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Waste to energy

Demand side management

The EI one year on

Contents

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Cover

New waste-to-energy plant under construction some months ago on the Isle of Man. The plant, built by Kvaerner and to be operated by SITA Isle of Man, is now largely complete and undergoing testing. See page 2 for a view on why the UK needs to use more of its waste to generate energy.
(Photo courtesy of SITA UK)

Energy from waste – part of the solution to depleting supplies

Geoff Loram

As energy prices rise with the growing awareness that oil depletion is for real, the energy industry will be searching for new fuels to replace oil and gas. One such family of fuels that has been given little attention in the literature to date is the large variety of combustible wastes produced by industry, commerce and households that is currently buried in the ground. Together they have the capacity to make a very significant contribution to the overall energy supply.

To illustrate this one can take the Government figures for the tonnages of municipal wastes and commercial and industrial wastes currently disposed of to landfill at 27 million tonnes of waste per annum (mtpa) and about 20mtpa respectively, apply established net calorific values of 9.5 GJ/tonne and 12 GJ/tonne and known generating efficiencies and the calculations will show that, if it could all be used, the generating capacity, on base-load working, would be in the order of 3,300 MW. That is equal to 80% of Drax, Europe's largest power station. Whilst it may not be feasible to recover all that energy, the figures above are conservative and indicate the scale of the resource.

Bagasse to coffee grounds

For more than a century industry has quietly been recovering energy from various wastes. The oldest established is probably bagasse, the discarded fibres of sugar-cane, though household waste may be as old since incinerators were recovering heat in the 1880s and the streets of Oldham were lit by electricity generated by the local incinerator in 1896. In those days the energy was in the ashes from domestic fires that were so inefficient that the ash could contain as much as 70% of the calorific value (CV) of the coal. The nature of municipal waste changed between the wars but the advent of more packaging kept the CV up. The rebuilding of the badly bombed German cities after the Second World War gave rise to the use of district heating in that country and much of this was provided by a new breed of much larger and more efficient incinerators. The generation of electricity became more common in the 1960s and 70s.

In the UK, the past 30 years have seen the Government helping to bring renewable energy towards the market place and some new wastes, such as poultry litter and straw, have been used. Most of the poultry litter has been catered for but there is still enough straw for another plant or two in the eastern half of the country.

In industry you will find that Nestlé and Kraft do not waste the very considerable amount of energy in the spent coffee grounds arising from making instant coffee and there must many more examples that have gone unrecorded. The rising prices of oil and gas will encourage more of this trend and it would make a great deal of sense for each large industrial estate to have its own energy-from-waste (EfW) plant, generating electricity from the estate's wastes and selling that and heat to the factories there. Selling the power directly into the retail market is very good economics and avoids any difficulties posed by NETA.

Alternative to landfill

The largest resource, however, are those wastes still largely sent to landfill; here an impetus to correct this enormous waste of energy is coming from a non-energy source – the EU Landfill Directive. This decrees that the biodegradable content of waste sent to landfill shall be progressively reduced to 75% of 1995 levels by 2010, down to 35% by 2020. Since tonnages have gone up since 1995 that is likely to be nearer 70% and 30%. The politician's hope that the reductions can be achieved by recycling and composting but a recent visit to the new Huddersfield EfW and waste recycling plant indicated very strongly that this will not happen. Despite Kirklees MBC's best endeavours with a separate recyclables collection, the best they could achieve was to send for recycling 6% of the waste needing disposal.

There are respectable arguments that EfW is a benign way of generating electricity because a major part of the fuel is part of the natural carbon cycle, that little energy and environmental damage were involved in its arrival at the generating plant, that EfW plant's emissions are very tightly controlled and that the electricity would being generated where it was needed, thus saving transmission losses. These arguments were accepted by previous Governments and EfW was included as a major part of the Non Fossil Fuel Obligation (NFFO) scheme and also exempted from the Climate Change Levy. It was, however, excluded from the Renewables Obligation though the logic of that decision is hard to discern since it is cheaper than offshore wind power and as reliable as fossil fuel. One has to assume that the reasons were political.

To return to the opening theme, when the oil supply can no longer meet demand – within the next decade if not a lot earlier – its price and that of gas will escalate and the country will need all the benign electricity it can generate. Since it takes five or six years to bring EfW plants on stream, changes in existing policies have become urgently necessary.

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World governments commit to increase renewables

Described as the largest ever meeting of government and private sector leaders on renewable energy, an international conference on renewable energy, 'renewables 2004', held in Bonn, Germany in June ended with a declaration by 154 governments that renewable energy should supply an increasing portion of the world's energy needs.

The conference produced an international action programme that contains 165 individual commitments by governments, international agencies, and private groups to promote the use of renewable energy.

The World Bank committed to increase its renewable energy and energy efficiency lending by at least 20% annually over the next five years; China pledged to increase its use of wind, solar, biomass, and small hydropower generation to 60,000 MW (about 10% of its generating capacity) by 2010; and Germany announced plans to increase its use of renewable energy to 20% of its energy supply by 2020. Germany will also provide 500 million in low-interest loans over the next five years for renewable energy projects in developing countries.

The US Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) says it contributed four commitments: to advance technologies necessary to build integrated bio-refineries to produce power, heat, fuels, and products from biomass; to reduce the cost of geothermal power to 5 US cents/kWh by 2010; to reduce the cost of solar photovoltaic power to 6 cents/kWh by 2020; and to reduce the unsubsidised cost of onshore and offshore wind power in areas with good wind resources to 3 and 5 cents/kWh, respectively, by 2012.

At the same event, the International Energy Agency (IEA), revealed some disappointing data on the development of renewables so far, and into the future.

Overall, the share of renewables in total primary energy supply in IEA countries increased from 4.6% in 1970 to just 5.5% in 2001. Most of this increase occurred between 1970 and 1990, when renewables supply grew by 2.8% a year. From 1990 to 2001, some renewables, including hydropower, traditional bio-energy and geothermal energy grew more slowly. As a result, renewable energy sources, which fuelled 24% of total electricity production in 1970, accounted for only 15% by 2001, said the IEA.

Solar and wind electricity generation have increased significantly, growing by an average of almost 18% a year from 1970 to 2001 and the pace has quickened in the most recent decade to over 20% per year. But these renewables started from a very low level and are concentrated in just a few countries. Therefore, their rapid growth does not compensate for the slower growth of mature renewables, says the report. In 2001, 86% of the installed wind capacity was located in Denmark, Germany, Spain and the US. About 85% of the installed solar photovoltaic capacity was in Germany, Japan and the US.

While renewable energy shows great potential for contributing to the solution of some of today's energy security and environmental challenges, more attention needs to be paid to what is really happening with renewable energy policies and markets, with particular consideration given to cost-effectiveness, said the IEA in a new report: *Renewable Energy – Market and Policy Trends in IEA Countries*.

The report, which documents the experience of IEA countries in the years since the oil crises of the 1970's initiated a surge of investment in renewables research and development, shows that significant market growth has always resulted from combinations of policies rather than single policies. For example, in Spain, wind technology is supported by feed-in tariffs, low-interest loans, capital grants and local support for turbine manufacture. In Japan, photovoltaic technology was supported by extensive RD&D investments to increase the competitiveness of the technology, by demonstration projects, through financial incentives and by requiring utilities through net metering to accept excess power generated by PV systems at the retail price of electricity.

US grid operator invests in 'negawatts' to cut peaks

Local electricity grid operator ISO New England is taking a new approach to improving the reliability of its system, by contracting for energy efficiency services from Conservation Services Group (CSG). The company is to deliver 4 MW of on-peak energy efficiency services to help ISO over the next four years.

CSG's energy efficiency programme consists primarily of retrofitting buildings in Southwest Connecticut with power saving lamps and fixtures. The company is targeting medium-sized to large buildings, schools, warehouses and commercial facilities, offering incentives to building owners to install measures through participating local energy services companies.

In addition to securing an 'energy efficiency contractor', the ISO has signed up several other companies to reduce load at times when the electricity grid's reliability is stressed – using emergency generation, demand response and load management programmes.

CSG's efforts aim to provide about 2% of the overall resources needed, but it represents the introduction of a new strategy that may expand over time. Reducing in peak loads through energy efficiency measures instead of building new megawatt generation capacity has been described as investing in new 'negawatts'.

Stephen L Cowell, CSG's chief executive officer, said, "Working with ISO New England to enhance reliability through long-term reductions in the need for on-peak power, is a precedent-setting, unique partnership and a great victory for energy efficiency policy. We realize that energy efficiency can't do it alone, but it is certainly one of the cleanest and most economic ways to help reduce stress on the system and ensure reliability."

Open gas markets 'need government input to deliver security of supply'

Open gas markets are good for security and reliability of supplies, so long as governments continue to play a role to make markets work, says the International Energy Agency (IEA), launching a new report: *Security of Gas Supply in Open Markets: LNG and Power at a Turning Point.*

The opening of gas and electricity markets, the increased use of gas for power generation worldwide and the emergence of a global trade in LNG provide a need for new market mechanisms to ensure secure and reliable gas supplies. The new role of governments, which in the past often directly or indirectly managed the sector, is to define rules for the market to work and deliver reliable gas supplies to the final customer, and to define the roles and responsibilities of each player, says the IEA.

The concurrent opening of gas and electricity markets in all IEA countries has changed the environment for security of gas supply. With market opening, new instruments such as gas hubs, spot and futures markets evolve, allowing gas to be directed to its highest value use. The challenge for security of supply is to ensure that the market can always achieve a balance, and that adequate investment all along the gas chain can be mobilised in a timely way. The unbundling of activities makes it essential to ensure that investment from the wellhead to the final customer is well aligned, says the report, as it is not certain that investment decisions in supply and capacity will always coincide along the chain.

Gas-fired power generation is fast emerging as a new, global driver of gas demand, projected to represent 70% of the increase in demand in OECD countries over the period 2000–2030. Increased links between open gas and power markets offer the chance for more efficient use of both systems. However, the reliability of each system must take into account this interlinkage, in order to avoid simultaneous failure, says the IEA.

OECD countries increasingly need to import gas, as the discovery of additional gas reserves in OECD countries has not kept pace with the depletion of gas reserves and the increase in gas demand. Growing import dependence calls for a greater awareness of gas policies in supplier countries such as Russia, or LNG suppliers and along transit routes, adds the report.

Order a copy of* Security of Gas Supply in Open Markets: LNG and Power at a Turning Point *from IEA Books at: www.iea.org/books

Seattle orders more than 230 hybrid buses

The largest order of hybrid (diesel/electric) buses in history has started to go into service in the Seattle, US, area, where 235 hybrid buses are expected to avoid the burning of 750,000 gallons of petrol annually once the order is completed.

General Motors plans to roll out more than 270 of its hybrid propulsion system buses to 10 cities in 2004. These buses deliver 60% greater fuel economy than conventional transit buses, and can reduce certain emissions by up to 90%.

Seattle's Metro Transit has ordered 213 of the new hybrid buses. The order also includes a further 22 buses for Sound Transit Regional Express.

"GM is committed to applying hybrid technology to the highest fuel consuming vehicles on the road, including mass transit buses," said Beth Lowery, GM vice president of environment and energy. "King County's decision to purchase more than 200 of these buses will save taxpayers hundreds of thousands of dollars in fuel savings and more than 750,000 gallons of fuel each year."

US cars and trucks 'average 20.8 mpg; no change from 2000'

The average mileage-per-gallon figures for new cars, vans, sports utility vehicles (SUVs), and pickup trucks in the US is slightly higher than the corresponding figure for 2003, according to an annual fuel economy trends report from the Environmental Protection Agency.

Model year 2004 vehicles are estimated to average 20.8 miles per gallon (mpg) and the overall trend is essentially flat, says the EPA. Since 1997, average fuel economy has ranged from 20.6 to 20.9 mpg. Average fuel economy peaked in 1987 at 22.1 mpg, but has declined since then due to the increasing popularity of less fuel-efficient light trucks, particularly SUVs.

While fuel economy levels have been relatively unchanged recently, vehicle performance (eg power) has nonetheless increased as manufacturers respond to consumer demands and apply innovative technologies to more cars and light trucks, adds the EPA. And refinements to catalytic converters, transmissions, fuel injection, and electronic controls have made today's cars cleaner and more durable than ever before.

New gas-fired power plant for Mexico

A new, 1180 MW combined-cycle power plant is to be built in Altamira, Tamaulipas, Mexico to provide electricity to the booming northern industrial zone of the country, as well as stabilising the electrical grid in the area. Power generated will be sold to the Federal Electricity Commission under its programme to develop independent power producers.

The $570 million 'Altamira V' plant will be built by ICA Fluor, the engineering company jointly owned by the Fluor Corporation and Empresas ICA Sociedad Controladora, under a contract awarded by Iberdrola Energía S.A., a subsidiary of Spain's Grupo Iberdrola.

The project, the third power plant awarded by Iberdrola to ICA Fluor, is scheduled for completion in November 2006.

US wind industry 'stalls' without federal support

This calendar year looks like being a difficult period for the US wind energy industry, according to the American Wind Energy Association (AWEA), which is forecasting little to no growth in installed capacity this year, compared with a near-record 1,687 MW in 2003.

The reason for the drastic fall-off is the inability of the US Congress to pass a timely extension of the federal wind energy Production Tax Credit (PTC), which expired at the end of 2003. In May this year, the Senate passed legislation containing a three-year extension of the credit, but this legislation must still be approved by the House of Representatives and a Senate-House conference committee before it is signed into law.

AWEA now projects that new installations in 2004 will be less than 500 MW, a figure that is falling daily until Congress extends the PTC, as developers require at least six months of lead time to arrange for the purchase of equipment, obtain permits, and arrange for financing and construction.

The nearly 1,700 MW of new wind power installed last year brought $2 billion of new investment to rural areas of the country and most industry participants predicted that 2004 could have been an even better year than 2003 had the PTC not expired, says the AWEA.

Security of supply is top concern for utilities

Power blackouts on both sides of the Atlantic have propelled security of energy supply to become the top concern for utilities companies across the world, according to the annual report from PricewaterhouseCoopers (Pwc). The report, which presents the views of 148 leading companies world-wide, indicates that securing power supply has risen from the fourth concern only twelve months ago to the highest ranking issue of 2004.

The change in attitudes is a direct result of increasing difficulties in the balancing act of power generation, demand and transmission, says Pwc. Demand is now outstripping supply, and world energy demand is expected to rise by two-thirds between 2003 and 2030. In the same period, global electricity sector investment needs are estimated $10 trillion, three times higher than investment in the electricity sector during the past 30 years.

Manfred Wiegand, Global Utilities Leader, Pricewaterhouse-Coopers said: "Security of supply is a global concern. If blackouts are not to become a regular feature of the future, major investment in the sector is required. Across the world we see ageing infrastructure, coupled with increasing demands, on generation and transmission capacity. A consistent and stable regulatory environment is required to make the sector more attractive to investors. Capital will only come with good rates of return."

Utility companies are also concerned about regulatory uncertainty, emissions trading and competitive differentiation, according to the report.

Biofuels for transport: more effort needed for significant displacement of petroleum

In the absence of strong government policies, the worldwide use of oil in transport will nearly double between 2000 and 2030, leading to a similar increase in greenhouse gas emissions, according to a new report from the International Energy Agency (IEA): *Biofuels for Transport: an International Perspective.*

However, biofuels such as ethanol, biodiesel and other fuels derived from biomass could help change this picture, by offering an important, low-greenhouse gas alternative to petroleum over this time frame, adds the report. If fully implemented, recent policy initiatives, could result in up to a 5% displacement of motor gasoline use with biofuel (mainly ethanol) worldwide by 2010.

However, in OECD regions most of this production will probably be of conventional ethanol using grain feedstocks such as corn and wheat. While this type of biofuels production can provide important benefits, production costs are generally high and reductions in fossil energy use and carbon dioxide emissions are modest, says the IEA. Further, grain-based ethanol (as well as conventional oil-seed-based biodiesel) must compete for land with crop production for other purposes, such as for food and animal feed, and supplies are likely to be limited.

Countries such as Brazil and India – that can grow and utilize sugar cane as a primary feedstock – are already producing relatively low-cost bio-ethanol with excellent characteristics, says the report. The high-yielding sugar cane that these countries use also provides sufficient crop waste to power the conversion of sugar to ethanol, virtually eliminating the need for fossil energy inputs and providing large 'well-to-wheel' reductions in carbon dioxide.

Since, over the next two decades, these and other developing countries may be able to produce more sugar cane ethanol than they need domestically, the IEA proposes that a global trade in biofuels be pursued.

However, for the longer term, research into advanced biofuels production techniques is bearing fruit. It now appears likely that within a few years the first commercial-scale production facilities will be built to produce ethanol from cellulosic feedstocks such as crop wastes, grasses and trees, using far less fossil energy and providing much larger reductions in carbon dioxide emissions per litre of fuel than the current processes.

Use of cellulosic feedstocks would also substantially increase potential biofuels supply, says the IEA.

Advanced biomass conversion to synthetic diesel fuel is also under development, using gasification and other techniques, which could eventually allow commercial production of much higher yielding, low-greenhouse gas biodiesel fuel, adds the report.

Order a copy of* Biofuels for Transport: an International Perspective *from IEA Books at: www.iea.org/books

RCEP calls for 'heat obligation' to support biomass use

Britain needs a 'renewable heat obligation' to stimulate the production of heat energy from biomass alongside electricity generated from renewable sources. This is one of the conclusions of a new report from the Royal Commission on Environmental Pollution (RCEP): *Biomass as a renewable energy source*.

"The use of biomass energy has benefits not only for climate change but also offers new opportunities for UK agriculture and forestry and increases the security of the UK's energy supply," said Tom Blundell, the Commission's Chair at the launch of the report. "The government has recognised this and has attempted to stimulate the sector through a range of policies, but the policies so far have failed to integrate the supply chain and support viable technologies. I am disappointed that energy from biomass has not developed as quickly in the UK as elsewhere in Europe. Biomass energy could make a vital contribution to the UK's targets for combating climate change, but is failing to develop under fractured and misdirected government policies for this important energy source."

Biomass differs from other renewable energy sources in two important respects: it is controllable and it can provide heat as well as electricity. "Changing government policy to encourage the use of biomass fuels for both heat and power could provide the impetus that the sector needs," added Blundell.

The report calls for:

- a new renewable heat obligation that would bring encouragement to the generation of heat rather than just electricity;
- the formation of a new government/industry biomass forum; and
- biomass fired CHP in all new-build developments.

Significant existing resources of biomass in the UK could be exploited for immediate progress on carbon dioxide reduction, says the report. Use of these resources would offer additional income streams for farmers and foresters, and initiate the development of an infrastructure for biomass supply. Co-firing with wood in existing power stations could be a useful step in the development of the sector, but even here ill-designed policies have inhibited the use of biomass.

In the longer term, the use of biomass for energy would depend largely on the production of energy crops (such as willow). This would require a significant change in agricultural land-use by 2050, and the Royal Commission recommends approaching this change in four distinct stages that provide opportunities for periodic assessment of the environmental impacts, the social acceptability and the economic viability of biomass utilisation. Following this approach, biomass could provide 10–15% of the UK's energy by 2050.

Heating systems using biomass are common elsewhere in Europe and serve as positive examples of integrated development that we need to see here, says the report. The introduction of a 'green heat' credit would help to raise the profile and profitability of schemes that use biomass. Use of biomass for heat or cogeneration CHP would also encourage better efficiency in energy generation, and increase the carbon dioxide savings of the UK energy sector.

In the UK, there are already substantial resources in the form of agricultural residues, forestry materials and municipal arisings (park and tree cuttings) as well as dedicated energy crops. The failure to realise the potential of these resources is due to a lack of effective, co-ordinated government policy to establish investor and farmer security and to develop the supply chain, says the Commission.

North Sea oil and gas production likely to fall

The prospects of sustaining North Sea oil and gas production at 3 million barrels of oil equivalent per day (boepd) are receding, according to the latest annual report from PILOT, the joint Government-industry body for the UK offshore oil and gas industry.

The report: *The Work of PILOT in 2003* highlights progress in a number of initiatives launched since 2000, when PILOT was created to improve North Sea competitiveness and maintain the UK as a pre-eminent centre for oil and gas production and supporting services. It also charts the progress towards the PILOT vision for the North Sea in 2010, which includes sustaining capital investment at £3 billion a year and oil and gas production at 3 million boepd.

In the report's foreword, Energy Minister and chair of PILOT, Stephen Timms says: "While the current level of capital investment in the UK continental shelf is expected to remain strong, forecasts suggest that meeting PILOT's 2010 production target of 3 million boepd is becoming more challenging. We need to work quickly to influence this. Production costs are rising and exploration is at an all time low."

The report also includes updates on:

- maximising recovery and progressing partnerships, the new processes which have been introduced to help unlock remaining offshore reserves of up to 31 billion boe;
- safety, reporting a 42% improvement in the time lost through injury but also12 fatalities in 2003; and
- UK-Norway co-operation, highlighting progress towards the new treaty between the two countries, the smoothing of a number of regulatory and infrastructure issues to allow free movement of hydrocarbons across the international boundary.

Meanwhile, responses to the 22nd offshore and 12th onshore licensing round have shown that there is still a great deal of international interest in the opportunities afforded in the UK for oil and gas exploration and recovery, says the DTI. In addition to the traditional licences and the recently introduced 'promote' licences, the 22nd offshore round saw the introduction of the innovative 'frontier' licence, designed to spark interest in the newly offered blocks to the North and West of the Shetlands islands. All three licences generated an encouraging amount of interest.

Bracknell plans district energy scheme

Bracknell Forest Borough Council has won funding from the European Commission to support its ambition for the regenerated Bracknell town centre to be powered by green energy. The project, christened Renaissance, will enable high standards of energy efficiency and renewable energy technologies to be built into plans for the redevelopment of the now outdated new town.

The grant has been awarded under CONCERTO, a new Initiative to support local communities in demonstrating the social, environmental and economic benefits of integrating renewable energy, energy efficiency and energy-management systems on a community scale.

The funding will enable the Council to work with a range of partners to design and install a state-of-the-art district heating, cooling and power system to serve the town centre, which may run on sustainably produced wood fuel. Waste wood thinnings from local forests and woodland will help power the energy plant in the short term, with new short rotation coppice planted to provide fuel in the medium to long term.

The innovative plans could also include wind and solar energy installations. The project will also involve a significant amount of research and development to ensure that the highest possible standards of energy efficiency are adopted into the design of the new buildings and for those that will be refurbished.

The Renaissance project involves a consortium of three urban areas in Europe, each taking similar actions to increase the take up of sustainable energy and learning from one another in the process. Lyon in southern France and Zaragoza in northern Spain will partner Bracknell, which will co-ordinate the project. The project is scheduled to commence in 2005 and conclude in 2009.

2004 – expect a record year for wind

The UK wind industry is on course to deliver a record year of new generating capacity in 2004, according to the British Wind Energy Association (BWEA). Four projects, totalling 68.3 MW have already gone live this year, and construction is underway on a further eight. As a result, a minimum of twelve new wind energy installations, representing 325 MW are confirmed for commissioning in 2004, says the Association.

Construction is also scheduled to start this year on a minimum of 300 MW of capacity for completion in 2005. By comparison, last year the industry installed just over 100 MW and during the past decade has installed an average of just 50 MW a year, says the BWEA.

Progress is also being made offshore in the UK's first phase of development at sea. By the end of 2004, the BWEA expects Scroby Sands off the coast of Great Yarmouth, the second of the UK's large-scale offshore projects, to be fully operational. Projections for offshore in 2005 are also positive, with confirmations that at least a further three 'Round One' projects, at Barrow, Gunfleet Sands, and Kentish Flats, with a combined capacity of almost 300 MW, should be built and fully operational by the end of 2005.

Enough gas and electricity for next winter

Energy consumers can rest assured that there will be enough gas and electricity available to meet customers' needs for winter 2004–2005, according to annual energy forecasts from National Grid Transco (NGT) published by Ofgem.

For electricity, NGT forecasts that it will be able to meet winter peak electricity demand with the return of some mothballed plant in time for winter. Around 1.7 GW of mothballed plant – enough power for a million homes – can be returned to the market within a month. Even in the event of severe winter conditions, NGT have said that a flexible market response will ensure electricity supplies to customers.

For gas, NGT reports that the supply of UK offshore gas this year will not be as high as previously forecast, but that under all credible scenarios, security of gas supply can be maintained using a combination of UK supplies, imports, storage and, where necessary, demand-side response from large gas users.

Ofgem Chief Executive, Alistair Buchanan, said: "Last winter, we saw how well the electricity market responded to rising prices by bringing back mothballed plant and increasing the 'safety cushion' of surplus generation available during the months where demand for electricity is greatest. We are confident that the market will continue to work well in delivering security of supply this winter. However, no system in the world can give a commitment that there will be no power cuts and, therefore, there can never be any room for complacency."

The first of a series of forecourts selling only biodiesel has opened for business Eric East's Daleside garage in Witton-le-Wear, County Durham, the first filling station to be branded as a new 'One Green Route'. Aimed at improving car efficiency and economy and also reducing carbon dioxide emissions, the biodiesel sold at the One Green Route in Witton-le-Wear is being supplied by Petroplus, part of the North East Biofuels consortium.

The biodiesel pumped at Daleside is currently produced from imported oils but, if demand grows, the hope is for the region's farmers to supply rape seed oil to make biodiesel in the Tees Valley, where the Biofuels Corporation is planning to build the world's largest biodiesel production plant.

BWEA urges support for UK wave and tidal power

The British Wind Energy Association (BWEA) is recommending urgent government action to kick-start the UK's wave and tidal sector to ensure the country doesn't miss out on becoming world leaders. A study: *Into the Blue: Financing the Future of the Emerging Wave and Tidal Power Sector*, undertaken by specialist merchant banking firm Climate Change Capital, examines the level and type of financial support that the sector needs to move it forward from its current research and demonstration phase.

The report recommends a series of actions that have been presented to government over the past few weeks by the BWEA. Main conclusions are:

- The UK has a fantastic opportunity to become a world leader in the development and deployment of wave and tidal power. Most of the companies involved in the sector, including those not currently based in the UK, see the UK as the place to develop their businesses.
- Government financial support should focus on rewarding success and offer the tax payer best value for money.
- A £75 million 'Marine Performance Fund' is proposed for the first 50 MW of wave and tidal projects and developers would obtain premium payments for a suggested five years following production of electricity.
- Given the right support framework, private capital will continue to be attracted to the sector, removing the need for the government to 'pick winners' through allocation of capital grants to companies in advance of deployment.
- Government support in the form of capital grants for grid connection, decommissioning and consenting work should also be made available at a potential cost of some £40 million.

Meanwhile, AMEC, ScottishPower and Ocean Power Developments (OPD) are to conduct a large-scale feasibility study of wave power off Scotland. Working under a memorandum of understanding, the three companies will assess the technical and commercial viability of a demonstration project utilising OPD's floating Pelamis (Greek for sea snake) generator.

Pelamis comprises four 24 m canisters aligned perpendicular to the waves, generating electricity from the relative motion at the flexible joints between each of the canisters. Each Pelamis machine has a maximum output of 750 kW. The first full-scale unit has been built and trials at the Marine Energy Test Centre in Orkney are due to start this summer.

Eight generators to be used for the world's first commercial-scale floating wave energy converter have been supplied to OPD by AEG Electric Motors of Crewe.

Major investment needed for the electricity network

The most significant barriers to the achievement of the 2010 renewables target are the level of investment required in electricity network reinforcement and new build, and the associated planning process. Indeed, planning bottlenecks could seriously delay construction of new network capacity and in turn frustrate renewable generation plans. These are the conclusions of a study, carried out by Mott MacDonald, for the Carbon Trust and the DTI to assess the ability of the UK electricity network to accommodate the government's target to have 10% of electricity generated from renewable energy sources by 2010, and its aspiration to double that percentage by 2020.

Mott MacDonald carried out a capacity mapping and scenario modelling exercise for the government's 2010 target using a 'bottom up' approach to build up renewable power capacity on the networks taking information provided by project developers on actual projects and longer-term business plans.

The company also carried out a transmission network topography analysis which highlighted the scale and level of investment required for the construction of new transmission capacity to enable renewable energy to be fed to load centres. Much of the investment stems from the fact that most new renewable generating capacity will be located in rural areas away from existing grid strong points.

The study also considered the impact on the networks of the intermittent nature of renewables, in particular wind. At the current target levels, the study concluded that intermittency is not a significant issue affecting the development of renewable generation. Standby costs associated with wind power generation capacity consistent with the government's 2010 renewables electricity target are of the order of 0.16–0.24 p/kWh, says the study.

Meanwhile, the new Energy Networks Association (ENA), which represents the UK's electricity and gas network transmission and distribution system operators, has warned renewable developers that their ambitions for connecting to the electricity network might not be achieved. ENA chief executive Nick Goodall said that, "We cannot second guess where the onshore wind farms will be built and speculatively lay connections to the electricity network, also offshore wind will be 'stuffed' unless we secure a regulatory regime that encourages network companies to build connections."

Ofgem fines Transco; still investigating winter prices

Energy regulator Ofgem has confirmed a £1 million financial penalty on national gas pipeline operator, Transco, for the poor performance of its connections business.

The penalty was initially proposed by Ofgem in March following complaints which brought to light widespread problems with Transco's connections business. The company frequently failed to provide timely quotations and often did not turn up to carry out planned work. A wide range of customers was affected, including gas suppliers acting on behalf of home owners wanting a new gas connection, competing connections firms and building contractors.

Transco has already paid out £2.6 million in compensation under an enforcement order imposed by Ofgem in 1999 which set out performance targets and compensation arrangements for certain customers. The company is now working with Ofgem to bring in a new condition to its licence later this year aimed at achieving better standards of service.

Meanwhile, the regulator has closed its enquiries on five of the seven potential causes of high wholesale gas prices last winter. Between September and October 2003, wholesale spot gas prices rose by 80% even though gas demand was at similar levels to previous years. Following a number of complaints from customers and companies, Ofgem launched a probe into seven potential causes – enquiries into five of these have now been closed.

Further questions are being put to certain producers and interconnector shippers on two outstanding issues:

- why were gas deliveries from the UK gas fields lower than expected; and
- why did shippers not increase imports from continental Europe across the interconnector quickly in response to the high prices in Britain?

Renewable electricity supplier Good Energy, previously known as unit[e], has launched a new tariff to allow small-scale renewable energy generators to sell their electricity. Under its 'Home Generation' tariff, small-scale generators will be able to sell their electricity to Good Energy simply based on readings they submit from their existing meter. Customers will receive 4 p/kWh for all the renewable electricity they produce, including the energy they use themselves.

The initiative takes advantage of a recent move by Government to make Renewable Obligation Certificates (ROCs – which demonstrate that electricity has been produced to renewable standards and are a tradable commodity) available to micro-generators, including building-integrated photovoltaic systems. It also removes the need for small generators to invest in expensive metering systems to measure the amount of electricity produced.

Government to sell special shares in energy companies

The Government has announced plans to redeem the special shares it holds in five energy companies, while confirming that it also plans to retain its special shares in British Energy, but with modified powers.

The Secretary of State for Trade and Industry plans to sell the special share held in National Grid Transco plc; the Secretary of State for Northern Ireland will redeem the special shares for Viridian Group plc and Phoenix Natural Gas; and, the Secretary of State for Scotland will do likewise for special shares held in Scottish Power and Scottish and Southern Energy, says the DTI.

Special shares in these companies were put in place at privatisation, giving the government a variety of different rights in each company. The decision follows reviews by the government departments who hold energy special shares. These concluded that the current legal and regulatory framework in most cases now provides adequate protection of the public policy objectives, which the special shares were initially set up to cover.

Only two provisions of the existing special share in the British Energy Group of companies are proposed to remain with the government:

- the requirement of ministerial consent for anyone to purchase more than 15% of British Energy issued shares; and
- the requirement of ministerial consent for the disposal of a nuclear power station by British Energy.

It is proposed that both of these provisions will be amended to ensure that government consent can only be refused on grounds of national security.

Hydrogen from coal – pr

Coal is a traditional, dirty old fuel gradually being phased out around the developed world, while hydrogen is an important facet of the shiny, new sustainable energy future. So runs the simplified argument. But coal may, instead, be an important source of hydrogen for the future. Here, Andrew Cox surveys international efforts to produce hydrogen from coal.

The development of the hydrogen economy is increasingly seen as an essential element in a global low carbon future. But where will the hydrogen come from? This is very complex question; the answer to which will depend on a wide range of factors, including the existence of existing fossil fuel reserves and renewable energy resources. In some countries, coal could be the primary feedstock for hydrogen production. But how can coal, often viewed as a dirty fuel from the past, be seen as a key driver in the development of the hydrogen economy?

Gasification technologies – including Integrated Gasification Combined Cycle (IGCC) systems – can produce a syngas which, after cleaning and chemical processing, can produce a high purity stream of hydrogen. This hydrogen could be used for low emission power generation or for a wide range of other applications – particularly transportation. However, the commercialisation of fuel cells and other technologies will be required before a significant hydrogen economy can develop.

Hydrogen is not the only 'clean fuel' that could be produced from coal. The syngas from coal gasification plants could also be used in the synthesis of a range of other fuels – including methanol, dimethyl ether, Fischer-Tropsch liquids, as well as substitute natural gas. One of the main advantages of clean fuels is that they can be used as an energy storage medium for electricity production. They can be cogenerated with electricity in IGCC plants or they can be exported in the same way as conventional fuels for use in the transport or power sectors.

European Union programmes

In 2003 the European Union unveiled its vision for the energy sources of the 21st century. The EU research programme includes measures aimed at developing new clean energy sources and carriers (such as fuel cells, hydrogen carriers and carbon dioxide capture and sequestration associated with 'clean' fossil fuel plants) that are affordable and can be incorporated into energy supply networks. An important component will be the development of near-zero emission plants.

Despite recent European Commission policies which have backed away from coal, it is thought that there may be the possibility of a renaissance occurring, with the recognition that, for some countries, coal remains important as a secure and affordable source of energy.

US Energy Programme

Current US energy policy highlights the importance of coal in meeting the country's future energy needs. Presidential speeches and policy documents have indicated that coal can offer a key energy security advantage to the US energy mix and also be a major component of the emerging hydrogen economy.

A recent report from the influential National Research Council (NRC) indicated that coal could be one of several long-term, reliable sources of hydrogen. The NRC stressed that a massive effort required to produce hydrogen could use abundant domestic supplies of US coal resources, and this would prevent an over-reliance on energy imports, particularly natural gas. Advanced coal plants of the future could co-produce electricity and hydrogen, achieving high efficiencies using advanced turbines and fuel cells, while sequestering the by-product and pollutant carbon dioxide. The US Department of Energy was urged by the NRC to continue its R&D in these areas, while striving to better link its programmes on hydrogen, carbon dioxide capture and storage.

According to the NRC, hydrogen-from-coal and IGCC technology development should be pursued in tandem. Gasification systems, while commercial, need further development with respect to hydrogen production. There is also a need to accelerate the development and evaluation of carbon capture and sequestration technologies. The importance of public acceptance of all of these efforts is also emphasised throughout the report.

The NRC expect natural gas/distributed generation to dominate markets during a 25 year transition period, with coal then used to produce greater amounts of hydrogen from large central plants. Coal plants would need to be large to achieve economies of scale, and demand would have to be sufficient to support the correspondingly large-scale investment. It is forecast that by 2050, coal-to-hydrogen could amount to 13-15 quadrillion Btu/year. Were that the case, by 2050 the US would need to have sequestered approximately 20 billion tonnes of carbon dioxide. Recent studies indicate that there appears to be sufficient capacity in geological formations to store the carbon dioxide. The NRC saw no insurmountable barriers to the development of capture and sequestration technologies.

The NRC anticipates that, from a coal perspective, technology advances will lower the costs of hydrogen from coal by approximately 25%. System analyses have indicated that carbon dioxide capture would add around 10% to the cost of producing hydrogen from coal without sequestration. The NRC report cites US$1.03/kg as the current cost of

By Dr Andrew W Cox, Energy Intelligence & Marketing Research, Newcastle upon Tyne

ospects and challenges

producing hydrogen from a large central power station. This figure could be reduced to $0.90/kg if R&D could lead to key advances – which include capital cost reduction, standardisation of design, reliability improvements, process integration, and oxygen plant optimisation. Co-production of electricity and hydrogen would lower costs as would the co-capture of carbon dioxide and sulphur, and other major pollutants.

Another key finding from the NRC report was that hydrogen from a central power station plant (produced from natural gas or coal) that is utilised in fuel cell vehicles can be roughly cost equivalent to gasoline fuels in a hybrid vehicle on a 'gasoline-efficiency-adjusted' basis.

UK-based projects

Supporters of the UK coal sector have consistently argued that coal-based RD&D work is grossly underfunded in the UK. There seems little prospect of the current government either providing substantial R&D expenditure or financial support for a large-scale or commercial-scale clean coal technology demonstration plant (such as IGCC technology) which could assist the development of hydrogen production using coal as the primary feedstock.

Despite this lack of government support, two major projects involving the production of hydrogen from coal, based in the south Yorkshire and south Wales coalfields, have been the subject of detailed technical appraisals – with planning applications being submitted by the relevant companies. Other potential projects, including the Wansbeck Energy Project, an IGCC project in Northumberland, appear to have been abandoned.

Coalpower Ltd submitted a planning application to develop a 430 MW IGCC plant on a site adjacent to Hatfield Colliery, near Doncaster, South Yorkshire. Coalpower received planning permission from Doncaster Council and, more importantly, in August 2003 it received consent from the DTI to build and operate the new plant.

Regrettably, the Hatfield IGCC project has been derailed by the financial crisis that subsequently overwhelmed Coalpower. In late-2003, major losses incurred by the colliery led to Coalpower being forced into administration. Hatfield Colliery has ceased production and may not re-open.

A second project in the UK has been proposed by Valleys Energy Ltd. The company has submitted proposals for a £375 million, 460 MW IGCC power station project on the site of the former Drym opencast coal site, near Onllwyn in the Dulais Valley, south Wales. If it is developed, the Valleys Energy project will create around 120 new jobs at the power station and help create and maintain up to 1,000 other jobs in the various supporting companies – including the South Wales coal sector. The plant will consume locally-produced coal (from Tower Colliery and other mines) as well as petroleum coke.

The company has also stressed that the new IGCC plant will produce high quality hydrogen which will be consumed in an advanced gas turbine. The station is being specifically designed so that, in the future, carbon dioxide can be captured for long-term storage. The project could also help Wales win a share of the emerging hydrogen market – with the supply of 'green' fuel for vehicles, as well as power for homes and industry.

The DTI's recent Energy White Paper: *Our Energy Future – Creating A Low Carbon Economy* (February 2003) indicated that current policy envisages a reduced contribution to UK electricity supply from coal-based generation. It stated that coal-fired generation will either play a smaller part than today in energy provision or be linked to carbon dioxide capture and storage (if that proves technically, environmentally and economically feasible). The White Paper envisages hydrogen-based fuel cell technology playing a greater part in the economy by 2020 and beyond, initially in static form in industry or as back-up energy storage, and then increasingly in transport applications. Crucially, the White Paper's authors felt that the hydrogen will be generated primarily by non-carbon electricity.

Outlook and challenges

The transition to the hydrogen economy will be a long and complex process, and will take several decades. Coal could be a significant driver in the development of the hydrogen economy – particularly in countries such as the US which have extensive reserves of coal that can be mined at low cost. Geopolitical and strategic issues concerning the availability of energy sources may also act as a powerful driver in developing these technologies. However, the continuing large-scale use of coal will also require an extensive RD&D effort to develop and build a generation of plant that can produce hydrogen and other fuels at a price that is competitive with other fuel sources. Equally important, large-scale, coal-based systems will require the development of economically competitive carbon capture and storage technologies – with the goal of producing near-zero emission plants.

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Demand side bidding in a co

An International Energy Agency project looking at the role of demand side bidding in competitive electricity markets has recently come to an end, culminating in the production of a practical guide to demand side bidding. The project, led by EA Technology, formed part of the IEA Demand Side Management Programme and involved participants from Finland, Greece, the Netherlands, Norway, Spain, Sweden and UK. Here we review some of the findings of the project and provide a flavour of the Guide.

Demand side bidding (DSB) is a mechanism that encourages consumers to offer to undertake changes to their usual pattern of electricity consumption in return for financial reward. The financial reward can be in the form of reduced electricity prices, or via a direct payment for electricity they have 'not consumed', or even an availability payment for the promise of being available to make a consumption change at an agreed time. DSB has become an important feature of many markets, and has the potential to grow in importance, as its operation becomes more fully understood.

Although DSB is often thought of purely as a mechanism by which consumers can earn money, it may also play an important role in terms of energy efficiency. For example, load reductions by consumers can displace the use of fossil fuel generation for maintaining the quality of electricity supply or for balancing. Alternatively, DSB can have an important role to play where demand exceeds capacity or when network constraints occur for only a very limited length of time. In such cases, it may be more appropriate to seek short-term demand reductions from consumers instead of additional generation capacity or network reinforcement.

DSB is closely related to, but very different from, demand side management (DSM) – the main difference arising from the impact the two have on the demand profile of consumers – see Figure 1.

Figure 1. Demand side bidding versus demand side management

The role of DSB in market mechanisms

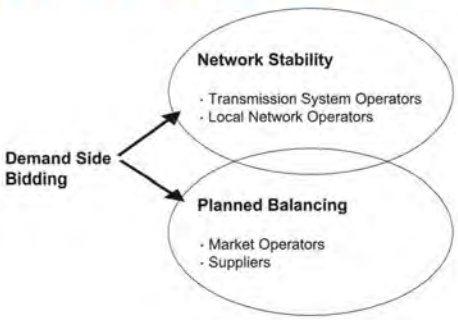
There must be a balance between supply and demand of electricity at all times (ie on a second-by-second basis). However, for practical purposes electricity is not traded on a second-by-second basis, but rather trades are settled over a longer time interval – typically half hourly or hourly – depending upon the market regulations in force. Market participants, such as suppliers and generators, are given the responsibility of balancing supply and demand over these trading periods or otherwise face financial penalties.

Thus two types of balancing action are required – see Figure 2:

- those undertaken to maintain balance in real time to prevent system imbalance and ultimately network failure (network stability); and
- those undertaken to balance supply and demand over a trading period for the purpose of avoiding imbalance charges (planned balancing).

DSB can be used for both of these purposes.

Figure 2. Two types of balancing action



Network stability

For example, a very successful area of DSB in the UK is frequency response. In an emergency – such as the loss of a large generator – the system frequency can fall dramatically from its normal value. It is the job of the transmission system operator to correct this and return the system frequency to normal within a specified period. Normally this is achieved by having reserve generators in a state of readiness. However, consumers capable of instantaneous shutdown can also provide the same frequency correction.

In the UK, a demand side aggregator (Gaz de France) is currently offering an instantaneous load reduction of 110 MW, aggregated across thirteen cement production sites. The crushing and milling processes at cement works are ideal for frequency response – consuming large, predictable and steady loads, which can be easily interrupted and restarted.

Usually DSB is far removed from the day-to-day priorities of consumers, the very people who DSB is aimed at. Consequently DSB can easily be seen as an unwanted distraction. Often, as in the case of the cement industry discussed above, the role of an

mpetitive electricity market

aggregator or service provider is crucial in providing the necessary impetus to make DSB happen. The aggregator may be an independent company or an electricity supply company. In either case, it is he who brings together knowledge of electricity markets, an understanding of the processes of the end consumers of electricity, and the expertise to implement the necessary control, monitoring and communications technologies.

Planned balancing

Most successful DSB schemes to date have been used to cope with abnormal or unusual situations, as in the network stability example described above. Similarly, the successful planned balancing examples have tended to be where price spikes occur just occasionally, for example, in generation-limited networks. Here very high prices can occur for a relatively few hours per year and demand response is desirable to reduce prices and ensure a secure system.

In a Nordic project, investigation is currently underway as to whether it is feasible to group together a large number of small consumers to provide a cost-effective solution. From a market perspective, the problem is one for the suppliers. However, in practical terms the network operator may be best placed to solve the metering and settlement issues that arise – though it is worth noting that, at least in the case of Sweden, a target date of 2008 has been set to put the market mechanisms in place for this to be undertaken by the suppliers.

The future

DSB, like competitive electricity markets themselves, is an area that is constantly evolving, and many changes can be expected over the coming years.

Demand side bidding is seen as an important component in ensuring that competitive electricity markets behave in an efficient manner. It is all about encouraging flexibility in the use of electricity by the demand side – the actual consumers of electricity. Thus the demand side becomes involved in the processes of setting prices and maintaining the quality of supply, and hence provides a counter to the otherwise dominant role of the generators.

The recently completed project has shown that a wide range of DSB schemes are already available, but with the vast majority targeted at large consumers. The challenge for the long term success of DSB is to build on this initial success and to extend its applicability to encompass smaller consumers (particularly those who, within the context of liberalised markets, do not currently require time of use metering). A number of practical issues to do with verifying demand side bids (will metering be too expensive, can consumption profiles be used as a lower cost alternative, is aggregator validation sufficient?) require addressing; as do the questions of who will drive DSB forwards – will it be aggregators and service providers, or will it require active intervention from system operators?

These and other questions will be addressed by a new IEA project also being led by EA Technology and currently underway: 'Time of Use Pricing and Energy Use for Demand Side Delivery' – see box.

To obtain a copy of this guide, contact Linda Hull at: linda.hull@eatechnology.com

The next step: time of use pricing

EA Technology has now been commissioned to produce a report on how domestic and other smaller electricity consumers, can be motivated to become involved in time of use pricing and demand side bidding. Called 'Time of Use Pricing and Energy Use for Demand Side Delivery', the project is being led by EA Technology on behalf of the UK, Finland, Spain, Greece, Denmark and the Netherlands, under the auspices of the International Energy Agency (IEA).

The strategic aim of the project is determine how smaller users can contribute towards balancing supply and demand by helping to flatten out peaks and troughs of consumption, which will also reduce overall emissions of carbon dioxide.

EA Technology project manager Linda Hull explained: "Essentially, the project will examine all the way in which smaller consumers can participate in demand side management techniques, which are becoming increasingly commonplace among industrial and commercial electricity users. The big question is – what will and will not work in persuading consumers to play a part in management of electricity demand: financial incentives, education or a combination of both?"

"We will be studying a large number of international trials and schemes that have already been implemented. We will be looking at how customers can be motivated to become more energy efficient by giving them more information about what they consume – for example, providing smart meters which will tell them exactly how much energy their appliances, such as washing machines, are using and how much they cost to run."

"We will also be examining how consumers can be persuaded to shift patterns of consumption, for example by incentivising them to programme dishwashers to operate at night, using techniques such as half-hourly tariffs."

One of the most radical ideas under review is to involve domestic consumers directly with network operators in voluntary agreements which would enable operators to control consumption directly under agreed circumstances. An example of this would be to enable an operator to remotely turn off storage heaters or air conditioning units for short periods to balance demand.

EA Technology expects to complete its report in April 2005.

Micro-interruptions and

Decentralized energy production, standalone photovoltaic generation systems for the third world, smart control of domestic devices using the Internet – Dave Whitman has been thinking about the future for electricity use in both industrialised and developing countries. Here, he argues that coordination between power and computer systems offers a way forward for electricity networks.

By Dave Whitman, Energy International (UK) Ltd

At this, the start of the twenty first century we live in a world in which over two billion people live and cook through the burning of crop residues, scavenged wood and animal dung, while (most) western administrations spend time agonising over how to reduce energy usage. At a time when we recognise the need to reduce energy usage internationally, there is a simple humanitarian case for a vast number of people to increase their energy consumption. If the inequalities between rich and poor worlds are to be reduced, both will need to develop new, more sustainable energy systems, delivering energy in a manner appropriate to the living conditions and lifestyles of those people using the energy. The development and commercialisation these systems, whilst keeping the overall energy consumed around the world at levels which do not threaten the environment, is one of the major engineering challenges of the next century.

In addition to concerns about the overall levels of energy used internationally, there are growing concerns of security of supply within nations. One incident in the northern US last year demonstrated dramatically how a simple power outage can rapidly escalate to an event which is now estimated to have cost $8 billion.

Research is now needed on a range of issues which relate to the development of new energy systems, and the optimum design of networks to deliver energy. This will require the imaginative use of all the tools at our disposal. As with all technological development, this will require a blend of revolutionary inventions and incremental developments to existing technology. Neither approach can be forgotten, and both can sometimes be difficult to disentangle in a period of rapid development.

Interrelated systems

The interactions between several interrelated networked systems can be difficult to predict and control but, if anything, our energy delivery systems must become more complex to cope with the multiple demands of introducing renewable energy sources, improving network security against a range of man-made and natural threats, and deregulation of most components of the system.

We need to apply new ideas, and maximise the positive contribution of existing and emerging technologies, in order to create the energy systems we need for the next century. Let us consider one problem, and its ramifications, and see if we can apply some new thoughts. The largest peak demands on the UK national electricity network are linked to the time of showing of adverts in television programmes or televised sports events. Peaks are problematical because:

- they require large amounts of spinning reserve to be in place (turbines spinning and using fuel but not producing electricity, waiting for peaks);
- a peaky system is harder to supply with renewable energy sources, a problem that will worsen as the renewable contribution increases;
- more installed plant is required – the system is being sized to suit very short-lived events; and
- unforeseen peak demands can destabilise networks, and ultimately may cause events such as the recent US power outage.

In the past, we have seen examples of demand side management in the guise of commercial products such as interruptible gas contracts and electric load shedding. As energy networks become more complex, and geared to a wider range of energy sources, there will be a greater need to link complementary systems – for example to link energy networks with information networks such as the Internet.

We also note that there is a trend within developed economies towards innovations in embedded generation such as micro-CHP systems for the home (see for example see John Parson's article in *Energy World May* 2004). Embedded generation and other technologies are leading to changes and new developments in metering and control systems.

Micro-interruptions

From these initial ideas we have been lead to propose the use of the Internet to coordinate sequences of 'micro-interruptions' to domestic premises. For example, a number of households in a neighbourhood or virtual community could have very short-lived interruptions to a portion of their supply. One candidate could be a 'smart kettle' which could be briefly turned off by the Internet coordinating software. Across a community, these micro-interruptions could be sequenced to reduce the overall peak demand from that community – see Table 1. A 'peak limiting' tariff could be used as an economic reward for allowing such intervention.

Micro-interruptions would clearly have some impact on individual users, but this would be limited to slightly lengthening the time take to boil the kettle. On a national scale, the 'Coronation Street peak' could be considerably reduced, whilst also providing network engineers with a new tool for dealing with emergencies. If some unforeseen event causes demand to rise quickly enough to potentially destabilise the system, all the kettles fitted with the Internet connection could be turned off.

de-networking

Table 1. Example of a micro-interruption sequence for five homes. The homes do not have to be physically next to one-another

House 1	House 2	House 3	House 4	House 5
Off for 1 second at t = 0 s	Off for 1 second at t = 1 s	Off for 1 second at t = 2 s	Off for 1 second at t = 3 s	Off for 1 second at t = 4 s
At = 5 seconds the sequence repeats				
Each home has their kettle switched of for 1 second in every five. Only four kettles out of five are operating when the sequence is running. The micro-interruption sequence delivers a 20% increase in time to boil a kettle and a 20% reduction peak power demand.				

Clearly such a proposal raises a range of questions, among them:

- What is the optimum scale for the neighbourhood/community size?
- Are straight on/off interruptions better than fade off/fade in?
- How can manufacturers be persuaded to add the 'widget' to their kettles?
- Should the widget communicate through mains signalling or wireless connection?
- What would the costs be, over the timescale that such developments are likely to be deployed?
- How can communities be persuaded to accept micro-interruptions?

The concept of short lived, Internet-coordinated interruption could be extended to other domestic loads, as well as suitable loads in industry and commerce, such as on- and off-peak space heating, comfort cooling and cold store refrigeration plant.

If the energy Internet becomes a reality over the next decade or so, there will be enormous opportunities for software developers to create automated agents to roam or crawl the network. These agents could look for potential problems or seek to bring energy consumers in touch with companies offering systems that will save energy in each consumer's particular situation.

If the UK succeeds in developing efficient, economic and sustainable energy systems that suit modern consumers whilst minimising damage to the environment, then there are huge opportunities to export technology and expertise to the world market. Strategies that work well in the UK would be quickly adapted to suit other developed economies.

Living without a network

The desire to reduce electricity consumption in mature economies such as the UK may be far surpassed by the desire simply to have a reliable and plentiful electricity supply. Some of the more radical new technologies which we expect to be deployed in developed economies over the next decade may also be applicable to informal settlements – see Table 2. We have already seen the spread of mobile phones into shanty towns. Lead acid batteries are often used for lighting. Perhaps renewable energy sources could provide a better method for recharging batteries, allowing electricity to be sold in small packets. Full techno-economic feasibility studies need to be carried out to assess such concepts.

Table 2. Networks and standalone systems

Old – networked delivery systems	New – no wire no pipe delivery systems
Telephone networks	Mobile phone networks
Water or gas networks	Individually fuelled fuel cells (eg bottled gas)
Electricity networks	Standalone PV installations

Thinking about living without a network does not only produce solutions for developing economies. Non-networked solutions such as standalone PV generators, also offer solutions for network operators, for example to reinforce electricity supplies to outlying areas on the fringe of the network. Network engineers in the US have certainly seen cost and environmental benefits from such an approach.

In general, it appears that there is an urgent need for a wide-ranging exploration of the basic concept of linking the Internet to the energy network, and using this to create new types of networked cooperative and commercial behaviour, alongside established and emerging energy technologies. There is a particular need to start exploring at feasibility study level the concepts outlined here, particularly to consider optimum scales in a range of network solutions, including micro-interruptions.

For the world market there is also a need to consider non-networked systems, whilst remembering that this may still involve the most modern energy technology available. And, even if energy consumers are not connected to an energy network, they may be connected to information or telephone networks working without wires.

Bill Clinton urged us, in 2001, to 'think outside of the box', to break down the walls between people. In energy systems, maybe we need to think how to usefully network the boxes to allow cooperation, and the evolution of sustainable systems for the next century.

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One year on from the mer

Twelve months ago Energy World asked Louise Kingham, then Director General of the Institute of Petroleum and Chief Executive Designate of the proposed new Energy Institute (EI), for her 'view from the top' as she and a team of members and staff began to implement plans to create the EI. Now, as the Institute reaches its first anniversary we have asked Louise, now Chief Executive, to reflect on the new organisation – how it is 'bedding in', the shape of the merged structure, and prospects for the immediate future. This interview also appears in the July issue of Petroleum Review.

The Energy Institute was created a year ago, on 1 July 2003. A year on from then, how do you feel the process of merging two long-standing organisations has gone, and how much is left to do?

In short, it has gone very well. The members and staff have done an incredible job so far. Mergers between membership organisations are renowned for their complexity and the length of time they take to complete – several years in many instances. From the point at which members determined the future – when votes had been counted at the beginning of February 2003 – to creating the EI as a legal entity, only five months were allowed to elapse.

During that time a shadow Council emerged, together with 13 temporary task groups comprising members and staff working together on issues from future strategy and governance systems through to membership services and integrating branch structures. All of these groups had either concluded their planning, ready for implementation by 1 July or, based on the activity, by the end of the summer of 2003. From that point to the end of 2003, only a further six months, we worked to implement the outcomes from these groups. Some became obvious (and operational) instantly on 1 July. For example, implementing effective governance and membership structures, together with rebranding a large amount of material. Others, such as integration and development of a new branch structure – led by members active in the pre-existing networks – has required more time, quite rightly, to organise.

However, my interpretation of how the process has gone not only comes from my personal review of performance but, most importantly, from how those we exist to support view it. Members, both individual and those representing organisations; potential members; and partners in learning, business and government circles have all, at some point in the past year, given me a view of how they feel as witnesses to major change. So far, amongst an exceptionally positive reply, less than a dozen individuals have alerted me to further changes they would like to see or simply admit that they remain to be convinced.

Louise Kingham – Chief Executive of the Energy Institute. Louise was previously Director General of the Institute of Petroleum and, before that, Secretary and Chief Executive of the Institute of Energy.

We intend to canvass wider opinion more formally later this year, as peoples' perceptions and experiences are what tell me whether we are on the right track. Yes, there is still much to do – most of which is in further consultation with groups of members and potential members as activities that are linked to new service development. These include establishing demand for special interest networks, the future format of key publications and future career development services – all of which will be determined by research in coming months. Beyond that, significantly extending our reach across all activities keeps us focused on the longer term.

To what degree has the organisation 'gelled' into a cohesive whole, and to what degree has it been necessary to keep it as two different organisations? How do you see this developing as we go forward?

At the planning stage Trustees from both predecessor Institutes locked themselves in a room only to emerge once key elements around the EI's purpose, aims and vision had been agreed. By doing this at the beginning we were always likely to design a new Institute fit for purpose, rather than simply trying to stitch, somewhat untidily, the two predecessor organisations together.

It might sound an obvious order of things, but many mergers fail and I believe one key reason is that unless you agree at the very beginning about what you are creating, you will be unlikely to concur about the end result. It was at this very early stage that we thought hard about the differences there would inevitably be among the membership and agreed that there was no need to try and blur any distinctions. Rather, these distinctions, often represented through differing views on issues, are what make an Institute, as the facilitator of debate, a lively and thriving organisation.

Forming policies on issues, however, can be more of a challenge – one that we are working on right now. Essentially, we made a commitment in the merger prospectus to maintain depth and breadth of subject matter, so ensuring this is our priority.

As far as 'gelling into a cohesive whole' is concerned, what I can tell you is that when I visit

'ger – the Energy Institute

branches or attend functions members seem to be getting on well – but any more insight would need to come from them. The staff, too, are best placed to tell you if they now feel part of a whole organisation. For the team as a whole, it has been an unsettling year, for obvious reasons. But I think that their achievements collectively, not least relating to the EI's positive financial performance in 2003, tells me that they are settling into their new organisation pretty well and as quickly as can be expected.

Two different organisations have never been, and are not, part of the plan. Building the capacity of one diverse organisation, with a wide range of interests and the capability to home in on any particular energy topic, is how I see the EI developing.

How is the EI now being organised internally? Has the process of merging business systems been completed, and has there been any movement away from the organisation being overseen by, and reporting to, committees of members?

The Council of the EI is the governing body, comprising members – just as its predecessor Councils did. The sub-committee structure is different, however, with three mandatory committees of Council: Professional Affairs, Finance and Audit, and Human Resources. In addition to these groups, the technical team works with a members committee known as the Scientific and Technical Advisory Committee (STAC) and the communications team works with a members committee comprising a representative from each EI branch.

It would be fair to say that the members and staff co-exist and, in most cases, our activities would cease if the partnership collapsed. However, the culture is one of working together – not one for another – and that is different to how some other similar organisations operate.

Systems have been integrated and we are just embarking on a project to upgrade some very dated IT systems, specifically to get better functionality and help us to introduce some new services either towards the end of 2004 or early in 2005.

The EI staff team is organised into four directorates. The heads of these groups, together with the Chief Executive, comprise the management team. This group works with the various committees, as do other members of the staff team. However, they also have their own executive responsibilities, targets and challenges to think about and work towards. This can often mean working together with individual members, other contacts in the industry or entire organisations.

Although both were membership-based organisations of energy professionals, there were considerable differences between the old Institutes of Petroleum and Energy. The former served a single, relatively focused petroleum industry and the latter covered a vast area, specialising in facilitating debate on energy policy. How are these different approaches being merged? And how do you see this process going forward?

Almost 12 months ago I set out what I believed the purpose of a professional body is to be – to bring together a learned community to share knowledge and expertise and, by doing so, collectively we would benefit those individuals involved and ultimately, wider society. The vision, values and future plans for the EI's first few years of operation reaffirmed this position.

On most energy-related issues we will facilitate the debate and encourage members with differing views to develop these and share their knowledge with others – this is how policy develops. On some issues the EI will develop its own voice, as well as facilitate debate, and it will work with groups of members to do so, via Council and a Communications Panel. One example we are working on right now is our concern about skills shortages in the energy industry and how we can work together with other organisations to address the problem. You would expect your Institute to have a voice on this issue, and there will be others topics to address in the future. However, our position on any issue will always be based on sound science and fact. (Members interested in finding out more about being involved in the Communications Panel can get in touch directly with Louise; contact details at the end of this feature.)

How have individual members of the two former organisations reacted to the merger? What are current membership plans and targets?

Less than half a dozen members have resigned as a result of the merger. We have received some really helpful and warm communications from members throughout the process, for which I am particularly grateful. Members have driven many of the key elements of the merger, so I believe they have reacted well. However, I am sure, as members are so busy, that I will still bump in to one or two who will ask whether we've merged yet! Our target

for this year is to recruit 1,000 new members across all grades of membership.

There are possible tensions between the relatively narrow focus of the petroleum membership and the wider interests of the old Institute of Energy members, many of whom are focused on end-user and sustainability issues. Has this tension been creative or destructive, and how is it being handled both now and for the future?

Firstly, I cannot recall seeing evidence in the past 12 months of any tension, although in the early days of an amalgamation there are always sensitivities based on peoples' expectations. Where I have seen differing opinions and views exchanged by learned members, I have also seen patience, understanding and interest – even if disagreement prevails at the end of the discussion. So, I would view that as creative, certainly not destructive.

Both *Petroleum Review* and *Energy World* provide a forum for exchange of views, however wide ranging, as we have seen recent examples of – particularly around viewpoints and letters to the editor. Our events also provide an excellent forum for acknowledging different positions on energy issues – all of which I believe to be healthy and positive. I think most would agree that if we all viewed the world in the same way, life would be much less interesting.

What has been the reaction to the creation of the EI by other organisations – eg government departments, the Engineering Council, other institutions?

Very positive. Obviously, the relevant government departments were formally consulted about the creation of the EI and were supportive then, as was the Engineering Council UK. Other institutions have also been generous in making the transition to work collaboratively with the EI as the successor partner to either the former IP or InstE.

You have presided over an enormous agenda for change in the last two years. Are you now looking forward to a period of stability or are there more changes to be made?

When you run a mid-sized organisation positioned at the centre of the energy industry, is there such a thing as steady state? I think not. But there is stability in the sense of managing and driving the EI forward whilst recognising the continuous change around us as 'normal' as opposed to generating such huge internal change.

How do you see the EI developing over the next few years and what will be its driving principles?

Driving principles over the next few years will be the purpose, vision, values and strategic aims of the EI. There is still much to do in order to be at the forefront of peoples' minds when they think of energy – and that is where I want us to be. A rolling strategic plan and annual operating plans fall out from these driving principles and I have no doubt that the EI will continue to operate in this way, by being very aware of the world around it.

Both the Council and I know we want step changes in several areas of our activities to be more successful, for those we exist to support and drive the energy agenda higher in the minds of the public – after all, we exist as a charitable organisation, which means we are about providing public benefit, ultimately. I simply urge readers to continue to stay in touch with us and share your thoughts so that step changes we implement to build the capacity of the EI meet with your approval.

Contact Louise Kingham at: lkingham@energyinst.org.uk, tel: 0207 467 7101

Senior management of the EI

Chief Executive:	Louise Kingham
Finance and Administration Director:	Ian Dixon
Professional Affairs Director:	Sarah Beacock
Communications Director:	Currently vacant
Business Development and Technical Director:	Lawrence Slade

EI Branches

Aberdeen, Highlands and Islands
East Midlands
Essex and East Anglia
Hong Kong
Houston
Humber
Ireland
London and Home Counties
Netherlands
North East
North West and North Wales
Northern Ireland
Southern
Southern Scotland
South West, South Wales and the Channel Islands
Switzerland
West Midlands and Mid Wales
Yorkshire

Boiler turns waste coal into useful energy

Power Consultants Inc (PCI) has developed a small internal circulated fluidised bed (ICFB) boiler system to produce steam for large institutional complexes, and industrial and commercial estates. Steam can be used either for electricity generation by means of a steam turbine generator, or simply to produce steam and hot water for heating, cooling, processing and domestic uses.

The first unit has been built, and is in successful operation at East Millsboro, near Pittsburgh, Pennsylvania US, where it provides steam, hot water and cooling, via chillers, for a substantial prison. Pleased with the success of the plant, the Pennsylvania State Correctional Department has ordered a second installation at another similar facility.

The plant contains two 2 k/s mini ICFB coal-fired boilers, three 1.3 kg/s gas-fired back up boilers. The system is capable of burning low-grade, low-cost coal.

At Fayette, using low-grade bituminous coal has exceptional economic benefits. The fuel is burnt in a unique, patented fluidised bed boiler. The steam generating system can heat or cool with waste coal or other biomass fuels far less expensively than with high-grade coal, gas or oil costing more than ten times as much, and just as cleanly as with natural gas, says PCI.

Continuous on-site and remote monitoring of the operations is provided. The Internet-based server operation enables engineers to monitor and regulate the operations from a remote control point.

The computerised control system has been designed for one man operation during normal hours of working, and for remote monitoring during the night and at the weekend. At Fayette, they are already using only one man per shift.

Not only does the system produce heat and/or power at low cost, but it also has enormous advantages in clearing environmental eyesores caused by the dumping of low-grade waste.

In addition to waste coal, the plant will operate on any of a number of biomass fuels, including waste wood, waste oil, fats, turkey feathers, refuse derived fuel (RDF) pellets, dried sewage sludge and chicken litter. The key to the use of these fuels is the mixing in the correct proportions, and the control of the fluidised boiler, says PCI. All can be successfully used as fuels, with extremely low emission rates. The residual ash can be used as the basis of a high quality fertiliser.

The plant is built on a modular basis, so that it can be readily dismantled and moved to another site where fuel is available.

The company also offers the opportunity for a user to purchase heat and/or power from one or more of their systems, using specified and agreed fuels, without any capital investment. PCI will finance, install and operate systems charging only for the energy supplied.

Negotiations are currently underway to bring the technology to Holland, where it is proposed to burn RDF, instead of expensive natural gas, to produce steam and/or power for use in greenhouses.

Contact David Goldsmith of PCI in the US on tel: +1 717 218 5462, or via Colin Brookes in London, on tel: 0208 968 9995

The two waste coal-fired boilers at Fayette Correctional Facility

New gas storage plant and pipeline for Hampshire

Britain's latest gas storage facility is to be built and managed by AMEC, which has won a £50 million contract from Star Energy HG Gas Storage Ltd to develop the plant and associated pipeline at Humbly Grove, Hampshire.

The contract follows AMEC's successful completion of the front-end engineering and design for the project and its work in supporting planning approval.

The company will also install a new electricity generating turbine to supply power to the new facility, which will enable Star Energy to compress gas supplied from the National Transmission System (NTS) and store it, for future use at the existing Humbly Grove oil field. After storage, the gas will be treated to remove impurities such as water and liquid hydrocarbons.

An underground pipeline will run 27 km from the Humbly Grove facility to Barton Stacey where it will connect to the Transco NTS. The route has been selected to minimise environmental impact.

The pipeline has been approved by the DTI, having undergone thorough environmental and archaeological investigations and consultation with landowners, residents and local authorities. Construction work is due for completion in October 2005.

How to minimise boiler e

Action Energy has recently revised two of its most popular publications aimed at companies wanting to save money on their steam and boiler operations. Last month, Energy World reviewed Energy Consumption Guide ECG092 Steam distribution costs. This issue, we look at Good Practice Guide GPG369 Energy efficient operation of boilers.

One of the best guides available on how to operate a boiler to optimise efficiency, save energy and cut carbon emissions has been further improved. Now in a shorter length, *GPG369 Energy efficient operation of boilers* has been revised to cover the latest technology developments and provide up-to-date cost information.

The guide provides practical advice for energy managers, engineering staff and maintenance teams involved in the day-to-day operation of industrial steam boiler plant. The issues are covered mainly for shell boilers in the range 5–30 MW, although much of the advice is applicable to other boiler types and sizes. Areas for improvement are detailed, with guidance on the potential saving in each area.

Energy savings of 10% can generally be achieved by improving the design and operation of boilers and their associated distribution systems. Surprisingly, some of the largest savings can come from simple methods requiring little investment.

GPG369 shows that efficiency increases when the boiler load is maintained steadily, consistently and continuously. Efficiency is reduced during periods of no-load or low-load, or when boilers are banked or on hot standby. Savings of up to 5% can be made by improving the boiler operating regime.

Water treatment is essential, because impurities and contaminants can reduce boiler efficiency, over and above safety and reliability requirements. GPG369 covers the key issues in effective water treatment and offers tips that could realise savings of up to 2%.

Both energy and water treatment efficiency can be improved by recovering flash steam and residual heat from boiler blowdown. Heat recovery from boiler blowdown can reduce losses by up to 50%, offering a total energy saving opportunity of between 0.5 and 2.5%.

One manufacturer invested in automatic boiler blowdown and realised energy savings of £12,000/year. In addition, effluent charges fell, providing total savings of £22,000 and a payback period of less than nine months.

At a Devon creamery, a steam recovery vessel used in conjunction with an automatic TDS system achieved energy savings worth £5,740/year, giving a payback of 1.7 years.

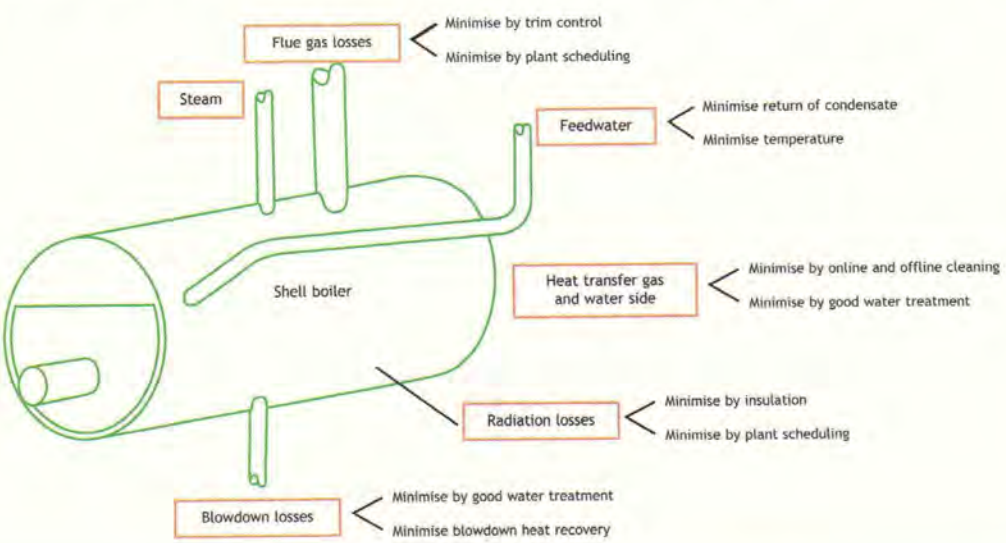
GPG369 explains the importance of checking combustion conditions and minimising flue gas oxygen levels. Optimising combustion conditions through a boiler and burner management system will provide excellent savings, while a modern digital control system can maintain good fuel/air mixture. A 2% reduction in oxygen levels in the flue gas will give a fuel saving of 1.2%.

A major hotel realised energy savings worth £13,750/year by investing in new burners and a control system for the boilers.

Significant electrical savings can be made by using variable speed drives (VSDs) for combustion air fans in place of air inlet dampers. Although throttling with dampers is simple and reliable, these mechanical systems generally have poor control characteristics. A VSD provides better control while reducing the electrical energy used by the fan, and generally reduces average noise levels.

A significant amount of heat can be lost from a boiler when it is in a standby or shutdown state. During these periods there is a continuous flow of air through the boiler, owing to natural convection,

The boiler energy saving diagram from GPG369

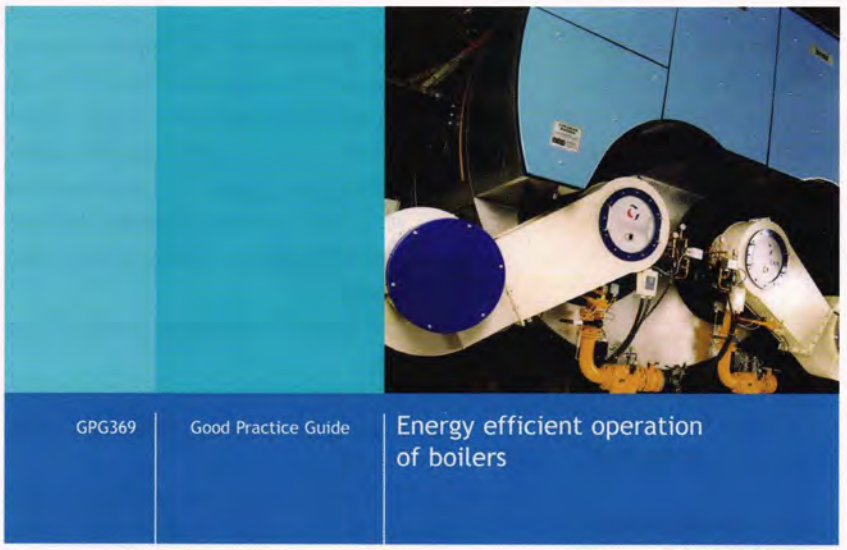


energy costs

and heat is lost from the furnace tubes. When required to start up this heat will need to be replaced. Flue shut-off dampers prevent heat loss from the boiler when on standby by providing an automatic gas-tight seal in the boiler flue or at the combustion air inlet. The guide shows that the installation of a flue shut-off damper can provide typical savings of 1–2%.

The flue gas from a boiler is at a higher temperature than that of the steam produced and is typically 200°C. An economiser is a gas-to-water heat exchanger inside a purpose-built section of the flue. The most common use of an economiser is to preheat the boiler feedwater before it is introduced into the boiler. During normal boiler operation, the economiser receives a continuous flow of water, corresponding to the boiler steam production. Economisers can be used on both gas and dual-fuel fired and are suitable for units over 2 MW. Significant energy savings are possible and are typically 3–5% of fuel input. Payback could be expected to be greater than two years but depends on boiler loading.

Combustion air is normally taken from the boiler room and when it enters the boiler has the effect of cooling within the boiler. Efficiency can be improved by pre-heating the incoming combustion air to reduce the cooling effect and provide a higher flame temperature from the burner. Heat sources for preheating the combustion air include: the heat remaining in the boiler flue gas; higher temperature air taken from the top of the boiler house; or heat recovered by drawing air through or over the boiler casing to reduce shell losses. Burner manufacturers now supply a range of low-NOx burners for both cold-air and hot-air firing. Saving potential from using preheated combustion air can be 2%.



ACTIONenergy
From the Carbon Trust

To obtain a copy of GPG369 Energy efficient operation of boiler, call the helpline on 0800 58 57 94, or download a copy from the Action Energy website: www.actionenergy.org.uk

Other Action Energy publications

ECGuide 092 – Steam Distribution Costs (revised)
A benchmark guide with data from 100 sites for engineers who want to reduce costs and run their steam systems at optimum efficiency (see *Energy World* review last month)

GPCS442 – Energy and Cost Savings from Steam Trap Replacement (New)
Case Study from the refinery area at BP Grangemouth

GPCS443 – Improved Condensate Recovery Reduces Boiler Operating Costs (New)
Case Study of how a condensate recovery process can be adapted to reclaim hot product condensate for reuse

GPCS444 – Steam Boilerhouse Efficiency Improvements (New)
Case Study demonstrating how a gas-fired boiler can be improved by retrofitting an economiser and advanced control system

GIR063 – Energy Management Pathfinder (Revised)
Introduction to all energy management publications available from Action Energy, signposting readers from one level of energy management competence to the next. Ideal for those new to energy management or those who want to go further

For more information on other sectors/technologies from the publications library and how Action Energy can provide advice on how to save energy and money, phone the Helpline: 0800 58 57 94 or visit the website at: www.actionenergy.org.uk

Help from Action Energy

Action Energy works with organisations to reduce costs and improve environmental performance and, alongside Government, to tackle climate change. Many of the technologies identified in the guide above appear on the Energy Technology List, which gives companies the chance to claim tax relief through the Enhanced Capital Allowance (ECA) scheme. The Energy Technology List identifies 6,200 energy saving products that meet the Government energy efficiency criteria. The list can be found at www.eca.gov.uk

EU emissions trading – im

No-one is suggesting that understanding emissions trading is easy. Among the many initiatives organised to spread an understanding of the issues and practicalities in both Britain and Europe was a workshop, organised by the British Energy Association and held in London in April, which was chaired by Graham Ward. This article is a summary of some of the key points made in the four presentations.

The four speakers were:

- *Justin Mundy, Senior Adviser at Deutsche Bank Emerging Commodities Unit with responsibility for Climate Change issues, and Senior Adviser at the European Centre for Nature Conservation;*
- *Steven Drummond, global CO2e team leader and formerly of PwC where he lead the Climate Change Financial Advisory Services Group;*
- *Robert Casamento, Senior Manager at Deloitte & Touche's UK Energy Market team and Project Director of the World Economic Forum's global climate change initiative; and*
- *Mark Meyrick, Manager of Renewables & Emissions Trading at EdF Trading, with a mandate to build up a trading presence in renewable certificates and EU emissions.*

By Graham Ward FEI, senior partner in PricewaterhouseCoopers and Chairman of the British Energy Association

Kyoto has nothing to do with corporations, it is an international agreement between governments and tells us what to do, not how to do it. It will come into force when Russia ratifies and compliance starts from January 2008. Developed countries ('Annex B') are capped and country allocations are called assigned amounts. There are three 'flexibility mechanisms' for Annex B governments:

- *allowance* trading of Assigned Amount Units (AAUs);
- trading of *reductions* from projects in Annex B countries, called Emission Reductions Units (ERUs); and
- purchase of *reductions* from projects in non-Annex B countries under the Clean Development Mechanism (CDM), called Certified Emission Reductions (CERs).

Governments may delegate the ability to trade in these instruments to legal entities.

There are 6,000 UK companies involved in emissions trading. There are no direct links, however, between the UK ETS and the EU ETS, although some installations are potentially covered by both schemes, so operators can apply to opt out of the first phase of the EU ETS. Governments in the EU have devolved a proportion of their cap to corporates. Anything with over 20 MW thermal input has imposed EU emissions trading. There are fines for those who are non-compliant and they have to make good, so it is in their interests to comply. The current compliance period ends September to December 2004, so allowances should be in compliance accounts by mid-February 2005. In the EU ETS, the last closing price for Phase I Allowances for '05 delivery was €6.95 for 5000, whereas in the UK ETS there are offers at around £4.00 for 5000. '06 and '07 deliveries have also traded but activity level is lower. There is no current market pricing on Phase 2 EU Allowance (2008–12), but these are being worked on.

There are several pricing issues. There is scope for generous allocations in phase I and in accession countries in both phases. Scope exists for fuel switch to unused gas generation capacity at small cost.

A CER is an instrument issued by the CDM Executive Board. It represents one tonne of carbon dioxide equivalent reduced by a project in a developing country that reduces greenhouse gas emissions below what they would have otherwise been. Bids are around $5.00 flat for a CER stream from now until 2012. Principal issues are underlying technology and whether the buyer or seller takes the political risk of CERs not becoming compliance instruments. The political risks are also high but they are narrowing and there is an excess demand for good supply.

Joint Implementation (JI) is for projects in developed countries that have capped their emissions under the Kyoto Protocol. The instrument created is an ERU, which is worth one tonne of carbon dioxide equivalent. They have similar pricing characteristics to CERs but, because the rules are more vague, there is very little buying activity from corporates. There is reduced opportunity for JI projects inside the EU due to issues of 'double-counting' with the EU ETS.

If the National Allocation Plans (NAPs) create a material shortage, the EU ETS is expected to have around 70 large active traders providing liquidity. The rest (10,000 companies?) will be compliance-driven emitters, entering the market a few times a year. Banks/large traders are expected (and needed) to act as aggregators. Trading is expected to get serious once the NAPs are settled, via electronic and exchange based trading, as well as voice.

Accounting implications of the Directive

To what extent and in what direction (positive or negative) will the EU ETS affect financial performance? The answer depends on a number of elements of financial performance and the shareholder will only see one quarter of the process, i.e. the figures. It breaks down into economic modelling, trading & risk management, financial analysis and business support and taxation.

In accounting, emissions trading schemes give rise to an *asset* for allowances held, a *government grant* when allowances are allocated by government for less than fair value, and a *liability* for the obligation to deliver allowances equal to emissions that have been made. This approach treats assets independently to the liabilities and netting off of the asset and liability is not permitted. Whether or not a company is compliant, the EU ETS will have an effect on the bottom line, because EU allowance/liabilities could be significant.

Preliminary tax discussions have focused on how to treat expenditures for, or the proceeds

nplementing the Directive

from sales of, emissions allowances. Discussions with the Inland Revenue have confirmed some general principles, but no UK legislation is expected to deal specifically with the EU ETS or emission allowances.

With VAT, the key questions relate to supply of services and at what rate VAT is payable. Discussions with HM Customs and Excise yielded a preliminary decision that an allowance is a supply of services and will be subject to VAT when traded in an open market. When issued, however, an allowance will not attract VAT because the activity of issuing an allowance is free of charge – it is not undertaken in return for any consideration.

Practical emissions trading

Implementation of the ETS directive will need time and cost because it requires an adequate emissions register compatible with trading, plus emissions data collection systems in operation by 2005. Harmonisation of allocations is also needed between sectors, between operators and sectors, and between same sectors in different countries, in order to ensure consistency. Some countries are struggling to submit their NAPs on time. Some may be rejected, some companies will challenge their allocations and some companies may try to sue the EU.

The effect on energy-intensive users and the European economy is potentially significant. The dollar level has damaged European competitiveness and carbon dioxide will be an additional burden not inflicted on the competition eg US steel producers. Also, electricity costs would rise, so producers will gain but consumers will lose and the most cost-effective measures are unavailable due to investment lead time, for example in the case of CCGTs we're looking at one year permitting plus a two year construction period.

The EdF opinion of the carbon price is that it is not predictable and it has thus far been based on extremely thin volumes. Member states must comply with the ETS directive requirements if they are short and the price outlook is over €15/t but initial analysis of fundamentals is way above this value.

In the first period of the ETS directive (pre-Kyoto, 2005–2007) use of 'hot air' from new member states or outside the EU is not theoretically possible and there is no time to build CCGTs for replacing coal plants. There are, therefore, few options to lower greenhouse gas emissions beside the power sector and there are probably not enough saving options to meet the target at reasonable cost. Something therefore has to give. 'Hot air' is tacitly allowed from accession countries, by generous NAPs. Flexible Mechanism credits are allowed in the first period and existing Member States make overly generous NAPs. Otherwise carbon dioxide prices will become very high, or the scheme won't be implemented.

Practical issues to consider in carbon trading are set out in Table 1.

Table 1. Practical issues to consider in carbon trading

- The master agreement
- Recording the transaction, ie risk management capability
- Credit – allowances likely to be sourced from a wider variety of counterparts than anyone has dealt with before in any market
- Liquidity
- How many registry accounts to hold, and the cost of so doing
- Practicalities and administrative burden of buying Flexible Mechanism credits
- Banking strategy

Mechanisms are established by the Kyoto Protocol for project-based emission reduction activities in developing and developed countries. Capped countries can invest in CDM projects, which reduce emissions of greenhouse gases from the level they would have been without the project, in return for emission reduction credits. Joint Implementation, ie emission reduction projects jointly implemented by entities within different industrialised (developed) nations, will be allowed. Instruments for emissions reductions are Certified Emission Reductions (CERs) from CDM projects and Emission Reduction Units (ERUs) from JI projects. CERs can be used to offset emissions during Period 1, following a decision by the EU Commission.

In conclusion, there is real scope for a Europe wide exchange and clearing and there is a strong chance that the '07 price for allowances will crash. Thus far, price conclusions have been difficult to make without knowing the credit status of the two parties and settlement terms, and of course the $64,000 question is "What should the carbon dioxide price be?"

Contact Graham Ward at:
graham.n.ward@uk.pwc.com

Events

July

6-9 July
Marine renewable technology
Blyth, NE England
Details: The Institute of Marine Engineering, Science and Technology
Tel: 0207 382 2620
Email: eyda.moot@imarest.org

12-16 July
Wind power technology
Summer school, Loughborough
Details: Centre for Renewable Energy Systems Technology
Tel: 01509 223466
Web: www.crestuk.org

13-15 September
Power-gen Middle East
and
Iraq reconstruction: petroleum, power, water
Conferences, Manama, Bahrain
Details: PennWell Coporation
Tel: 01992 656 643
Email: deekas@pennwell.com

20-21 September
Thermal treatment of municipal waste
Course, Leeds
Details: University of Leeds
Tel: 0113 343 2494
Web:
www.leeds.ac.uk/fuel/shortc/sc.htm

September

5-9 September
World Energy Congress: delivering sustainability
Congress and exhibition, Sydney, Australia
Details: World Energy Council
Web:
www.tourhosts.com.au/energy2004

29-30 September
Delivering building sustainability
CIBSE national conference, London
Details: CIBSE Event Team
Tel: 0208 675 5211
Web:
ww.cibse.org/nationalconference

HEATING DEGREE DAYS
to 15.5C base temperature

	Region	Mar 04	Apr 04	May 04
1	Thames Valley	253	154	83
2	South East England	281	186	111
3	South Coast	265	160	97
4	South West England	247	176	104
5	Severn Valley	263	175	94
6	Midlands	278	183	106
7	West Pennines	266	170	108
8	North West England	286	191	118
9	Borders	281	203	157
10	North East England	291	188	140
11	East Pennines	272	175	112
12	East Anglia	281	183	128
13	West Scotland	290	204	127
14	East Scotland	288	199	147
15	North East Scotland	305	215	152
16	Wales	276	210	146
17	Northern Ireland	283	203	142
18	North West Scotland	278	216	169

For earlier data see http://vesma.com/ddd/history.htm

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An in-depth knowledge of the industrial conversion processes, particularly related to energy and utilities.
Liaising with and presenting cases to customers at a high level.
A knowledge of the regulatory environment in which industrial customers are working (including CCL, IPPC, EUETS, etc)

The successful candidate will be responsible for developing energy strategies for customer sites leading to energy reduction programmes and continual improvement. There will be an element of training activity required to develop the concept of energy management.

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EI MEMBER:
£1400.00 (£1645.00 inc VAT)
NON-MEMBER:
£1600.00 (£1880.00 inc VAT)

This **three-day course** comprehensively covers the oil and gas supply chains from exploration through field development, valuation and risk, production, transportation, processing and refining, marketing, contracts, trading, retailing, logistics, emerging markets and competition with alternative energies. As such, it provides understanding and insight to the processes, drivers, threats and opportunities associated with the core industry activities.

WHO SHOULD ATTEND?

Personnel from a range of technical, non-technical and commercial backgrounds, new industry entrants and those with expertise in one area wishing to gain a broader perspective of all industry sectors. It also provides a valuable industry overview for those requiring an informed introduction to the economic and commercial background and general trends within the oil and gas industry.

PRICE RISK MANAGEMENT IN TRADED GAS AND ELECTRICITY MARKETS

energy

COURSE DATES:
4 - 8 October, 2004
COURSE VENUE:
The Møller Centre,
Cambridge, UK
£2550.00
(£2996.25 inc VAT)

On this **five-day course**, delegates will identify the areas of price risk in different areas of operation; trade futures, forward, swaps and options markets; hedge and then manage a corporate position; analyse price charts; separate price and supply through the use of exchange and OTC instruments

WHO SHOULD ATTEND?

Those affected by changes in international gas and electricity prices, including those in companies affected by traded markets in the gas and electricity industries; the supply, marketing, finance and planning departments of gas, electricity and integrated energy companies; energy related government departments and regulatory authority staff; purchasing, planning and finance in major energy consumers; energy publications; banks, accountants, auditors and others associated with gas and electricity companies; advisors and policy makers.

INTRODUCTION TO PETROLEUM ECONOMICS

energy

COURSE DATES:
18 - 20 October, 2004
COURSE VENUE:
London, UK
EI MEMBER:
£1400.00 (£1645.00 inc VAT)
NON-MEMBER:
£1600.00 (£1880.00 inc VAT)

This intensive, **three-day course** concentrates on economic evaluation techniques applied in upstream and downstream oil and gas projects. It will discuss the fundamental variables and issues associated with petroleum project valuations and provide an appreciation of how to assess the key uncertainties involved. The course will incorporate a number of short exercises to reinforce the key techniques discussed.

WHO SHOULD ATTEND?

The course is pitched to appeal to professionals with a large range of technical and commercial backgrounds and varying levels of experience seeking insight to the broad range of economic valuation techniques required across the industry. In addition, for those employed by financial, commercial, legal, insurance, governmental, service, supply and advisory organisations, the course will also provide a valuable overview of the micro-economic issues facing oil and gas project operators .

ECONOMICS OF THE OIL SUPPLY CHAIN

energy

COURSE DATES:
18 - 22 October, 2004
COURSE VENUE:
The Møller Centre,
Cambridge, UK
£2150.00
(£2526.25 inc VAT)

On this **five-day course**, delegates will examine the various activities of the fictional Invincible Energy Company to explore the economic forces which drive the oil supply chain. They will concentrate on the main areas of risk and opportunity from the crude oil supply terminal, through transportation, refining and trading to the refined product distribution terminal.

During their time in Invincible's refinery, delegates will learn about the quality aspects of product supply. They will study refinery process economics and the effects of upgrading.

WHO SHOULD ATTEND?

This course is the essential foundation for people entering the oil industry or for those with single-function experience looking to broaden their knowledge. It also forms the basic building block for the other trading-related courses.

TRADING OIL ON INTERNATIONAL MARKETS

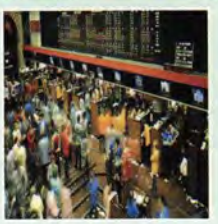
energy

COURSE DATES:
25 - 29 October, 2004
COURSE VENUE:
The Møller Centre,
Cambridge, UK
£2800.00
(£3290.00 inc VAT)

During this **five-day course**, delegates will become part of Invincible's fictional trading team, taking decisions about the company's activities to maximise profits through an understanding of the economics of trading and the management of inherent price risks.

Delegates will trade the live, crude oil and refined product markets worldwide, under the guidance of an expert team of lecturers, reacting to events as they happen and using real-time information from Reuters and Telerate screens and daily price information from Platts and Petroleum Argus.

Exercises are performed in syndicates, with comprehensive debriefs studying the consequences of the decisions made. The course expects a high degree of participation from delegates.



LNG - LIQUEFIED NATURAL GAS INDUSTRY

energy

COURSE DATES:
17 - 19 November, 2004
COURSE VENUE:
London, UK
EI MEMBER:
£1400.00 (£1645.00 inc VAT)
NON-MEMBER:
£1600.00 (£1880.00 inc VAT)

This **three-day course** covers technical and commercial perspectives of all segments of the LNG gas supply chain from gas field development, liquefaction processes, shipping, re-gasification, storage, supply into a gas distribution network, embedded opportunities for LNG within existing gas markets, supply and construction contracts, project finance and economic valuation. This differs from other LNG courses in providing an integrated insight to the technologies, the markets, the economics and the finance of the industry.

WHO SHOULD ATTEND?

Those working in the LNG industry in production, liquefaction, transportation and receiving, including those reliant upon LNG supply or the financing of LNG projects; analysts, planners and commercial staff; personnel operating in the gas, electricity and related energy industries and markets, regulators, advisors and policy makers, bankers, financiers, legal advisors and risk managers.

For more information, see enclosed inserts or contact Nick Wilkinson

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or visit: www.energyinst.org.uk e: nwilkinson@energyinst.org.uk