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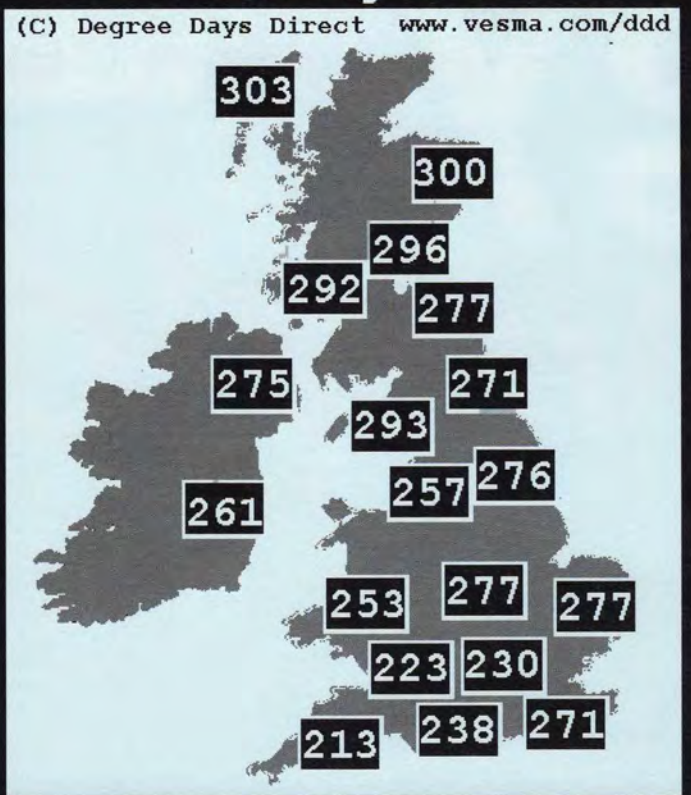

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COVER

An Airbus A330 powered by Trent 700 engines from Rolls-Royce. Fuel efficiency and emissions from commercial aircraft have both been improved considerably over recent years – a modern aircraft uses less than half the fuel to move a passenger a kilometre than that of the 1960s. But these gains are likely to be swamped by projected substantial increases in demand for air travel and transport. Air travel's contribution to climate change is likely to nearly double over the next 50 years.
See page 10 for the full story.

Viewpoint

Avoiding the apocalypse - the UK strategy

by Steve Hodgson

Publication of the Government's plan to tackle global warming - *Climate Change: Draft UK Programme* - came and went last month with a remarkable lack of fuss.

Low interest levels can partly be explained by the fact that the document was yet another draft for comment rather than the real thing, and partly due to the dearth of anything new in its contents. Rather than announcing any new initiatives, the document lists what has already been done and what might be achieved by recently- and yet-to-be-announced measures.

But the other problem with climate change is that it has been, until recently, such a nebulous concept. Although there are projections about the likely effect on local climates, changes are hard to see though the scatter of variable weather events. People in Britain who have heard of climate change tend not to worry about how it might affect them, and many look forward to the better summers which the original term, global warming, seemed to imply.

The very scale of the problem, and its enormous potential impact, make its appreciation difficult, as does its international component. Climate change is caused by us here in the developed world and will be, or already is, felt throughout the globe, often in disastrous, but distant, circumstances. The unilateral actions of any one country, however vigorous, will have an almost negligible effect on its manifestation.

The UK programme

Yet vigorous action has to be taken and we in the UK now know how our Government plans to do its bit. The UK has a legally-binding target enshrined in the 1997 Kyoto Protocol to cut greenhouse gas emissions by 12.5% from 1990 levels by 2008-2012; the Government also has a more challenging domestic goal of cutting carbon dioxide emissions by 20% by 2010.

Launching the programme, Deputy Prime Minister John Prescott said that it would lead to cuts in greenhouse gases of 21.5%, considerably more than the Kyoto target, and "could also achieve" the domestic goal. Prescott added that UK greenhouse gas emissions are expected to fall to15% below 1990 levels this year, but without further action would bottom-out and soon start to rise again, reflecting growth in the economy. The policies and measures in the draft programme will keep emissions on a downward path, at least until 2010.

So what is in the programme? Its philosophy is to gradually move all sectors of the UK to a more sustainable, lower carbon economy. The 20% target is challenging, says the document, but that is its purpose: "to signal clearly the direction in which policy is moving, aiding long term planning and stimulating innovative responses". And policies selected to achieve cuts should also have spin-off benefits to enhance competitiveness, lower energy costs and improve the environment.

The main policies are listed as:

- improving business' use of energy through the climate change levy, integrated pollution prevention and control (IPPC) and carbon trading;
- stimulating more efficient sources of power generation through a new obligation on electricity suppliers to source 10% of their power from renewables and a new target to double CHP capacity, both by 2010;
- cutting emissions from transport by an EC agreement to improve the fuel efficiency of new cars by 25% or more by 2008, and the measures put forward in the UK paper on integrated transport;
- improving energy efficiency in homes by new ëEnergy Efficiency Standards of Performance' (announced on the same day as the draft programme) and the New Homes Energy Efficiency Scheme; and
- continuing the fall in emissions from agriculture, forestry and the public sector.

The programme acknowledges that some change is inevitable and includes action to deal with the effects already on the way; including dealing with more regular flooding and new ways to build houses. Looking to the future, the Government also recognises that the 12.5% UK target, itself just one component of the EU overall target of 8%, is just a start, and that much bigger cuts, perhaps 60% or more, will be needed globally in the longer term.

Extreme events

For the present though, recent extreme weather events have at last ended the doubt about the reality of climate change. Indeed, evidence of the catastrophic effects of climate change is already all around us, even if individual events cannot be traced back to increased concentrations of carbon dioxide in the atmosphere.

One of the largest and most visible events of the last few months was the appalling flooding in Mozambique and Zimbabwe, which killed hundreds of people and left 300,000 homeless. The insurance industry, forced to recognise and work with the reality of climate change by being directly affected, lists many more extreme events, eg mud slides and floods in Venezuela, together with storms in Denmark last December left clean-up bills of more than £600 million. Hurricanes in the Caribbean, a typhoon in Japan, a tornado in the US and hailstorms in Australia all caused damage worth hundreds of millions of pounds.

Closer to home, the three day storm which hit France last Christmas led to 90 fatalities, destroyed 270 million trees and caused an estimated £5-7.5 billion of damage. The storm dwarfed the UK's own "great storm" of 1987, the biggest extreme event to hit the UK for decades.

Avoiding similar events in the future is what the *Climate Change: Draft UK Programme* is really about.

Copies of Climate Change: Draft UK Programme are available, free, from DETR Free Literature, tel: 0870 1226 236, fax: 0870 1226 237, and on the DETR website at: www.detr.government.uk Comments should be returned by 2 June.

Producing hydrogen from algae

US Department of Energy funded research has led to the discovery of a mechanism to produce significant quantities of hydrogen from algae. For 60 years, scientists have known that algae produce trace amounts of hydrogen, but have not found a feasible method to increase its production. Now scientists from the University of California, Berkeley, and DoE's National Renewable Energy Laboratory claim to have found the key.

After allowing the algae culture to grow under normal conditions, the research team deprived it of both sulphur and oxygen, causing it to switch to an alternate metabolism that generates hydrogen. After several days of generating hydrogen, the algae culture was returned to normal conditions for a few days, allowing it to store up more energy. The process could then be repeated many times.

Producing hydrogen from algae could eventually provide a cost-effective and practical means to convert sunlight into hydrogen for powering fuel cells.

Climate fund aids CDM projects

Britain's Foreign & Commonwealth Office is about to consider a second round of proposals for projects to be supported under its Climate Change Challenge Fund. Launched in February 1999, the £500,000 initiative aims to provide a flexible source of funding to help business and developing countries meet the challenges of climate change. The main objectives are:

- to help developing countries move towards less carbon-intensive economic growth;
- to raise the profile of the UK in climate change and related sectors, among decision makers in developing countries;
- to help British companies with expertise in the field take advantage of the opportunities offered by the need for climate-friendly economic growth.

Among projects supported in its first year are:

- UK-Brazil CDM initiative - a joint initiative by Baker & McKenzie, Enviros Aspinwall and the Brazilian Fabio Feldmann Consultores, which aims to demonstrate how the Clean Development Mechanism proposed under the Kyoto Protocol, can work in practice.
- Feasibility studies for biomass energy projects in China and Central America on the potential of materials such as rice husk, pig slurry and palm oil mill effluent.
- Seminar by the Centre for Clean Air Policy on the CDM with participants from developed and developing countries including: France, Canada, The Netherlands, New Zealand, US, Brazil, India, Malaysia, Mexico, Samoa, Zimbabwe as well as the UK.

Shell launches emissions trading scheme

The Royal Dutch/Shell Group has launched an internal emissions trading system, called the Shell Tradeable Emission Permit System (STEPS). Under the scheme, permits, each worth 100 tonnes of carbon dioxide or its methane equivalent, will be traded via a special internal website and managed by Shell Energy, the Group's European energy trading unit.

Each participant will be issued with permits based on 98% of the emissions they made in 1998 (the most recent data available) – thereby committing them to make a 2% reduction over the next three years. Participants can achieve their target in two ways: either by buying permits or by investing in their businesses to reduce emissions and then selling off their surplus permits. As there are a limited number of permits, it is not possible for emissions to increase overall.

Mark Moody-Stuart, chairman of the Royal Dutch/Shell Group, said: "We have always maintained that market mechanisms, such as STEPS, are the best means of reducing greenhouse gas emissions at a minimum cost to society, since they promote the most cost-effective reductions in emissions, wherever they occur."

The Group has pledged to make an overall 10% reduction in its greenhouse gas emissions, compared with its 1990 levels by 2002 and participants in STEPS will use the permit trading systems as a method to achieve their contribution to the overall Group target.

BP, Sonatrach to develop Saharan gas

BP Amoco and the Algerian state company, Sonatrach, are to go ahead with developing a $2.5 billion complex of gas fields in the Sahara Desert in central Algeria. The fields will supply some nine billion cubic metres of gas a year to the fast-growing markets of southern Europe.

First deliveries of gas from the seven In Salah fields are due in 2003. Some four billion cubic metres of gas a year have already been assigned to ENEL in Italy and negotiations are at an advanced stage to sell the balance in the Italian and Spanish markets.

The decision to develop In Salah follows a three-year exploration programme which established reserves of more than 7.5 trillion cubic feet of high-quality gas.

Internet economy 'saves energy'

E-commerce could reduce energy-related greenhouse gas emissions significantly, according to a new report by the US Center for Energy and Climate Solutions. In fact, says the report, the internet already may be having an effect on US energy use.

The US economy grew by more than 9% in 1997 and 1998, while energy demand stayed almost flat despite low energy prices.

E-commerce saves energy by reducing the need for energy used in commercial building space, by reducing energy used for transportation, and by saving paper. For example, traditional bookstores use 16 times more building energy per book sold than Amazon.com uses, according to the report. While shipping packages by overnight air - the most energy-intensive delivery mode - uses 40% less fuel than driving roundtrip to a shopping mall, it adds.

World Bank creates emissions market

The World Bank has launched the 'Prototype Carbon Fund', a first attempt to experiment with the creation of an international market in greenhouse gas emission reduction credits. The fund will invest in cleaner technologies in developing countries and economies in transition (eg the former Soviet Union).

Emission reductions will be independently verified and certified, and transferred to the fund's contributors in the form of emissions reduction certificates.

So far, four governments (Finland, The Netherlands, Norway, and Sweden) and 23 companies in the energy, financial, and trade sectors in Canada, Denmark, Finland, France, Japan, Norway, Sweden, Switzerland, the UK, and the US are participating in the fund. The fund is capped at $150 million and is expected to start operating this month.

Giant hydroelectric plant in Brazil

A consortium led by ABB ALSTOM POWER has received a 325 million euro order from Electrobras subsidiary, Electronorte, for Phase II of the giant Tucurui hydroelectric power plant in Brazil. Phase II will add 3,670 MW additional generating capacity at the 4,250 MW plant, which is currently the fourth largest in the world.

Phase II covers the supply, erection and commissioning of eleven 380 MW units by ABB as well as intake gates, penstocks, stop-logs for draft tubes, cranes, protection and control systems and insulated busbars. Manufacturing of the turbines and generators will be carried out in Brazil at ABB ALSTOM POWER's factory at Tabauté.

The plant is owned and operated by Electronorte, the utility responsible for power generation and transmission in North Brazil. Situated on the Tocantins River in the State of Para, Tucurui supplies power to the whole Amazon region and Brazil's national grid.

Gas turbines for 23 new US power plants

In one of the largest commitments of its type in the history of the US power industry, GE Power Systems has secured agreements totalling nearly $4 billion to supply power generation equipment and services to Duke Energy North America.

The agreements cover the purchase of 84 gas turbines, 17 steam turbines and long-term services agreements for up to 23 merchant power plants across the country. When completed, the power plants will produce more than 13 GW of power for the wholesale US market. The units ordered by Duke Energy North America represent enough electricity to power up to six million homes.

- Meanwhile GE Power Systems is to supply ten gas turbine-generators plus a long-term service agreement for three new power plants in Turkey that will produce nearly 4 GW of power, increasing the country's electrical capacity by 17%.

The University of Queensland SunShark Solar Racing Team achieved a remarkable third place in last year's World Solar Challenge (a 3010 km endurance race across Australia) with the help of high performance, lightweight rechargeable lithium-ion batteries from Saft. The on-board batteries are used to store solar energy to power the car during low light conditions as well as providing a boost in power for climbing hills. The Li-ion technology's combination of very high energy density and suitability for use with solar charging equipment makes the batteries much more efficient than the lead-acid batteries the team had used in previous races. SunShark employs an eight metre square solar array comprising 15 panels with 64 commercial grade cells in each panel.

BNFL savaged by HSE – Sellafield 'lacks a high quality safety management system'

British Nuclear Fuels Ltd (BNFL) has been soundly criticised by the Health and Safety Executive for its operation of the Sellafield site in Cumbria. BNFL lacks a high quality safety management system; is failing to treat sufficient quantities of its highly active liquid waste stocks; and its poor management has allowed quality assurance data on fuel pellets to be falsified.

Publication of the three critical HSE reports has been followed by moves by customers in Japan, Germany and Sweden to pull out of reprocessing contracts with BNFL.

Energy Minister Helen Liddell called for a thorough review of management at BNFL following publication of the reports. Chief executive John Taylor was subsequently replaced by Norman Askew, joining the company from Virginia Power in the US.

Before his departure, Mr Taylor said he: "deeply regrets these events and the problems they have caused for our customers. We now need to get on with implementing the action plan and restoring our credibility".

Perhaps the most damaging report was that on MOX fuel data falsification. The report, by HSE's Nuclear Installations Inspectorate (NII) concludes that: "a systematic management failure allowed various individuals to falsify quality assurance records for fuel pellet diameter measurements. However, although QA data was falsified, this would have no effect on the safety of the fuel in a nuclear reactor, since the diameter of all fuel pellets is checked and recorded at an earlier stage in the process by a fully-automated system"

Laurence Williams, HSE's Chief Inspector of Nuclear Installations, said: "The MDF plant is shut down and will not be allowed to restart until we are satisfied that the recommendations in our report have been implemented. In particular, the deficiencies found in the quality checking process will have to be rectified, the management of the plant improved and operators either replaced or retrained to bring the safety culture in the plant up to the standard HSE requires for a nuclear installation."

Hardly less damaging was the conclusion that BNFL's Sellafield site lacks a high quality safety management system overall, according to the second HSE report, which also found that the site lacks:

- sufficient resources to implement the existing safety management system; and
- an effective, independent inspection, auditing and review system within the company.

The report is the result of an inspection by the NII set up after a series of events in 1999 which pointed to weaknesses in control and supervision.

The inspection focused on: incidents; control and supervision of operations; and staffing and resources, plus central issues associated with the management of the site. The report makes 28 recommendations which BNFL needs to implement to ensure that Sellafield remains safe into the future.

While "satisfied that the current site operations are safe", Laurence Williams added: "We will use our regulatory powers to ensure that the company implements the report's recommendations to reverse the decline in safety performance."

The third report is an updated safety review of high level liquid waste storage at Sellafield, which covers progress since HSE's last report on this issue in 1995.

The report covers the highly active liquor (HAL) storage facility (B215) at Sellafield. While, again, the NII believes that the B215 operations remain acceptably safe, it also wants stocks of liquid waste to be cut by more than 80% because of safety concerns over the tanks and their cooling systems.

The report sets out HSE's regulatory strategy to achieve reductions in stocks to a 'buffer quantity', the minimum required for safe and efficient operation. It also says that HSE will use its regulatory powers to ensure that BNFL reduces HAL stocks to the buffer quantity by around 2015.

NETA 'will save of up to £1 billion this year'

New Electricity Trading Arrangements (NETA) in the wholesale market, heralded in the Utilities Bill, are already providing savings on annual electricity prices for the UK of up to £1 billion this year, according to the Utility Buyers' Forum (UBF) and utility research consultancy, EIC. This will comprise an estimated £500 million this year for business and commerce, with a similar figure flowing though to domestic customers shortly thereafter.

Savings in the industrial and commercial market result primarily from:

- a concerted push for market share by suppliers in the contract market in anticipation of NETA,
- major oversupply, and
- increasing scope and improved incentives under NETA for larger users to manage their demand.

EIC research director Robert Buckley has been reporting discounts of up to 10% off current wholesale electricity prices to run from April 2000 for industrial and commercial customers.

UBF technical director, Bob Spears, added: "There is still much further to go to get electricity prices to reflect properly underlying costs. But these are encouraging signs that NETA in particular is starting to work."

'Less than half' North Sea oil and gas remains

North Sea oil and gas – as much again

UK offshore oil and gas production will continue well into the 21st Century, despite the increasing maturity of North Sea fields and international competition for investment, says a report by the UK Offshore Operators Association (UKOOA).

UKOOA's *1999 Economic Report* highlights the industry's key strengths – a highly skilled workforce; its existing infrastructure in the form of extensive offshore networks of pipelines and installations; and the remaining potential in existing fields.

It also reveals that most estimates of UK reserves indicate that, under optimal conditions, there is only about as much oil and gas remaining to be recovered offshore as the 26 billion barrels of oil equivalent (boe) already produced in the last 30 years.

However, the extent to which the remaining exploration potential is captured will depend on a number of factors, says UKOOA. Production costs in the UK sector are high and new field sizes small compared with other oil producing countries. Therefore, cost reductions and the application of new technology will be key if the province is to continue to attract investment and the Government's Oil and Gas Industry Task Force target of 3 million boe per day for 2010 is to be realised.

New London headquarters for Ofgem

Ofgem has announced that its future headquarters will be at 9 Millbank, London. Staff will begin moving into the building – at present occupied by ICI – in August. The move will be complete by October.

At present, the main Ofgem workforce is located in two offices in London and one in Birmingham. The new building will enable the majority of staff to be housed in one place. Ofgem's 14 regional offices are not affected. Their main responsibilities will be transferred to the Gas and Electricity Consumer Council when the Utilities Bill becomes law.

Ofgem will occupy four floors of the eight-storey building, which will provide sufficient space for up to 450 people. Ofgem will retain its Scottish office in Glasgow and its technical section in Leicester.

West Burton to get FGD

Energy Minister Helen Liddell has approved a proposal from Eastern Merchant Generation fit flue gas desulphurisation plant at its coal-fired power station at West Burton in Nottinghamshire. "With enhancements such as this, coal can compete on an environmental basis with other fuels. Cleaner coal can contribute to realisation of the Government's objectives of security, diversity and sustainability in energy supplies."

The flue gas desulphurisation plant will be designed and operated as a chemical absorption process. Injection of a limestone slurry which will remove over 90% of the sulphur dioxide from the combustion gases.

Eastern parent TXU Europe Power is currently concluding the details of the construction contract for the project and hope to award this in the next few weeks. Construction work is expected to begin this spring and is scheduled for completion in autumn 2003.

Up to 500 people will be employed on-site during construction of the new plant.

National Power Cogen's latest CHP plant to enter commercial operation is the 135 MW electrical and 234 MW thermal unit at Esso's Fawley Refinery in Hampshire. In its first three months it has achieved the remarkable record of 100% availability. The CHP plant, which cost £60 million to build, comprises a Frame 91TE gas turbine supplied by Alstom Gas Turbines Ltd. This exhausts into a supplementary fired waste heat recovery boiler, which when fully fired can produce over 300 tonnes per hour of steam.

Blair asks business for help on climate change

Prime Minister Tony Blair and several other ministers have held top level talks with the business world on working together to tackle the threat of climate change.

They have asked the Advisory Committee on Business and the Environment (ACBE) to work with Government to:

- help make the move to a successful low carbon economy,
- identify technologies and commercial opportunities for climate-friendly investment, and
- advise on options for a 'Climate Change Office'.

Mr Blair and Deputy PM John Prescott explored not only the challenges ahead but the potential economic benefits of moving to low carbon technologies. At a Downing Street seminar, Messrs Blair and Prescott were joined by Environment Minister Michael Meacher, Financial Secretary to the Treasury Stephen Timms, Trade Minister Patricia Hewitt and EU Environment Commissioner Margot Wallstrom to hear ACBE's views on the challenges and opportunities business faces.

Specific topics covered included the economic opportunities to be delivered by an early move to an energy efficient economy which relies less heavily on carbon fuels; emissions reduction projects abroad and emissions trading. The Government reiterated its support for the establishment of a domestic emissions trading scheme as quickly as possible.

The Prime Minister commented: "Without business on board the targets set by politicians are meaningless. I welcome what has been done so far, but we can do better. Climate change is not going to go away. If we don't tackle it, we risk leaving a terrible environmental legacy for our children and the generations to come. And if business does not seize its chance, it risks being left behind in the race to exploit low carbon technologies, which will mean lost jobs and other economic opportunities".

Netherlands-based Aerpac, manufacturers of wind turbine blades which set up a blade manufacturing operation in Fife, Scotland, in 1997 with eight employees, has announced major expansion plans, which involve doubling its current workforce to 200 by the end of the year. Aerpac UK Ltd has moved to larger premises in Kirkcaldy from Glenrothes as part of a £3 million investment in its Fife operations.

The new 11,000 m² building at Mitchelston Industrial Estate, Kirkcaldy, trebles production space, enabling the manufacture of 29 m glass-fibre blades, the largest ever produced in the UK. The company is also continuing to produce 23 m and 7.5 m blades.

UK's first offshore wind project for Blyth Harbour

Two of the world's most powerful wind turbines are to be raised off the UK coast by a consortium, called Blyth Offshore Wind Limited, comprising Border Wind, PowerGen Renewables (a joint venture between Abbot Group and PowerGen), Nuon UK and Shell Renewables for the country's first offshore wind project.

The turbines, each of 2 MW capacity, will be the largest erected offshore in the world and the first to be built in such a demanding position, subject to the full forces of the North Sea.

Blyth Offshore wind farm will be built during the middle of this year, says the consortium. The turbines will be manufactured by a Danish wind energy company, Vestas, and installed by the marine division of AMEC Capital Projects and Seacore.

The two wind turbines will be erected 1 km off the coast of Blyth, Northumberland, close to the existing Blyth Harbour wind farm in an average water depth of eight metres. First electricity is expected to be generated in August.

The £4 million project will receive financial support from the European Commission Thermie Programme. It will be monitored and evaluated as a part of the DTI's Wind Energy Programme, which aims to enable offshore wind power development and to support UK industry.

- Meanwhile, National Power is to build a second hydro electric power station in Scotland as part of its plans to increase production from renewable sources of energy (see *Energy World* March issue for news of the first). The 590 kW generating plant will be constructed at a cost of almost £1 million near Auchtertyre, south of Tyndrum in Perthshire.

Taxing carbon in fuels

by Rob Arnold, Science and Policy Advisor, Greenergy International Ltd

The Climate Change Levy, the Government's first piece of legislation in response to its Kyoto Protocol obligations, is already outdated even before it has begun, as is the UK's other main energy tax, fuel duty excise, according to Greenergy's Rob Arnold. The problem is that neither tax targets the carbon content of the energy source.

Concern has been voiced over how the proposed Levy, due for introduction in April 2001, covers energy supplied to business, but has little bearing on road fuels. At first glance, this appears to have the alarming effect of turning transport fuels into a vast, unregulated source of greenhouse emissions. But this is not the real point of issue.

The true problems lie not in bringing road fuels within the scope of the Climate Change Levy, but in the introduction of reforms that better integrate greenhouse gas emissions into taxation. Both fuel duty and the Levy concentrate on maximising efficiency of use and minimising air pollution – SOx, NOx and particulates in the case of fuel and SF_6, CO_2 and various halocarbons in the case of the Levy.

The present system fails to accommodate the development of a market in the management and trade of carbon and greenhouse emissions and may jeopardise the competitiveness of UK business. Further extension to the Levy in order to encompass road fuels may not be necessary, but an overhaul of climate and emissions-related law is definitely required.

A fixation on efficiency

In his report on possible approaches to meeting Kyoto commitments, Lord Marshall saw no reason to apply the Levy to liquid fuels, such as gas oil and fuel oil, as they "are already subject to [their own] excise duties". Consumers were "already receiving price signals to encourage greater efficiency".

The existence of price signals for greater efficiency of fuel use is beyond doubt – the fact that excise duty accounts for over 80% of the retail price of petrol is undeniable proof of this. Certainly this has the beneficial effect of limiting excessive or unnecessary burning of fossil fuels. Nonetheless, the stress is still on the *efficiency* with which the fuel is used, rather than the greenhouse gas emissions associated with using a particular fuel.

The Climate Change Levy, too, is preoccupied with efficiency of use. This results from the Government's belief that it is impossible to track the original sources of delivered electricity and calculate the emissions attributable to the individual suppliers. Efficiency has been used as the 'next best thing', with greenhouse gases produced as a result of non-energy services, such as the disposal of organic waste or emissions from chemical processes, being completely ignored.

Both levy and fuel duty overlook the issue that they are supposed to address – that, irrespective of methods used, UK CO_2 production must be reduced to 87.5% of 1990 levels or less by 2012. In each case, insufficient attempts have been made to account for production levels of greenhouse gases per unit of useful energy supplied – the 'carbon intensity' of the fuel.

The problem with focusing on energy efficiency is that it is unlikely to alter the trend towards increasing energy consumption in an industrialised country like the UK. Our dependency on energy is too great to change rapidly, making the relevant markets very unresponsive to fiscal policy. If it is energy use alone that is taxed, all that will happen is that business costs will increase and there will still be no incentive to switch to power sources with low associated greenhouse emissions.

A good illustration of the inefficiency of tax incentives as instruments to promote changes in energy consumption patterns is LPG (liquid petroleum gas). Originally hailed as an ultra-clean fuel technology, LPG has been heavily incentivised by UK taxation policy, in the hope that the public could be persuaded to switch to it. However, the fuel is incompatible with either petrol or diesel engines and is not widely available in UK filling stations. Combined with reticence over the adoption of a new technology, this resulted in very little increase in LPG use during the 1990s.

In comparison with energy taxes, the promotion of low carbon intensity energy and fuels is a far more effective approach to reducing CO_2 output. Low carbon intensity technologies not only imply low greenhouse gas emission, but usually lead to reduced emission of other pollutants. If these are promoted and become widely available, energy efficiency becomes less of a factor in minimising environmental impacts.

No focus on CO_2

The present differentials in fuel duty were originally introduced to combat air pollution from sulphur and nitrogen oxides and particulates – an excellent principle, but one that misses the carbon issue. There have been some recent concessions to carbon intensity, as in the case of ultra-low sulphur diesel, now taxed at 1 penny per litre less than DERV. However, any reflection of this in most of the other road fuels is largely due to historical coincidence.

Meanwhile, the stage has been reached where modern engine designs, combined with contemporary, high quality fuels all produce very low levels of air pollution compared with those of ten or fifteen years ago. A new petrol car in the year 2000 produces around 1/20th the amount of non-CO_2 emissions than its equivalent 1990 model.

Unlike greenhouse gases, the problem of toxic emissions has increasingly becoming a controllable one, and current

duty levels stand at odds with national CO_2 targets. LPG can now be matched in emissions performance by conventional fuels, but its whole-of-life greenhouse gas emissions – those resulting from manufacture, distribution and use – are greater than those of petrol and diesel. Consequently, the government finds itself still promoting fuels with low environmental performance and unnecessarily high levels of CO_2 release.

The current tax regime provides no incentive to promote low-carbon emission technologies. For instance, conventional unleaded petrol has the same duty charge as reformulated gasoline. Often sold as 'citypetrol' in the UK, this is a required fuel for the operation of the new GDI (gasoline direct injection) engines. GDI produces much lower levels of greenhouse gas per kilometre than normal petrol engines and yet, although they were available on the market throughout the late 1990s, their enabling technology of citypetrol was never given tax incentives.

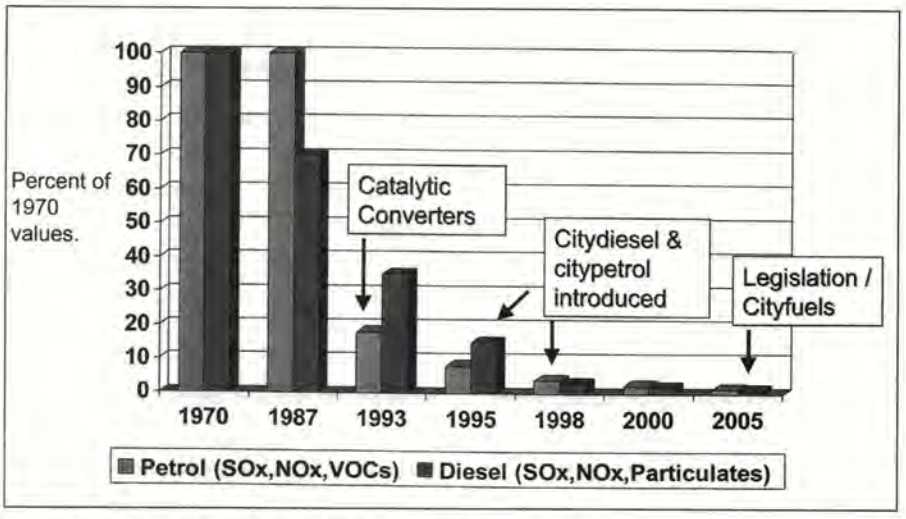
Incentivisation between grades of the same fuel really does work. Throughout the 1990s, Greenergy pushed for it in favour of ultra-low sulphur diesel (ULSD) against conventional DERV. Within a short time of this being achieved, ULSD and all its associated environmental benefits are now virtually 100% of the diesel market.

Restructuring fuel duty excise on the carbon intensity of fuels would encourage the same thing to occur with citypetrol and facilitate the introduction of cleaner technologies.

Carbon markets – beyond the Levy

Carbon intensity is likely to be fundamental to the growth of a new commodity: that of tradable greenhouse gas emissions or the 'carbon economy', as it is also known. This will be of seminal influence to business practice in the early twenty-first century and to ignore it in policy formulation is a major gamble.

Future legislation in many signatory countries to the Kyoto Protocol is likely to place strict controls on greenhouse gas releases and allow title to emissions reductions to be bought and sold. Companies will therefore be able to buy elements of their emissions management on the open market.



Improvements in air pollution from conventional engines

A business's effect on the climate, measured in terms of greenhouse gas output, will become as crucial a factor in its planning as that of energy, personnel or raw materials management is today. At present, it is a risk to be managed, but over the next few years it can be expected to take on a real economic value and to be reflected in the competitiveness of businesses around the world.

Britain's system of energy taxation genuinely tries to recognise the importance of reducing climate change and air pollution, but does so by focusing on outdated concerns. If this development of UK taxation policy fails to account for the development of a carbon market, the efforts of UK business will be diverted into pursuing issues of energy, rather than carbon efficiency.

Tax structure

This presents a dilemma – the tax system needs reform in order to reduce greenhouse gas emissions effectively, but this must be done without reversing all the benefits in pollution and energy efficiency matters that have already taken place. An apparent solution to this would be to restructure both Climate Change Levy and fuel duty excise around the carbon intensity of individual energy products.

As a result of pressure from various sectors, the Chancellor of the Exchequer declared in his recent pre-budget speech that power from CHP and renewable resources would be exempt from the new charges. Many providers of these undoubtedly welcome this, Greenergy included, but it highlights a contradiction between the DETR and the DTI.

For this policy to be enforced, it is essential that the proportion of CHP and renewable sources be identified in supplied electricity. This implies that, despite Government claims, it is possible to track supplied electricity back to its original sources. Thus, one can calculate a particular power supply's greenhouse gas emissions and estimate its carbon intensity. If this is the case, there is no reason not to base climate taxation upon this, charging according to the 'greenness' of an individual supply.

Emissions regulations in Britain have performed well so far, but there is still vast scope for improvement. Nowhere is this truer than in greenhouse gas legislation, even at this early stage in its development. The real benefits of reform would not just lie in effective emissions reduction but also in the rationalisation of UK taxes in the light of a global carbon trade.

Greenergy carbon management services include a range of carbon-certified fuels and electricity. Contact the company on tel: 020 7484 0500, or www.greenergy.com

Climate change – the contribution from air travel

by Colin Beesley, Environmental Strategy Manager, Rolls-Royce plc

Last year, the Intergovernmental Panel on Climate Change (IPCC) published its report "Aviation and the Global Atmosphere". The work was commissioned at the request of the International Civil Aviation Organisation (ICAO) and the Montreal Protocol, and is the only report of its kind to concentrate on a specific industry sector. This 'special' treatment was required because aircraft uniquely deliver emissions above ground level, where their effects on the atmosphere are different to those arising from the rest of man's activities, reports Colin Beesley from Rolls-Royce.

The report was the combined effort of over 300 international experts and has been universally welcomed and acclaimed by the aviation industry, policy makers and environmental organisations. It has quantified the effect of aviation on the atmosphere on a global basis and highlighted areas of uncertainty.

The report estimated that the amount of additional radiative forcing arising from aviation in 1992 was 3.5% of the total of man's activities. Radiative forcing is a measure of the perturbation of the energy balance in the earth-atmosphere system, and is used to calculate the magnitude of the climate change contribution. The report evaluated a range of scenarios and predicted that the proportion of the total anthropogenic radiative forcing due to aviation will rise, most likely to 5-6% by 2050. This is because operational and technical improvements will be outpaced by the world's increased demand for the benefits of air travel and air transport.

At ground level, the effects of the combustion of fossil fuels are relatively well understood. The main contribution to climate change is carbon dioxide emissions. CO_2 has a long residence time in the atmosphere, over 100 years, during which time any emissions are dispersed throughout the atmosphere. Carbon dioxide emissions from aviation, resulting from the combustion of kerosene, are thus no better or no worse than from equivalent emissions at ground level. However, NOx and water vapour emissions from aircraft at altitude give rise to effects that are less well understood but may be more significant than CO_2 from a climate change perspective.

Water, as vapour, has very little effect, but in the form of clouds is one of the most potent features of the earth's natural greenhouse effect. Under certain conditions of humidity and temperature, the water vapour in the exhaust from an aero engine freezes into tiny ice crystals and form the familiar condensation trails or 'contrails'. The additional radiative forcing of contrails is thought to be significant and whether there is an interaction with high level cirrus clouds is a further area of concern, although the level of understanding of this effect is very poor.

NOx emitted from subsonic aircraft acts to increase tropospheric ozone, which leads to global warming but also destroys methane, leading to reduced global warming. The combined effect is complex and not fully understood, and may give rise to localised effects. The best estimate by the IPCC is that the total additional radiative forcing from aircraft emissions is 2-4 times than that would be predicted from the CO_2 emissions alone. One piece of good news is the IPCC established that subsonic aviation is not contributing to the depletion of the protective stratospheric ozone layer.

Reducing emissions

Throughout the history of commercial jet aviation, the manufacturers of aircraft and engines have worked relentlessly to reduce the environmental impact of aircraft and to increase their efficiency. A modern aircraft will use less than half the fuel to move a passenger one kilometre compared to that of the 1960s. During this time the noise from the engines has been cut by 75%, and the smell and smoke have been virtually eliminated. Recent advances in combustion technology are showing significant reductions of NOx emissions. All this has been achieved against the background of increased reliability and safety and a reducing cost of operation, resulting in more affordable air travel enjoyed by an increasing proportion of the world's population. Such technology improvements are continuing at very high costs to the manufacturing industry.

As manufacturers, we are often asked, "What are we going to do to reduce the contribution of aviation to climate change?". Unfortunately, there is no one simple answer. We can, and will continue to improve the fuel efficiency and reduce the emissions of engines and aircraft. In the very long term, radically different aircraft may provide part of the solution. In the short term the whole industry needs to work together to seek out and implement the best holistic solutions. Improvements in aircraft and aero engine technology, modernising airline fleets, increasing load factors, improving aircraft routing, and reducing delays can together deliver significant benefits. However, with most projections of future demand for air travel, these improvements will not fully offset the increased growth.

One factor that limits improvements is that with a highly developed and optimised modern aircraft it is difficult to improve one factor without compromising others. The number one priority for the industry is safety, which cannot be compromised, even for environmental considerations. Designers of aircraft attempt to minimise the environmental impact of the aircraft and are seeking to reduce emissions, noise and fuel burn simultaneously. However, the perception of this best balance changes as knowledge of the local and global impact of aviation increases.

Trying to predict what the perception will be in 30-40 years time, when the designs being worked on now will still be

flying is almost impossible. We need help from the atmospheric scientists to remove the uncertainties surrounding the atmospheric effects so that we can be sure that the improvements we make are targeted correctly. We then need clear and fair international standards so that the effects of aviation are tackled on a global basis. If the best technical solutions are to be developed and introduced then additional funding will be required.

Aviation growth

Whilst accepting that significant improvements can be made, this still leaves the problem of the increasing total impact of aviation due to its growth. The use of market based options, including charges, voluntary agreements and emissions trading are being investigated by ICAO. The introduction of internationally based charges, which encourage good environmental performance, and recycle funds to the industry to contribute to the funding of new technology is one approach.

Another would be emissions trading, where the growth of aviation could be accommodated by ensuring that more cost effective emissions reductions are made in other sectors, where there are more opportunities to make the required savings. Either of these approaches is preferable to measures designed to cut the demand for air travel, as this would deny the people of the world the benefits and advantages of air travel.

Rolls-Royce Trent 700 engines power the Airbus A330 aircraft

The whole aviation industry, the airlines, airports, manufacturers, fuel suppliers, air traffic controllers, together with climatologists, local communities, pressure groups, politicians and policy makers and, probably most importantly the passengers, have a contribution to make in addressing this issue. We have made a big first step, which is to acknowledge and estimate the magnitude of the problem. The next step is to work together to find and implement the best solutions.

Contact Colin Beesley at colin.beesley@rolls-royce.com

Cooled jet fuel could help airliners to fly safer, cleaner and further

By using cooled jet fuel, the airline industry could make its aircraft safer to fly and more environmentally friendly while increasing their range, according to researchers working in the US.

The idea is simple enough: cooling the fuel increases its energy density, essentially enabling aircraft to fly further on an equal volume of fuel. The cooler fuel also significantly reduces the formation of fuel vapour from evaporation. Fuel vapour within an aircraft's fuel tanks poses a risk for explosion and fire. When the vapour vents from the tanks, it also creates smog-forming ozone.

The concept was tested in September at Fort Worth International Airport. Researchers from the Energy & Environmental Research Center (EERC), with the assistance of personnel from the Odegard School of Aerospace Science at the University of North Dakota in Grand Forks, began the first phase of a project with Fuel Dynamics Inc of Texas.

EERC research manager Ted Aulich says that during warm weather, the sun's rays and certain onboard aircraft systems heat jet fuel to temperatures of 90°F or more, speeding evaporation and lowering the fuel's energy density.

During the test at Fort Worth, one wing tank of a private jet was loaded with normal-temperature fuel while the other wing tank was loaded with fuel cooled by the Polarjet technology, enabling scientists to measure the differences in fuel vapour within the tanks. Following this ground demonstration, the project will move to the flight testing phase with a variety of aircraft.

The best-known example of a fuel vapour explosion occurred in July 1996, when TWA Flight 800 exploded and crashed into the Atlantic Ocean off the coast of Long Island, killing all 230 people aboard. Government investigators say the source of the explosion was fuel vapours in the 'plane's centre fuel tank, although they don't know for certain what sparked the explosion.

The Polarjet technology uses a high-tech refrigeration system to lower the temperature of large quantities of jet fuel (25 billion gallons are used each year by the US alone) to as low as 25°F, creating what Koethe says are "safe wintertime conditions during the summer."

Electric and fuel-cell cars emerge in America

The truth of America's reputation as a nation driving 'gas-guzzler' cars may be starting to slip, as the major vehicle manufacturers begin to produce and sell hybrid-electric and alternative-fuelled vehicles. One major focus of activity was the recent North American International Auto Show, where several international car makers unveiled new concept cars.

General Motors (GM) showed its new 'Precept' advanced vehicle at the show, in both hybrid electric and fuel-cell-powered versions.

The four-wheel-drive hybrid electric car uses a 35 kW three-phase electric motor to drive the front wheels and a lean-burn, compression-ignition, direct-injection diesel engine to drive the rear wheels. GM says the hybrid electric Precept should achieve 90 miles to the gallon – the efficiency equivalent of achieving 80 miles per gallon with gasoline. The extremely aerodynamic vehicle replaces rear-view mirrors with cameras and uses electric latches instead of door handles. It saves weight with plastic, composite, aluminium, and titanium components, while saving energy with light-emitting diodes for lighting.

The fuel-cell version of the Precept is a front-wheel-drive vehicle with a hydrogen fuel cell. The hydrogen will be stored in chemical form as a metal hydride, rather than as a gas. The car is under development and is expected to be running by the end of the year.

Think Ford

Meanwhile, the Ford Motor Company plans to begin selling its own hybrid electric vehicle, the 'Prodigy', in the US by 2003. The five-passenger sedan, also on display at the NAIAS, uses an advanced four-cylinder diesel engine with an electric motor to provide extra power when needed. The Prodigy is capable of achieving 80 miles per gallon, according to Ford, and the hybrid drive will add about $3,000 to the price.

Ford also announced that it is starting a new automotive brand, 'TH!NK', which will be "the first full-line automotive brand dedicated exclusively to producing environmentally responsible technologies and transportation".

TH!NK will start small in June, with the offering of two electric bikes that can be purchased on the Web, but that will be followed in November with 'TH!NK neighbour', a low-speed neighbourhood electric vehicle suitable for trips within closed communities such as a college campus. Within the next three years, Ford says it plans to start selling a small, two-seat 'TH!NK city' vehicle in the US.

Ford also introduced the TH!NK FC5 fuel-cell-powered prototype at the NAIAS. The four-door sedan, based on the 2000 Ford Focus, uses methanol as fuel and converts it into hydrogen using an on-board reformer. The hydrogen supplies a fuel cell that generates electricity to power an electric drive. The TH!NK FC5 is expected to be road-tested this summer.

Ford followed up its vehicle launches by breaking from the Global Climate Coalition (GCC), saying that credible evidence of global warming exists and companies should work together to find technological solutions to combat the threat. The GCC has been denying the existence of global warming and lobbying the US Congress to take no action.

Japanese angle

Honda Motor Co unveiled a prototype fuel-cell-powered car, the FCX, at the same show. The four-door sedan, which runs on methanol and includes an on-board reformer to generate hydrogen for the fuel cell, should be in production by 2003.

Honda also announced its next-generation high-efficiency conventional engine. The two-litre, four-cylinder engine is light and compact, achieving low emissions while boosting efficiency by 10-20%. Debuting in Japan this autumn, the engines will start appearing in US models next year.

Honda's Insight - the first hybrid gasoline-electric car on sale in the US - was also on display at the show. Models began rolling off the production line and arriving at West Coast dealerships last December.

Toyota was represented at the NAIAS with a display of its hybrid electric Prius, which will go on sale in the US this summer.

DaimlerChrysler

More recently, DaimlerChrysler unveiled the ESX3, a hybrid diesel-electric concept car that achieves the gasoline equivalent of 72 miles per gallon. The five-passenger car features a three-cylinder diesel engine that works along with a motor drive on the front wheels to propel the car. During braking, the motor generates electricity to recharge the car's lithium battery pack. The ESX3 also includes an advanced electro-mechanical automatic transmission and a lightweight body made of injection-moulded plastic.

DaimlerChrysler also announced that one of its subsidiaries, dbb Fuel Cell Engines GmbH, and Shell Hydrogen have successfully developed and tested a prototype gasoline reformer to produce hydrogen for fuel cell applications. In the future, such systems could enable fuel-cell-powered cars to be fuelled with gasoline. The companies have integrated the reformer into a compact fuel processor that can provide enough hydrogen for a 50 kW fuel cell.

Buying electric

Meanwhile, the US Postal Service is to purchase of 500 electric vehicles from Ford, which will begin producing the vehicles in the autumn at a rate of 45 per month. The purchase - the largest electric vehicle purchase in US history - will double the number of electric vehicles in use by the US federal government.

Lockheed Martin Control Systems announced in February that New York City Transit has ordered 125 buses equipped with a hybrid diesel-electric drive system developed by the company. Orion Bus Systems will build the buses, which will hit the New York City streets in early 2001.

In addition, New York State is purchasing 70 compressed natural gas buses to service New York City, Long Island, and Rochester. And ten DaimlerChrysler electric-powered EPIC minivans will be used to shuttle commuters in and out of Los Angeles World Airport. The minivans are each expected to log up to 100,000 miles per year.

New LPG carriers include plate heat exchangers

Norwegian gas shipper Bergesen is to take delivery of two new LPG carriers, which will be equipped with reliquefaction units utilising plate-type heat exchangers instead of the more conventional shell and tube condensers.

The company has two very large LPG carriers under construction in Poland, the first ships to be equipped with such units incorporating AlfaRex plate-type heat exchangers. These will add to its existing fleet of 63 vessels with capacities ranging from 8,000 to 86,000 cubic metres, which makes Bergesen is the largest owner and operator of gas carriers in the world.

During transportation by ship, gas is kept in the liquid phase. However, heat leaking into the cargo tanks causes the temperature and pressure of the cargo to rise. A reliquefaction plant is installed to reliquefy the boil-off and keep the temperature and pressure in the cargo tanks within design limits. The average gas carrier has three or four reliquefaction units installed, normally incorporating shell and tube condensers. However, having experienced problems with corrosion in shell and tube condensers onboard another ship, the Havsol, Bergensen had the plant replaced with plate heat exchangers.

According to Alfa Laval, AlfaRex is a gasket-free, all-welded plate heat exchanger fitted with titanium plates that are impervious to seawater corrosion and designed specifically to meet the challenges of gas condensation. It can handle temperatures of up to 350°C and pressure of 40 bar.

The plant performed well on the Havsol, and Bergesen has since contracted the two new gas carriers, each with a cargo carrying capacity of 78,500 cubic metres, from the Gdynia shipyard in Poland for delivery this year. Each vessel will be equipped with four customised skid-mounted reliquefaction units incorporating AlfaRex plate heat exchangers instead of tube condensers.

As part of the AlfaRex delivery, Alfa Laval supplies a self-cleaning seawater filter to be installed on the main seawater line. This prevents possible clogging of the AlfaRex and other seawater applications onboard, such as the spray system. The company is also supplying a complete range of engine room equipment, including separators for fuel and lube oil, plate heat exchangers for the central cooling system/lube oil system, and a freshwater generator with a capacity of 30 m^3/day.

Recovering crude oil vapours from tanker loading

Norsk Hydro has installed a liquid absorption system to recover oil vapours previously lost to atmosphere during the loading of oil tankers at its Sture Terminal outside of Bergen, Norway.

Until recently, 400 oil tankers loaded 40 million m^3 of crude oil annually at the terminal, with 30,000 tonnes of volatile hydrocarbons escaping to the atmosphere, wasting valuable crude oil and polluting the atmosphere.

The terminal now benefits from a patented cold liquid absorption system, from Cool Sorption A/S in Denmark, which recovers 90% of the escaping vapours. The installation has a projected payback time of seven to eight years.

One of the main components in the system is Alfa Laval's spiral top condenser, mounted directly on the top of the stripper column. This spiral top condenser serves as a reflux condenser on the stripper column.

Cool Sorption's system is a vapour recovery process based on the absorption and condensation processes. When oil tankers put into port at the terminal on the Norwegian West coast, they are loaded with crude oil from the North Sea stored in five underground caverns. During the 10 to 30 hour loading process, the crude oil vapours are absorbed in a stream of kerosene, cooled to -25°C, from the top of the tower. The cold kerosene, now laden with crude oil vapour, is routed to the stripper. The inert gases are now clean and are discharged to the atmosphere.

The kerosene mixture from the absorber tower, now containing the absorbed hydrocarbon vapours, is then pre-heated and enters the stripper column where a fraction of the mixture is flashed. The vapour mixture enters the spiral top condenser which separates the purified hydrocarbon vapours from kerosene condensate. The hydrocarbon vapours are then led to the re-absorber where they are condensed or absorbed in a stream of crude oil and finally returned to the underground caverns. The kerosene condensate, still contaminated by hydrocarbons, is refluxed back to the stripper column. In the bottom of the stripper column, the liquid mixture is circulated and heated and flashed into the stripper vessel.

Sture Terminal stores crude oil from six offshore fields in the North Sea. A total of 760,000 barrels per day is piped to Sture's underground rock caverns on Norway's west coast ten miles northwest of Bergen.

Westminster buys its first fuel cell vehicle

Westminster City Council has taken delivery of an emission-free electric vehicle powered by hydrogen fuel cells for use as a parks maintenance van in the Borough's 123 parks, gardens and open spaces.

The 5 kW alkaline fuel cell (AFC) system combines hydrogen and oxygen electrochemically to generate electricity and water. Pure water vapour is the only emission, and the vehicle can operate all day without recharging.

Westminster City Council has purchased the almost silent-running vehicle for £33,000. Designed for an urban environment, it has a top speed of 100 km per hour and does 0-50 km/hr in 15 seconds. The vehicle is driven in much the same way as a normal van, carrying a maximum of three people.

The new vehicle will be the cleanest in Westminster's fleet, which already includes 24 vehicles fitted with catalytic converters and particulate traps, including 13 which run on alternative fuels such as LNG, CNG and ultra-low sulphur diesel.

Leader of Westminster City Council, Councillor Melvyn Caplan, said: "Reducing air pollution is a key priority for central London. We intend to introduce nil or low emissions vehicles to our fleet at every opportunity, and this new hydrogen fuel-cell van is clearly the way forward".

The new van will be used for parks maintenance in the Borough

Westminster Council, along with all local authorities nationwide, has to meet national air quality targets by 2005. This will require significant reductions in air pollution in city centres.


Hydrogen storage on board

Alkaline fuel cells combine hydrogen (the fuel) and oxygen taken from air to produce electricity, with only pure water as the by-product. The fuel cell operates as an on-board, traction battery charger, preserving all the benefits of the electric vehicle, and giving the added advantages of long range and rapid refuelling.

These robust alkaline fuel cells are inexpensive to manufacture and are thermodynamically the most efficient of all the fuel cell types, says ZEVCO. They require only simple management systems and the fuel cell is virtually silent in operation.

In the past, AFC technology was considered prohibitively expensive due to the need for bottled pure oxygen to be carried on-board, and platinum as the reaction catalyst. However, ZEVCO engines now use a chemical scrubber to purge air of its damaging carbon dioxide content, and have trimmed the amount of platinum required to a mere sliver.

Westminster's zero emissions vehicle is supported by ZEVCO, Air Products plc and Shell Hydrogen, and part-funded by the Energy Savings Trust Powershift Programme.

Wavedriver onboard electric vehicle system

Chester-based EA Technology has acquired the Wavedriver electric vehicle control and rapid charging system from PowerGen and will take it into commercial production. The company has purchased all the designs, rights and pre-production prototypes involved in the project and is working on production versions in-house.

Wavedriver is a compact, fully-integrated electric vehicle management system which is fitted onboard and eliminates the need for external charging equipment. Connected to an appropriate mains supply, it has the potential to give vehicle batteries a 50% state-of-charge replenishment in less than 30 minutes - a fraction of the time taken by conventional chargers.

EA Technology transport systems manager John Baker explained: " Fast onboard charging is clearly Wavedriver's biggest feature, but it also provides integrated electronic control of the electric drive train and the vehicle's subsystems, such as lights and wipers. The unit offers major advantages for electricity network operators, too. It can draw power from distribution networks with minimal harmonic distortion and variable power factors. In effect, it can be tuned to the characteristics of the local distribution network."

At the heart of the unit is a solid state four quadrant converter, which is able to handle bi-directional power plus AC and DC currents. The company plans to launch Wavedriver as an off-the-shelf fitment for a wide range of electrically-powered vans, light commercial vehicles and PSVs.

Contact EA Technology on tel: 0151 339 4181

Making markets in power

by William W. Hogan, Professor of Public Policy and Administration, John F Kennedy School of Government, Harvard University

The Royal Society for the Encouragement of Arts, Manufactures and Commerce chose Energy and Society as the subject of this year's Cantor Lectures. This article comprises extracts from one of the three lectures, delivered by William Hogan, who has advised many electricity companies in the US, and several more overseas, on electricity market reform.

After discussing the tensions between the concepts of centralised coordination of electricity systems, and creating room for competition, Professor Hogan moves on the criticise the UK's current electricity reform process, NETA. He concludes that NETA represents taking several steps backward.

Where you stand depends on where you sit. I sit in a chair at the Kennedy School of Government at Harvard. Many of you may be more familiar with Harvard's Graduate Business School. As I tell our prospective students, there is at least one simple difference between these schools situated on opposite sides of the Charles River. At the Business School, my colleagues teach their students how to seek out or create advantage, and generally find protection from competition; all this in the interest of maximising profits. At the Kennedy School, we teach our students how to structure the rules of the game so that these businesses succeed individually in the short run but fail collectively in the long run; all in the interests of greater efficiency, where competition eats away excess profits while leaving the improvements in products and services.

This tension between public and private, between government and business, between regulation and markets, is the background for my continuing interest in the public policy issues woven through the story of making markets in power.

Coordination for competition

The privatised electricity problem is especially challenging because of the particular nature of the remaining monopoly services. In the wholesale market, with some leap of faith, we can accept that the generation sector is or could be competitive and largely deregulated. But everyone recognises that the transmission and distribution wires will continue to be regulated. We are unbundling the products and services and separating the companies that provide them. The task then, is to set the rules and prices for access to the wires.

An extreme, but not unrepresentative, argument is that central coordination is antithetical to markets, and decisions should be left to the many hands of the competitive market. Were it possible to fully decentralise the decisions, this argument might carry some force. However this is simply not possible under current technology. When we look closely at such proposals, through the fog of empty claims about who shows the greater commitment to real markets, we find that there is always a system operator who provides the coordination services. Hence, the debate is not over centralised or decentralised operation; rather the debate is over who exactly will determine the rules for centralised coordination. We can have good rules or bad rules. We don't have the option of having no rules.

This presents an immediate challenge for government. On the one hand the government could require a set of rules that would support the public interest, setting the stage for the operation of a competitive market. Or the government could defer to a stakeholder process that seeks the least common denominator in setting the rules. At best, the latter approach is an abdication of responsibility. At worst, defective rules threaten the reliability of the system.

In much of the debate that occurs in various countries, the process of formulating the market rules has some of the elements of 'the foxes designing the hen house'. Basically, the best models for organising the coordination services under a 'Poolco' framework have the feature that they solve the hardest problems and make it easy for small players to enter and participate in the market. Balancing services, provisions for losses, emergency responses, and so on can be handled naturally and efficiently, with market participants bearing the costs of their own actions. There is scope for large aggregators and other middlemen, but a limited need for their services in providing the basic commodity. In retrospect, it should not have been a surprise that some of these middlemen would be unhappy with such an efficient market design.

A Poolco by any other name

The debate continues today. The source of much of the early enlightenment on the subject was here in England and Wales. Little more than a decade ago, you were wrestling with an electricity directive from the Thatcher government to reform, with a strict deadline. To make along story short, nearly two years were spent in a futile effort to avoid the inevitable need for active coordination of the short-run electricity market. In the end, you threw up your hands and in a few months put together a completely different approach that resulted in your 'Pool' with explicit responsibilities for such market coordination. The idea was that the market participants would submit bids for producing and using electricity, and the Pool operator would find the balanced equilibrium with its market-clearing price. The Pool would combine the functions of a market exchange with those of managing the complex physics of the electricity system.

It was a brilliant innovation, and the whole world was watching. Or at least the whole world that was close to England in geography or culture. It turned out that reformers in Chile had anticipated the basic ideas by several years. But this is only a quibble. After all, they did it in Spanish, and far away. Yours was a remarkable achievement that included reinventing the idea from commodities markets that for most business purposes financial contracts could stand in the place of physical transactions, with only a final settlement at

the price revealed in the spot market. And here the essential spot price would be readily available from the Pool.

Soon Norway, New Zealand, Australia, and others adopted and improved on the basic ideas, all the while giving credit to the vanguard in England and Wales. Eventually, even the former colonies in the United States took up the task.

Unfortunately, the underlying debates are never far from the surface, and in every region there has been a long and not always successful process to educate all the parties to the essential facts of the electricity system: government could not recede completely. There are remaining natural monopolies, including the complex requirements of coordination services. There must be a system operator, and in the end there is a natural division of labour. Market competitors can compete, and governments can decide on the rules that will produce a workable market with a level playing field.

the debate is not over centralised or decentralised operation; rather the debate is over who exactly will determine the rules for centralised coordination

Regional transmission organisations

The latest round of such conversations in the United States culminated at the end of last year with the Federal Energy Regulatory Commission issuing its Order 2000, elucidating the need for and design of regional transmission organisations. The subject of this substantial tome is the lineal descendant of the Pool in England and Wales. Order 2000 builds upon that innovation and subsequent experience to craft a framework that recognises the reality of electricity systems, sets the primacy of public interest in establishing a workable and efficient competitive market, and makes a major contribution to the delineation of the boundary between the public and the private sectors.

As with the Pool in England and Wales, as I read the Order, it relies on a coordinated spot market, within the limits of security constraints, using the bids of market participants to find the most economic use of the system consistent with a market equilibrium. Learning from one of the few mistakes in the initial Pool design, the broader framework recognises that market clearing prices can and will be different at every location. Financial contracts of the same type as found in England and Wales play a prominent role, as do financial transmission rights that extend the idea to cover the difference in prices at different locations. Costs for the grid are collected through regional access charges, and investments are pursued in large part through the incentives of the market place.

This is a state-of-the-art design, with a clear debt to the work on the Pool in England and Wales and its progeny. Progress has been slower than we might like, but there is progress nonetheless. However, the cost has been high, with the expense compounded by taking the occasional step backwards. And there are no guarantees of success, even now.

The sometime failures in this process illustrate many lessons. First, there is the human failing that it is difficult to learn from the mistakes of others; you have to make the mistakes yourself. England and Wales made a mistake in setting up too few competing generators, so competition was slow in coming through entry.

Second, there is ample support for the observation attributed to Nietszche that "to forget one's purpose is the commonest form of stupidity". We want marketers and brokers to provide new products and simplify the process of capturing the benefits of a competitive market. But we do not want marketers and brokers *per se*. Too often we see the argument that with an efficient design of wholesale and retail markets there may be little, perhaps no, need for marketers and brokers who cannot provide real added value. The absence of many traders and much visible trading is often mistaken as a problem, not as evidence of a solution, and the move is then on to break what is not broken, in order to give more middlemen something to fix.

The most extreme form of this syndrome is in the process of setting up subsidies for new competitors to enter the market, particularly in the retail sector. Once the electricity spot market is available, the easiest way for customers to participate in the market is just by taking the spot price and absorbing minute by minute price variations, which average out over a month. This is also the simplest form of default service, as pioneered by England and Wales, and advanced in Norway. But potential retailers complain that they cannot compete with the spot price, and require more 'headroom' to enter the market. Headroom is a technical term for imposing a tax on the default service that can be avoided if you switch to a new supplier. Thus we will demonstrate that you can get as many competitors as you want, if you are willing to pay enough.

Pitfalls on the road ahead

As I look ahead, I see a number of other pitfalls along the way. For an outsider like myself, with such high regard for the contributions made in England and Wales to the electricity market design a decade ago, it is painful to read of your recently proposed reforms, which are well along the path to implementation. To be sure, there are problems in your existing wholesale market design, as witnessed by the improvements that have been adopted elsewhere. You have too few competitors in generation. The aggregation to an artificial single market price, rather than the locational reality, creates bad incentives but could be easily fixed.

However, you are about to fix what isn't broken and hide the truly broken gears of the machine, which will continue to grind away and do more damage. Your so-called New Electricity Trading Arrangements (NETA) appear to have been captured by a romance with a market myth. The proposals enshrine trading and traders as desired ends in themselves, not as mere means. The proposals abandon the singular achievement of the coordinated spot market of the Pool and replace it with reliance on aggregators and middlemen. These intermediaries will be happy to see what I expect will be a sharp increase in transaction

costs, which they will be paid to manage. But how is this in the public interest?

In any event, despite the claims to the contrary, you will not avoid the need for coordination through a system operator. This central coordinator is there in the design. It is buried within the National Grid Company. But rather than fixing the rules to reflect the pricing that would prevail in a competitive market, the new arrangements obscure what is being done through *ad hoc* and costly balancing mechanisms that are at best opaque and at worst unsustainable. If this reactionary reform goes forward, you will take several steps backward.

Perhaps the explanation of the different directions here and across the Atlantic is found in the old adage about two countries divided by a common language. The documents I read that purport to explain the proposed reforms in England and Wales seem to ignore or misperceive the practical experience in the United States and its embodiment in the scripture of Order 2000; not to mention the workings of the markets in New Zealand, Norway, and Australia. And the alleged purpose of the reforms, to reduce market power, is not connected to any sustained argument that can persuade. If I were you, or Callum McCarthy, your talented regulator, I would take charge of the process and go back to basics, subjecting this whole apparatus to the kind of scrutiny where logic and evidence play more visible roles.

It won't be easy, because a major lesson of the electricity reforms echoes my tale of the difference between Harvard's Business School and Kennedy School of Government. The more inefficiencies in the market and the more market power you can find, the greater the opportunity to transfer wealth and make a profit. We count on the ingenuity and innovation of the market participants that follow this lure of profits, hopefully huge profits protected from competition. And the counterbalancing responsibility of governments is to set up the rules so that they succeed individually in the short run and fail collectively in the long run in avoiding competition, as each innovation leads ultimately to lower costs and better products. Competition should eventually eliminate excess profits, but only if the rules support true competition, not just more competitors.

However, the participants don't really want competitive markets for themselves, just for everyone else. Hence, there is constant pressure on both sides. On the supply side, there are pressures to change the market rules and impose costs that create protected market niches. On the consumers' side there is the constant pressure for regulators to intervene when scarcity and efficient market responses lead to higher prices.

the (NETA) proposals abandon the singular achievement of the coordinated spot market of the Pool and replace it with reliance on aggregators and middlemen

The regulators, as the only group charged with the public interest, don't have it easy. They face a delicate balancing act, and the increased complexity of the unbundled market does not make it any easier.

Nobody asked, but based on my experiences I would summarise a few recommendations for regulators:

- Focus on the public interest. If you don't, who will?
- Support competition, not competitors. It is easy to confuse the two.
- Insist on aggressive failure analysis, before you fail. Market design flaws should be identified as soon as possible; never underestimate the ability of market participants to exploit design flaws; never accept a blithe assertion that the market will overcome the design flaws any time soon.
- Use the market to reinforce operational reliability. Prices and the profit incentive can and should be consistent with the physical reality and the dictates of reliability.

I could go on, but this is enough to make a difference.

Save the best of the old ideas

There is some urgency to all this, an urgency separate from the high cost of delay. While we dither, we are spending a wasting asset. At the core of the electricity system we typically find a team of engineers with broad experience in running electricity networks. The rules they follow are only partly subject to codification and computer programming. There is still a good deal of judgement involved, and we should be grateful that they are there because, in the end, this is what keeps the lights on. This engineering corps typically developed its rules and its ethic within the framework of the old monopoly, and with reference to the broader engineering profession. The rules were not driven primarily by commercial considerations, not the least because the commercial incentives were so distantly removed. And the engineering ethic to serve the public and keep the system working is worthy of respect and preservation.

However, market reforms are eroding the foundations of this system. Many of the previous functions of the engineers have been unbundled and put in the hands of the decidedly commercial market participants. In the battle over efficient market design, the mistakes often appear in the form of restrictions on the operators to reinforce the profits of the middlemen, rather than to reinforce the reliability ethic of the engineers. If the system operators do not honour a culture that emphasises the broader public interest, but rather bow to the interests of the most vocal stakeholders, eventually the operators will do not as they know they should, but as they are told, or as they are paid.

We have already seen the early signs of this change in behaviour in many places in the United States. The most visible evidence is in the pressure to replace the voluntary rules for reliability coordination with a system of mandatory enforcement. But this policing solution pays far too little attention to the force of the new incentives, or the opportunity to design the markets so that the participants face incentives to cooperate with the engineers and support the public interest, rather than to work at cross purposes.

We know how to do it. A great deal is at stake here. It is a great opportunity for leadership from the public sector. If we don't do it right, we deserve what we get.

Looking to the future for R&D

Predicting the future is never easy; predicting even near-future movements in energy supply and demand trends almost impossible. But the Government's Foresight Programme exists to do just that in order to add a long-term component to UK planning for R&D provision. Now, the second phase of Foresight is beginning to look at the implication for R&D of future energy scenarios.

Launched by the previous Government in 1994 and managed by the Office of Science and Technology, part of the DTI, the Foresight initiative has been described by Tony Blair as "a long overdue attempt to address the UK's failure to translate excellence in basic science into industrial success". The programme aims to bring foresight to the fore by "anticipating the future, identifying potential needs, threats and opportunities – highlighting action needed now to guide today's decision makers".

Now in its second phase, the programme aims to build on its earlier achievements, which include 16 major panel reports and around 400 recommendations for action.

Among the first wave of activity were reports on combined cycle gas turbines, clean coal research and energy from the sea. Foresight Task Groups recommended:

- the establishment of a research, development and demonstration programme on gas turbines, with private sector and public sector funding,
- continuing the Government's cleaner coal technology programme, focussed on performance and environmental goals, and
- the creation of a virtual centre for marine energy technology, where synergies between conventional (hydrocarbon) and renewable offshore energy could be exploited.

A new, industry-led Task Force has now taken over co-ordination work on gas turbines and clean coal, while the University of Glasgow is taking forward the proposed marine energy centre.

Also among the first wave of reports is *Environmental Futures*, which proposes and defines four possible future development scenarios for the UK for 2010-2040, which "are a stimulus for wide-ranging debate that leads to companies and organisations to think about and develop strategies for the future".

Energy futures

Among the organisations now using the scenarios is a specialist *Energy Futures Task Force* of Foresight's new Energy and Natural Environment Panel. Chaired by Professor John McMullan, Director of the Northern Ireland Centre for Energy Research and Technology, the Task Force includes representatives from the Government; research bodies; energy companies such as the National Grid Company, Shell and ABB ALSTOM POWER; academia and special interest groups the Energy Saving Trust and the Green Alliance.

The Task Force aims to study the implications on energy supply, demand and market structure of the four scenarios. It will also attempt the impossible; to "envision the potential range of possible future energy scenarios and the challenges and opportunities they pose". Work will progress to a draft report in July/August – this will be widely circulated for comments – and culminate in a final report in December.

Professor McMullan's first job is to bring the existing Foresight scenario work up to date, eg adding an e-commerce dimension, and then building on that to produce "a plan for energy R&D activities for UK plc". Foresight does not make policy, stresses McMullan, but formulates a view upon which policy can be built.

Professor McMullan is convinced that the Foresight's work is both important and influential: "The wide mixture of interests represented in the Task Force, from energy suppliers, through users to the green lobby, ensures that our conclusions will be worth listening to. And the various Research Councils, which decide most of the funding questions, are committed to listening to Foresight".

Scenarios

The scenarios themselves; defined in terms of social values and governance systems, are interesting. *World markets* combines an emphasis on consumerist private consumption with an integrated world trading system. *Provincial enterprise* shifts the policy-making focus to regions rather than global. *Global sustainability* is a world in which social and ecological values are more pronounced. *Local stewardship* is where stronger local and regional governments allow social and ecological values to be demonstrated at local levels.

The energy sector picture from each scenario is no less interesting.

In world markets, energy markets are dominated by fossil fuels, particularly natural gas, but alternatives to conventional oil, such as tar sands, emerge by 2020. Renewables and nuclear power make little progress and demand for electricity and transportation fuels continue to grow. Energy prices stay low, with little concern for energy efficiency.

In provincial enterprise, fossil fuels continue to dominate and renewables do not develop. Energy efficiency again fails to thrive due to lack of investment capital and lack of concern over environmental issues.

Things begin to change with global sustainability. Natural gas dominates until 2010 but renewables gain a large market share after then. Carbon sequestration also takes off. Large global markets are established for solar energy and infrastructure for using hydrogen, which is used significantly from 2030. There is a partial revival in nuclear power from 2015. Energy providers move into energy services, energy efficiency is popular, energy prices high.

It's a similar picture in local stewardship, but with an added emphasis on the exploitation of local energy resources such as wind, biomass, PV, small-scale hydro and locally-sited CHP. Green tariffs are popular and high energy prices aid the take-up of energy efficiency. Small-scale nuclear power develops in some areas. Energy demand falls only in this scenario.

What, exactly, the new Task Force concludes from the scenarios is as yet unclear. But any organisation working to stimulate and prioritise energy research needs to be listened to.

To access Foresight information, or to add your own views, visit the website at www.foresight.gov.uk

How feasible is the renewables solution?

Sir

The letter from Paul Spare and John Bond (*Energy World* February 2000) is full of fallacies, but not all the Friends of the Earth data looks very sound either. I hardly know where to begin.

I'm amused by their final comment that supply interruptions are "largely unknown". In mid-December 1999 a large area around here was blacked-out from 8 pm to 8 am. Twelve hour interruptions only occur every year or so, but interruptions from a second to 30 minutes are so routine that we almost lose count of them.

Nor is this situation even new. Analyses in the USA 25 years ago showed that most breaks in supply were attributable to problems in the low-voltage system near the consumers, not to power station failures. Embedded generation or storage could actually make the overall system more reliable, even if some of the individual power plants became less reliable.

I have doubts over some of the Friends of the Earth figures, especially the wave power and wood. The problem, though, is that the debate has descended to sterile arguments between rival forms of energy supply. What's the point of debates which totally ignore energy efficiency?

Here are two simple ways to displace 1 GW of electricity:

- Subsidise manufacturers or importers so that laptop PCs compete with (or undercut) desktop PCs and are used in a large fraction of new IT purchases. This rapidly eliminates many million 150 W microcomputers from office desks, in favour of machines which can look the same but consume an average of about 5 W.
- Ditto with domestic 'cold' appliances, to ensure that virtually all domestic fridges and freezers bought in the next five years are A or B rated instead of C, D or worse.

These measures are CO_2-free and are cheaper than wind and combined-cycle plants. Which do you prefer - lots of wind farms, or considerably less wind farms, plus low-electricity fridge-freezers? The measures invite no planning or consumer objections and could be begun tomorrow.

There are thousands of other unexploited opportunities for energy efficiency, and it stretches credulity to imagine them being controversial. They're also cheap. Why then, do they receive so little political attention? Mainly, I suggest, because energy supply interests continue to lobby government with special claims that their technology is 'the solution' to climate change, thus diverting attention at the heart of government from what we should be doing, and what some other countries are now doing. Namely, investing, first, in energy efficiency. Second, in gas-fired CHP and, increasingly, in renewables.

David Olivier MInstE

Sir

Spare and Bond ask 'How feasible is the renewables solution?' (*Energy World* February 2000). This is the wrong question to ask. The right one is 'Are we leaving a healthy ecosphere to our descendants?' I have just been blessed with a great grandson, and by the time he is my present age, it will be the year 2084.

If we are to ensure that the greenhouse effect will not have made the world uninhabitable by that year, we must rapidly reduce the world total emission of fossil carbon to the atmosphere to the figure of 4 gigatonnes/annum recommended by the IPCC. Even this may not be enough, but it is certainly much more hopeful than the present plans to continue our grossly extravagant use of electricity and our use of 'gas-guzzlers'.

The public has already decided, in my view correctly, that nuclear power is unacceptable because it leaves all kinds of radioactive mess to our descendants to handle from which they get no benefit.

I think and hope that within the next few years, the general public will get so scared of the ever-increasing effects of the greenhouse effect that they will come to regard the unessential use of electricity and the gas-guzzler as public enemies, as we did in the 1939-45 war.

Then the only acceptable cars will do 100 km on 2 litres of gasoline, all lighting will be by high efficiency bulbs and all houses will be insulated. The Institute of Energy will have fully fulfilled its key role of eliminating all waste of energy.

Med Thring
Past President

Sir

In their rather negative critique of the renewable energy scenario put forward by Friends of the Earth (*Energy World* February), John Bond and Paul Spare have attempted to ridicule the feasibility of the UK installing some 3,600 MW of onshore wind energy capacity by 2010.

They have done this by calculating that it would require the installation of nearly 29,000 turbines. I believe this is a gross exaggeration for two reasons.

First, they have multiplied the required installed capacity by four to allow for a load-factor of 25% when that has apparently already been taken into account in the figures in the table. Second, they assume a rated capacity of only 0.5 MW per turbine. They should know that the latest machines are commonly rated at over 1 MW. For example, a proposed wind development in my Community Council area in Midlothian (which will supply about one-third of the annual electricity demand in the county) will have turbines rated at 1.2 MW.

Taking both these factors into account, the required number of wind turbines falls by almost a factor of 10.

It may also be noted that one European country, Germany, has already installed 3,500 MW of wind power in the last decade.

Kerr MacGregor
Napier University, Edinburgh

Events

April 2000

PowerEx Europe 2000
Exhibition, 11-12 April, Brussels
Details from DMG Media, tel: 01737 855301, e-mail: *tickets@dmg.co.uk*

Mediterranean gas and power 2000
Conference, 11-12 April, Tunis, Tunisia
Details from Economatters Ltd, tel: 020 7650 1430, e-mail: *confs@economatters.com*

Worldwide deepwater technologies
Conference, 11-12 April, London, £849 + VAT
Details from IBC Global Conferences, tel: 020 7453 5491, e-mail: *cust.serv@incuk.co.uk*

Gasification for the future
Conference, 11-13 April, Amsterdam
Details from the Institution of Chemical Engineers, tel: 01788 578214, e-mail: *jblack@icheme.org.uk*

Understanding heat treatment
Course, 11-13 April, Birmingham, £790.
Details from the Wolfson Heat Treatment Centre, tel: 0121 359 3611, e-mail: *whtc@aston.ac.uk*

Industrial furnaces and boilers
Conference, 11-14 April, Porto, Portugal.
Details from INFUB, tel: +351 2 9734624, e-mail: *conference@infub.pt*

UK nuclear waste: finding a way forward
Conference, 12 April, London
Details from Thomas Telford Conferences, tel: 020 7665 2315, e-mail: *frye_s@ice.org.uk*

Commercialising fuel cell vehicles
Conference, 12-14 April, Berlin
Details from Intertech, tel: +1 207 781 9800, e-mail: *info@intertechusa.com*

Solving the policy jigsaw
17 April, London
Details from C Maude at the Energy Industries Luncheon Club, tel/fax: 0162 285 8762

Utility strategy in the new millennium
Conference, 17 April, London, £945 + VAT
Details from the Strategic Planning Society, tel: 0020 7636 7737, e-mail: *events@sps.org.uk*

Gas turbine technology
Course, 17-19 April, The Netherlands
Details from The Center for Professional Advancement, tel: +31 20 638 2806, fax: +31 20 620 2136

Energy management
Institute of Energy course, 18 April, Bristol, £99 + VAT
Details from Beatriz Cano, tel: 0202 7580 7124, e-mail: *bcano@ioe.org.uk*

Petrotech 2000
Exhibition, 18-20 April, Rotterdam.
Details from Ahoy' Beurzen bv, tel: +31 10 293 3213

Boilers, boiler control and burner management
Course, 25-28 April, The Netherlands
Details from The Center for Professional Advancement, tel: +31 20 638 2806, fax: +31 20 620 2136

May 2000

Offshore technology
Conference, 1-4 May, Houston, US
Details from Offshore Technology Conference, tel: +1 972 952 9494, fax: +1 972 952 9435

Heat exchangers
Course, 1-5 May, The Netherlands
Details from The Center for Professional Advancement, tel: +31 20 638 2806, fax: +31 20 620 2136

Energy policy – the driving forces of change
Institute of Energy conference, 3 May, London
Details from Beatriz Cano, tel: 020 7580 0008, e-mail: *bcano@instenergy.org.uk*

European wholesale electricity markets
Course, 8-10 May, Brighton, £1195 + VAT
Details from Powerink Ltd, tel: 01273 202920, website: www.power-ink.com

Turbo Expo 2000
Gas turbine exhibition and conference, 8-11 May, Munich
Details from John Gorton, tel: 020 7886 3102, e-mail: *john.gorton@montex.co.uk*

Renewable energy fair
Workshop, 15 May, London
Details from ABS Consulting, tel: 020 7378 0006, e-mail: *co-ops@absconsulting.uk.com*

Getting regulation right
16 May, London
Details from C Maude at the Energy Industries Luncheon Club, tel/fax: 0162 285 8762

Energy management
Institute of Energy course, 18 May, Shaftsbury, Yorkshire, £99 + VAT
Details from Beatriz Cano, tel: 0202 7580 7124, e-mail: *bcano@ioe.org.uk*

Accurate electricity demand forecasting
Conference, 18 May, London, £999 + VAT. Details from IIR Ltd, tel: 020 7915 5055, e-mail: *registration@iir-conferences.com*

Natural gas in the fuel mix
Institute of Energy Ellis Memorial Lecture, 18 May Birmingham. Details from Mr H Freeman, tel: 0121 353 2397, e-mail: *hfreeman@talk21.com*

The future of European energy 2000
Conference, 29-30 May, Brussels
Details from IFMR Conferences, tel: +31 20 531 2857, fax: +31 20 428 9639

Education for energy efficiency

Early in 1999, the Energy Efficiency Best Practice Programme (EEBPP) commissioned Martin Fry and Associates, in conjunction with the Institute of Energy, to undertake a Scoping Study of the Engineering Higher Education sector. The aim of the Study was to determine whether the demand for a growth in the energy management capabilities of graduates, as a result of the Government's rigorous energy efficiency targets for up to a 20% reduction in CO_2 emissions by 2010, would be met through engineering education.

The Study has shown that, apart from the minority of exemplar academic institutions, most universities do not cover the subjects of energy management and energy engineering in any serious way. This lack of coverage can be attributed to a variety of reasons:

- Lack of staff / student interest
- Lack of staff skills
- Lack of time / space in the curriculum
- The view that provided the core skills of thermodynamics and heat transfer are taught all else will follow
- The view that energy management is soft and therefore not technical enough for engineering because it relates to management practices and people issues.

In order for engineers to meet the energy efficiency challenge, it will be necessary for the rich mix of technology, finance and resource management that comprise 'energy management' to become part of the aspiring engineers' portfolio. However, at the moment, the impetus encouraging academic institutions to incorporate the mix into the engineering curriculum is lacking.

The Engineering Council's new Standards and Routes to Registration (SARTOR) provide the framework for academic institutions seeking course accreditation for Chartered and Incorporated Engineer registration. SARTOR refers to the need for environmental awareness but allows the individual engineering institutions to interpret the requirements and set their own standards for course accreditation. The InstE, CIBSE and the IChemE all include energy efficiency as an accreditation requirement. Other bodies, however, defer to the academic institutions to set their own priorities. Furthermore, not all academic institutions seek accreditation and are, therefore, not subject to the environmental awareness requirements at all.

This has resulted in a wide variation in commitment, with a large number of engineering graduates lacking the basic skills to engineer and manage projects or facilities with energy efficiency or management in mind. As a result of the findings of the Scoping Study, it is proposed to create an Energy Efficiency Educational Forum to forge links between exemplar academic institutions, professional bodies, industrial/ commercial energy users and the EEBPP. The Forum would seek support to create customised training materials, modules, case studies and other tools, so as to encourage academic institutions to deliver energy efficiency education. Training or briefings could, also, be provided for teaching staff, so as to strive towards to a consistent approach to what is an exciting and, nowadays, fast moving area of study.

For further information, please contact:
Martin Fry, Martin R Fry & Associates: 01628 829959
Tracey Fisher, The Institute of Energy: 020 7580 0077

Hong Kong Year 2000 Symposium

Albert Tang CEng MInstE, Hong Kong branch

In recent years, both the Institute of Energy headquarters and local Hong Kong branch have worked closely with the Institution of Fire Engineers Hong Kong branch in various respects from accrediting degree programmes to participating in symposia.

On 6th and 7th December last year, the Institution of Fire Engineers Hong Kong branch organised a two day "Year 2000 Fire Symposium" with a theme of Building a Safer Place in a Better Environment. The Institute of Energy Hong Kong branch provided a speaker at the Symposium and also sent delegates. Dr Dennis YC Leung, a member of the InstE Hong Kong branch committee, delivered a paper on the "Potential Use and Safety Aspects of Biodiesel Fuel in Hong Kong".

Dr Leung presented his work and findings in introducing this substitute fuel to diesel oil in Hong Kong in terms of environmental, economic and safety aspects.

The Hong Kong branches of the InstE and the IFE will continue to work together for the benefit of their members.

Workshops for the workforce

The Institute of Energy continues to work with the Best Practice Programme and a variety of trade unions to bring companies energy and waste reduction via the workforce. A week of energy and waste-saving workshops and seminars was held at Allied Distillers Limited, Dumbarton in February with the aim of encouraging project ideas from the workforce. The groups enjoyed discussing the site processes through the non-contentious issue of the environment. They had some age-old problems to address, including glass wastage, and found ways to work smarter by discussing how to solve them. Empowered to take action by forming partnerships across the organsation, the groups wrote action plans for their energy and waste-saving projects and discussed the communication methods that would be best suited to their audience.

Some members of the new energy and waste-saving teams are due to visit the Super Savers team at Perkins Engines in Peterborough, the Partnership for Best Practice's flagship case study team. With the view that those who do the job know where the wastes are, the Super Savers team at Perkins have a system for recording project ideas from staff, providing feedback to those who contribute within a specified time-frame. This constant cycle of energy and waste-saving ideas coming to fruition contributes trust and communication and results in savings at the bottom-line for Perkins Engines.

In March the Institute also hosted workshops for GKN Westland Transmissions in Yeovil. Somerset. The Institute of Energy can offer companies in the Group Member Scheme on-going support for the energy and waste-saving teams that have been established through these workshops. The Institute provides an external liaison point for the teams and facilitates their communication across the organisation through newsletters reporting on their achievements. The scheme has attracted interest from private industry, the public sector and some SME's.

If the Institute of Energy could tell you more about encouraging energy and waste-saving projects from your workforce contact Katie Howe on tel: 020 7580 7124, fax: 020 7580 4420 or email: *kthowe@instenergy.org.uk*

CODE 2000 careers event

The "Code 2000" careers event took place this year, on 2nd February, in the Lodge Room at Austin Court in Birmingham. The Institute of Energy Midlands branch was asked to provide and man a stand for the interest of the students attending the event. Committee members involved in organising and manning the stand at the event were; Bill Mahoney, Kevin Turnbull, Malcolm Hoggarth, Ken Parker and David Bryan.

At this event the Membership sub-committee of the Branch decided to go for on a "hands on" display to cover the breadth of the energy industry. Committee members pooled resources to furnish the stand, which included a video display (provided by British Gas), playing back footage from explosion tests at Spadeaham; a laptop PC, amongst other equipment supplied by the Government Office for the West Midlands; a lighting control demonstration and sunpipe displays from Birmingham Heartlands Hospital; and a graphics display of photographs, which included Travel West Midlands Gas powered buses. Also featured on the stand were items concerning operating theatre lighting upgrades from Birmingham Heartlands Hospital and Danny Brennan, the Midlands Branch Chairman, loaned two different optical pyrometers. Institute of Energy logos and literature were also displayed and dispensed to those attending.

Kevin Turnbull at the Institute of Energy, Midlands Branch stand at the Code 2000 careers event in Birmingham. Display items include, a lighting control display (left), video footage of explosion tests at Spadeaham (centre) and a sunpipe (right).

The students who visited the stand expressed interest in the items on display and the video. However, the numbers of attendees was very noticeably down on last year. Indeed, the organisers had invited 420 schools but only 14 had responded and attended. Nevertheless, the branch was pleased to receive favourable comments on the quality and content of their display by several visitors. This led the committee team to discuss the prospect of coming up with a working display of variable speed motor controls for the next major event, as well as procuring more photographs of energy aspects from other potential sponsors. It is hoped that this will continue the momentum gained from the positive feedback received at the event.

Annual General Meeting

Notice is hereby given that the seventy-third Annual General Meeting of the Institute of Energy will be held at the Institute of Energy at 2.00pm on Thursday 22 June 2000, to transact the following business:

1. to sign the minutes of the 72nd Annual General Meeting held on the 22 June 1999.
2. to receive the Annual Report and Accounts of the Institute for the year ended 31 Decemeber 1999, together with the report of the auditors.
3. to receive the Annual Report and Accounts of the Benevolent Fund of the Institute of Energy for the year ended 31 December 1999, together with the report of the auditors.
4. to elect Lawford Kernon & Co., chartered accountants, to serve as auditors for the ensuing year and to agree that their remuneration be agreed by the Executive Committtee.
5. to determine the level of annual subscriptions payable by individual grades of membership for 2001.
6. to announce the names of new members of Council.

Dated this 2nd February 2000.
By order of the Council.

L A Evans
Secretary & Chief Executive

Engineering students and graduates - register your training NOW!

Initial Professional Development, or IPD as it is generally known, is the training element that graduates are required to undertake to develop their skills, build on their academic knowledge and ultimately achieve professional status. IPD bridges the gap between the educational base and the professional qualification. All relevant work experience may be counted towards IPD, including pre-graduate experience from sandwich, part time or vacation work, provided that the trainees register, with the InstE, their intention to undertake the training prior to it commencing. A total of two years full time equivalent structured training is required, of which at least 6 months should be after graduation.

Students undertaking work placements during their studies should register their training with the InstE prior to it commencing, if it is to count towards their training. Student members who are about to graduate are reminded to transfer their membership to graduate status and to register their training at the commencement of their employment. The InstE will provide a logbook to all trainees on commencement of IPD, for them to keep a record of all their training.

IPD should be supervised by a tutor who holds a position of responsibility within the organisation and, wherever possible, is a member of the InstE to ensure that they are familiar with the IPD requirements of the InstE and the Engineering Council.

It is expected that the mentor/supervisor will provide guidance and advice to the trainee, review and track progress, discuss the development of the programme and assess the logbook at periodic appraisals and on completion of the training programme.

Whether the training is part of a formal structured training scheme or is 'on the job' training, the trainee must complete a planned programme of training to demonstrate that the gap between the educational base and professional qualification has been completed. This can be provided as evidence when registering with the Engineering Council.

By registering your training, you will be able to keep in touch with the latest news on training and development in order to meet the professional standard.

Register your professional status NOW!

With the new SARTOR regulations now in place, it is essential that all graduates, students and members who have not yet sought professional registration with the Engineering Council do so as soon as possible, so as not to miss out.

Do you have an HND/HNC engineering qualification or equivalent?

If the answer is yes, then you could be registered with the Engineering Council as an Incorporated Engineer, provided that you register before 2001.

Candidates who register after this period, without a BEng qualification, will need to undertake additional study to be registered as an Incorporated Engineer.

Do you have a BEng (Hons) qualification or equivalent?

If the answer is yes, then you could be registered with the Engineering Council as a Chartered Engineer, provided that you register before 2003.

After this period, anyone who requires registration as a Chartered Engineer, but has not completed an MEng degree, will have to undertake additional study regardless of the year their degree was awarded.

All engineering graduates are encouraged to register their engineering qualifications with the Engineering Council on the Stage 1 (Interim) register in order to achieve professional status on transfer.

All existing members who ought to be registered but have never attempted to do so are strongly recommended to contact us to register as a professional engineer either on the Chartered or Incorporated register, before it is too late!

For details on IPD and registration with the Engineering Council, please contact the Membership & Education Department on tel: 020 7580 0077, fax: 020 7580 4420, email: *education@instenergy.org.uk*

Branch Events

All members are welcome to attend these events regardless of the branch they are organised by

APRIL 2000

STONLEIGH,

Arthur Rank Centre,
National Agricultural Centre
Monday 3 April, 7.30pm
"Small Scale Biomass Heating in the UK" -
Mr P Teisen (Teisen Products).
Joint meeting with Institution of Agricultural Engineers.
Contact Mr H Freeman, Midland branch,
tel: 0121 353 2397
Email: *hfreeman@talk21.com*

GLASGOW,

Albany Hotel,
Friday 7 April
AGM & Branch Dinner.
Contact J Currie, Scottish Branch, tel: 0131 455 2253.
Email: *j.currie@napier.ac.uk*

FALKIRK

Saturday 8 April
"Career Tools for Engineers & Scientists" exhibition at **Falkirk College** Contact J Currie, Scottish Branch, tel: 0131 455 2253.
Email: *j.currie@napier.ac.uk*

NORTHERN IRELAND

Date to be confirmed
Energy 2000 Forum
Contact Dr D McIlveen-Wright, Northern Ireland branch,
tel: 01265 324477 Email:
dr.mcilveen-wright@ulst.ac.uk

CHESTERFIELD

Thursday 13 April
Visit & case study on the New Low Energy Office building at 1 Future Walk. Joint meeting with CIBSE. Contact A Mallalieu, Yorkshire Branch,
tel: 0113 276 8888, Email:
AM@evanstabouniversal.co.uk

BRISTOL

University of the West of England Tuesday 18 April
One day short course in Energy Management.
Contact Ms B Cano, Institute of Energy, tel: 020 7580 0008
Email:*bcano@instenergy.org.uk*

TEMPLEPATRICK

Stakis Park Hotel.
Tuesday 18 April
Seminar: Energy Recovery from Industrial & Agricultural wastes.
Contact Dr D McIlveen-Wright, Northern Ireland Branch, tel: 01265 324477
Email: *dr.mcilveen-wright@ulst.ac.uk*

WARRINGTON

Thursday 27 April,
5.30 for 6.00pm
AGM at AEA Technology, Risley
Contact M Worthington, North West Branch,
tel: 0151 448 6115 Email:
Worthington_Maurice_R@lilly.com

NEWCASTLE

Thursday 27 April
Coal Industry in transistion.
Joint meeting with IMM.
Contact CR Howarth, North East branch tel: 0191 222 7303
Email:*c.r.howarth@ncl.ac.uk*

HONG KONG

Date to be confirmed
Technical talk on Biodiesel. Joint event with HKIE Gas & Energy.
Contact Dr D Leung, Hong Kong branch.
Email: *ycleung@hkucc.hku.hk*

NORTHERN IRELAND

Date to be confirmed
AGM .Contact Dr D McIlveen-Wright, Northern Ireland branch, tel: 01265 324477
Email: *dr.mcilveen-wright@ulst.ac.uk*

MAY 2000

LONDON, CBI

Wednesday 3 May
Energy Policy Conference 'Energy Policy - The Driving Forces of Change'.
Contact Ms B Cano, Institute of Energy,
tel: 020 7580 0008
Email: *bcano@instenergy.org.uk*

DROITWICH

Thursday 4 May
AGM and works visit at Nu-Way Ltd.
Contact Mr H Freeman, Midland branch, tel: 0121 353 2397
Email: *hfreeman@talk21.com*

CPD Events

10-14 April
Short course on Diesel Particulars & NOx Emissions at School of Process, Environmental & Materials Engineering, University of Leeds. Contact Alison Whiteley, CPD Unit, University of Leeds,
tel: 0113 233 2494,
fax: 0113 233 2511, email:
cpd.speme@leeds.ac.uk

8-10 May
European Wholesale Markets Power Ink Workshops approved by InstE at the Metropole Hotel, Brighton, Sussex
For further details, contact Power Ink Ltd,
tel: 01273 202920,
fax: 01273 203720, register online:www.power-ink.com

DECEASED MEMBERS

It is with great regret that we report the deaths of the following members of the InstE:

PARKER, Frederick Patrick, MInstE, South Coast branch

WILLIAMS, Allen Geoffrey, MInstE, London & Home Counties branch

WADE, Anthony Lucas, FInstE, South Wales & West of England branch

New Members

EAST MIDLANDS

Dr OJ Ebohon, MInstE
De Montfort University

LONDON & HOME COUNTIES

Dr DJ Martin, MInstE
Mr JE McLeod, MInstE
Unicorn Consultancy
Services Ltd
Ms D Panrucker, Graduate

NORTH WEST

Mr M Gibbons, AMInstE
McKinnon & Clarke Ltd

SCOTTISH

Dr D Tang, FInstE
Integrated Envir. Serv. Ltd

SOUTH WALES & WEST OF ENGLAND

Mr RL Sale, AMInstE (transfer)
Sevalco Ltd

YORKSHIRE

Mr P Jones, MInstE
City of Bradford Metropolitan District Council

FRANCE

Mr F Jenny, Graduate

HONG KONG

Dr K Sumathy, MInstE
University of Hong Kong

Course Accreditation and Approval

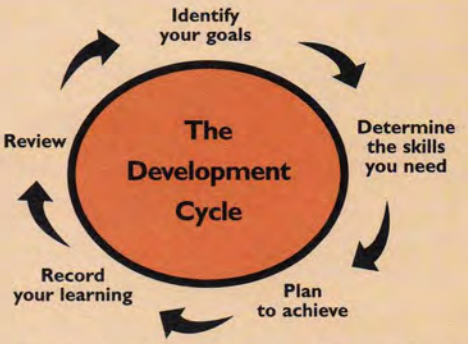
The following courses have recently been approved for Institute Membership or accredited for registration with the Engineering Council.

University/ College	Programme	Intake Years	Grade
University of West of England, Bristol	BSc (Hons) Environmental Engineering	1999-2003	AMInstE
City University Hong Kong	BEng (Hons) Fire Engineering	1999-2002	MInstE Provisional Partial CEng
City University Hong Kong	PG Dip Fire Engineering	1999-2003	Provisional MInstE
Cranfield Institute Technology	MSc Applied Energy (Energy Systems & Thermal Processes & Energy & Buildings)	1999-2003	Provisional MInstE
University of Leeds	BSc (Hons) Environmental Science	1999-2003	MInstE
University of Leeds	BSc (Hons) Fire Safety & Management	1999-2003	MInstE
University of Leeds	BSc (Hons) Fire Science	1999-2003	MInstE
University of Leeds	BSc (Hons) Fuel & Combustion Science	1999-2003	MInstE
University of Leeds	BEng (Hons)/MEng Environmental Energy Engineering	1998	CEng MInstE (SARTOR2)

There are a number of other courses currently going through the accreditation and approval process. The decisions of the Accreditation & Approval Panel will be passed on to you in an update later in the year.

Demonstrate your Professional Competence

Continuing Professional Development has become a central issue for professional bodies and their members. This reflects the national concern for a culture of continuous improvement through the process of lifelong learning. CPD is not about accumulating points or hours in order to fulfil the requirements of professional bodies. The basis of CPD is to continuously update and expand your professional competence. A record card has been enclosed in this month's Energy World which focuses on your learning outcomes. You are requested to complete the card or forward your personal planners to the Institute so that we can continue to provide services which will assist you in your personal and professional development.



The Institute of Energy is committed to providing services to enable you to keep up to date with developments in the industry as well as providing information on courses in the commercial sector.

Please take just a few moments to review and record your past year's professional development and to plan your future learning for career development and maintenance of professional competence.

SITUATIONS VACANT

Commissioning Manager
Thailand
For 2100MW CCGT.
At least 10 years' experience of large power plant in a similar position required. 1yr.

Also required are
Resident Electrical Engineers, Resident Mechanical Engineers, C&I Engineers and Civil Engineers
for large gas turbine power plant with 10+ yrs experience and degree or C.Eng.

Maintenance Engineer
A mature Engineer with experience of gas turbine, power station, continuous process or rotating equipment maintenance, operations or commissioning is urgently required for a staff position at a new site. Hands on experience is more important than qualifications.
To £35,000
Location: Sussex

Please apply to The Ames Consultancy Ltd,
P. O. Box 128, Reigate, Surrey RH2 7FT
Tel: 01737 222161 Fax: 01737 222979
Email: *jobs@ames.co.uk*

Friskies Petcare (UK) Ltd wish to offer a twelve month placement in its environmental department.
The position will offer a wide involvement in energy management within the group.
Based in Northwich, the position will appeal to a newly qualified graduate.
Salary negotiable.
Contact Mr. V. P. Davies on
01606 812 850

Environmental Data Interactive Exchange

For the latest environmental jobs visit EDIE's environmental job centre.
www.edie.net

Please note: This space will be dedicated each month to individuals and organisations wishing to advertise situations vacant or situations wanted. Please note that this service is FREE.
For more details contact Katie Howe or Beatriz Cano on tel: 020 7580 7124, fax: 020 7580 4420 or e-mail: eworld@instenergy.org.uk

the institute of energy

Energy 21: Making The World Work

22 June 2000

Join us for truly multi-media millennium experience.

In the sensational domed theatre of the London Planetarium
Walt Patterson, Companion of the Institute of Energy,
will be awarded the Melchett Medal 2000 by the President, Richard Coldwell
for his significant contribution to the energy debate.
His Melchett Lecture will attempt to reassess the link between energy and human purpose -
what we humans want from energy, whether we can get it and how.

Walt says "*We need urgently not only to reassess but also to realign the link between energy and human purpose, to make the world work better for all of us.*"

To reserve your place at a Melchett Lecture photocopy and fax back this registration form

I/we will be attending the Melchett Lecture on 22 June 2000

Name(s) _____

Job Title(s) _____

Organisation(s) _____

_____

_____

Address _____

_____

_____

_____

_____

Tel: _____ **Fax:** _____ **Email:** _____

Are you a member of The Institute of Energy? **YES/NO**

Membership Number: _____

Attendance is FREE but priority will be given to members of The Institute of Energy

All delegates will receive a FREE visitors pass for the London Planetarium to use at a later date

Fax back to: Beatriz Cano
The Institute of Energy 18 Devonshire Street London, W1N 2AU
Tel: 020 7580 7124, Fax: 020 7580 4420, email: *bcano@instenergy.org.uk*