater cooperation between transmission system operators (TSOs).

France and Spain last month unveiled a new link that doubles the interconnection capacity between the two countries, while Belgium and the UK signed a joint venture agreement to build the Nemo link, a new 1000 MW interconnector.

France is also planning to strengthen its interconnection with the UK by building IFA2, and last month UK regulator Ofgem also recommended the Viking interconnector, which could have a capacity of up to 1400 MW.

As *TEI Times* went to press, the UK's National Grid announced it would

sign an ownership agreement with Statnett, Norway's TSO, signalling the start of construction of a 730 km-long, 1400 MW link from northeast England to Kvilldal in Norway, costing €2 billion.

The European Commission is keen to increase Europe's interconnection capacity to bring the single energy market closer to reality and improve security of supply. In March it opened a €100 million call for bids for projects that will help to reduce grid bottlenecks, end energy isolation and complete the European energy market.

It is offering financial assistance to projects that are on the Commission's list of projects of common interest that was initially adopted in 2013. The Commission hopes that the money "will also act as a catalyst for securing additional financing by private and

public investors".

It expects to make a total of €650 million available for grants in 2015, and plans to hold another call for proposals later in 2015. The funds will be sourced from the Connecting Europe Facility (CEF).

"Reliable and well-connected energy networks are vital for achieving a resilient European energy union," said EU commissioner for climate action and energy Miguel Arias Cañete. "We need major investments to make our energy grid fit for the future. This funding is an investment opportunity to build a competitive, sustainable and secure energy market, and ultimately bring the benefits into our homes and businesses."

In most cases the EU funding will cover up to 50 per cent of the cost of studies and works for a project, with

the rest procured through private finance. The Commission says that in exceptional circumstances it will support up to 75 per cent of costs where a project "contributes significantly" to security of supply.

Other interconnectors under development in Europe include a 700 MW link between the Netherlands and Denmark and a 1000 MW link from Belgium to Germany. The UK could build a third link to France, known as the FAB Link.

Under the CEF, €5.85 billion in EU financing is available for energy infrastructure from 2014 to 2020. The majority of the money will go to grants, the Commission said, but some will be spent on setting up financial instruments for infrastructure development, including a contribution to the European Fund for Strategic Investments.

V2G prospects brighter with Nissan agreement

The possibility of using batteries in electric vehicles (EVs) to supplement electricity grids came a step closer to reality with an agreement between Endesa and Nissan Iberia.

The two firms are planning to launch a commercially viable system of EVs and charging infrastructure that allows a bidirectional power flow known as vehicle to grid (V2G).

The V2G technology allows EVs to be used as an energy source for the electricity network – for example providing power to a home or as an energy storage device – as well as for their primary automotive purpose.

Considering that electric vehicles have a capacity ranging from 10 to 100 kWh and spend more than 90 per cent of their lives parked, systems such as V2G could play a significant role in the transformation of energy systems, said Endesa.

"Thanks to this technology, electric vehicles will become a fully integrated part of the electric system, adding new storage capacity and utilising that capacity in new and innovative ways, for purposes other than mobility," said Jose Bogas, CEO of Endesa.



Hinkley faces mounting legal challenges

EDF Energy is pressing on with negotiations with potential Chinese partners in its Hinkley C nuclear project against a background of opposition from green groups and European neighbours.

| Siân Crampsie

Opponents of EDF Energy's Hinkley Point C nuclear power project in the UK say that their case has been strengthened by the revelation that the British government wants to own a 'golden share' in the scheme.

The government revealed in March that it had held initial discussions with the European Commission about seeking approval for ownership of the share, which would give it certain voting rights in key issues such as ownership changes and supply chain matters.

The green lobby says that the move indicates a lack of clarity around the project and alters the UK's case for state aid for Hinkley C, a proposed 3.2 GW nuclear plant in Somerset, southwest England.

Last month Luxembourg said that it would back Austria's move to file a lawsuit against the European Commission for its decision to approve

state aid for Hinkley C. Germany's Greenpeace Energy has also announced plans to contest the Commission's decision.

Austria believes that the UK government's plans to provide financial support for Hinkley C – including a "contract for difference" (CFD) for 35 years and an infrastructure guarantee scheme – breach European state aid rules. Greenpeace Energy said that "highly subsidised nuclear power from this plant will noticeably distort European competitiveness".

The European Commission approved the government's investment contract with EDF in October 2014, noting that the CFD and guarantee constituted an appropriate and proportionate way for the UK to meet its need for secure, low carbon energy.

The UK government will finalise these contracts with EDF once the French firm has sealed investment agreements with potential Chinese partners.

Under the terms of an agreement

reached in October 2013, China General Nuclear (CGN) and China National Nuclear Corporation (CNNC) together will take a 30-40 per cent stake in Hinkley C.

Media reports suggest that the Chinese firms want a greater role in the project than a straightforward financial partnership. If an agreement is reached in the next few weeks, a final investment decision will be possible by the end of the year, according to EDF, which had initially wanted to take the decision in mid-2014.

Hinkley C would be the UK's first new nuclear power plant in a generation. The UK government agreed with EDF a strike price of £89.50/MWh under its new CFD scheme, provided another planned new nuclear power plant at Sizewell goes ahead.

Green MEPs in Europe have criticised the "deep uncertainty and confusion" surrounding the financing of Hinkley and have called for the deal between EDF and the government to be referred back to the Commission.

Study shows impact of green energy on distribution grids



A new study by DNV GL for the European Commission is the first to consider the impact of renewable energy on distribution grids.

The study shows that large amounts of renewable energy could be integrated into Europe's networks, provided that a number of mitigating technical and regulatory measures are implemented.

An extensive expansion of infrastructure would also be required, says DNV GL, which carried out the research with Imperial College London and NERA Economic Consulting.

The need for infrastructure expansion and mitigating measures depends on the different structures of the European distribution grids as well as the mix of distributed generation technologies in individual countries, says the study.

The analysis shows that different measures like smart grid technologies can be taken to minimise the need for distribution expansion. These include examples such as active voltage control by distribution networks and decentralised generators, a selective use of decentralised energy storage,

or a limited restriction of solar PV to avoid excessive peaks of decentralised generation.

In addition, demand response stands out as a particularly promising measure to reduce costs, especially in light of the significant load growth assumptions taken from the scenarios of the EU Energy Roadmap 2050. If deployed alongside a balanced geographical distribution of renewables, i.e. taking wind and solar capacities away from the best resource location and towards load centres, the cost of integrating renewables can be significantly reduced.

"The research findings present a positive image of the role renewable energy sources can play in keeping with the objectives of the EU's Energy Roadmap 2050," said Christian Hewicker, Head of Section Energy Markets at DNV GL. "However, our analysis suggests that there are a number of technical, regulatory and market-based measures that should be used to facilitate the integration of renewable energy sources – while keeping the need for additional, costly infrastructure to a minimum."

Saudi Arabia takes on SMART mantle

At least two nuclear reactors could be built by South Korea in Saudi Arabia after the two nations signed a deal in March.

Leaders from the two countries inked a memorandum of understanding under which a three-year preliminary study will be undertaken by 2018.

The study will review the feasibility of building SMART reactors in Saudi Arabia as part of the Saudi's plans to build more than 12 nuclear power plants by 2040.

SMART reactor technology was designed by the Korea Atomic Energy Research Institute (KAERI) and is a 330 MWth pressurised water reactor with integral steam generators and advanced safety features. It is designed for electricity generation (up to 100 MWe) as well as thermal applications, including desalination.

The technology was developed with Middle East markets in mind but its development has been stalled by a lack of orders for an initial reference unit.

The MOU also calls for the two countries to cooperate on the commercialisation and marketing of SMART reactors to third countries.

Building two SMART reactors in the Kingdom would cost around \$2 billion, according to the agreement.

KAERI said in a statement: "With the agreement, the South Korean government expects to win \$2 billion worth of nuclear reactor deals in Saudi Arabia and additional orders in the future. If realised, it will be the world's first case of small- and medium-sized reactors being exported to a foreign country."

Saudi Arabia wants to use nuclear energy in order to conserve its domestic oil reserves and meet growing energy demand.

According to a new report by Timetric's Construction Intelligence Center (CIC), Saudi Arabia is set to invest almost \$150 billion in power projects in the coming years.



Still under construction: the Kusile power plant in Mpumalanga

Eskom's board has suspended CEO Tshediso Matona and three other senior executives

Eskom's woes deepen

- C&I contract terminated
- Eskom launches investigation

Siân Crampsie

Eskom's troubles deepened last month when it agreed to terminate a contract for Alstom to supply the control and instrumentation (C&I) system for a new coal fired power plant in South Africa.

The move is the latest blow to Eskom's plans to expand generating capacity in the country and came just days after the South African utility said it would suspend its chief executive officer and several senior executives while it carried out an investigation into the company's poor performance.

Eskom is implementing regular load shedding events as demand for electricity outstrips supply. It warned in January that the need to keep the lights on had pushed the electricity system to its limits and unplanned break-

downs would be more common.

In March Eskom said that it had terminated the C&I contract with Alstom for the Kusile power plant, which is currently being built in Mpumalanga. It later announced it had appointed ABB as the new C&I contractor for the project.

Eskom said in a statement that "a consensual termination" with Alstom had been reached "on a co-operative walk-away basis". It added that the termination would not affect Alstom's work at the Medupi power plant, the first unit of which came on line in March.

The termination could delay the 4800 MW Kusile power project, which was due to start operating in 2014. Earlier this year Eskom said that Kusile's first 800 MW unit would be synchronised in the first half of 2017 and that it would enter commer-

cial operation in the second half of that year.

The delays and cost overruns at Eskom's key power plant projects are two aspects that Eskom will examine in its investigation.

The firm's board has suspended CEO Tshediso Matona and three other senior executives and says that it will appoint an independent firm to carry out the inquiry.

The investigation will also look at the high costs of primary energy and cash flow challenges, and is expected to last for three months.

It was announced just days after Eskom said that the first unit of the 4788 MW Medupi coal fired power plant had been synchronised to the grid. Medupi is itself around four years behind schedule and its first 794 MW unit is expected to start commercial operations in June 2015.

Fortunately for the country, several renewable energy projects are progressing, however.

Enel Green Power said in March that it has started construction on three photovoltaic (PV) solar power plants with a combined capacity of 231 MW. The three plants – Tom Burke, Pa-leisheuwel and Aurora – are located in Northern Cape, Western Cape and Limpopo Provinces and will sell their output to Eskom under power purchase agreements.

Abengoa, meanwhile, announced that its 100 MW KaXu Solar One concentrating solar power (CSP) plant, the first of its kind in South Africa, had started generating electricity. The Spanish firm has also secured \$660 million in project financing for another CSP plant – the 100 MW Xina Solar One – in Northern Cape Province, it said.

Solar import prices set to rise

Solar panel importers in Europe are reported to have been shipping re-labelled solar modules from China via Malaysia and Taiwan in a bid to evade duties.

Solar panels from China are subject to a minimum import price (MIP) under a deal between the EU and Chinese governments signed in 2013 to prevent a trade war erupting.

Dutch customs last month confirmed to *Solar Magazine* that solar modules from 22 different manufacturers are being held in several European ports as part of a wider investigation. Some of the modules may be from Chinese firms that have not signed up to the EU-China trade deal and would therefore be subject to duties of 65 per cent.

Investigators believe that the solar modules are shipped to Taiwan or Malaysia where they are re-labelled with stickers, waybills, invoices and certificates of origin, and put on new containers.

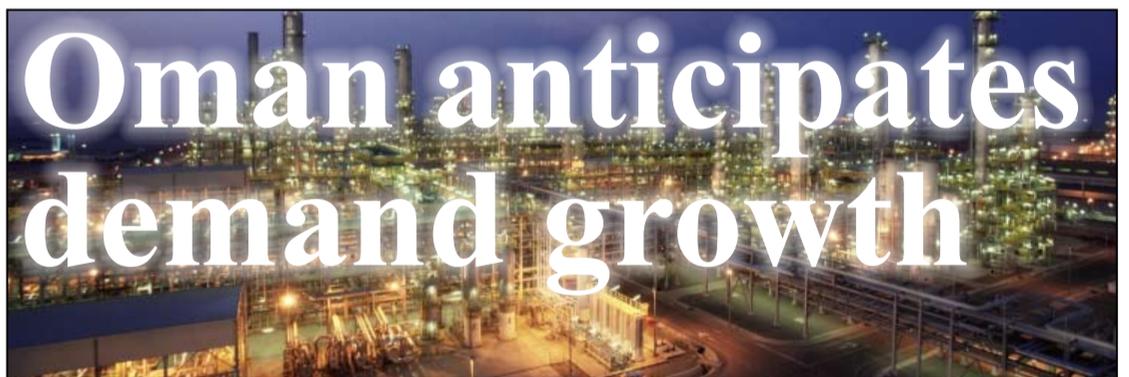
The European Commission was due

to review the MIP on April 1 and many solar market players are expecting an increase because of the impact that the weakening euro has had.

The Commission sets the prices according to the Bloomberg New Energy Finance (BNEF) module price index, which is determined in US dollars. Luc Graré, Senior Vice President Sales & Marketing at REC, said that the weakening euro meant that an adjustment of the MIP for Chinese solar panels was "absolutely justified".

As of April, Chinese PV manufacturers that have committed to the European Union's so-called Undertaking, or minimum import price agreement, will have to sell their solar modules for €0.56/watt in the EU.

■ China is to help build a 400 MW solar power plant in Ghana aimed at easing the energy crisis. According to the Charge d'Affaires at the Chinese Embassy in Accra, Zhou Youbin, the Chinese Hanergy Group will be at the forefront of the \$1 billion project.



Oman is ramping up installed power generating capacity in anticipation of rapid growth in electricity demand.

The Oman Power and Water Procurement Company (OPWP) said last month it would issue a request for proposals (RFP) for the construction of two new power plants with a combined capacity of 2600 MW.

OPWP said it would issue the RFP to international developers who met its prequalification criteria for the competitive selection process. The winning developer would be awarded a license to develop, finance, design, engineer, construct, own, operate and maintain two gas fired power plants and associated facilities to be located at Ibri in Dhahirah Governorate and Sohar in Batinah North Governorate. The combined capacity of the plants

could be later expanded to 3200 MW, said OPWP.

The full capacity is expected to be commissioned and made available by April 1, 2018, although there is a requirement for the successful bidder to make available early power capacity of 700 MW at the Ibri site by April 1, 2017.

In choosing to locate part of the capacity in Ibri – the first power project planned for implementation in Dhahirah Governorate – OPWP is catering for what is anticipated to be a major ramp-up in infrastructure and economic investment in this region of the Sultanate.

Ibri is tipped to host a major industrial park as well as a mega logistics hub integrated with the Oman National Rail Project. Its proximity to the UAE border

at the point where the national rail system connects with the GCC Rail Network makes Ibri an advantageous location for investments in logistics, value add manufacturing, and rail-related maintenance, say experts.

Oman is also looking to renewable energy to boost generating capacity.

Officials at the Rural Areas Electricity Company (Raeco) said in March that work on the country's first large-scale wind energy project would start in June 2015.

The \$200 million, 50 MW project is being funded by Masdar. A contract for construction of the wind farm was due to be awarded at the end of March.

Raeco told local media that several international firms had submitted bids for the project, which is due to start operating in 2016.

EU extends GE-Alstom merger deadline

■ More time to reach a deal ■ Paris set to be renewables HQ

| Siân Crampsie

GE and Alstom have won more time to reconcile their differences with the European Commission over their proposed merger.

The European Commission has extended its investigation into the \$17 billion merger between the two firms by 20 days, giving the parties until August 6 to find a solution.

The Commission is concerned about the impact of the merger on competition in Europe's equipment market, particularly for gas turbines. GE and Alstom say that the Commission's

concerns are unfounded because the European market for gas turbines is so small that it would be unaffected by the merger.

The companies also recently revealed that their merged renewable energy businesses would be headquartered in Paris rather than in GE's Schenectady campus.

Alstom's renewable energy business is focused on offshore wind and hydropower, while GE's is focused on onshore wind. After the merger, the combined renewables business would become a standalone, "tier one" business unit, overseen by Jérôme Pécresse

in Paris and reporting directly to Jeff Immelt, GE's CEO.

The European Commission launched an in-depth probe into the two firms' merger in February with a target deadline of 8 July for completing the investigation.

It said then that a GE-Alstom deal would remove one of GE's three main competitors in the heavy duty gas turbine market in Europe, leaving just Siemens and Mitsubishi Hitachi Power Systems. It believes that this may not only impact prices, but also technology innovation in the sector.

Margrethe Vestager, the European

Competition Commissioner, said in a February statement that technology was crucial in helping Europe meet its environmental goals.

Both GE and Alstom say that they have held constructive dialogue with the Commission. GE wants to close the merger deal by mid-2015, although this is less likely given the extension to the investigation.

Patrick Kron, CEO of Alstom, told France's parliament in March that the firm had sold three gas turbines in Europe in the last five years. GE says that around five gas turbines are sold in Europe each year, a very small

proportion of the global market of 200.

The firms have also pointed out that Europe's gas turbine market is shrinking as utilities mothball existing plant in the face of low energy demand and prices.

The Commission is also looking at the long-term picture, however, noting there could be a surge in demand for gas turbines, as coal-fired stations are decommissioned. The International Energy Agency believes that demand for gas turbines will rise in line with a projected rise in investment in gas-fired generation.

European utilities struggle to balance books

Europe's utilities are looking at ways to improve balance sheets affected by a tough market and the changing energy landscape.

E.ON and RWE, Germany's largest utilities and two of the world's biggest power companies, face grim prospects, their chief executives said last month.

Falling demand for power and heavy government subsidies for renewable energy have so undermined their traditional business model that earnings will be squeezed this year, they said.

RWE says it is aiming to cut costs further to prevent a drastic decline in earnings in 2015.

The German utility said in March that the "crisis in conventional electricity generation" would continue and would drag earnings to a lower level than those in 2014. It avoided posting a loss for last year but said this year's outlook was less certain because of lost income at its conventional power plants.

It is planning to make cuts to capital expenditure as well as in administrative and IT functions to shore-up its balance sheet this year.

RWE swung to a net profit of €1.7 billion from a net loss of €2.8 billion last year when it wrote down the value of several conventional generating plants. Chief Executive Peter Terium, who recently signed a new five-year deal to remain as head of the company, said that between 35 per cent and 45 per cent of RWE's coal and gas-fired power plants are not commercially viable.

It has identified a further €500 million in cost cuts over the next few years and is now targeting cost cuts of €2 billion by 2017.

According to reports, RWE is also considering selling a 10 per cent stake to Abu Dhabi investors. Bloomberg earlier reported that the company has been in talks with investors about a

potential sale since last year.

E.ON, meanwhile, posted its largest-ever net loss of €3.2 billion for 2014. The company has been shedding its assets in Italy and Spain and in November said that it would split into two companies, one focused on green energy and the other on fossil fuels.

EnBW (Energie Baden-Wuerttemberg) also announced a swing to a 2014 net loss on higher provisions and impairment charges, and issued a bleak outlook for the next several years. The company says it is seeking to cut a further \$424 million from annual costs by 2020.

There was slightly better news for some of Europe's other energy companies.

Fortum last month completed its move out of power distribution with the sale of its Swedish electricity grid business.

The Finnish utility sold the business for €6.6 billion to a group of Swedish pension funds and Canada's Borealis. In 2013 it sold its Finnish grid business to another consortium that also included Borealis for €2.5 billion.

Fortum says that it will concentrate on growth and development of its core businesses, including hydropower and nuclear power generation and combined heat and power production. It expects to book a one-time sales gain of €4.4 billion in the second quarter of 2015 from the sale.

Including the latest sale, Fortum will have gained €9.3 billion from recent divestments in Finland, Sweden and Norway.

Meanwhile, Czech-based power company CEZ announced that 2014 full-year earnings surpassed the company's guidance and it set slightly lower guidance for this year. It noted that fourth-quarter net profit declined over the year amid lower electricity prices.

New initiative aims to cut wind costs

■ New industry initiative launched
■ Adwen JV deal closed

Europe's offshore wind energy sector should increase turbine size, foster competition and tackle challenges in the supply chain in order to reduce costs.

A new study from Ernst & Young (EY) says that the sector should shed 26 per cent of its current outlays in order to be cost-competitive with conventional forms of energy by 2023.

The report shows that deploying larger turbines could reduce costs by nine per cent, while increased competition between industrial players could save seven per cent. Commissioning new projects could lead to a further seven per cent saving and tackling supply chain issues, three per cent.

The report was released as three major players initiated a joint declaration – called United Industry – aimed at reducing costs in the sector.

Dong Energy, MHI Vestas and Siemens Wind Power and Renewables have pledged to undertake joint and individual actions across the whole of the value chain to deliver "major long-term and tangible advancements".

The three firms say cost reduction is a top priority in the industry as is the drive to create profitable investments

independent of subsidies. "In a united industry, all stakeholders across the whole value chain are equally responsible to contribute and deliver," said Michael Hannibal, CEO Offshore of Siemens Wind Power and Renewables. "Siemens takes full ownership of this challenge. If we all do that, we will win."

Thomas Becker, who recently stepped down as CEO of the European Wind Energy Association, said that offshore wind energy would be "a major contributor to the continent's energy security now and over the course of the next decade".

The drive for cost reduction has seen a number of collaborations between major industry players.

Last month Gamesa and Areva signed the definitive agreements for the creation of Adwen, a 50-50 joint venture focused on the offshore wind sector.

According to the two companies, Adwen is ideally positioned to become a leading player in the offshore wind segment, with a 2.8 GW project pipeline and the objective of garnering a market share of close to 20 per cent in Europe by 2020.



Hannibal: "all stakeholders across the value chain are equally responsible"

Adwen will offer an 8 MW platform, initiated by Areva and further optimised by Gamesa, which will reach serial production in 2018.

In addition, Adwen 5 will offer two complementary 5 MW turbines available for immediate projects: the AD 5-135 and AD 5-132. The AD 5-135, formerly called M5000-135, is Areva's 5 MW technology with an installed base of 650 MW which will reach 1 GW with Wikinger wind farm installation. The AD 5-132, developed by Gamesa and formerly called G132-5.0 MW Offshore, complements the product portfolio with a competitive turbine.

■ Mitsui is expanding its capabilities in the renewable energy sector with the purchase of a 25 per cent stake in Gonvarri Eólica, S.L., which controls wind turbine tower manufacturing firm GRI Renewable Industries Group. GRI has ten manufacturing plants in Spain, Brazil, China, Turkey, India and South Africa, and Mitsui says it will work with GRI to establish new facilities in Asia and America to reflect growing demand in the onshore segment, and also in Europe to meet demand in the offshore wind energy sector.

10 | Tenders, Bids & Contracts

Americas

South America expansion for Nordex

Uruguayan state power company Usinas y Trasmisiones Electricas (UTE) has placed an order with Nordex SE for the construction of the Pampa wind farm in Tacuarembó, north central Uruguay.

Nordex will supply, install and commission 59 of its N117/2400 wind turbines. It has also signed a ten-year premium service contract with UTE for the units.

Nordex will commence infrastructure work on access routes, foundations and cabling in the first half of 2015. The wind farm will go on-line around mid-2016.

Power Machines on point for La Mina

Colbun has awarded Power Machines a contract for the design, manufacture and supply of hydro equipment for a 34 MW power plant under construction in Chile.

Power Machines will supply two hydropower units for the La Mina project including a radial-flow hydro-turbine, generator and electromechanical auxiliaries.

Power Machines will also be responsible for installation, pre-commissioning and commissioning of the electromechanical equipment. The plant is scheduled to be commissioned in 2016.

Wärtsilä supplies flexible generation

Coffeyville Municipal Light and Power (CMLP) of Kansas, USA, has awarded a contract to Wärtsilä for the supply of a 56 MW smart power generation power plant.

The new plant will consist of three gas fired Wärtsilä 50SG engines and is scheduled to start commercial operation in January 2017. The flexible, fast-start capability of the new plant will improve CMLP's position in the electricity market.

"We like the fact that Wärtsilä engines can go to full power in less than 10 minutes. That makes us much more competitive," CMLP's Director Gene Ratzlaff said.

Asia-Pacific

Solar Frontier, Welspun seal supply deal

Solar Frontier and Welspun Renewables have signed a 100 MW solar module supply agreement.

Solar Frontier will supply its proprietary CIS thin film solar modules to Welspun for installation in upcoming solar projects in India. Welspun has signed a number of power purchase agreements with state governments and is aiming to commission over 1 GW of solar and wind capacity in fiscal 2015, it says.

Marubeni to build Thai plant

Japanese trading house Marubeni Corp. and Alstom Power Systems have signed a deal with Thailand's electricity authority to build a 600 MW coal-fired power generator at a power plant in northern Thailand.

Under the \$1 billion contract, the two companies will replace four existing power generators at the Mae Moh lignite fired power plant in Lampang Province.

The new unit will be the first in Asia to burn lignite under ultra-supercritical conditions.

It will start operating in 2018.

Zhanhua Heavy to build offshore wind farm

Shanghai Zhenhua Heavy Industries Co. Ltd. has won an order to construct a 150 MW wind farm off the coast of Rudong in China's Jiangsu province, for power producer China General Nuclear Power Group (CGN).

Under the CNY160 million (\$25.5 million) contract, the company will install 38 Siemens 4 MW turbines, and additional equipment. It expects to complete the job within nine months.

China currently has around 670 MW of operating offshore wind capacity and is targeting an installed capacity of 5 GW by the end of 2015.

Sumitomo awards Duyen Hai 3 contract

Sumitomo Corporation has awarded a contract for the supply of a supercritical steam turbine and generator for the Duyen Hai 3 extension project in Vietnam to Japan's Toshiba Corporation.

Toshiba will make delivery in 2016 a 688 MW steam turbine generator to the coal-fired power plant project in the Duyen Hai district of Tra Vinh province. The project is due to start operating in 2018 and will help the country to meet rapidly rising energy demand.

MAN seals service agreement

MAN Diesel & Turbo has signed a service agreement with PT Berkas Bima Sentana (BBS) for the maintenance of four 18V48/60TS engines in a newly built power plant in Belawan in the north of Sumatra, Indonesia.

The five-year agreement covers the supply of spare parts for scheduled maintenance intervals and PrimeServ Online Service, an automatic and continuous monitoring of all four engines.

MAN Diesel & Turbo supplied the plant in Belawan with the four 48/60TS engines and successfully commissioned the facility at the end of 2014. The plant has a total capacity of close to 160 MW, approximately 80 MW of which are supplied by the new 48/60TS engines. The remaining power is generated by eight overhauled MAN 9L58/64 engines.

ABB powering up Philippines

ABB is to supply an integrated electrical and control solution for a new power plant that will help meet peak demand and ease power shortages in the Philippines.

The San Gabriel Avion open cycle gas-fired power plant will provide 97 MW of much needed power for the island of Luzon – the economic and industrial hub of the Philippines and home to around half the country's 100 million population.

The contract was awarded by Istroenergo Group a.s. (IEG), a Slovakia-based engineering, procurement and construction contractor that is building the plant for First Gen.

IEG and ABB will deliver the project in just 10 months. This will enable First Gen to start producing energy in April 2015 in time to counter the expected power shortfall in Luzon a few weeks later.

The plant will have peaking capability and be able to reach full load within 10 minutes of start-up and handle 2000 rapid starts a year.

Europe

Alstom signs two biomass contracts

Alstom is to supply the steam turbines for two new biomass power plants being developed in the UK by

Burmeister & Wain Scandinavian Contractor (BWSC).

Alstom will supply a 23 MW geared reaction steam turbine for a waste wood combined heat and power (CHP) biomass plant in Widnes, Merseyside that is being developed by BWSC and UK logistics company Stobart Group.

It will also provide a 50 MW geared reaction steam turbine for the Snetterton biomass plant, in East Anglia, which will burn energy crops such as straw, cereals and oilseed rape.

ABB wins NordLink order
Statnett and TenneT has awarded ABB orders worth \$900 million to supply equipment for NordLink, a new power cable connecting the German and Norwegian power grids.

ABB will supply the onshore high voltage direct current (HVDC) converter stations and the cable system on the German side of the link, which will be the first power interconnection between Germany and Norway.

NordLink will also be the longest HVDC link in Europe and is scheduled to start operating in 2020.

Atkins and Dong team up

Atkins and Dong Energy have signed a contract for engineering design services for three offshore substations at Dong's proposed Hornsea Project One offshore wind farm.

Atkins says it will take a standardised approach to fabrication of the substations to drive down costs and increase engagement with the UK supply chain. It now has major contracts with Dong for detailed engineering design of eight offshore substations, including those at the planned Burbo Bank Extension, Race Bank, and Walney Extension offshore wind farm projects in the UK.

Hornsea Project One is located 120 km off the Yorkshire coast and covers approximately 407 km². The project is scheduled to commence operation by 2020 when it would become the world's first GW-scale far-from-shore wind farm.

Hitachi builds big data platform

Hitachi Consulting has been chosen to build a first-of-a-kind 'big data' platform for the city of Copenhagen.

The Copenhagen Big Data project is anticipated to deliver the first platform on which data collection, integration and sharing is centralised for an entire city. Hitachi says it will work with the city of Copenhagen, Danish organisation Clean and an alliance of consortium partners, to develop the platform.

The integrated platform is expected to establish a city data marketplace for the sale and purchase of data between businesses and is one of the first times public data and private data will be combined. The platform will enable advanced analytics to support city functions like green infrastructure planning, traffic management and energy usage by integrating data from multiple sources.

The data marketplace is also expected to offer businesses unprecedented insight into interactions and relationships between different city functions, supporting core business planning and fostering new business opportunities.

Vattenfall success at Horns Rev

Vattenfall has won the concession to build and operate Horns Rev 3, a 400 MW offshore wind farm in the Danish North Sea.

The Danish government awarded Vattenfall the concession in March,

but still requires approval from the Danish parliament. The wind farm is due to start operating in 2017, producing electricity for 450 000 households.

With Vattenfall as owner of the concession for Horns Rev 3, the company gets a unique opportunity for synergies between several offshore wind power farms, according to Alberto Mendez Rebollo, Head of Vattenfall Nordic Wind Power operations.

International

CG to provide Saudi smart grid solutions

CG has been awarded a contract worth €3.4 million by Saudi Electricity Company (SEC) to supply smart meters as part of a wider smart grid development programme.

CG says that it bagged the largest lot for the supply of the first batch of industrial smart meters tendered by SEC. It will supply its ZIV three-phase smart meters, which will be connected to current transformers and communicate via modem (GPRS).

Small-commerce end users will be the first to have the new smart meters installed and subsequent contracts are expected to be awarded soon.

Siemens adds 650 MW in Egypt

Siemens is to supply four turbines to a new power plant near Egypt's Suez City to add more than 650 MW of capacity to the national grid.

The German firm will supply its E-class gas turbine technology for the Attika power plant under a contract with El Sewedy Power Systems Projects.

The new plant will boost energy supplies to Egypt's grid, which is increasingly under strain because of rising demand, a lack of investment and gas shortages.

Yokogawa wins orders for Saudi plants

Yokogawa Electric Corporation has booked orders with Saudi Electricity Company (SEC) to supply distributed control systems (DCS) for two combined cycle power plants (CCGT) under construction in Riyadh.

Yokogawa Saudi Arabia will deliver the Centum VP integrated production DCS for the monitoring, control, and operation of plants' gas turbines, heat recovery steam generators (HRSGs), steam turbines, and electric systems as well as a plant operator training simulator (OTS).

The PP13 and PP14 plants will each have a combined net output of 1980 MW. Power blocks 1 and 2 of the PP13 plant are scheduled to begin operating in May and October of 2016, respectively, while the two power blocks at PP14 are scheduled to start in November 2016 and April 2017.

Malawi orders ABB solution

ABB has won an order from the Electricity Supply Corporation of Malawi (ESCOM) for a system that will enable the monitoring and control of its power distribution network.

The new system will help the utility manage electricity demand and improve power supplies by reducing the frequency and duration of outages experienced by customers.

ABB's solution comprises hardware, software, storage and communications equipment. The distribution management solution comprises Scada (supervisory control and data acquisition), DMS (distribution management system) and OMS (outage management system) software.



Oil

Saudi Arabia determined to ride out oil price fall

- Opec will not take sole responsibility of cutting production
- Saudi denies any "grand scheme"

David Gregory

Saudi Arabia is producing around 10 million b/d of crude oil and clearly intends to stick to current policy for as long as it takes the Opec leader to achieve its goals.

Judging by statements from Saudi Oil Minister Ali al-Naimi, Riyadh appears certain that it can cope with crude oil prices that could fall lower than they are now.

During late March West Texas Intermediate (WTI) was moving in the \$45/b range and Brent was struggling to maintain at \$55/b. Some analysts argue that signs are indicating a further fall from last year's mid-June high of \$115/b.

And while oil producing states and companies remain hopeful of a turnaround at some point, some market watchers are saying it is likely that \$100/b oil is out of the picture for a

considerable time to come.

Speaking in Riyadh in late March during an energy conference in the Saudi capital, Naimi stated once again that Opec will not take on the sole responsibility of cutting production in an attempt to correct the oil market.

According to Opec data, Saudi Arabia produced 9.64 million b/d in February, and it continues to turn a deaf ear to other Opec members who see lower crude oil prices as trouble for their own domestic budgets.

Naimi recalled to reporters that in 1998 when oil prices were depressed, Opec and other oil producers worked together to improve oil market conditions, but that is not the case today he said.

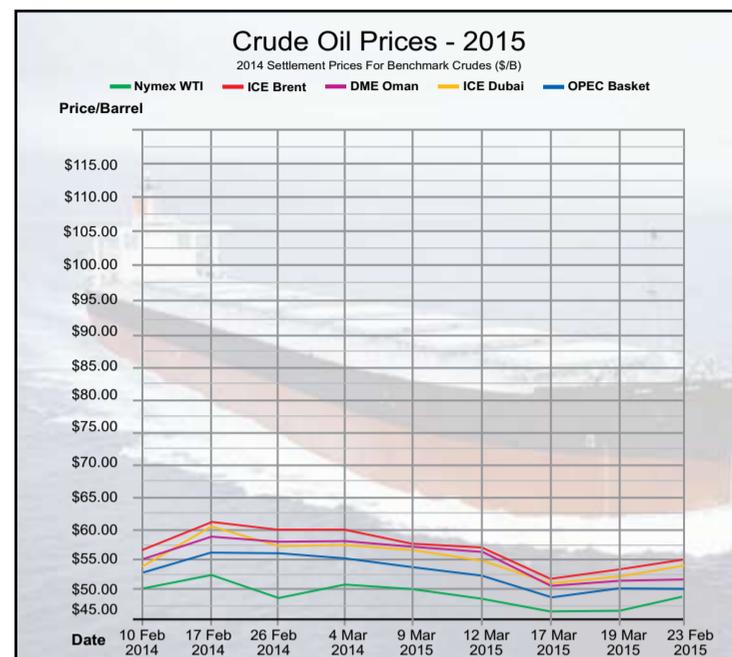
"Today, the situation is difficult. We have tried and met, but we have not succeeded due to the insistence of countries that Opec alone shall

bear this burden," Naimi said, adding that Opec has only 30 per cent of the global market.

US shale oil producers have clearly had a significant role to play in the volumes of oil that are now available on the market. While US crude is not exported, the fact that it has provided an alternative to foreign imported oil to the US market has led to a surplus of as much as 2 million b/d on world markets.

In theory, as prices come down, it will force volatile shale oil producers to halt production. This might be working in some respects, but there is also the chance that once prices begin to make a comeback that will serve to encourage their restart.

There is also the argument that some shale oil can be produced at pretty low rates, so it remains to be seen if the goal to force shale oil off the market with high production



from conventional means will work.

But Naimi continues to deny that there is any grand scheme in Saudi oil policy. No one is the target of Riyadh's decision to stick with output of around 10 million b/d, he said.

"There is no conspiracy and we tried to correct all the things that have been said but nobody listens," he said. "We are not against anybody, we are with whoever wants to maintain market stability and the balance between supply and demand," adding that the oil price is what the market decides it will be.

One new matter that is looming on the horizon, however, is the possibility of Iran putting more oil on the market if it reaches an agreement with the P5+1 committee over its nuclear research programme.

An Iranian oil ministry official told an energy conference in Fujairah in the UAE in late March that Iran could increase its oil production to around 4 million b/d within two years, from around 3 million b/d now, if international sanctions are lifted. The official said Iranian production could be boosted to 5.5 million b/d within five years.

But if Iran should have the capacity to put a lot of crude oil on the market in a very short time, it can only be expected to add to the existing glut. Furthermore, it could lead to a new dimension to Saudi-Iranian rivalry within Opec, with Iran and possibly Iraq arguing for the organisation's quota system to be adjusted to reflect the production potential of other Opec members.

Gas

Egypt improves terms for foreign companies

Egypt recently signed a number of deals designed to reinvigorate its energy sector. The goal is to have its hydrocarbon sector back on track within five years.

Mark Goetz

Egypt is taking steps to improve the terms for foreign oil and gas companies operating in the country. Energy demand is climbing and it is expected to continue to do so, but foreign firms have been reluctant to invest in new development due to the fact that the government is behind on payments for deliveries.

During the rule of former president Mohammed Mursi, unpaid debts to foreign companies reached as high as \$7 billion by some estimates. Since the ouster of Mursi and the creation of a new government, Egypt has made moves to pay off the debt. It is estimated that some \$3 billion is still owed but Cairo has promised to pay off the debt by mid-2016.

In the last year Cairo has taken steps to get its energy sector back on track. Cutting subsidies, which at one point cost the government \$15 billion a year or more, has been a move taken by President Abdel

Fattah al-Sisi's government. Renegotiating contracts with working companies is another and so is the fact that Egypt will soon become a natural gas importer – in the past (with gas reserves estimated at 77 trillion cubic feet) Egypt had exported gas by pipeline to neighbouring countries and in the form of LNG.

Gas imports in the form of LNG will begin in April through a floating storage and regasification unit (FSRU) rented from Norway's Hoegh LNG and installed at Ain Sukhna in the Gulf of Suez.

Egypt's Minister of Petroleum Sherif Ismail stated recently that the country should have its hydrocarbon sector back on track within five years.

In its latest step towards that goal, Egypt announced a new arrangement with Germany's RWE Dea regarding price and production at the Disouq operations in the Nile Delta region. Gas from the field feeds Egypt's domestic gas grid which supplies power

generation facilities and industries.

Under the new agreement, Egypt will boost the price that it pays RWE Dea for natural gas to \$3.50 per million Btu compared to \$2.50/mBtu previously. RWE Dea will also increase production at its operations from 145 million cubic feet per day (mcf) to 210 mcf by this summer. By the summer of 2016, gas production is to average 300 mcf when Phase 2 of the onshore project comes on-stream.

Until now, Egypt has been paying foreign operators \$2.65/mBtu, but a number of other reports say that Egypt has agreed to increase rates for other companies. Cairo has agreed to pay BP \$4.10/mBtu for gas produced in the offshore West Nile Delta project, which when at peak production will pump 1.2 billion cfd from 5 trillion cubic feet of offshore reserves.

The West Nile Delta project will boost Egyptian gas production by about a fifth of its current production rate of 5.1 bcf/d.

The pay rate has also been increased for BG Group to \$3.95/mBtu for new investments.

Other producers are in negotiations with the government over increased payment rates, some of which will determine whether companies can afford to build new infrastructure in order to get the gas to Egypt's market.

In mid-March Egypt signed a number of deals designed to reinvigorate its energy sector. During the Egypt Economic Development Conference held in Sharm al-Shaikh, Egypt and BP signed a memorandum of understanding covering \$12 billion in new investment for the West Nile Delta project, which also holds an estimate of 55 million barrels of condensate.

The deal follows a previous agreement made by BP and BG Group, which enables BP to use BG's existing infrastructure to produce the gas, all of which will go to Egypt's domestic market.

In early March BP announced a gas

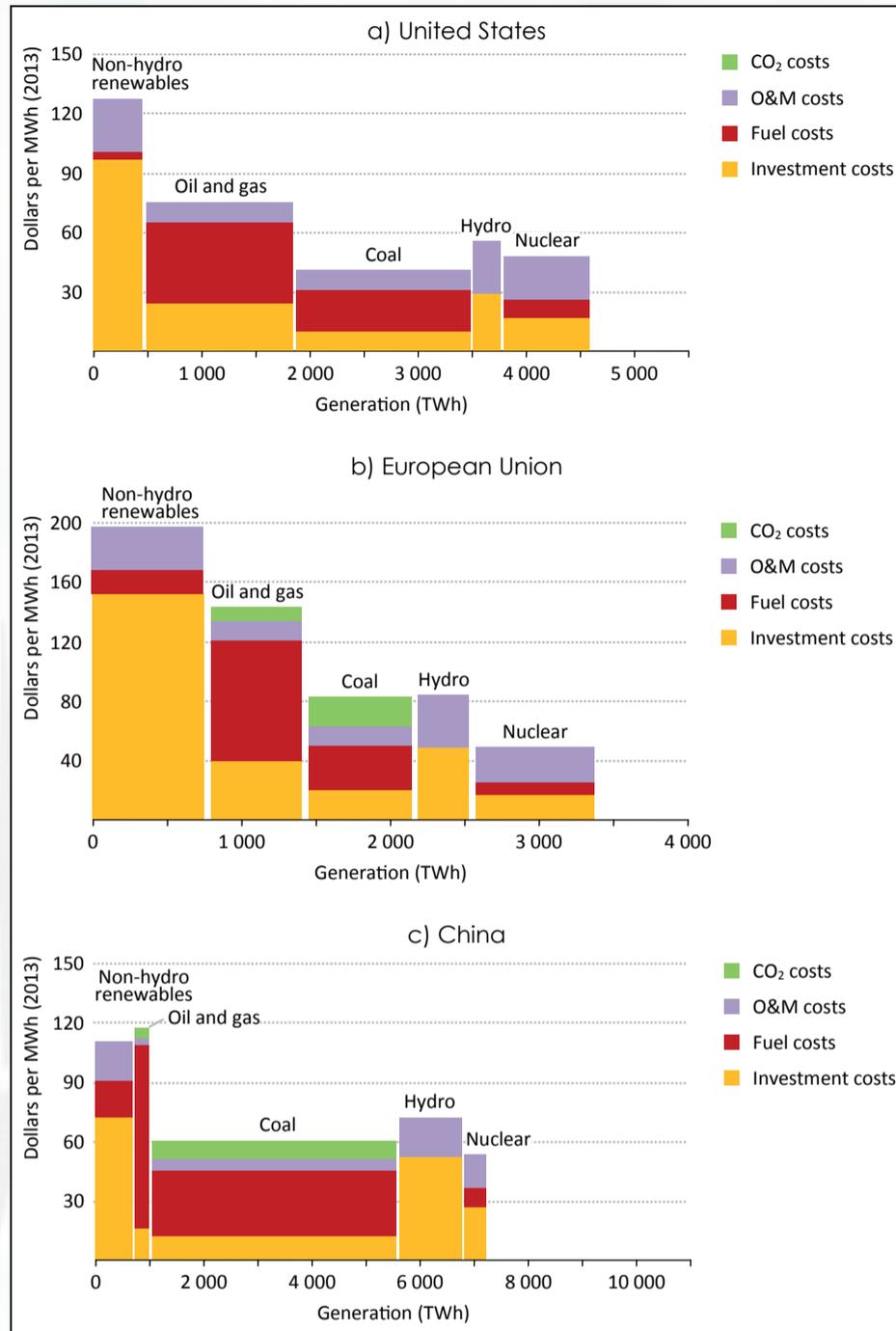
discovery at its Atoll-1 well in the offshore North Damietta concession. This follows an earlier discovery in the block at the Salamat well.

Also during the conference, Egypt and Italy's Eni signed a heads of agreement that reaffirmed Eni's long-standing commitment to the development of Egypt's oil and gas resources, plus the security of return on Eni's investments. The accord agrees that terms of contracts will be modified for some concessions and gas prices will be adjusted when necessary.

Discussions are also underway between Egypt, Cyprus and Israel covering the import of East Mediterranean gas by pipeline. Most of the gas supplied by Cyprus and Israel would be directed to Egypt's two idle LNG export facilities at Idku and Damietta, which are operated by BG and Union Fenosa Gas respectively.

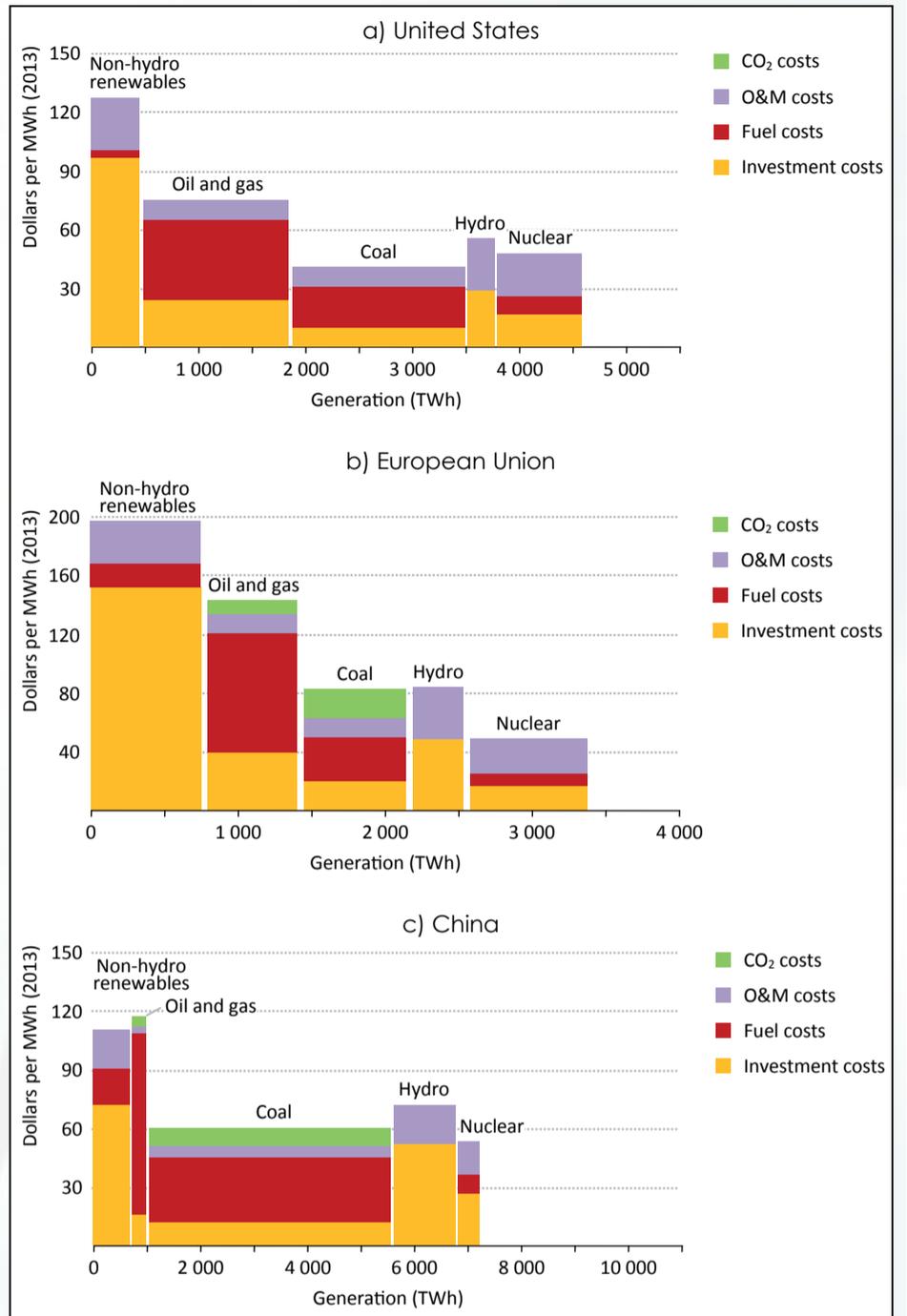
Since the start of the year, Egypt has lined up a number of LNG deliveries from international suppliers.

Total power generation costs by selected region in the New Policies Scenario, 2020



World Energy Outlook 2014, © IEA/OECD, Figure 6.13, page 222

Total power generation costs by selected region in the New Policies Scenario, 2040



World Energy Outlook 2014, © IEA/OECD, Figure 6.14, page 223

Note: Investment costs are calculated as the annuity payments required to recover past capital investments.

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Creating value for cities and industry

Waste-to-energy has huge benefits for cities and industry. Accordingly, the European Commission is formulating a new waste management proposal aimed at creating a new circular economy but the plan has to be ambitious, says **Marta Gurin**

Waste-to-energy (WtE) plays an important role in waste management and energy systems in Europe.

In 2012, 456 plants across the EU28 plus Norway and Switzerland produced 32 TWh of electricity and 79 TWh heat, while preventing about 78 million tonnes of waste from being landfilled. This amount of energy is enough to supply about 28 million inhabitants with electricity and heat.

Energy produced in WtE plants helps to achieve the EU's policy for renewable energy sources to cover 20 per cent of the whole energy consumption by 2020. This is due to the fact that a significant part of the waste treated in WtE plants (about 50 per cent on average) is biogenic – biomass – which means that about half of the energy produced by WtE plants is renewable.

Residual waste represents a local, cost-effective, secure and sustainable energy source that is already used in some district heating and cooling (DHC) systems across Europe. This allows cities to deliver affordable energy, reduce primary energy consumption and diversify the energy mix for the benefit of their inhabitants.

About 60 per cent of the WtE plants across Europe are combined heat and power (CHP) installations, providing electricity through a steam turbine and then recovering heat with high efficiency for both district heating and steam supply to neighbouring industries. Recovered energy from waste for DH systems represents 50 TWh per year, i.e. around 10 per cent of the total heat delivered through DH systems.

UNEP recently published a report – 'District Energy in Cities: Unlocking the Potential of Energy Efficiency and Renewable Energy' – that details the potential of district energy

systems. It identifies modern district energy as the most effective approach for many cities to transition to sustainable heating and cooling, by improving energy efficiency, enabling higher shares of renewable and improving air quality.

Energy from waste is presented as one of the ways to produce very low-cost heat and often initiate development of a city's district heating network, utilising the energy content in non-recyclable, combustible waste. The reports states: "Waste incinerators produce very low-cost heat and often initiate development of a city's district heating network."

Connecting waste and heating/cooling utilities can result in cost savings for both parties, reducing the cost of waste management and energy provision in a city. The report shows the comparative costs of different district heating sources, and WtE has the lowest price in terms of \$/MWh.

The following two examples demonstrate efficient use of resources by cities.

The A2A Brescia WtE plant in Italy delivers both electricity and heat through a DH system, satisfying the energy needs of one third of the inhabitants of the city of Brescia. In 2013, the WtE plant supplied 561 GWh of electricity and 805 GWh of heat for district heating. This represents fossil fuel savings of about 150 000 toe (tonnes of oil equivalent) and avoids 400 000 tonnes of CO₂ emissions. It is worth noting that in the city of Brescia the WtE plant delivers 68 per cent of the local district heating demand.

In the Netherlands almost 12 per cent (2013) of all sustainable energy produced in the country was generated by WtE plants. The WtE plant of Twence, supplies heat to the local DH system of the city of Enschede and supplies 180 GWh of heat for 57 000 households. This saves about 22.5 million m³/year of natural gas and avoids around 280 000 tonnes of CO₂ emissions.

WtE plants can help industries achieve their climate and energy objectives and create strong partnerships through delivery of the process steam. The following two examples demonstrate efficient use of resources by industry.

Energy represents 80 per cent of the total variable costs for the production of AkzoNobel Industrial Chemicals. The WtE plant of Twence in the Netherlands supplies steam to AkzoNobel's salt production plant via 1.5 km steam pipeline. Thanks to this pipeline, which delivers 838 000 tonnes of steam per year, AkzoNobel Industrial Chemicals managed to reduce its consumption of natural gas by 80 million m³/year.

Another Dutch WtE plant, AVR Rozenburg, supplies steam to industry located in the area of Rotterdam harbour. In 2013 the WtE plant supplied 416 GWh of process steam to several industrial plants via an over-ground steam pipeline developed in 2012. For example, high-pressure steam is delivered to Emerald Kalam Chemical BV, for use in the company's toluene-based production processes. This steam pipeline has led to an annual reduction of 25 000 tonnes



Gurin says the new Circular Economy package should be ambitious in minimising landfilling of recyclable and recoverable waste

of CO₂ emissions and 15 million m³ of natural gas usage.

When fully implemented, by expanding to other users in the harbour area, steam delivered from the AVR WtE plant through the pipeline is expected to cut industrial CO₂ emissions by up to 400 000 tonnes per year.

These examples clearly demonstrate WtE provides substantial benefits for cities and industry. Further, considering that in 2012 the EU 28 imported 106 billion m³ of natural gas from Russia (Eurostat), it is worth noting that the energy content of the waste treated by WtE plants in the EU equals 19 per cent of Russian gas imports (2012).

However, even more can be achieved by improving energy and environmental policy at the European level. Better infrastructure (for district heating and cooling and steam delivery for industry) and diverting more waste from landfill to quality recycling and energy recovery are necessary in order to develop WtE's full potential for providing high energy efficiency solutions.

The European Commission has recognised that more is possible and is moving to amend current directives waste. "Recent trends suggest that further progress on resource efficiency is possible and that it can bring major economic and social benefits. Turning waste into a resource is an essential part of increasing resource efficiency and closing the loop in a circular economy," it said.

Europe's future Circular Economy package is a new proposal to be presented by the European Commission by the end of 2015

Setting the context for the proposal, the Commission notes that the EU's economy currently loses a significant amount of potential secondary raw materials, which are found in waste streams. It says that in 2011, total waste production in the EU amounted to approximately 2.5 billion tons. By way of example, only a limited share (40 per cent) of the municipal waste generated in the Union was recycled, with the rest being landfilled (37 per cent) or incinerated (23 per cent) of which around 500 million

tons could have been otherwise recycled or reused.

The Commission states: "The Union thus misses out on significant opportunities to improve resource efficiency and create a more circular economy leading to economic growth and jobs which in turn would reduce greenhouse gas emissions and its dependency on imported raw materials."

The Commission also identifies an implementation gap amongst its Member States. In 2011, while six Member States landfilled less than 3 per cent of their municipal waste, 18 lost resources by landfilling over 50 per cent, with some exceeding 90 per cent of landfilling. This, says the Commission, shows large divergences in terms of waste management performances, which need to be addressed as a matter of urgency.

The Confederation of European Waste-to-Energy Plants (CEWEP) believes the new Circular Economy package should be ambitious in minimising landfilling of recyclable and recoverable waste, in order to maximise the use of waste. It should take a holistic approach that considers the supply of raw materials as well as secure and sustainable energy, which is an important part of the European Energy Union.

CEWEP endorses the Commission's proposal to phase out landfilling of recyclable, and eventually recoverable, waste. However, we would have preferred a more ambitious deadline: by 2020 rather than 2025 and 2030, respectively. This delay is a lost opportunity for improving resource use, considering that more than 80 million tonnes of municipal waste is still landfilled in the EU 28 each year.

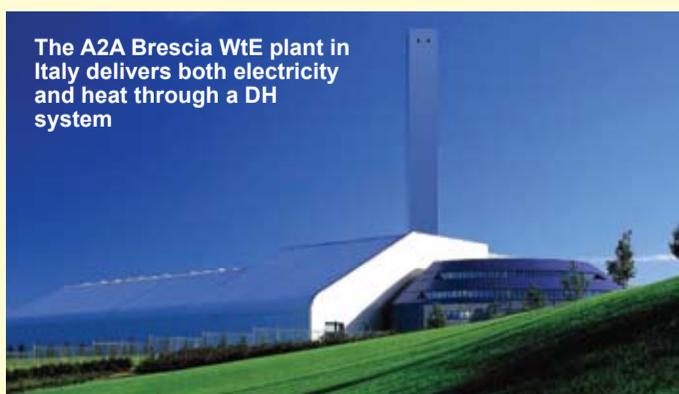
If Europe minimised landfilling and maximised the use of waste, the future would look bright for recycling and WtE. At the same time this would be beneficial for the environment, jobs and growth in Europe.

Marta Gurin is Technical & Scientific Officer of the Confederation of European Waste-to-Energy Plants, the umbrella association of the owners and operators of waste-to-energy plants across Europe.

Turning waste to energy

Waste-to-Energy (WtE) – waste incineration with energy recovery – safely treats residual waste that is not suitable for recycling, while producing energy from it. WtE plants are creating value for cities and industry by treating unavoidable waste and delivering cost-efficient energy such as heat for district heating (DH) and steam for industrial applications.

The primary purpose of waste incineration with energy recovery is to safely treat the remaining waste. By doing so WtE helps to divert waste from landfills, thus reducing possible impacts on land, air and groundwater quality. At the same time WtE ensures high quality recycling by treating all residual waste that is not suitable for recycling.



The A2A Brescia WtE plant in Italy delivers both electricity and heat through a DH system

The fall and rise of gas

Gas use for power generation in Europe has fallen dramatically in recent years. Arthur D. Little's **Kirsty Ingham** and **Yvonne Fuller** analyse the causes and prospects for the future.



Ingham: it is unlikely there will be any change in the position of gas-fired generation relative to coal in the short-term



Fuller: generators will increasingly have to monitor developments on a global scale as gas markets become more interconnected via LNG

EU gas consumption has fallen dramatically in recent years, by 13 per cent from 2005 to 2014. Gas use in the power generation sector represents 90 per cent of this drop, or around 50 bcm. Current total gas demand forecasts are for low single figure growth for annual consumption over the next decade, although peak demand is expected to grow faster.

This dramatic change is due to a combination of economics and policy interventions. Clearly electricity demand erosion, due to the recession and the slow economic recovery plays a part. But there has been a fundamental change to the generation merit order stack, caused by the prioritisation of must-run renewables in the order, and favourable economics for coal-fired production, which has increased its role in the generation mix.

This resurgence of coal is a result of the low prices of coal and CO₂ emissions certificates (EUAs), meaning that the clean-dark spread (the difference between the power price and marginal cost to generate from coal) is higher than the clean-spark spread (for gas). In other words, it's more profitable to generate power using coal than gas.

This shift of gas to a position higher in the merit order and the intermittency of renewables, explains the growth in peak gas demand: gas plants currently run when power demand peaks, and on windless, cold days. The impact is already seen in the development of capacity mechanisms to prevent gas plants from closing entirely.

In the short-term, it looks unlikely that there will be any change in the position of gas-fired generation relative to coal.

Electricity demand erosion has resulted in a surplus of CO₂ certificates, depressing EUA traded prices (from around 30 €/t pre-economic crisis to a low of < 3 €/t in 2013, and around 6 €/t today). The surplus is unlikely to be addressed by the small annual decreases in the emissions cap set by the EU or by increased electricity demand, so only the changes which will be implemented for the next phase of the ETS, from 2021, will

change this situation.

Recovery in energy demand, and thus EUAs, is being slowed by the speed of economic recovery and is depressed further by the effects of increasing energy efficiency and the growth of micro-renewables. In the UK, the government aims for its Carbon Price Support measure to increase the price of carbon unilaterally for its own market – but the floor price has already been revised down once and this could happen again.

On the commodity side, coal prices are set to remain low as ongoing strength in US shale gas production will mean excess US coal continues to spill onto the global market, depressing global coal prices.

Some believe the recent decline in crude oil prices could be the saviour of European gas demand. Oil-indexed long-term contracts for European gas imports used to be the standard, aiming to value gas according to the best substitute fuels (and other factors) to ensure that gas sales to end-users were competitive. Hence, it might be expected that a drop in oil prices might lead to lower gas prices.

However, due to excess gas supply resulting from the gas demand slump already described, hub trading increased and contracts have been changed. According to the IGU 2014 survey, less than 50 per cent of EU gas import volumes are now indexed to oil, the rest are linked to traded hub prices.

Import contract pricing terms are all different, incorporating variations in the combination of indexation references, pass-through terms (in the timing lag and reference period for the index price) and the frequency of price updates. The effect of a drop in oil prices is therefore dampened and is not immediate. The same goes for the recent recovery in oil prices to around 60 \$/bbl.

Forward gas prices have also strengthened somewhat, so it appears that oil prices will not be the direct driver of the major gas price collapse anticipated by some. Although oil-indexed prices are below gas hub prices today, economic fundamentals suggest that prices will converge in

the longer-term.

But in light of all these factors, at around €23/MWh, the current gas forward price is still not low enough in the short-term for gas to displace coal. This is illustrated in the chart below, which shows that, based on fuel and carbon forward prices, and including operating costs and plant efficiency differences, coal is the favoured fuel for generation on a marginal cost basis.

Gas would need to drop to a price of €16.50/MWh to compete with the current 2016 coal forward price of \$58.50/tonne. Based on the forward prices for gas and coal, the carbon price level that would make gas competitive is €25/tonne i.e. a return to pre-economic crash levels. Of course, the level of electricity prices may mean that neither fuel is profitable: as is the case in Germany at present, where coal makes less of a loss than gas.

Looking at other impacts and prospects in the longer term, there has been the question of how international shale gas developments might affect EU prices and availability.

The next phase of the US shale gas revolution is expected by the end of 2015, as LNG exports begin from the Sabine Pass terminal to several international buyers. Two other facilities are expected to begin operations in 2018, with others awaiting final approvals before moving to Final Investment Decision (FID).

There are three key uncertainties with US shale gas.

Firstly, where will it go? With a wide range of buyers and gas purchased on a free on board (FOB) basis, the destination of the gas is uncertain. The majority, if not all, of the US LNG export projects have been developed with Asian markets (and their recent high prices) in mind.

The same motivation lies behind the new wave of Australian LNG export projects. But the lower oil price is eroding gas demand in Asia, particularly Japan, as buyers switch away from gas and back to oil, with the prospect of a restart for Japanese nuclear plants acting as a further dampener on gas demand. While some LNG export projects may be cancelled due to demand uncertainty, those going ahead may result in periods in which excess LNG is sold on Europe's spot markets, lowering prices there.

The second uncertainty is: will shale gas production continue at lower oil prices? Associated shale gas production (gas produced from shale oil wells) may decrease if lower oil prices are sustained. But the cost of extracting non-associated shale gas has fallen so substantially in recent years that its production is likely to continue to grow even if a low oil price slows shale oil development.

Many plays remain attractive, covering long-run marginal costs, at current low Henry Hub prices of around \$3/mmBtu, and more will become viable at this price level as technology develops and the cost of extraction continues to fall.

The third uncertainty is: what will be the impact on the Henry Hub price? US LNG exports will make the first physical and pricing link between the US and other global gas markets, representing another step towards a

global gas market. This, coupled with growing US demand, may increase the traded Henry Hub price, to which many export contracts are indexed, and which has traded lower than oil-indexed prices in recent years.

Buyers will need to weigh up potential volatility at Henry Hub against oil indexation, and may have opportunities to optimise between reference prices. For Europe, US LNG might provide an effective cap on European wholesale prices, especially in winter.

There is much speculation on the potential global impact of shale gas from other markets, particularly China, which has estimated recoverable shale gas reserves 70 per cent higher than the US. However, progress in developing production has been slow. Reserves are often located in deep formations and in remote areas where water, essential for fracking, is in relatively short supply.

Aggressive production forecasts have been downgraded several times recently. Our current view is that shale gas in China is a long-term story, and shale gas production will not offer a significant supply until beyond 2030, unless there is a change in policy. Unless China wants to increase its security of supply by pushing domestic production hard, its recent long-term contracts for Russian gas look likely to be the preferred source to meet China's rapidly growing gas demand to 2020.

We also believe Chinese shale gas will be destined for its domestic market, in part due to the remoteness of reserves making exports costly, but also to meet increasing domestic demand and provide strategic security of supply. Based on current demand forecasts, with Chinese gas consumption growing from UK scale in 2010 to EU scale in 2025, China could also mop-up any excess LNG supplies in the mid-term, once additional terminals are built.

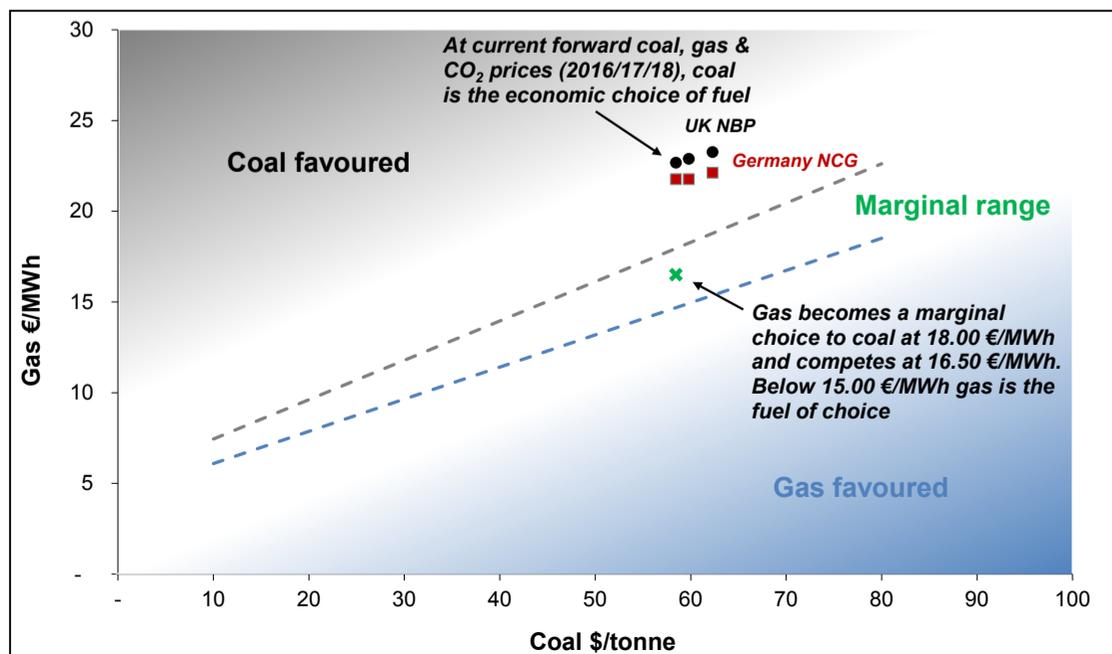
In conclusion, cycles of gas supply excess and deficit will continue, as trade between regions develops, but in the short-term we expect a supply surplus, a "buyer's market" and downward pressure on European gas prices, though price levels are not expected to displace cheaper coal in the short term. Rather, the outlook for EU power generators, to the mid-term, will be driven by policy, rather than the level of gas prices. Even when coal is displaced, renewables will still affect the operation of gas-fired plant, particularly as the cost of renewables continues to fall.

Going forward, players will increasingly have to monitor the development of the energy markets on a global scale as the gas markets of North America, Europe and Asia become more interconnected via LNG. Scenario planning and monitoring key parameters in each region become vital as player strategies, regulation, cost bases and prices evolve and major capital projects are rescheduled.

We are on the brink of a global gas market, with opportunities for diversifying purchasing and portfolio optimisation, but it is clear that regional factors will still have a heavy influence on those operating within it.

Kirsty Ingham and Yvonne Fuller are Principals at Arthur D. Little

At around 23 €/MWh, the current gas forward price is still not low enough in the short-term for gas to displace coal



Technology

Wave powered desalination: the future for island nations?

Wave powered reverse osmosis is close to becoming a commercially viable option for providing drinking water to developing island nations.

David Stoddart-Scott

Many of the world's developing nations are islands with limited fresh water supplies, and equally limited traditional hydrocarbon energy reserves.

Indeed water scarcity has long been recognised as a technical and social challenge, one important enough to be highlighted by the US president John F. Kennedy in 1962: "If we could produce fresh water from salt water at low cost, that would indeed be a great service to humanity, and would dwarf any other scientific accomplishment."

The key takeaway from this statement is the "at low cost" qualification. Reverse osmosis (RO), the most prolific desalination technology, is very energy intensive requiring salt water to be pumped up to high pressure and have up to 50 per cent forced through a semi-permeable membrane leaving concentrated salt water as a by-product.

Pressurising water with electric pumps, whilst being the most convenient commercially available method, is inherently of low efficiency on a wire-to-water basis. This is compounded in island situations where the main source of power generation is from diesel generators, with high cost fuel, further increasing the cost per unit.

A further economic impact is that fuel for power generation is invariably imported, sending hard earned currency back out of the economy, negatively impacting Gross Domestic Product.

One alternative is to use solar power to provide freshwater through evaporation and condensation. Whilst successful on smaller scales, both space requirements and weather dependency make the process unsuitable for industrial production. In the Caribbean and most parts of the world RO has proven to be by far the most cost effective technology for desalination.

Wave power was first touted as a potential renewable energy source as far back as the 1890s, with patents filed for an outrigger "wave motor" capturing hydraulic power from the ocean. In its simplest form, wave energy is extracting work from a floating body that moves with the ocean's waves.

The current crop of wave energy converters are quite varied, but a number have consolidated around utilising a working fluid to capture the reciprocating motion of the waves. This removes the disadvantage of locating power generation equipment on the device, which has proven to be a difficult proposition in the harsh sea environment, particularly for the delicate power electronics required to condition the electricity for the grid.

A fluid also allows for pipes and hoses to be used instead of dynamic power export cables, which are expensive and prone to failure. In this way energy capture can be smoothed between multiple devices and combined to then be used at a central point. This can be for the generation of electricity by using proven technologies such as Pelton turbines.

At a high enough pressure the kinetic energy of the oceans could be fed directly into a reverse osmosis plant. This would bypass the normal multiple changes of energy state with the associated efficiency and cost implications.

So realistically, how far is this technology away from commercialisation? A great deal has been achieved in the wave energy industry in the past 10 years with multiple devices being tested at the European Marine Energy Centre (EMEC) and around the world, as far afield as Australia. The harsh environment and extreme survival conditions generated in storms have proven a difficult challenge to crack.

Nevertheless, strides are being taken in the right direction with Carnegie Wave Energy recently commissioning a wave powered desalination plant on Garden Island in Western Australia using its Ceto hydraulic wave energy converter. Up to 150 m³ of fresh water per day from wave power will be delivered in the next six months once water quality conditions have been met.

UK-based developer Seatricity has also had much success in the development of its Oceanus wave energy converter (WEC), which originated from the requirement for fresh water and electricity in Antigua & Barbuda, West Indies. The technology is

being developed in the UK using government funded testing sites EMEC and Wave Hub.

The Oceanus technology is a self-latching point absorber that pressurises seawater through a novel pump design the main aim of which is to reduce the cost of wave energy. Current activity includes the deployment of a full scale WEC at Wave Hub 10 miles off St Ives for sea trials whilst planning for a commercial array of up to 60 devices in the near future.

The Oceanus 1 technology was successfully demonstrated at EMEC in 2012-13 pumping seawater to shore at up to 90 bar, the pressure required to feed an RO plant. The technology has graduated to Wave Hub and a larger 2nd generation machine that will complete commercial testing in 2015-16.

This means that in 2016 there will potentially be two wave conversion technologies on the market that can supply high-pressure water suitable for RO.

Other wave energy converters are out there; currently well down the path of development, so these are by no means the only two options that will present themselves. Development will be required in order to integrate the technologies with RO, but commercialisation is in the not too distant future.

The large scale economic impacts on an island nation's balance sheet by displacing imported fossil fuels with domestically generated power for desalination are hard to quantify.

The current unit cost of RO desalination varies depending on the initial cost of energy, but is in the region of \$0.75-\$2 per cubic metre of fresh water, the lower value relating to mainland USA water production. Initial estimates of production from wave energy put the cost in the region of \$1-2/m³ (based on Seatricity's Oceanus units in a 300 kW -1MW array). This would of course require a suitable wave climate within 5 km of the desalination plant. An average height of 1.5m waves is all that is required for the Oceanus technology, meaning it is suitable for most islands of the Caribbean.

Further cost savings can be made through efficiencies in the RO

process along with the savings that will undoubtedly be made in the cumulative deployment of wave energy devices. For example, surface inlet seawater requires pre-treatment prior to desalination, which takes the form of filtration for the removal of large organic and inorganic particulates.

By drawing water from depth at sea, this filtration process can be greatly reduced – thus saving cost. Energy capture of the remaining concentrated pressurised water at the outlet of the RO plant can be used to increase efficiency. A turbocharger or Pelton turbine is used to convert the pressure into kinetic energy, which in turn can generate electricity to feed the pumps in an electrically powered plant, or be used to pressurise further seawater to increase the throughput of the RO plant without electrical losses.

Although theoretically competitive at the outset, there is potential for wave generated RO to reduce in cost through development. Whilst the cost of fossil fuelled RO is up to 50 per cent fuel, a cost the operator cannot control.

The environmental advantages of wave powered desalination are immediately obvious when displacing hydrocarbon power generation. It is estimated (depending on power generation type) that 10-20 kg CO₂ is produced per cubic metre of RO water. This would equate to a conservative saving of 100 t of CO₂ per day for Curacao's Aqualetra RO plant, and maybe more when considering the limited smog control on generation plants in many developing island nations.

So the environmental advantages are clear. But what about the environmental impacts of wave energy in island nations that often rely on the ocean for revenue, whether from tourism or fishing? Each particular ecosystem must have impacts quantified, however the extensive testing that has been performed in UK waters has shown that wave and tidal energy devices have a very limited impact on the environment.

It is clear that there will be social impacts to deploying wave energy in island nations that have other ocean users that may be displaced, but these will have to be judged on a case by case basis and balanced against the benefit delivered by a project.

Wave powered desalination has a future in developing island nations. Indeed it offers a cheap and clean method of storing what is an intermittent renewable resource in infrastructure that is probably already in existence, freshwater storage tanks.

The pathway to commercialisation of these technologies is near, and further gains will be able to be made in the not too distant future, further driving down the Capex and Opex costs of the arrays along with the cost per m³ of fresh water produced. The cost of the technology will also be fixed for the life of a project insulating the operating entity from the vagaries of the fluctuating cost of oil and diesel products.

David Stoddart-Scott is a wave and tidal energy specialist who is currently Operations Manager for Seatricity, a wave energy converter technology developer based in Falmouth, Cornwall, UK.

Oceanus 2 under tow in Falmouth harbour, Cornwall, UK





Junior Isles

Jumping at shadows?

It may have been hardly noticeable in many parts of Europe. In London, the grey sky got a little greyer and for a few minutes there was more of a bite in the air. If I did not know there was an eclipse, the event would have gone unnoticed.

For Europe's transmission system operators (TSOs), the fact that it passed by unnoticed was a good thing. With the growing amount of solar on the European grid, especially in countries such as Germany, the solar eclipse looked set to provide an unprecedented test of the impacts of a sudden massive drop-off in renewables across the region.

ENTSO-E, Europe's association of grid operators, had been preparing for the March 20th solar eclipse for several months. Due to the amount of solar generation, it was necessary to evaluate and mitigate the risk, with the aim of bringing the risk of an incident back to the level of a standard operating day.

In its Solar Eclipse Impact Analysis, ENTSO-E noted that in 2015 the installed capacity of solar photovoltaic (PV) in the synchronous region of Continental Europe is expected to reach 90 GW and the eclipse could potentially cause a reduction of the PV in-feed by more than 30 GW during clear sky conditions.

"This situation will pose a serious challenge to the regulating capability of the interconnected power system in terms of available regulation capacity, regulation speed and geographical location of reserves", the report stated.

With its installed solar power capacity amounting to around 39 GW as of the end of January (nearly 45 per cent of Europe's total), Germany was particularly exposed to the eclipse. There were also serious concerns for Italy,

"The challenges presented by the solar eclipse are a window to the future... as the proportion of renewables increases, the impact of weather changes will be more complex to manage."

where around 19 GW is installed.

At the time of the eclipse, the sun was shining brightly in southern Germany and northern Italy where the concentration of PV is higher than anywhere else in the ENTSO-E area. The most critical time came between 10:45 and 11:15 when the solar generation started to rise again.

Careful preparation was key. The TSOs forecasted with a great deal of precision the effect of the eclipse on

solar generation and developed mitigating strategies. They took into account the 'worst case scenario' that the eclipse would take place on a sunny day.

Germany's TSOs smoothly managed the very high and fast variations of solar generation by relying on power reserves at national and regional level. During the eclipse, PV capacity in Germany dropped from 25 GW to 5 GW and increased again without any electricity shortfalls or meaningful

fluctuations in frequency.

In Italy, energy grid operator Terna, in cooperation with DSOs and generators, took the decision to reduce risks by turning off all of its large-scale (>100 kW) PV plants for the day in order to prevent severe energy fluctuations on the grid. About 5 GW of PV was taken off the system between 07:00 and 14:00. After 14:00, Italian TSOs began reconnecting the PV, restoring full capacity.

Elsewhere, French transmission grid operator RTE said it would increase its electricity production reserves by 70 per cent during the eclipse to avoid the risk of imbalance in the European power grids. Reserves were increased from the usual 1000 MW to 1700 MW during the morning of March 20th.

Spain's grid company Red Eléctrica said that "reserve levels had been raised and big consumers could have been disconnected".

The coordinated actions meant the situation on the European grid was back to normal at 12.00, after the solar eclipse was over.

Although Europe passed the test this time, the eclipse was a sort of wake up call.

As David Hunter, Energy Analyst at Schneider Electric put it: "The challenges presented by the solar eclipse are a window to the future. Grids already have to cope with constant variability with wind and solar changes. However, as the proportion of renewables increases within the energy mix, the impact of weather changes will be more complex to manage."

Strong changes in wind and solar power supply within just one hour will be a more regular event in 2030, according to a recent study commissioned by Agora Energiewende and conducted by German research institute Fraunhofer Ise.

The study assumed installed onshore wind power capacity of 71.2 GW, installed offshore wind power capacity of 15 GW and installed solar power capacity of 58.2 GW in 2030, in line with German grid operators' expectations in their long-term network expansion plans. German onshore wind power capacity totalled 38.1 GW at the end of last year, while offshore wind power capacity connected to the German grid was just above 1 GW and installed solar power capacity also reached approximately 38.1 GW.

Intermittent renewable power generation will rise by more than 9 GW within one hour in 100 hours in 2030 and will fall by more than 9 GW in more than 60 hours. The highest hourly increase is pegged at 14 GW

for 2030, while the highest hourly decrease is predicted to be 12 GW, the study stated.

By comparison, the strongest hourly increase in renewable power generation in 2014 was 7 GW, while the highest hourly drop that year was 6.6 GW.

Such a challenge will call for more and more rapid advances in network development.

Scott Henneberry, Strategy & Innovation VP, Smart Grid Strategy at Schneider Electric commented: "The solar eclipse is just one example of how the intermittency of renewables can quickly change the dynamics (and therefore the stability) of the grid. And, why it is imperative that the transition to a connected, intelligent and responsive grid takes place."

Luc Graré, Senior Vice President Sales and Marketing of global solar energy solutions provider, REC, commented: "Industry analysts predict that solar will be the world's most common energy source by 2050 due to rapidly decreasing system costs, with generation costs as low as 2 eurocents per kWh."

"However, a sustainable electricity infrastructure in future is a smart one and consists not only of solar installations but also other renewable energies, storage technology and e-mobility, which we expect to take off in the next few years."

ENTSO-E and its member TSOs are already planning the development of their network in accordance with EU policy objectives.

For example ENTSO-E's 2014 Ten-year network development plan explains what would be needed in terms of infrastructure to integrate up to 60 per cent of renewables onto the power system.

ENTSO-E is partner to an EU funded R&D project – the eHighway2050 – for which results will be released in November. The project is aimed at creating a model for the development of the grid to move very large amounts of RES faster across Europe.

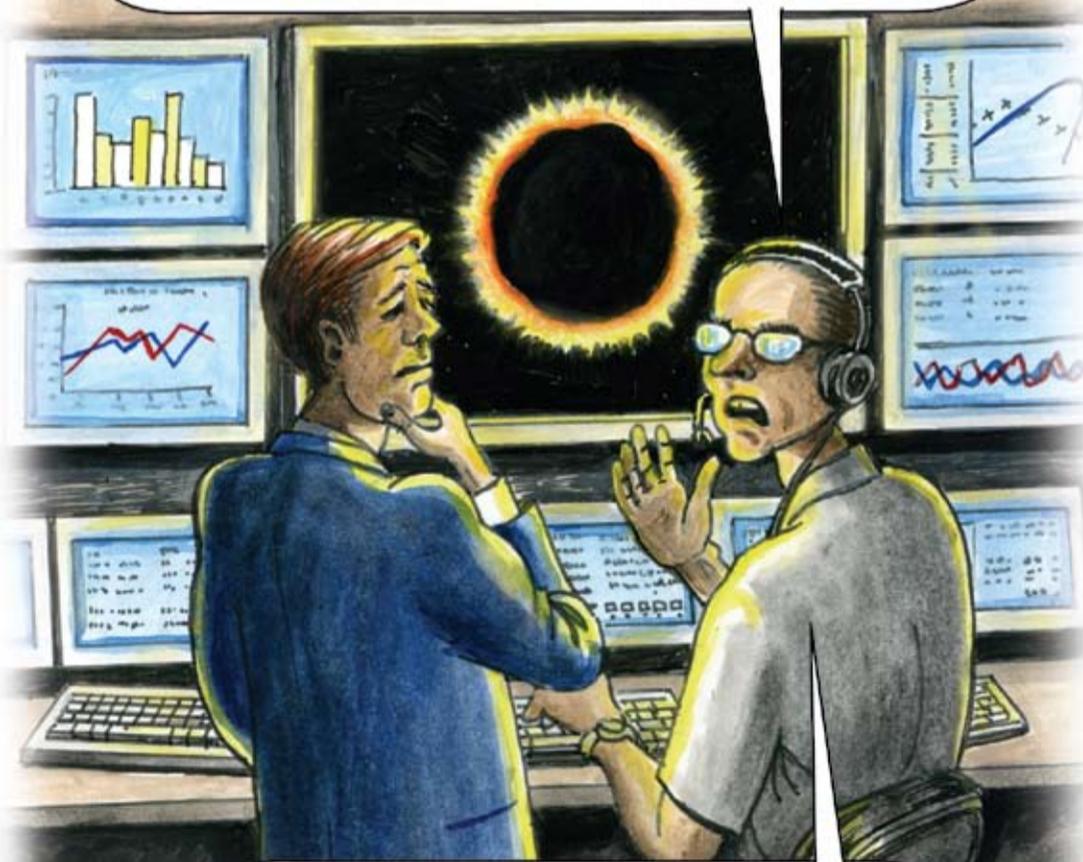
It is establishing EU network codes – technical rules that become law once adopted by EU members states, Parliament and Council – that revise connection, operational and market rules at pan-European level to meet the EU energy objectives (greater integration) and the climate objectives (more renewables, energy efficient, etc). One Network Code was adopted in December 2014 and ENTSO-E hopes the others will be adopted in 2015/beginning of 2016.

ENTSO-E is also strengthening its cooperation with the DSOs to make networks more secure, smart ready and increase amount of RES integration. In short, all are working towards providing solutions to build the right hardware and software to meet Europe's ambitious objectives.

With the uneventful passing of the eclipse, some might say the industry was jumping at shadows. But if nothing else, the eclipse proved that the energy transition is technically possible. However, regional and pan-European coordination of TSOs, as well as between other market players including regulators, will be crucial for this transition to be as smooth and cost-efficient as possible for Europe's consumers.

Hopefully with the network codes in place, when the next solar eclipse takes place in 2026, the management of such a challenging event will be much easier – leaving all to enjoy the darkness without fear of a blackout.

The bad news is that it's a massive asteroid, not an eclipse



The good news is that it'll be very windy when it hits