

The magazine of The Institute of E

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Number 221 September 1994

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#### Your invitation to

# An Institute of Energy Conference



# INTERNATIONALISATION

# **Power & Energy Services** THE BUSINESS OPPORTUNITIES FOR UK COMPANIES

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HUSINESS OPPORTUNITS

Graham Atkinson, Head of Projects, Export Division 2, DTI.

Increasingly UK energy utilities are moving into overseas markets. A direct result of the restructuring and privatisation experience in the UK and the effect of regulatory constraints and competition on the main business at home.

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This important conference will specifically consider the new prospects for suppliers to the industrial power market. There will be strong emphasis on practical issues with key players discussing their own experience and future plans. Demonstrating how going international not only offers tremendous benefits to individual businesses but also to UK plc.

> For further details please contact: **Judith Mackenzie** The Institute of Energy **18 Devonshire Street** London W1N 2AU Tel: 071 580 0008, Fax: 071 580 4420

Thursday 1 December 1994 The Café Royal, 68 Regent Street, London W1.







#### **SEPTEMBER 1994**

Number 221

#### The magazine of The Institute of Energy

Published by H Howland Associates, The Martins, East Street, Harrietsham, Kent ME17 1HH, on behalf of The Institute of Energy, 18 Devonshire Street, London W1N 2AU. Editorial tel/fax: 0622 850100 Conferences: 071-580 0008 Administration: 071-580 7124 Membership, Education and Journal subscriptions: 071-580 0077 Fax: 071-580 4420

Editor Johanna Fender

#### Advertisement sales

David Speculand, Adept, tel: 0472 388808; fax: 0472 388697

Printed by Headley Brothers Ltd The Invicta Press, Ashford, Kent

#### THE INSTITUTE OF ENERGY

Patron

Her Majesty The Queen

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Energy World is circulated free of charge to all paid up members of The Institute of Energy. To libraries, organisations and persons not in membership it is available on a single subscription of £70 (UK), £80 (overseas) for 10 issues.

ISSN 0307-7942

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#### COVER

This month's cover picture shows part of Hamworthy Combustion Engineering Ltd's centralised research and development test facilities at Poole in Dorset. The range of furnace availability enables full-scale burners from approximately 0.3 MW to 100 MW to be fully tested on liquid or gaseous fuels.

# VIEWPOINT

# Regulating for the common good

ALMOST without debate a major area of public policy — the regulation of privatised utilities — has been hived off, beyond serious democratic accountability. Water, gas, electricity and telecommunications affect almost every aspect of our daily lives, yet the way in which they are regulated by powerful appointees is barely understood and hardly scrutinised.

It is almost 10 years since the first utility regulator was appointed: Sir Bryan Carsberg who headed the Office of Telecommunications. He quickly assumed a high public profile (later moving on to head the Office of Fair Trading). Known as the man from OFTEL, Carsberg was subsequently joined by regulators for gas (OFGAS), water (OFWAT) and electricity (OFFER). Together they employ 600 staff on a total budget of £32 million.

The regulators preside over industries which play a critical, strategic role in the UK economy. In 1993 the utility companies had combined pre-tax profits of £7.8 billion, a stock market valuation of £61 billion and a workforce of over 400 000 contributing around four per cent of gross domestic product (GDP).

Regulators are not merely guardians of the consumer. They effectively determine policy over crucial areas such as energy, with little scrutiny by Parliament. For instance, during the 1992-93 coal dispute, the director general of OFFER, Professor Stephen Littlechild, insisted that forcing the electricity generators to maintain existing coal volumes would infringe competition rules. This amounted to a veto on an alternative energy policy by a public appointee. His ruling was seen merely as an 'objective' one, in line with his regulatory function to promote competition in a free market. Yet its consequences were highly political.

Some people may be aware of the spaghetti-western style shoot out between British Gas and its regulator, OFGAS and its referral to the Monopolies and Mergers Commission. Others may have heard mutual complaints between BT and competitors like Mercury over market access and pricing.

But, largely because of the secrecy culture perpetrated by the regulators themselves, few people are aware of the real issues involved. Acronymic jargon and impenetrable pricing formulae also provide an impressive barrier to clarity and simple understanding.

Regulation reformers are now queuing up. All conclude that utility regulation is in crisis. The Right wants to scale back the powers of the regulators and subject utilities to greater competition. If, as would seem to be the case even under a Labour Government, renationalisation of the utilities is unlikely, then an alternative Left agenda is urgently required. It should spring from an analysis of the serious shortcomings of the existing regulatory system.

As an alternative, I would suggest that attempts to break up natural monopolies should be resisted, for they provide the only means of guaranteeing universal service at a uniform price. They also enable Government to promote strategic policies through these key industries, so allowing national interest to be prioritised. Potential abuses of monopoly power could be curbed by a reformed regulatory system.

The very existence of regulator discretion means even the existing system could be deployed in favour of alternative policies where competition is not at the expense of social, economic or industrial objectives. An incoming Labour Government should immediately appoint new regulators with a different ideological remit and thereby begin to change the direction of the utilities.

Primary legislation should then follow to underpin such a change of policy away from competition-at-all-costs. This would amend the objectives of each regulator to ensure that policies to advance strategic national and social interests always take precedence over promoting domestic competition or shareholders' profits.

Who would ultimately define 'national' or 'social' interests? Parliament, through approving guidelines drawn up by the Secretary of State, thereby squaring the circle of democratic accountability. This is the means by which democratic politics can take charge of utility policy and replace hived-off policy making with its own very definite ideological agenda. However, in order to avoid day-to-day Whitehall interference, regulators should be required to submit rolling plans of action which Ministers would approve. The regulatory regime could then be assessed against performance targets such as: universal tariffs, protection of supplies to the elderly and disabled, R & D, levels of investment and international competition.

The utilities already have a series of non-commercial obligations and regulators have been promoting competition which in practice transfers shareholder value from the existing utility to new markets entrants. So shareholders' rights under company law to get the best return on their equity are already circumscribed under the current regime. But the objectives of the regulators may still need to be refined to assert the primacy of strategic national or social interests over those of shareholders.

In addition, Government — or in the case of regionally based utilities, regional government — could retain or take a 'golden share' type ownership stake, appoint a director and exert influence at Board level. Properly managed in consultation with the large financial institutions which own nearly 90% of shares in the utilities, such a change need not be disruptive, especially since the utilities are seen as safe havens in the stock market. But there should be no misunderstanding about the aim: to ensure that the utilities serve public rather than private interests. If such a reform is resisted or fails, further measures will need to be considered.

Accountability could be improved by establishing a Parliamentary Select Committee to scrutinise the utilities. They could be compelled to report once or twice yearly alongside an annual debate on the floor of the House.

#### Peter Hain, Labour MP for Neath

This Viewpoint article is based on a GMB discussion pamphlet **Regulating for the common good**, price £10.00, available from the GMB, 22-24 Worple Road, London SW19 4DD.

# Falklands oil plan

STRATEGIES for exploiting oil reserves off the Falkland Islands which could be up to 50% larger than those in the North Sea are examined in a report recently circulated by the Falkland Islands Government.

Oil development strategies for the Falkland Islands by consultants ERM, looks at three possible scenarios for the development of the oil industry in the region, together with the impact on the people and economy of the Falkland Islands. These range from the establishment of minimal facilities to more extensive drilling and production activities, set against the need for a range of environmental protection measures.

# Solar technology in Sri Lanka

RURAL hospitals and community centres in Sri Lanka are among the beneficiaries of solar energy technology, designed by an Australian company and installed with funds from the Australian government's aid agency, AIDAB.

More than 120 sites in eastern Sri Lanka have had solar technology installed, providing power for lighting, water pumping, refrigeration and communications.

Large areas of the country are outside the regional and local power grids. The sites were chosen by the Sri Lankan Government because their chances of having grid electricity supplied were virtually nil, due to high installation costs.

The first site chosen was Ekiriyankumbra hospital. When AIDAB officials and BP Solar technicians first visited the hospital to plan solar power installation, wards were empty, and the dispensary was only open parttime through lack of medicines, and no refrigeration facilities. Four months later the team returned, following the installation of solar units, to find the hospital transformed.

# New gas pipeline for S America

A CONSORTIUM known as the BTB Group, has been chosen by Petroleo Brasileiro SA (Petrobas) to develop a natural gas pipeline linking Bolivian reserves with markets in southern and south east Brazil.

The BTB Group consists of British Gas, BHP of Australia and Tennecio Gas of the US. The proposed 2000-mile pipeline is a significant component in Brazil's strategy to develop an integrated natural gas project at an expected total cost of around US\$5 billion.

The pipeline project will now move into the validation phase, in which the BTB Group will work with Petrobas, Brazil's state oil and gas company, to review project specifics and undertake additional studies as needed. Construction will start next year, and gas should be flowing by 1997.

The consortium will work with Petrobas to expand the country's natural gas infrastructure and to develop new markets for cleanburning fuel, including electric generation plants, industrial facilities and local energy consumers. With a population of 85 million, southern and south eastern Brazil account for 82% of the country's aggregate industrial production and 75% of its total energy consumption.

# **Charter stalled**

THE JUNE meeting of the Conference on the European Energy Charter produced a political agreement on the Treaty (Basic Agreement). This document is the binding agreement to be signed in 1994.

However, Russia and the US expressed doubts about the text proposed after the meeting. Despite the Chairman of the Conference, Mr Rutten, having separate meetings with representatives from both countries, agreement could not be reached.

# Private power for Pakistan

PAKISTAN is to launch a plan to restructure and privatise its power sector.

The programme will set the stage for a deregulated market, with both public and private companies competing to supply and distribute electricity.

In addition the project will expand Pakistan's electricity infrastructure with a series of new generators and extensions of transmission and distribution networks to help reduce the country's chronic power shortages. The project will be financed by a \$230 million loan from the World Bank.

A series on ongoing improvements will add 4000MW of new capacity (mainly hydro) and more than 3000km of transmission lines. This will enable new service connections to almost two million low-voltage customers, with a rural electrification programme delivering electricity to around 500 000 new customers.

Pakistan's public utility, the Water and Power Development Authority (WAPDA), is to become a holding company with decentralised power generation, transmission and distribution subsidiaries. Each subsidiary will operate as a separate profit centre. An independent regulatory body will be created to oversee the largely privately-owned and operated power systems.

Additionally, the project will provide technical assistance and training to WAPDA to improve its environmental and resettlement capabilities.



THE Tyumen EC Energy Centre (pictured in the background, above) was opened in July 1993 in Western Siberia. Its purpose is to promote hydrocarbons technologies.

To increase awareness and interest in the activities of the centre, a joint visit by high-level representatives, from the EC and the oil and gas-rclated industries, took place in July this year.

In addition, high-ranking officials from Moscow, and the local government in Tyumen took part in the visit, which included a trip to a local oil field.

# HOME NEWS

## HSE reviews leukaemia findings

AN HSE report published in August announced the results of a review of its investigation into the incidence of childhood leukaemia and other cancers in the children of men employed at Sellafield over the period 1950-1989.

The review confirms the main conclusions of the original report, but has led HSE to modify two of its subsidiary findings. The changes weaken still further the support for Prof Martin Gardner's reported association between fathers' radiation exposure before conception and the increased risk of leukaemia and non-Hodgkins lymphoma in their children.

Copies of the review, price £2.75, are available from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 6FS.

## Radioactive waste document published

THE consultation document promised by John Gummer in the announcement of the Radioactive Waste Review, was launched in August.

The review will examine current policy in the light of changes since 1984, when the DoE published its National Strategy for Radioactive Wsate Management. The consultation document sets out the preliminary conclusions of the review.

It covers radioactive waste management as a whole, inviting comments on a range of issues, including the appropriate waste management strategies for different categories of waste, and the decommissioning of nuclear plant and the operation of the regulatory system.

Copies of the document are available from Renata Szymczak, Radioactive Substances Division, Dept of the Environment, Rm A523, Romney House, London SW1P 3PY. Closing date for comments is 14 October 1994.

# Coastline polluters to pay

NEW legislation will increase environmental protection for the UK coastline by making shipowners strictly liable for the oil pollution damage they cause.

Under the Merchant Shipping (Salvage & Pollution) Act 1994, from 1 October whenever actual damage is caused by oil from a ship, the shipowner is liable to meet the costs without the victim having to prove fault or negligence.

The Act began life as a Private Members Bill in 1993, with allparty support. It protects the right of the International Oil Pollution Compensation Fund to recover the cost of compensation payments from liable parties.

Minister for Shipping, Lord Goschen, said of the new Act: "Until now financial compensation has only been readily available for damage caused by laden oil tankers. Under the Act, the Marine Pollution Control Unit of the Coastguard Agency will be more easily able to recover the costs."

# OFGAS decision confirmed

THE DIRECTOR general of OFGAS, Clare Spottiswoode, has confirmed her decision on the new price control formula for the transportation and storage of gas.

Following consultation, she has decided to implement an RPI-X price formula with the value of X set at five, and the starting level of pricing set at 14.16 pence per therm. The price formula will take effect from 1 October, until March 1997.

### On the move

A DISPERSION modelling wind tunnel and two expert practitioners have transferred to the B u i l d i n g R e s e a r c h Establishment's Cardington Laboratory, from the former Warren Spring Laboratory.

The wind tunnel is one of only a few of its type worldwide, and should be operational by spring 1995.



An energy efficient lighting scheme, funded by all 12 RECs in England and Wales began in August. Low energy lightbulbs will be fitted in approximately 200 000 qualifying households.

The scheme has been developed with the RECs by the Energy Saving Trust, and the lights will be installed by companies working within the Government-funded Home Energy Efficiency Scheme (HEES). In all up to 200 000 recipients of HEES grants on meanstested benefits, who opt to receive energy efficiency advice, will benefit from one free lightbulb.

The scheme is financed from a special fund authorised by OFFER to which all the RECs contribute. In total they will be spending £100 million over the next four years on a range of energy efficiency projects.

Pictured above is Paula Bateau, one of the first qualifying recipients, with chief executive of the Energy Saving Trust, Eoin Lees (left) and Mike Brown, customer services director for London Electricity.

# Electricity price review

THE RESULTS of OFFERs review of the price controls on the distribution businesses of the RECs were announced by Prof Stephen Littlechild in August.

The proposals represent a significant change in the current direction of distribution charges, and will mean a cut in the price of electricity to consumers.

The X factors in the present controls have permitted price rises of up to 2.5% a year over the past five years. OFFERs present proposals require reductions of 11% to 17% immediately, with further reductions of 2% a year over the next four years.

The proposals also include two contributions of energy efficiency. One will encourage companies to reduce energy losses; the other will remove any artificial disincentive to companies promoting energy efficiency schemes to their customers.

In parallel with the price control review, Prof Littlechild also reviewed the standards of service provided by the companies. He announced the following further steps to raise standards: increase the minimum levels on most Overall Standards (including supply restoration and meter reading); improved response time; initiate reviews by companies on their codes of practice on payment methods, and services for the elderly and disabled, and to introduce new annual statements by the companies on quality of supply.

He also announced moves to protect customers by introducing competition to provide new connections to the distribution system. He said: "I shall be discussing with companies how best to secure the emergence of competition to cover such issues as design, specification, standards and supervision of work. It should be possible to deal with issues involved so that competition in connections can become effective from April 1995."

Professor Littlechild has requested that the companies respond to his proposals by the end of September 1994.

# COMMERCIAL NEWS

# Combustion engineering capabilities: Hamworthy Combustion Engineering Division

WITH a turnover of £60 million, the five Hamworthy Group companies make up one of the largest combustion engineering organisations in the world. The group comprises Hamworthy Combustion Systems, Hamworthy Heating, Airoil-Flaregas, Peabody Engineering Ltd in the UK and Peabody Engineering Corporation in the USA. Overseas offices and agents represent the group in all major industrialised regions.

The company is fully committed to the Quality Assurance Management principles mandated in the generic ISO 900 standards. Accredited approvals to ISO 9001/2 have covered the majority of the company's operations since 1987. All remaining areas are being actively progressed as appropriate.

Manufacturing capabilities are located at Poole and Birmingham in the UK and Stamford Connecticut in the USA. The majority of the company's products are produced in-house and benefit from CAD/CAM facilities. A comprehensive support technology is provided by the full scale combustion test rig facility in Poole, which also includes physical and computer modelling capability.

The company is dedicated to providing the most technologically advanced products to meet the world's increasing demand for reduced environmental pollution.

Hamworthy Heating have designed reduced emission boilers of very high thermal efficiency, including condensing capability for application in the commercial sector, covering hotels, hospitals, schools and offices.

Additional products include cold water booster and pressurisation sets, natural and fan assisted flue systems, direct fired gasfired water heaters and factoryassembled boiler rooms for rooftop installations.

In the industrial sector the company's supplies include burners and control systems for a very wide range of steam and hot water boilers from the smallest to the largest. These cover fire and water tube boilers from the smallest to the largest. These cover fire and water tube boilers for marine, industrial and power generation applications.

In addition the company also supply flare stacks, radiant wall, natural and forced draft burners, for a very wide range of process fired heaters for the world's petrochemical industry.

#### R&D

Successful companies must provide equipment to meet future demands, including environmental requirements. The company has taken the initiative and established a combined central R & D facility situated in Poole.

This centralised activity ensures that a coordinated R & D programme, utilising the best available technology inherent in the group of companies, is exploited.

The wide range of the test furnaces and modelling facilities available have led to an improved understanding of the combustion process and controls necessary for emission minimisation.

Detailed analysis of test rig performance, measurements and subsequent field trials, have resulted in the development of empirical models essential for performance prediction and guarantee purposes.

#### **Emission reduction**

The company's burner designs and system employ a menu of techniques for minimising NOx and particulate emissions. These include:  burner designs employ unique methods of combustion air staging:

 atomiser designs employ a combination of improved atomisation and spacial atomised fuel staging;

 vitiated combustion air achieved by recirculating flue gas, steam/water spray or twostage gas burning.

The company also has experience employing in-furnace controls including — burning zoning, burners out of service (BOOSE), and overfire air (OFA). Experience in the USA has also included selective now catalytic reduction (SNCR).

Each specific application is

fully evaluated and the most cost effective and appropriate techniques are identified.

#### Worldwide experience

The company's reduced emission burners have been installed worldwide and have covered a very wide section of fuels and applications. Stringent performance specifications have been met successfully.

The group has a total package and turnkey capability and can handle projects from initial R&D through in-house design, manufacture, installation, commissioning, environmental monitoring and after-sales service.

#### DEGREE DAYS: JULY 1994

#### Source: Degree days direct



These regional figures, calculated from daily outside air temperatures, provide an index of demand for space heating over the month and thus enable excessive consumption to be detected.

A well-controlled heating system should manifest a straight line relationship between monthly fuel used and the local degree-day value; any significant deviation from this 'target characteristic' is likely to signal the onset of avoidable waste (such as a stopped timeswitch or an open isolating valve).

Readers can get more information on the use of degree days from Vilnis Vesma, 17 Church Street, Newent, Glos GL18 1PU (0531-821350)

© Vilnis Vesma, 1994. Because different observing stations are used, the figures given here will not necessarily agree exactly with those from other information providers.

# ELLIS MEMORIAL LECTURE

# The political energy agenda: winners and losers

THERE is no shortage of critics of the Government's declared energy policy, but I suggest that many of them are shooting at the wrong target. My criticism is not so much directed at the policy, but at the failure to implement it.

The declared objective has been to establish competitive markets, by privatisation and liberalisation — in order to achieve greater efficiency, security and diversity in supply — allowing market forces to determine decisions by suppliers and consumers — with a handsoff Government, involved only in applying a touch of regulation and greenery — the environmental and energy efficiency agenda.

My complaint is that this has only partially happened. Why has Government not delivered what it promised? How has it failed? And what should have been done?

Some critics argue that competitive market forces are failing, because applying them is inconsistent with the sort of energy strategy required. Market forces cannot create an 'energy policy'. But what these critics refuse to recognise, is that market forces have not been given a fair opportunity to work.

It is not competitive markets that have failed. What is flawed is the Government's failure to set market forces free to prove their power. So we suffer from the worst of both worlds. We neither have the economic dynamism in the energy sector that should have been released, nor do we have a strategic policy framework to guide market-led decisions.

My indictment goes much further — to the flawed decision-taking process — a fundamental weakness at the heart of our system of Government. Our decision taking processes are full of contradictions, lack of coordination between Ministers and Departments and inconsistencies, 'ad-hocery' and 'short termism' instead of strategy.

\* Chairman, Major Energy Users Council by Peter Rost\*

The Institute of Energy's Midland branch held its annual Jim Ellis Memorial Lecture on 26 April 1994. This year's guest lecturer was Peter Rost, chairman of the Major Energy Users Council, and formally an MP and active committee member on several parliamentary energy groups. The following article is a summary of Mr Rost's full lecture.

No business can survive our market economy system without corporate planning, the longer term strategies based upon forward rolling assessments of what lies ahead and how best to structure policy responses.

Yet Governments find it difficult to coordinate any policy, because Departments operate in pigeon holes, barely talking to each other and not wanting to look more than a year or two ahead. Ministers come and go, like musical chairs, with the consequent lack of in-depth grasp of the issues and most of them only have time or ability to think forward to next week's Parliamentary business.

Some of these serious weaknesses in the decision-taking process, might be avoided if Ministers and civil servants were not so hostile to outside advice. Expertise from inside Parliament and from outside is rubbished or ignored. If some of the excellent contributions from the Energy Select Committee and from the expert 'think tanks', like the Institute of Energy, had been considered more seriously, our energy policy would not be in such a mess today.

However, it is a virility symbol for Ministers and their inner core of civil servants advisers, to pretend they know it all, and know it best. If they did not 'think of it first' it cannot be considered and probably has not been invented. It would be a slight on their expertise to accept policy recommendations or novel ideas from others.

When did you last hear a Minister admit he got it wrong? Such modesty might even be acceptable, if incompetent decision-takers in Government paid the price for their mistakes by prompt dismissal: the usual fate for failures in the real world of the private sector.



Peter Rost

A Conservative MP from 1970 until 1992, Peter Rost began his career as a financial journalist and stockbroker.

During his Parliamentary career Mr Rost was a senior member of the Parliamentary Select Committee on Energy, chairman of the Bow Group Energy Committee, deputy chairman of the Parliamentary Alternative Energy Group, deputy chairman of the Parliamentary Group for Energy Studies and a member of the Conservative Energy Committee.

He is vice-president and honorary life member of the CHPA, a companion of the Institute of Energy, an associate of the Watt Committee, and fellow of the Industry and Parliament Trust.

He is now chairman of the Major Energy users Council, and editor if its newsletter, *Major Energy User*. His current consultancy interests include energy efficiency management, CHP, renewable energy, coal, oil, gas and electricity.

#### How has it failed?

For examples to support my criticisms, we need go back no further than the pit-closure fiasco eighteen months ago.

Overnight, we had a 'U' turn from 'there is no alternative' to a full DTI review 'we will consider all options'. The about turn came not because Ministers conceded that they had neglected to look at all the options before announcing the closure of half of what little is left of our coal industry. The wide ranging review of energy policy, resulting in the recent White Paper, did not come about because Government realised it was needed or desirable; it did not come about because it was admitted the pit closure announcement had been taken in haste, without proper consideration of costs and benefits. It did not come about, because Government admitted it had not looked at why coal was being squeezed out of the market.

No! It came about only because the Government faced defeat in Parliament, thanks to a handful of Conservative rebels. What a way to take important strategic decisions, which go far beyond energy policy.

Even worse, when the wide-ranging review was released it still failed to address the principle reason why coal consumption was slumping — not because of its uncompetitiveness, but because of the rigged electricity generation market. Market forces have just not been given a chance to work.

British Gas was privatised as a monopoly, even though the creation of competition was the objective! Hardly the best way to set about it. OFGAS was not given specific powers except over regulating the tariff market and the voice of consumers in industry was not even part of the formal consultation process — although we were told it was all designed for the benefit of users.

The reality was that the Treasury dictated the structure, to raise the maximum cash quickly. There was to be nothing complicated in the prospectus, such as real competition built in, otherwise 'the Sids' would not have been so easily tempted. The privatisation was designed for the benefit of the Treasury, not to further declared energy policy, for competitive markets in which consumers could shop around.

So we had inflicted on us a 20th century version of the seven-years war: confrontation between British Gas, its customers and the regulator, leading inevitably to a virtual reprivatisation, helped by the monopolies and mergers commission (MMC). That was hardly fair to British Gas management, shareholders or consumers, as the goal posts are constantly shifting. The culprits, meanwhile, our politicians, wash their hands, hoping someone else will eventually sort out the mess.

When the Government turned to electricity

privatisation, being a naive, though increasingly cynical, ex-MP, closely involved with the privatisation legislation, I believed we had learned a few things, even if no one was prepared to admit errors.

But, despite well-researched expert warnings from the energy committee and many others outside Parliament, the Treasury again dictated a flawed structure. We were given a duopoly, less than eager to compete against each other, a subsidised nuclear industry, not allowed to offer a third competitive choice to customers, and a totally unacceptable highcost, cumbersome, phoney pool system, misleadingly described as a 'market'. No wonder business and industrial users are dissatisfied, and the Regulator feels he has been given an unfair burden to try and sort out the mess.

#### What should have been done?

If the Government intended to follow its own declared energy policy, generators should have been sold off as four or five competing companies. The regional electricity companies (RECs), having been given discretion to generate some of their own requirements, should have been offered a portion of the coal-fired power stations. Faced with a duopoly, and fears of restricted competition, the RECs had no alternative except to build new power stations - gasfired, of course - even though we have around 40% excess capacity. As the weird regulatory regime has not required the economics of new gas versus existing coal plant, to be tested in the market, the RECs, denied any of the existing coal plants are building CCGTs as if there is no tomorrow, sheltered from the realities of competition by longterm back-to-back contracts for gas supply and electricity sales.

The duopoly, of course, has been able to manipulate the Pool price with the RECs quite happy to see price convergence, in order to ensure a return on their 'dash for gas'. The generators have been able to close capacity, so further restricting competition. Plant has been steralised without allowing the market to test if competition wish to take over power stations the duopoly wants to close. Surplus power plants are sold to China to restrict competition in the UK.

As for the nuclear industry, that could and should have been privatised, if some of the liabilities of past investment errors and decommissioning costs had been taken out of the balance sheet. After all, it would not have been the only privatisation subjected to some creative accounting. Other industries, including electricity, have had their assets heavily written down, to make the prospectus look more tempting.

Nuclear Electric could then have started competing on a level playing field. Government could still have imposed its nuclear levy — but this would have gone straight to the Treasury — to pay for the liabilities from which Nuclear Electric was relieved. In reality the nuclear levy is going to the Treasury, so what's new?

Which brings us to the Government's most serious policy error — presiding over the burial of the coal industry.

Why was it not privatised a decade ago? Instead of sinking annually billions of £s of taxpayers' money to subsidise inefficiency, mismanaged investment and propping up the militant union stranglehold over incompetent management. The political no-go area of the energy scene should have been tackled *before* electricity privatisation.

If coal had been offered on a 'car-boot sale' basis much earlier, as is only now proposed, it would have been given a transition period before facing a playing field tilted against it by privatised generators.

A transitional tapered annual subsidy could have been offered as a dowry to takers, including management/miners consortia buyouts. Under more motivated and energetic management, the industry could become competitive, much sooner and in time to face the privatised electricity market. A five-year transitional subsidy, coupled to sales contracts with the CEGB at annually declining prices, would have transformed the energy scene. Minds would have been wonderfully concentrated.

There would have been pit closures, of course. But more new investment to improve productivity too. Moreover, the CEGB would have seen gradually declining prices towards world prices, and at privatisation, the generators would have seen the prospect of competitive UK coal on their doorstep. Would the generators have invested so heavily in coal import facilities? Would they have been so eager to close coal-fired plant and add so much new gas-fired capacity, when clearly existing coal-fired plant offered lower-cost electricity? In a genuinely competitive generating market generators that did not offer the lower cost electricity would go bust.

If the structure of the privatised electricity industry had been set up to promote genuine competition, the market for UK coal would not have declined to the extent it now has. Taxpayers would have saved enormous sums. British industry would be getting lower-priced power.

Moreover, a diverse, privately managed coal industry would probably have entered the power generation market, adding a powerful competitive player. New coal owners would have said to the generators: 'if you do not want our coal, we will take over your coal-fired plant and prove that coal can underprice gas!' RECs, on privatisation, would also have challenged the generators'

# ELLIS MEMORIAL LECTURE

duopoly, by bidding for coal-fired plants and, probably, invested in coal production. Clean coal burning technology would be nearer commercial application, as it is abroad.

#### Electricity prices experience

Most users have seen real price reductions since privatisation. Domestic consumers have benefited from a regulatory formula so that improved efficiency and lower coal prices have been partially passed on.

Smaller commercial and industrial users have seen some advantage from the option to shop around for contracts. Those using less than 10 MW have mostly seen real price reductions. With the lowering of the franchise to over 100 kW users this April, another 45 000 consumers are able to contract or obtain around a 10% reduction off their previous tariffs, from their host regional supply company, if they chose not to become a second tier user.

However, most larger energy intensive users have experienced price rises since privatisation. This has damaged the international competitiveness of sectors of UK industry and continues to arouse anger and frustration.

Our principal criticism is that price reductions have not been as large as they should have been. This is due to the flawed structure which has allowed two dominant generators to set the wholesale price. Managements and shareholders of the generators and RECs have had a disproportionate share of benefits.

The returns to the two generators, around 6%, is not unreasonable. But long run marginal pricing, which is what the generators have achieved through the Pool, is a distortion of competition. With substantial overcapacity, in a recession, with more generating capacity coming on stream, Pool prices should have been reflecting short-term avoidable costs.

The two generators are able to set system marginal prices for 90% of the time, even though they account for only 60% of generation, compared to the 78% of market share they had at vesting.

Energy intensive users, suffering from real price increases, are particularly aggrieved. They are told this was inevitable as the special subsidies they enjoyed before privatisation were phased out. But in reality it is lack of real competition which has allowed price convergence. Larger base-load users, with steady load factors, have not been able to use their purchasing muscle to obtain supplies nearer costs of production. They are paying too large a proportion of the cost of meeting peak demand, for which they are not responsible.

The flawed structure is aggravated because the duopoly still dominates the market. Although Nuclear Electric contributes @ 25% to supply, it is constrained by its Treasury shareholder from competing. Its remit is to maximise profit, and although now granted a second tier license, it is obliged to play as a market follower rather than a market setter. The 10% nuclear levy, paid by all electricity users, adds to the cost problems and helps to distort the market.

Nor is there much evidence that the new so-called independent gas-fired plants are adding to competition. Most are ventures with RECs, with sales guaranteed on longterm contracts and costs passed on to tariff customers. Little of the new CCGT capacity is required to sell into the market.

The only real competition appears to be evolving from industrial combined heat and power. Investment in cogeneration is going ahead. Government has removed restrictions and commercial viability has been enhanced. Exports of surplus power from CHP can compete well and may increasingly do so.

# Towards a competitive market

Users accept that a transition period was an inevitable part of the privatisation arrangement. The scene is indeed changing, with stronger signals that a real competitive market may emerge.

The Regulator's recent deal with the generators should be an important move forward. A divestment of 6 GW of capacity has been agreed, as an alternative to a referral to the MMC.

Whether or not this breaks the stranglehold over the marginal price, depends upon who takes over the power plants. A two-year agreed pricing cap for larger users, while generation is restructured, is welcomed as temporary relief.

The new gas-fired power plants will also face the colder winds of competition in 1988, when the franchise market is opened up. RECs will lose market share unless their inhouse contracted power from CCGT is competitive. By then, if not before, we anticipate the privatisation of Nuclear Electric and Scottish Nuclear. Creative accounting will be required to make balance sheets presentable. The scene would be set for nuclear to become a genuine player in the competitive market.

Before then, users should see some benefit from coal privatisation. Costs will come down further, to world prices, and in a competitive generation market, the full benefits could be expected to pass through Pool prices and contracts.

Last, but by no means least, pressure is building up on reforms to the Pool. National Grid's costs are far too high. Uplift charges need curbing into a cost-reflective pricing regime.

Original errors in structure and operation

are being corrected. But the transition has been unnecessarily painful. Proper consultation by politicians with users at the outset of our brave experiment could have avoided many problems. Consumers have had to fight their way into the debate and effect changes. Nor has it been fair to the Regulator or managements and shareholders of the supply companies, to start with a flawed structure, making constant moving of the goal posts inevitable.

Optimists have sound reasons to believe this radical privatisation will come right in the end, even if, on present evidence, the verdict remains open.

This is the sort of scenario Government could and should have provided, if only there had been some lateral thinking on a strategy best able to achieve its declared objectives. It would have gone a long way further to the creation of genuine competitive energy markets — where the lowest cost electricity sells and the rest gets left on the shelf.

We could find many other examples of the Government's neglect to think through a rational policy. What not use the fiscal carrot and stick to promote energy efficiency, as we have done with unleaded petrol? If CHP can make such an enormous contribution to reducing energy consumption and pollution, why are we so slow to reward it — as renewables are — for doing so?

Why are we only talking about rewarding suppliers for selling less through the regulatory regime, by investing in energy efficiency for their customers?

If clean-coal burning technologies, developed here, are being commercialised abroad, why are they not given higher priority in Government's energy R&D budget? Why no policy to tackle rising consumption and pollution in the transport sector? Because the Transport Department is not concerned with energy efficiency, and the Energy Minister in the DTI has no jurisdiction over transport policy!

We must ask, does all this really matter? We seem to muddle on, and is it fair to single out policy failures in energy, when we could apply a critical eye over most other sectors of Government? — education, social welfare, law and order, economic management.

Surely it does. Energy provision represents a large sector of GDP. Our standard of living and our competitiveness depend upon its efficient availability and use. Indeed our continues survival as a species may be determined by our ability to produce and use it more cleanly and less wastefully.

Does it not also matter that, although endowed with more abundant indigenous energy than most of our industrial competitors, we have failed to advantage our economy? Without a strategic 'UK plc corporate plan', are we not risking our longer term future by applying primarily a short-term,

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market-driven policy? Will this not make us too dependent on imported energy — coal and gas — and imported technology, such as renewables, nuclear, clean-coal technology and innovative R&D?

Unfortunately these considerations are not the most sexy on the political agenda — yet. Government has been able to get away with its, at best, neglect and, at worst, mismanagement of energy policy, subjected to only some disparate sniping and criticism. 'Divide and rule' is chapter one of the politicians guide to survival.

Those, like the Institute, who understand

what has gone wrong and have constructive contributions to make, have a responsibility to play a more vocal role in what will become an increasingly important national debate. Otherwise we may all become losers.

# **OIL & GAS INDUSTRY**

WORKING in the oil industry, one can become blase about work that is done to get oil out of the ground: about the whole process of exploration, appraisal, and then the lifting and transportation of oil. With a multitude of platforms and fields, daily producing oil as a matter of course, the business can seem very routine, the reality very flat. It can take the completion of a technically challenging project to make us look again at how different, how exciting and how demanding the oil business can be. In the North Sea, almost unimaginable feats of engineering complexity are achieved daily. And even though the oil industry has been active offshore for a good while now, the scale of achievement has not diminished. Technology moves apace, making possible the previously impossible, feasible the unfeasible, profitable the unprofitable but, unfortunately, not easy the mind-bogglingly difficult.

The advances made in North Sea changes are not as a rule of the *Eureka!* variety — though undoubtedly inspiration has played its part among the advances made. They tend to be steady, thoroughly checked and rechecked incremental changes that have pushed the juggernaut of technology to a point where the average user of the industry's products has no idea of the tasks undertaken on their behalf.

There is still a common perception of the

# Strathspey buried treasure

by Mark Crompton\*

Mark Crompton's article tells the story of how a Texaco team developed the UK's most sophisticated subsea operation. Twenty years after its first discovery, Strathspey oil flows.

oil industry drilling holes in the ground and pumping money straight into the bank. If the colossal investment and the length of view taken were understood, that perception would be very different.

A good example of the size of investment and of the steadiness of nerve the North Sea demands, is Texaco's Strathspey development which saw first oil at the end of last year. Discovered in 1972, it has taken until now for technology to get to the point where production was economically viable. And still, that technological ability was only just there. This is a development right on the leading edge of oil-producing technology.

In the early days of the Strathspey project, the tasks were those of risk assessment and analysis of economic viability. These would set the parameters for the rest of the project. It was clear that the field would not support the costs involved with a conventional production platform. The options appeared to be either a floating production platform or a subsea manifold.

After careful study of the initial outlays, operating and maintenance costs, safety and environmental factors, technical risk, and the ever present question of what is possible, the consensus developed that the subsea option was technically challenging, but had the most overall appeal. The experience gained with Highlander and Petronella, both subsea operations tied back to Texaco's own Tartan platform, gave a solid knowledge base from which to work, although Highlander and Petronella were much smaller scale projects.

In late 1990 the partners agreed: lower initial costs, good field life economics and the availability of capacity through the nearby Ninian Central platform all pointed to subsea development.

The field itself offered many complex challenges to the Strathspey team. The Strathspey field is located in UK North Sea block 3/4a, approximately 110 miles east of Shetland in a water depth of 450 feet. It comprises two reservoirs, Brent and Statfjord, one lying above the other, 10 000 feet below the surface of the sea. But the challenge was worth it with 89 million barrels of oil and 330 billion cubic feet of gas to be recovered.

Strathspey is unique in that it contains an oil reservoir and a gas/gas condensate reservoir. The Brent group sandstones are Middle Jurassic in age and contain a volatile oil and has a shut-in well head pressure of 3 500 psi, while the Statfjord formation sandstone (with a pressure of 5 500 psi) is Triassic to Lower Jurassic in age and contain rich gas/condensate underlain by a volatile oil rim. The

<sup>\*</sup>Texaco Limited

depth to the top of the Brent reservoir is 9 100 ft and to the top of the Statfjord is 9 800 ft.

A project team approach was adopted in which skills including petroleum engineering, facilities engineering, drilling, business, commercial and legal expertise were fully integrated. This kind of teamwork encouraged an unusual level of cooperation between the backroom team, working on the law and the numbers, and those tasked with making the project actually work.

The team approach to the project was mirrored by the formation of partnerships between companies. Ownership, and the high costs of the project, also demanded an alliance of partners - Texaco with 67%, Esso and Shell with 13.25% each and Oryx with 6.5%. In addition, the position of the field and the fact that it holds oil and gas in roughly equal quantities meant involving the facilities of more participants than usual: Chevron - for the use of its Ninian Central and Ninian South platforms; BP - for the use of its Sullom Voe terminal; and Shell for the use of its Brent A platform and FLAGS pipeline. These agreements between participating companies set an important precedent for the exploration of less accessible oil and gas fields.

The subsea production system lies nine miles from the Ninian Central platform and the ties between Ninian and Strathspey are complex, involving production and test flowlines and hydraulic and electrical connections to operate the subsea valves. After processing on Ninian Central an existing 36 inch pipeline carries oil from the platform to BP's Sullom Voe terminal. Gas is exported by a new 16 inch gas line which carries it 26 km to the Brent A platform and on to St Fergus on the Scottish mainland.

The Brent reservoir will be produced from eight wells with pressure support from three water injection wells. Six of the production wells will be at a central location, and two will be satellites separately connected to the subsea manifold. The Statfjord reservoir will be produced from six wells also at the central location. Two of these Statfjord wells are being drilled using horizontal technology to drain the oil rim of the reservoir. The horizontal wells are planned to penetrate the most productive zones of the reservoir with a horizontal section of up to 2 500 ft in the 85 ft thick oil rim. Injection water will be supplied from the Ninian Southern platform with rates expected to peak at 88 000 barrels per day.

Subsea manifolds themselves are not new, but they were normally used for smaller marginal fields. For volumes on this scale, combined with the complexities of the remote management of the large number of wells involved, it was new territory.

The Strathspey manifold is the physical



Lowering the manifold required the best seamanship and computerised positioning equipment.

hub of the system, serving as the collection point for 17 wells, two of which are over a mile away from it.

From the original concept developed by Texaco engineers, Brown Root Vickers designed the largely steel structure, which was then built by Highland Fabricators at Nigg Bay, Scotland. The fabrication, begun in April 1992, was completed a mere twelve months later.

The purpose of a manifold is to remove the need for each well to have a separate production pipeline to the processing platform. It also performs other functions, such as routing pressurised water for the injection wells and dosing production wells with anti-corrosive chemicals.

The pipework had to be laid down before the manifold could be put in place. The network of pipes carry oil, gas, injection water, and electric and hydraulic umbilicals which connect control equipment on Ninian Central with the valves and instruments installed on the subsea manifold. Fluids from each reservoir are not commingled as they are under different pressure regimes. Water injection service is supplied to the manifold by way of a dedicated pipeline from Chevron's Ninian Southern platform. The manifold is designed to accommodate all the equipment and valving necessary to control the wells and allow continued production during maintenance



and other routine operations.

There is a total of 87 miles of pipework for the project: the manifold and Ninian Central platform are linked by six pipelines which include separate production and test lines for each reservoir.

Steel pipes were supplied in 10 metre lengths which were then welded together to form one kilometre stalks. After joining a number of stalks together at an onshore yard the pipe was wound onto huge reel about 40 feet across, on board the pipe-laying vessel *Stena Apache*. This was the first time this method had been used on a 16 inch pipeline in the North Sea. It took 13 trips to the Strathspey and Ninian fields to lay all the flowlines, which had to be laid very precisely into trenches laid to retain heat in the pipes. Without this trenching there is a danger of hydrate or wax formation which can cause blockages.

Eventually, it was time for the manifold to be put in place. The manifold is 15 m long by 17 m wide and 10 m high; longer than three double decker buses, and weighs 950 tonnes; more than three jumbo jets. There was a narrow window of opportunity between the completion of the pipe-laying and the predicted onset of the winter gales. The lowering of the manifold required still seas.

Said quickly, 'the lowering of the manifold', sounds very simple. But to lower an object of that size and weight from a ship moving with the seas, to a specified point, 450 feet deep, and to an accuracy of under a single metre is by no means simple and required the best seamanship and computerised positioning equipment.

Once it was in exactly the right position which it was, first time — it was anchored in place by driving piles through prepared bores in the structure down into the seabed using hydraulic hammers.

The drilling programme for the development wells began in 1991 and is likely to continue into 1996. A total of 15 subsea wells will ultimately be arranged in a small cluster around a central manifold, with each subsea tree located on the wellhead connected back to the manifold via short flexible pipes and control umbilicals. Each subsea tree is a standard five inch by two inch 10 000 psi design which includes protection against snagging and impact loads resulting from any fishing equipment. The trees are designed for installation and retrieval without the aid of divers.

The Subsea Production System consists of a central manifold together with five other ancilliary structures. The subsea system is controlled from Chevron's Ninian Central platform, which is also the location where fluids produced from the reservoir are processed. The two satellite wells are grouped within a separate protection structure and linked back to the manifold via dedicated pipelines and control umbilical. On the Ninian platform, extensive process plant modifications were necessary to accommodate Strathspey production. Flowlines arriving at Ninian Central pass through conduits known as risers. Processing equipment located topside on the platform separates the oil, gas and water from the Strathspey wells and the products are metered and exported.

Throughout the project, two overriding requirements — safety and protection of the marine environment — have required consideration as an integral part of each process. All Strathspey's subsea pipes and valves have been rigorously tested, as have the emergency shutdown valves located below the Ninian Central platform.

The manifold itself is designed to prevent snagging of fishing nets, and the trenches for the pipes also help lessen the environmental impact, especially when the field is abandoned after the expected field life of ten years.

Now Strathspey is operational, early indicators are that field performance will be better than expected. But the lead time required for the project, the capital investment required, and the investment in, and dependence upon, the latest and the best in subsea technology, mean that success has been hard won. Few industries can be required to take a longer view than the oil industry, and Texaco's Strathspey project is a working example of that philosophy.



# Removal of offshore installations

THE TERM 'platform abandonment' is misleading: one of the few options rarely open to the operator of offshore installations is to abandon them when they have served their purpose.

It is a problem new to operators on the UK Continental Shelf (UKCS), as the area of development is a relatively new one — in oil industry terms. But it is one of increasing importance: what do we do with these massive structures once their useful life is over?

Back in May 1988, the International Maritime Organisation (IMO) published guidelines and standards in order to establish some authoritative documentation on the subject. Entitled *Guidelines and standards* for the removal of offshore installations and structures on the Continental Shelf and in the exclusive economic zone, the eight-page document covers the general removal requirement, as well as setting standards and issuing guidelines.

In Article 60 of the United Nations Convention on the Law of the Sea, 1982, states that installations or structures which are disused and/or abandoned should be removed. This is to ensure safety of navigation, and takes into account accepted established international standards. This removal must also have due regard to fishing and protection of the marine environment, as well as the rights and duties of other States.

As a competent organisation to deal with the subject, the IMO's Maritime Safety Committee decided in January 1986 to develop guidelines and standards, in line with Article 60. The sub-committee on Safety of Navigation prepared a preliminary draft text from the navigational safety point of view; and the Marine Environment Protection Committee from the environmental point and view. The draft was subsequently approved and finalised by the sub-committee on Safety of Navigation.

In April 1988 the revised draft was finally amended and approved, and published the following month. The guidelines were then transmitted to FAO, UNEP and the contracting parties to the London Dumping Convention for comments. In autumn 1989 by Johanna Fender

'Platform abandonment' as it is often, rather inaccurately called, is a subject which will be become increasingly important to UK-based oil and gas exploration companies, as the early North Sea fields start to run dry. The following article is based on International Maritime Organisation (IMO) guidelines published in 1988.

they were submitted for adoption as an Assembly resolution.

That Annex reads as follows:

#### 1 General removal requirement

1.1 Abandoned or disused offshore installations or structures on any continental shelf or in any exclusive economic zone are required to be removed, except where non-removal or partial removal is consistent with the following guidelines and standards.

1.2 The coastal State has jurisdiction over the installation or structure should ensure that it is removed in whole or in part in conformity with these guidelines and standards once it is no longer serving the primary purpose for which it was originally designed and installed or a subsequent new use or no other reasonable justification cited in these guidelines and standards exists for allowing the installation or structure or parts thereof to remain on the sea bed. Such removal should be performed as soon as reasonably practicable after abandonment or permanent disuse of such installation or structure.

1.3 Nothing in these guidelines and standards is intended to preclude a coastal State from imposing more stringent removal requirements for existing or future installations or structures on its continental shelf or in its exclusive economic zone.

#### 2 Guidelines

2.1 The decision to allow an offshore installation, structure, or parts thereof to remain on the sea bed should include a case-by-case evaluation, by the coastal State with jurisdiction over the installation or structure, of the following matters:

2.1.1 any potential effect on the safety of surface or subsurface navigation, or of other uses of the sea;

2.1.2 the rate of deterioration of the material and its present and possible future effect on the marine environment;

2.1.3 the potential effect on the marine environment, including living resources;

2.1.4 the risk that the material will shift from its position at some future time;

2.1.5 the costs, technical feasibility, and risks of injury to personnel associated with removal of the installation or structure; and

2.1.6 the determination of a new use or other reasonable justification for allowing the installation or structure or parts thereof to remain on the sea bed.

2.2 The determination of any potential effect on safety of surface or subsurface navigation or of other uses of the sea should be based on the number, type and draught of vessels expected to transit the area in the foreseeable future; the cargoes being carried in the area; the tide, current, general hydrographic conditions and potentially extreme climatic conditions: the proximity of designated or customary sea lanes and port access routes; the aids to navigation in the vicinity; the location of commercial fishing areas; the width of the available navigable fairway; and whether the area is an approach to or in straits used for international navigation or routes used for international navigation through archipelagic waters.

2.3 The determination of any potential effect on the marine environment should be based upon scientific evidence taking

into account the effect on water quality; geologic and hydrographic characteristics; the presence of endangered or threatened species; existing habitat types; local fishery resources; the potential for pollution or contamination of the site by residual products from or deterioration of the offshore installation or structure.

2.4 The process for allowing an offshore installation or structure or parts thereof to remain on the sea bed should also include the following actions by the coastal State with jurisdiction over the installation or structure: specific official authorisation identifying the conditions under which an installation or structure or parts thereof will be allowed to remain on the sea bed; a specific plan, adopted by the coastal State, to monitor the accumulation and deterioration of material left on the sea bed to ensure there is no subsequent adverse impact on navigation, other uses of the sea or marine environment; advance notice to mariners as to the specific position, dimensions, surveyed depth and markings of any installations or structures not entirely removed from the sea bed; and advance notice to appropriate hydrographic services to allow for timely revision of nautical charts.

#### **3 Standards**

The following standards should be taken into account when a decision is made regarding the removal of an offshore installation or structure.

3.1 All abandoned or disused installations or structures in less than 75 metres of water and weighing less than 4 000 tonnes in air, excluding the deck and superstructure, should be entirely removed.

3.2 All abandoned or disused installations or structures emplaced on the sea bed on or after 1 January 1998, standing in less than 100 metres of water and weighing less than 4 000 tonnes in air, excluding the deck and superstructure, should be entirely removed.

3.3 Removal should be performed in such a way as to cause no significant adverse effects upon navigation or the marine environment. Installations should continue to be marked in accordance with IALA recommendations prior to the completion of any partial or complete removal that may be required. Details of the position and dimensions of any installations remaining after the removal operations should be promptly passed to the relevant national authorities and to one of the World Charting Hydrographic Authorities. The means of removal or partial removal should not cause a significant adverse effect on living resources of the marine environment, especially threatened and endangered species.

#### 3.4 Where:

3.4.1 an existing installation or structure, including one referred to in paragraphs 3.1 or 3.2, or a part thereof, will serve a new use if permitted to remain wholly or partially in place on the sea bed (such as enhancement of a living resource); or

3.4.2 an existing installation or structure, other than one referred to in paragraphs 3.1 and 3.2, or part thereof, can be left there without causing unjustifiable interference with other users of the sea; the coastal State may determine that the installation or structure may be left wholly or partially in place.

3.5 Notwithstanding the requirements of paragraphs 3.1 and 3.2 where entire removal is not technically feasible or would involve extreme cost, or an unacceptable risk to personnel or the marine environment, the coastal State may determine that it need not be entirely removed.

3.6 Any abandoned or disused installation or structure or part thereof which projects above the surface of the sea should be adequately maintained to prevent structural failure. In cases of partial removal referred to in paragraphs 3.4.2 or 3.5, an unobscured water column sufficient to ensure safety of navigation, but not less than 55 metres, should be provided above any partially removed installation or structure which does not project above the surface of the sea.

3.7 Installations or structures which no longer serve the primary purpose for which they were originally designed or installed and are located in approaches to or in straits used for international navigation or routes used for international navigation through archipelagic waters, in customary deep-draught sea lanes, or in or immediately adjacent to routing systems which have been adopted by the IMO should be entirely removed and should not be subject to any exceptions.

3.8 The coastal State should ensure that the position, surveyed depth and dimen-

sions of material from any installation or structure which has not been entirely removed from the sea bed are indicated on nautical charts and that any remains are, where necessary, properly marked with aids to navigation. The coastal State should also ensure that advance notice of at least 120 days is issued to advise mariners and appropriate hydrographic services of the change in the status of the installation or structure.

3.9 Prior to giving consent to the partial removal of any installation of structure, the coastal State should satisfy itself that any remaining materials will remain on location on the sea bed and not move under the influence of the waves, tides, currents, storms or other foreseeable natural causes so as to cause a hazard to navigation.

3.10 The coastal State should identify the party responsible for maintaining the aids to navigation, if deemed necessary to mark the position of any obstruction to navigation, and for monitoring the condition of remaining material. The coastal State should also ensure that the responsible party conducts periodic monitoring, as necessary, to ensure continued compliance with these guidelines and standards.

3.11 The coastal State should ensure that legal title to installations and structures which have not been entirely removed from the sea bed is unambiguous and that responsibility for maintenance and the financial ability to assume liability for future damages are clearly established.

3.12 Where living resources can be enhanced by the placement on the sea bed of material from removed installations or structures (eg, to create an artificial reef), such material should be located well away from customary traffic lanes, taking into account these guidelines and standards and other relevant standards for the maintenance of maritime safety.

3.13 On or after 1 January 1998, no installations or structure should be placed on any continental shelf or in any exclusive economic zone unless the design and construction of the installation or structure is such that entire removal upon abandonment or permanent disuse would be feasible.

3.14 Unless otherwise stated, these standards should be applied to existing as well as future installations or structures.

# **Doing business in the CIS**

## an independent oil company's perspective

by William H Kaufman and Kurt D Reisser

CONDUCTING business in the former Soviet Union represents both unique challenges and opportunities for the western oil industry. The lure of enormous potential, hidden for decades behind the iron curtain, has attracted oilmen worldwide to these new republics. Unfortunately, many companies' efforts have derailed in the turmoil that has marked the political and economic transition period of the 'post-Soviet' era. Despite enormous difficulties, the situation is not entirely bleak. A growing number of western oil and gas ventures appear to hold great promise for success,

Earlier this summer, Oryx Energy signed two oil and gas agreements with the Republic of Kazakhstan: a joint venture to develop the Arman field, and a production-sharing agreement to explore a large block in western Kazakhstan.

and we at Oryx Energy Company believe that investment in carefully selected countries of the commonwealth of independent states (CIS) makes good business sense.

For the past two years, Oryx Energy

has worked aggressively to establish exploration and production opportunities in the CIS. The Republic of Kazakhstan recently approved two Oryx Energy projects: a joint venture to develop Arman Field and a production-sharing contract to explore and develop the approximately 3 million acre Mertvyi Kultuk block, both located in the Mangystau region of western Kazakhstan. The establishment of these projects resulted from a great deal of planning, commitment and hard work. This article contains perspectives gained by Oryx Energy, which we believe apply to the CIS.

Without extensive experience in dealing with the economic climate of the former

The authors



William H Kaufman

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Mr Kaufman received his degree in geology from the University of Toledo in 1969, and a masters in geology from the University of New Mexico in 1971. He is a member of the Advisory Board of the Council of The Americas, the Dallas Council on World Affairs, the American Association of Petroleum Geologists and the Association of International Petroleum Negotiators.

Kurt D Reisser is chief geologist, Kazakhstan Project, for Oryx Energy Company. He joined Sun Exploration and Production Company in 1981 in Denver and worked as a geology manager for several US regions before joining the New Areas group in 1991. He began his career with Exxon in 1976 as a production geologist in New Orleans and later worked for Getty in Denver as an exploration geologist.

Mr Reisser has a degree in geology from the University of Colorado, and



Kurt Reiser

received his masters in geology from the University of Nebraska in 1976.

He is member of the American Association of Petroleum Geologists, as well as an AAPG-certified petroleum geologist, and a member of the Dallas Geological Society, the Houston Geological Society and the Rocky Mountain Association of Geologists.



Bridging the gap between two cultures: employees of Zharkyn, a Kazakhstan joint stock company, celebrate the Arman joint venture with Oryx Energy.

Soviet Union, it is difficult to imagine the vast gulf that separates their economic culture from that of the west. Doing one's homework is essential, but it is even more important to visit areas that you are considering for investment.

When visiting areas that are often critically short of supplies as well as creature comforts, it may be tempting to assume that because of limited resources their scientists and technicians may be less capable than their western counterparts. This is a dangerous and erroneous assumption. The Soviet Union was the world's largest producer of oil and gas. The skills and education of its petroleum industry's technical staff often equal or exceed those in the west. In areas where they chose to explore and develop, they did a remarkably good job. In other areas, Oryx Energy found opportunities that, due to lack of capital and technology, were insufficiently explored and/or developed. These situations offered both near term production possibilities in conjunction with exploration potential that met our expectations and goals.

A clear process does not exist for establishing a venture in the CIS. What may have constituted the procedure last month may no longer apply. Navigating the maze of bureaucracies is difficult and cumbersome. Ministerial relationships are often unclear, both because they were originally designed

for a command economy with central control (which may now be weakened or non-existent) and they are often in a transitional state. Money is not a sole motivator, as many groups struggle to maintain employment for their workforce and improve the social conditions in their regions. A western company is likely to get mixed signals from different bureaucrats: some welcome with open arms, some want money, some want you to go away, while others recognise the importance of international alliances for the sharing of technology and attracting capital. Despite the difficulties involved, it is critical to establish on-going business relationships with local and federal government officials. This requires day-to-day contact and a willingness to learn as well as teach.

Identify and ally with individuals who are insiders and can assist in navigating the complex bureaucratic structures and introduce you to officials and ministries. Persons who have participated in training programmes in the west and thus possess some knowledge of western economic practices can effectively 'bridge the gap' between the two cultures. These are usually highly-respected officials who have been sent abroad for training. Oryx Energy supports the training of selected individuals in the US, and has enjoyed the benefit of their insight and advice in our efforts in the CIS. Though seeking foreign investment and western technologies, the CIS is not a big fire sale. Oryx Energy has examined deals assembled by speculators that are 'nearly approved' or 'just need some capital' to unlock vast reserves. If it looks too good to be true, it probably is. We believe the best philosophy is to establish realistic internal goals, and to develop long-term relationships with potential CIS partners with whom those goals can be reasonably met. In return, the western investor needs to be able to address the capital, business and technical needs of its partner if a good marriage is to be established.

Oryx Energy's international corporate goal is to add high quality reserves predominantly through exploration with occasional participation in development projects when appropriate. Within the CIS, a field development project can be attractive as it allows a western company to establish quickly a working relationship with a producing organisation and to test the feasibility of oil export and currency conversion.

Oryx Energy concentrated its efforts initially on several key basins with large undiscovered reserve potential and existing infrastructure. The initial high-grading ensured that we had reasonable expectations of discovering fields that would significantly enhance our corporate reserve base. We

excluded extremely remote areas without any existing pipeline infrastructure, as these would require significant investment and delay of production for any discovered reserves. When considering development opportunities, we preferred delineated fields which were undeveloped, as this represented an optimum situation to introduce new technology and modern equipment.

The Oryx Energy Mertvyi Kultuk exploration block is located in an extensive marshland, adjacent to the rising Caspian Sea. Here the difficult environment has hindered exploration and development efforts, and it met our criteria for unexplored potential. Local government officials expressed concern that oil and gas exploration and development be environmentally sound, and they desired environmentally friendly technology. We believe this exploration block represents a 'good fit', where our technological expertise will make a valuable contribution to our Kazakhstan partners.

Risk is unavoidable in petroleum exploration, but the former Soviet Union presents a different variety and mix of risks than many other environments. Quickly evolving new governments introduce political risk. In addition to this, civil unrest and organised crime represent peril. Petroleum and tax legislation continue to evolve in the CIS. Oil and gas laws are being rewritten to adjust to new political and economic realities, but much work remains. Unrealistically high taxes levied by many of the new republics of the CIS sometimes preclude any possibility of profit on the part of a western investor. Difficulties associated with transportation of



Old well at Arman, overlooking the Caspian Sea.



The area under exploration and development by Oryx Energy Company in the CIS country, Kazakhstan.

crude utilising existing pipeline infrastructure remain. Geologic and engineering risks compound the situation.

Oryx Energy was attracted to Kazakhstan because of its resource potential, and also because its government encourages western investment and provides clear authority over oil and gas licensing procedures. We were also encouraged because its fiscal regime provides a reasonable investment environment and an acceptable profit margin. From our standpoint, the Kazakhstan environment appeared to be one of the most comfortable and lowest risk in the CIS.

Western businesses primarily deal with one another on a corporate rather than a personal level. In the CIS we found personal relationships to be most important. Since CIS officials usually lack business experience outside the former Soviet Union, they do not recognise many of the large western corporations by their corporate identity. Rather, they more readily recognise and associate corporate identity with the representatives who visit the CIS. This presents an opportunity for a smaller company to 'level the playing field', as the early established personal relationships are those by which a corporation is likely to be judged. For these reasons, care must be exercised in establishing and building relationships.

To nurture and solidify personal relationships, Oryx Energy has tried to be consistent with the team of representatives that it sends to CIS countries. We hope to build a corporate identity on the basis of trust and mutual respect, initiated by acquaintance and friendship.

In addition to establishing relationships

with CIS officials, it is important to pay attention to cultural sensitives. These new republics contain mixtures of ethnic groups, each with its values and social mores. In Kazakhstan there is nearly equal ethnic mix of Russians and Kazakhs, and it is important to be aware of the cultural and political sensitives of each group.

Officials in CIS republics are often disillusioned with visiting western companies, who briefly look and then go home. In addition to seeking capital and access to technology, these republics look for western partners interested in long-term relationships.

Oryx Energy was one of the first oil companies to open a representative office in Almaty, Kazakhstan's capital. This office opened in January 1993, and our continuous presence has allowed us to understand better how to conduct business, negotiate, and monitor the political environment. By opening this office at an early stage, we also demonstrated our commitment to investment in Kazahkstan and increased our visibility in the new republic.

Data access is an initial dilemma, and a source of ongoing frustration for oil companies attempting to evaluate areas in the CIS. Data, like oil, is where you find it. It is often scattered among various operating groups, ministries and institutes. To complicate matters, many of the research institutes that supported oil and gas exploration and development are now located in different republics. The ownership of information outside a CIS republic's border is often a bone of contention. Official prices for data are often high by international standards, and the purchase of large amounts of data merely to evaluate



the potential of an area is often beyond the reach of a cost-conscious oil company.

Kazakhstan governmental agencies were generally quite cooperative with respect to showing our visiting technical staff data. Though we were not allowed to copy the information, we could access sufficient data to conduct our regional investigations to the stage of selecting areas and writing protocols. We then negotiated for technical data simultaneously with our contract areas. Throughout the investigation and negotiation process, Oryx Energy made it clear that we would only purchase data from approved government entities. By adhering to governmental guidelines and establishing a good working relationship with governmental agencies, we obtained a high level of cooperation in the process of locating and copying purchased data.

Western petroleum industry's significant technological breakthroughs are well known and widely applied throughout the CIS. Applications such as horizontal drilling and more advanced seismic processing have not been widely utilised, but these are not 'magic bullets' that will suddenly rejuvenate old fields or find giant structures. We approached the CIS as an exploration and production environment where technology would enhance rather than dramatically change the industry. Most lacking is basic equipment and capital.

For most citizens of the former Soviet Union, the tumultuous changes of the past few years have turned their world upside down. Western oil companies obviously would like economic issues to be settled right away so that deals can be signed and they can begin producing oil. But needed oil and gas legislation may have to take a back seat to electing a new representative assembly, writing a new constitution, solving defense issues and privatisation. Considering the magnitude of the issues involved, a great deal of progress has been made, even if not equally in all republics, or at the pace that many western businessmen would prefer.

Patience is a necessary virtue when dealing with the CIS environment. Many large projects such as Tengiz and Sakhalin have taken years of negotiation — but even now many issues remain to be resolved. Our CIS programme began in 1992, and negotiations for our Kazakhstan projects lasted well over a year, a relatively brisk pace for that part of the world.

Despite those who dwell upon the problems of investment in the CIS, the glass can validly be viewed as half-full rather than half-empty. Oryx Energy remains optimistic that the Kazakhstan agreements recently signed will be the beginning of a long and profitable business association in the CIS.

# CONFERENCE REPORT

THE UK is way behind many other countries in the introduction of incinerators to meet strict EC standards for energy from waste schemes using heat recovery.

This pertinent fact was recognised by many of the speakers at Waste to Energy '94 held earlier this year at the Winchester Guildhall. Following a report four years ago by the National Society for Clean Air Can we afford to waste municipal waste? only one new unit, SELCHP in London, is currently operating. Others are planned, however, but are currently still at the planning stage, or in the process of bringing their combustion and gas cleaning systems into line with EC requirements.

The two-day conference was organised by the Energy Technology Support Unit (ETSU) on behalf of the Department for Trade and Industry (DTI), with sponsorship from the World Resource Foundation (formerly the Warmer Campaign). In his opening remarks Dr K A Brown of ETSU contrasted the UK's record on waste utilisation with that of other European countries. Incineration with waste heat recovery being the favoured type of plant.

Dr Brown also recognised the need for well-conducted public consultation. Two major projects: in Portsmouth and in Belvedere in Kent, have recently been turned down at public enquiries. A third project in Cleveland has been relocated at Billingham.

# Waste: the burning issue

A conference report by Byrom Lees MSc SFInstE

American speaker, W C Mack, described the scene in America, where considerably more municipal solid waste (msw) is incinerated with heat recovery than happens in the UK. This is certainly due to high landfill tip fees - up to \$79 per ton in some States much higher than the gate fees charged in the UK. He pointed out the numerous advantages of incineration over landfill: ground water pollution, air emissions and their control; conservation of fuel, and last but not least, the aesthetic advantages. The contribution of landfill gas to global warming is also a subject which has received disportionately low consideration. Methane is a far more potent greenhouse gas than carbon dioxide, a fact not often given emphasis in the UK.

The consensus of the conference seemed to be for a tax of at least £20 per tonne, if we are to encourage municipal waste incineration. The residue from the incineration process, if landfilled, does not generate any methane, and should therefore not be subject to the same high rate of tax.

L Van Egmond of The Netherlands described the 10-year programme currently being implemented in Holland. In 1990 a plan was drawn up to decrease the amount of msw going to landfill. The aim is to incinerate 5.1 - 7.2 tonnes of waste per annum, with a maximum of 6 million tonnes (mt) of landfill capacity. From the late 1990s, burnable waste will be no longer go to landfill, which will be restricted to 3.6-5.7 mt per annum.

Modern incinerator designs are available now from several European countries, so there is no technical reason for the hold up. But a hold up there does appear to be. Only too often local authorities ignore a problem, until they can ignore it no longer. Hampshire was an example used to illustrate the problems associated with such procrastination. Nearly two-thirds of Hampshire's msw is landfilled, and the four old incinerators currently burning waste are due to close in 1996, when they will fall below EC standards. A new plant planned at Portsmouth failed to obtain permission. Hampshire County Council are currently working on a plan to modernise waste disposal services, whilst simultaneously satisfying local residents. The plan aims to meet the government target of 25% recycling. At least 460 000 tonnes per year will still have to be disposed of by 2001, and modern incinerator plant appears to be the best route forward.

# POWER OF WALES

OF ALL the regions of the United Kingdom, Wales has the greatest variety of energy sources and resources: from renewables to nuclear, with many others in between. As a major new tourist initiative, Mid Wales Tourism held the official launch of the Energy Trail at Ffestiniog power station in July of this year, presided over by local MP, Elfyn Llwyd.

The Energy Trail covers an area from Anglesey in the north, where Wylfa nuclear power station and the Rhyd-y-Groes windfarm are situated, to Cwm Rheidol power station, near Aberystwyth in Mid Wales, the southerly-most point on the trail. Far too extensive to cover in a single day - a week might be more realistic -the trail takes in a total of three windfarms; two nuclear reactors (one in the first stage of decommissioning); two pumped storage stations; one hydro electric plant, and several assorted windmills, treadmills and waterwheels. Although what will probably turn out to be the jewel in the crown for hikers on the Energy Trail is the Centre for Alternative Technology at Machynlleth, in the Dyfi Valley.

Beginning in the north, the Rhyd-Y-Groes windfarm has 24 turbines, and came on line in November 1992, since when it has contributed around a quarter of Anglesey's domestic electricity. In contrast, Nuclear Electric's Wylfa power station has an output of 900 MW — enough to power two cities the size of Liverpool. Wylfa was the last of the Magnox stations to be built in this country, and its site on Anglesey was chosen for a number of reasons. The level ground, with subsoil suitable to support the massive structure was one, as was the unlimited supply of cooling water from the sea; and of course an

# Hitting the energy trail

by Johanna Fender

The Institute of Energy has always agreed with, and when able to, supported, advances in energy education — with the establishment of CREATE, for example. It was therefore with enthusiasm that Energy World set off on The Energy Trail — an idea dreamt up by Mid Wales Tourism, to make the most of the wide variety of Welsh energy sources.

available workforce in the locality. The first of the station's two reactors came on stream in January 1971, closely followed in June by the second unit. The visitor centre, open daily from 9.30 am to 4.30 pm (except Christmas and New Year) has computer exhibits, and offers a guided tour of the station. If it all gets too much, you can wander the many nature trails surrounding the site.

Melin Llynon, also on Anglesey, is the only restored fully working traditional windmill in Wales. The miller himself will give visitors a guided tour, and larger parties, such as schools, are most welcome by appointment. The windmill is open to the public from 1 April to 30 September on Tuesday to Saturday (including Bank Holidays) from 11 am to 5 pm.

The last Energy Trail site on the Isle of Anglesey is the Beaumaris Gaol and Treadmill. Built in 1829, the gaol offers visitors a taste of the miseries of Victorian prison life. You can visit the punishment cell, the condemned man's cell and the gaol's unique treadmill — the only one still in its original position in the UK. The treadmill could be operated by up to six men, and was used to pump water to tanks on the roof of



Wylfa, on the Isle of Anglesey - the last Magnox power station built in the UK.

the prison. Walkman tours are available, and the gaol is open from 1 June to 30 September, Easter and at weekends in May.

Travelling south across the Menai Straits into Snowdonia, the first Energy Trail site is south of Bangor. The Welsh Slate Museum is in the old Dinorwig Quarry workshops, near Llanberis, beside Llyn Padarn. Much original machinery has been restored and is on display, including a 56 ft diameter waterwheel — the largest of its kind in the UK — in use until 1925 when it was replaced by the more efficient Pelton Wheel. Both can now be seen working.

From the Welsh Slate Museum its a very short journey to the Dinorwig pumped storage power station, and its audio-visual exhibition the Power of Wales, from where all tours start. Between 1976 and 1982 a remarkable feat was accomplished in a mountain near Llanberis: the heart of the mountain was tunnelled away, and the largest pumped storage power station in Europe was built inside. At a cost of £450 million, Dinorwig can supply enough power for several large cities for up to five hours, and in an emergency can provide 1320 MW of electricity within 12 seconds the fastest response of any pumped storage scheme in the world. A number of potential sites in North Wales were considered, but Dinorwig emerged as the best site because the high head from the top dam required only a small reservoir capacity for a given generating output. The existing lake meant little extra capacity would be required to form the lower reservoir, and only a short transmission connection was needed to connect the station to the national grid. Being in the heart of the Snowdonia National Park, it is important that the upper reservoir and short lengths of access road are the only surface features.

Marchlyn Mawr, an existing lake, has been enlarged to provide Dinorwig's upper reservoir. The water is retained by a 600 m long dam containing about 1.85 m cubic metres

# POWER OF WALES



Water from Marchlyn Mawr flows through hydraulic tunnels at the maximum rate of 420 cubic metres a second. Inlet tunnels three kilometres long, including a vertical shaft 557 metres deep and 10 metres in diameter, carry the water to the turbines.

Each of the six Francis reversible pumpturbines has a maximum capacity of 313 MW when the falling water drives them as turbine-generators. They each consume 285 MW when they operate as motor pumps powered by electricity from the national grid. Two of the six units are kept spinning in air, synchronised to the national grid, ready to provide an immediate reserve of electricity in the event of plant failure, or sudden peaks in demand. Electricity generated at 18 000 volts in the machine hall is conducted by aluminium bushbars to the transformer hall, where the voltage is stepped up to 400 000 volts. Two sets of underground cables carry the electricity 10 km to Pentir substation near Bangor where it is fed into the national grid.

Great care has been taken to protect this area of outstanding natural beauty. Local stone, much of it reclaimed from old quarry buildings, was used in the construction of the surface buildings. The new dam at Marchlyn Mawr and the embankments at Llyn Peris were built from local rock and landscaped with a selection of native grasses and heathers. Surveys were made within a radius of up to 8 km of the reservoirs to establish the 'zones of visual influence' and the landscaping was designed accordingly.

A short journey south will bring the intrepid Energy Trail follower to Dinorwig's sister station: Ffestiniog. Another pumped storage hydro plant, Ffestiniog's construction began in 1957, and was opened by the Queen in 1963. Both pumped storage hydro power stations are owned and operated by The National Grid Company.

A pleasant distraction from the energy theme is here in the form of the narrow gauge Ffestiniog railway. Now a tourist attraction, the railway was originally built to carry slate from the quarries and mines in Blaenau Ffestiniog to Porthmadog for shipment.

Following the trail south again, Nuclear Electric's Magnox power station, Trawsfynydd, gives the visitor the rare opportunity to see the decommissioning of a nuclear power station in action. Closed down in July last year, Trawsfynydd is currently in the first phase of decommissioning: removal of the fuel rods, which removes 99.9% of radioactivity from the site. There are several options for the next phase, which Nuclear Electric is considering in consultation with the local community. The first is known as 'early site clearance', and involves dismantling the plant and buildings into manageable size pieces which are removed and the site returned to its original state.

Option two: 'deferred site clearance' delays dismantling, allowing the radioactivity to decay naturally with time. Safestore structures would completely envelope the main buildings, until such time as the site can be cleared (the safestore structure is designed to last 135 years). This has the advantage of reducing radiation exposure to workers, and any potential release of radioactivity to the environment is less likely. Option two has the further advantage of being the cheapest route.

The third possibility under consideration is 'mounding', also called 'in-situ decommissioning'. The reactor blocks would be buried, leaving a visible mound, which in the case of Trawsfynydd could be achieved using local slate quarry waste, suitably landscaped. Trawsfynydd is only the second nuclear power plant to be decommissioned in the UK.

As with most of Nuclear Electric's sites, a free visitor centre is open from 9.30 pm to 4.30 pm, all year round, except Christmas and New Year.

Heading down into the Dyfi Valley, the Centre for Alternative Technology — CAT — probably holds the greatest interest for the visitor, and will be particularly popular with children. The seven-acre site is a wonderland of alternative, small-scale technologies, with a definite bias towards renewable sources of energy. On entry to the site, the visitor climbs aboard the water-powered cliff railway, which transports you up the hillside. Alternatively you may prefer 'leg-power': but be warned, the route is rough in places, and good walking shoes or wellington boots are advisable.

CAT's unique cliff railway can carry up to 15 people, and operates on the principle of 'water balancing'. Its stately progress around one metre per second — is controlled



The Centre for Alternative Technology's water-powered cliff railway. The seven-acre landscaped haven has a range of technological exhibits, including solar, water, wave and wind power.

# POWER OF WALES



The site at Machynlleth covers many aspects of renewable energy production and use. The low-energy self-build house, an example of which has been constructed on site, was designed by architect Walter Segal, and doesn't involve many of the traditional building skills such as bricklaving and plastering. Energy-saving features include: thick insulation of walls, roof and floor, and passive solar techniques - most of the glazing is on the south side, where a conservatory runs the full length of the house. Solar panels for water heating are incorporated into the roof. Electricity is provided by a small wind turbine. The Centre runs highly popular practical short courses on self-building techniques.

CAT is not connected to the national grid, and so has to generate all its own power. From a variety of sources, combined with both efficiency and conservation, the Centre is self-sufficient. Site residents are charged normal rates for the electricity they use, and the average bill for each person is £15 per year.

All electricity generated goes first to the control room, where supply is matched to demand on different parts of the site, and distributed accordingly. Any surplus goes to the battery store, or to heat water. The Centre also has a combined heat and power standby diesel generator, which it estimates provides around 10% of their power requirement.

Demonstration rigs are dotted around the site, some of which can be operated by children, to explain the concept of, for example, wave power.

In addition to the energy attractions, the Centre also has an organic garden — which grows much of the food for the Centre's restaurant. The fishpond and smallholding area will be a great hit with the kids.

It is impossible to do justice to CAT in an article of this brevity, but a resume of their philosophy may give the visitor a hint of what to expect. The Centre believes the technological systems of the future must be sustainable, efficient, equitable — ie sustainable even if universally adopted — ecological and holistic. Open seven days a week, from 10 am to 5 pm, it is best to telephone first for details of winter opening.

South-east of Machynlleth is the 17th century Felin Crewi working water mill — one of the last working water mills in Wales. Additional attractions include a riverside nature trail, farm animals and water birds. The water mill is open seven days a week, from 10 am to 5 pm from Easter to the end of October.



Felin Crewi, Penegoes, Machynlleth.

Cemmaes windfarm, slightly to the east of CAT and Felin Crewi, looks down onto the Dyfi Valley. 24 x 300 kW Wind Energy Group turbines generate enough electricity for 6000 homes. There is no car access to the site, but the public footpath from Commins Coch affords panoramic views over southern Snowdonia.

The Dyfi Furnace Waterwheel, built around 1755, is one of the best examples of a charcoal-fired blast furnace in the UK, and provides a fascinating insight into the process of early industrialisation. The waterwheel is open at all times from 1 October to 30 April, and from 9.30 am to 6.30 pm in the summer months.

A third windfarm, Penrhyddlan and Llidiartywaun, south of Newtown, is the largest windfarm in Europe to date. The 103 turbines have a total capacity of 30 MW.

To the west, the final site to visit on the Energy Trail is the Cwm Rheidol hydro electric power station, owned by PowerGen. Each stage of the scheme consists of a reservoir, an aqueduct and a generating station. In the upper stages there is a large 275 hectares reservoir, Nant-Y-Moch, enabling seasonal variation of rainfall to be regulated. Other, smaller reservoirs provide for daily regulation and flexibility of operation. Water from the reservoir is conveyed by pressure tunnel 4 km to the power station at Dinas, on the west bank of the intermediate reservoir, and has a capacity of 12 000 kW. The intermediate reservoir is formed in a rocky gorge of the river Rheidol by a curved-arch dam, holding 841 million litres of water. Some of the water from the river Castell is diverted into Dinas by means of a tunnel, and some from a small stream via an underground aqueduct. A 4.4 km tunnel conveys the reservoir water to Rheidol, the site of the main power station, which has two generating sets of 18 000 kW each.

The water from Rheidol power station is discharged into another small reservoir, formed by a regulating dam, which contains a 1000 kW generating set and a 100 kW set. The purpose of this smaller dam is eliminate rapidly fluctuating discharges from the main power station. A Borland fish lock with fish counter ('fish ladder') is also built into the dam, enabling fish to pass upstream past the dam.

Penrhyddlan and Rheidol provide a breathtaking end to a beautifully scenic tour. So if you fancy a busman's holiday, you couldn't choose a more varied, diverse set of energy sites anywhere else in Europe. Welcome to Wales.

• Opening dates and times vary from site to site, so it is best to ring and check first:

*Wylfa power station and visitor centre* 0407 711400

Melin Llynon windmill 0407 730797 (October — March 0407 840845) Beaumaris gaol and treadmill 0286 679098 Welsh Slate Museum 0286 870636 Power of Wales (Dionorwig pumped storage power station) 0286 870636

*Ffestiniog power station* 0766 830310 *Trawsfynydd power station and visitor centre* 0766 87622

Centre for Alternative Technology 0654 702400

Felin Crewi working water mill 0654 703033

## **FREE** A3 "ENERGY TRAIL" COLOUR POSTER and "ENERGY SAVERS" Vouchers for discounts on entry to Energy Trail attractions To obtain this fascinating poster and booklet of money saving vouchers, simply send an S.A.E. to:

D. Jenkins, ENERGY TRAIL, Cae'r Lloi, Penegoes, Machynlleth, POWYS, WALES SY20 8NG

# INSTITUTE NEWS

#### Obituary Richard Stern

RICHARD STERN BA (Chem) DipChemEng CEng FInstE MIChemE died recently at his home in Bournemouth, aged 76.

He was a highly respected chemical engineer, specialising in energy. He was a research officer at CEGB Marchwood for over 20 years from 1961, when it was opened by Princess Margaret until he retired in 1982. He continued to work as a consultant on feasibility analysis, conversion between fuels, corrosion prevention, heat exchangers, fuel chemistry and combustion. He became a Fellow of the Institute of Energy in 1969.

With his knowledge of ten languages, Mr Stern was used as an interpreter by Dorset police and the Bournmouth courts. He also did literary and technical translations. He was closely involved with campaigning on behalf of Soviet Jewry, and was chairman of a local support group for the Technion University in Haifa, Israel, and a teacher at Bournemouth's University of the Third Age. He was an active member of the New Forest Rambling Club and a keen cyclist.

A moving account of his early life is given in his memoirs *Via Cracow and Beirut* (Minerva Press, £6.99). It is the saga of a survivor from wartime eastern Europe: imprisonment, ill-treatment and military service.

Born in Poland, Mr Stern studied chemistry at Cracow University for three years, until 1939. Fleeing from the invading Nazis, he ran to the arms of the Soviet Union, idealistically believing he would be warmly embraced. Instead he was almost crushed to death. Imprisoned without trial, he suffered two years' hard labour in freezing temperatures on what was virtually a starvation diet. When the war reached a crucial stage he was conscripted into a Polish regiment, which came under British command, and was drafted to the Middle East. Badly wounded during the invasion of Italy and the Battle for Monte Cassino, he was awarded the Cross of Valour: Poland's second highest honour. It was only later he discovered that his mother, two brothers, three sisters, brother-in-law and two nieces had perished in Treblinka and Auschwitz.

Towards the end of the war, under Army auspices, he was able to resume his studies at the American University of Beirut, and then posted to London, where he used the facilities of Imperial College. With his degree from AUB he started job hunting. There were few opportunities for chemists, but some openings for chemical engineers — a relatively new discipline at the time — and he was excepted on an ex-servicemen's postgraduate course at South West Essex Technical College with a monthly grant of £20.

His first job was not in chemical engineering, however, it was as an assistant to a physicist in a test laboratory of Edison-Swan Electric Company at Ponders End. He earned only £6 per week, but after so much trauma, he was just happy to be settled.

Sadly Richard died just four days before his book was published. The proceeds will be divided between the Technion and cancer charities. Copies can be obtained from bookshops, or from his widow, Esther, by phoning 0202 394857.

He leaves two sons and a daughter.

Martyn Benn

# Institute of Energy: Branch Events

#### Northern Ireland

#### Autumn 1994 (date to be confirmed)

Prestige lecture (speaker to be confirmed), Ashby Building, QUB. Contact: Mr A McCrea, Tel: 0232 454336

#### September 1994

#### North Eastern

#### Wednesday 28 September

Joint meeting with the Tyneside Energy Group on 'Monitoring & Targeting' Friendly Hotel, Boldon. Lunch 12.15 pm, meeting 1.30 pm. Contact: to book lunch — Mr A W Potts, tel: 0670 712861

#### S Wales & W of England

#### (date to be confirmed)

Visit to BP LPG terminal and Bristol port authority, Avonmouth. *Contact: Branch Secretary for further details.* 

#### October 1994 Midland

#### Monday 10 October, 7 pm, rm 708

President's address, Mr D G Jefferies CBE, University of Aston, Birmingham. Free buffet. *Contact: Mr D E A Evans, tel: 0384* 374329

(continued on page 22)

#### New members

#### Student

Ben Watts, Leeds University Gary Wilson, Leeds University Adam John Williams, Nene College, Northampton

Alan Thomas Wylie, Leeds University Buzwe Ephraim Yafele, Leeds University

### Training in Energy Management by Open Learning (TEMOL)

IN JANUARY 1993 the Institute commenced a project, supported by the European Commission (DGXVII — SAVE), ETSU (on behalf of the EEO Best Practice programme), Seeboard and the University of the West of England, to design, develop, produce and pilot 90 hours of open learning materials in the area of energy management. This project is now complete, and what we have is 250 hours of open learning materials, plus a 100 hour project.

This then is a major achievement in the light of the original proposal and represents a unique and important step in the teaching of energy management.

The course has been designed so that it can be presented within a wide range of education and training, and is capable of being studied in isolation with minimum tutorial support or offered as part of a traditional university lecture scheme. The course structure and content is organised in four major blocks comprising fourteen elements.

Block one covers the essential technical content of the course. Block two links the technical content to the needs of energy managers. Block three covers the important fundamental techniques of energy management. Block four is a single unit on energy efficiency.

Although complete in itself, TEMOL can be expanded in depth and breadth by adding a range of elements from which choices can be made or specialist units designed to meet specific industrial needs, ie steel, glass, food etc. The course has undergone extensive piloting within the UK and a wider but less detailed analysis has been carried out with the assistance of organisations in the SAVE and OPET networks in Europe. Within the piloting students found the course easy to follow, informative and easy to assimilate. The reaction from industry was that the course satisfies a need in training programmes which hitherto had been unfulfilled.

The learning/teaching packs will be available from mid September and for more information please contact Louise Evans, Project Manager, The Institute of Energy, 18 Devonshire Street, London W1N 2AU. Telephone 071 580 7124; fax: 071 580 4420.

# INSTITUTE NEWS



Tuesday 11 October, 6.30pm for 7pm

'Tackling the hidden cost of avoidable waste' by Mr V Vesma, Trevithick Lecture Theatre, University College Cardiff, Newport Road, Cardiff. Saving energy takes on a new perspective. Through the use of case studies the lecturer will demonstrate how radical savings can be made. *Contact: Mr S Wilce, tel: 0454* 201101.

#### South Coast

#### Tuesday 12 October, 7pm

Technical visit — Central Boiler House at Greylingwell Hospital, Chichester. *Contact:* J Bartlam, tel: 0705 251657.

#### North Eastern

#### Tuesday 25 October, 6pm

Joint meeting with The Institution of Chemical Engineers. 'Thorp Reprocessing' Mertz Court, University of Newcastle upon Tyne. Tea & biscuits available before the meeting. *Contact: Mr A W Potts, tel: 0670* 712861.

#### Midland

#### Friday 28 October

Annual dinner & dance, Belfry Hotel,

Wishaw, Nr Sutton Coldfield. *Tickets from K* B Hill, 204 Barnett Lane, Kingswinford, W Midlands DY6 9QA. Tel: 0384 273836. November 1994

# Midland

#### Wednesday 9 November, 6.30pm

Refrigeration Technology' by Mr J Fielding (Trane Ltd), Chamber of Edgebaston, Birmingham. Light buffet from 6pm. Contact Mr D E A Evans, tel: 0384 374329.

#### S Wales & W of England Wednesday 16 November, 5.30pm for

#### 6.30pm, rm SR1/2

Joint seminar with IChemE, IMechE & IEE. 'Manufacturing in Wales beyond the Year 2000: a prospective view' by Mr J Cameron, Industrial Director, Welsh Office. Trevithick Bldg, University of Wales, College of Cardiff. Will there be any major power users/producers in S Wales in the next century? Or will we all be petty bureaucrats in aircon offices? Come along and get the Welsh picture. *Contact: Mr S Wilce, tel: 0454* 201101

#### North Eastern

#### (date to be confirmed)

Social evening. To be advised. Contact: Mr A W Potts, tel: 0670 712861.

#### December 1994 Midland

#### Thursday 1 December, 7pm

'Fuel cells for small-scale CHP' by Prof K Kendall, (University of Keele), Snr Common Room, University of Aston, Birmingham. *Contact: Mr D E A Evans, tel: 0384 374329.* January 1995

#### S Wales & W of England

# Wednesday 18 January, 6.30pm for 7pm

'Tidal and hydro power in Wales' by Dr P Padley, Trevithick Bldg, University of Wales, College of Cardiff, Newport Road, Cardiff. *Contact: Mr S Wilce, tel: 0454* 201101

#### Midland

#### Thursday 12 January, 7 pm

'Opportunities for hybrid vehicles for public and private transport' by Prof D H Tidmarsh (University of Central England) Snr Common Room, University of Aston, Birmingham. *Contact: Mr D E A Evans, tel:* 0384 374329.

# **READERS' LETTERS**

# FGD - value for money?

# LORD FLOWERS: "Desulphurisation is the billion dollar solution to the million dollar problem."

The report on the FGD plant at Ratcliffe on Soar (*Energy World*, June 1994) briefly summarised the design of this new plant which will be operational early next year. The capital cost of this plant, together with that of Drax, will be over £1 billion, and will remove 90% of the SO<sub>2</sub> generated at each power station. I appreciate that this helps Britain meet the EC target for sulphur reduction, but are we getting value for this expenditure, and are measurements being taken to assess the effects of these two enormous schemes?

It is stated that Ratcliffe is one of the largest and most efficient coal-burning power stations in the country. When FGD is operational, I understand that the cost of power from this station will increase by some 20%. Relating to global warming, what is the increase in CO<sub>2</sub> emissions for a given output resulting from the introduction of FGD? What is the increase in NOx emissions?

A very high proportion of the SO<sub>2</sub> produced by British power stations precipitates as a dry deposition according to P F Chester. In a paper in 1988 to the British Association for the Advancement of Science, he said that even in Germany, where there has been massive expenditure on FGD at power stations there is some doubt about the effectiveness of the operation. According to Fisher (Fisher B E A, *JInstE*, 1984, 57, 416) 50% — 75% of the SO<sub>2</sub> emitted from coal-fired power stations in the UK precipitates harmlessly in the sea surrounding Britain.

Are measurements being taken to assess whether the reduction of dry deposition of SO2 is having any detectable effect on crops, buildings or health in Britain? Measurements should be organised by ETSU or AEA Technology to make an assessment of any improvements resulting from the introduction of FGD at these power stations. Possibly Rothanstead could determine the effect of the reduction in SO2 emissions on agricultural yields in the UK particularly in East Anglia and Humberside. I understand that the reduction in SO2 has not only resulted in an increase in black spot on roses, but will result in sulphur addition being required to sustain certain crops.

We are fully aware of acid rain problems said to be affecting trees and lakes in Scandinavia. Are measurements being taken to assess whether the big reduction in emissions of SO<sub>2</sub> from the UK power stations by FGD and the use of natural gas for power generation is reducing the problems said to be associated with acid rain? Is the reduction of pollutants from Britain as effective as the low cost alternative of liming those Norweigian lakes which are said to have acidification problems?

It will be recalled that I recommended (Lees, B, *Energy World*, 1988, 158, 2) that fine magnesium hydroxide powder should be injected in a controlled scientific manner into flue gases of British power stations to counter acid rain problems.

Measurements should be undertaken to assess whether this low-cost additive approach is an effective alternative to desulphurisation. It could be applied quickly at many power stations, where fuels with a moderate or high sulphur content, such as UK coal, fuel oil or Orimulsion, are used.

When we are undertaking massive programmes which result in higher electricity costs, we should know what benefits accrue based on scientific measurements, not on conjecture.

Byrom Lees

# **BOOK REVIEWS**

#### Recommended

#### 'Power in Perspective: players, performance, prospect and potential privatisations' by Keith Boyfield. Published by European Policy Forum, July 1994, £20.00.

KEITH BOYFIELD'S report is most apposite at the current time, released within weeks of the DTI announcement in late May, inviting submissions of the UK's future nuclear power policy. This report will assist organisations in formulating their views. In addition, it will be of much interest to those working in the energy field, whether on policy, strategy, management or technology.

Boyfield's study identifies what he recognises as the main theme on which the energy sector is based. The author's work is primarily in the power generation market, and he analyses the recent changes and addresses future prospects, both in the UK and Europe.

The early chapters examine each of the four primary fuels in turn, without forgetting the renewable sector, although the latter consists of only four paragraphs in the report. This may be a little disappointing to some renewable advocates, bearing in mind that some 650 applications have been placed with the DTI for financial support under the NFFO structure.

The reader will, I think, form the view that the core questions (for which answers are attempted by the author), surround the role that nuclear power should play in the UK's future. Within the privatised electricity market, can and should Nuclear Electric and Scottish Nuclear be released from state ownership and how would this be achieved?

The present Government is keen to disassociate itself from all the energy sectors. They claim their main objective is to allow the market for energy full freedom, providing it effectively operates within a stable and fair framework.

The author addresses such topics as energy policy issues, security and diversity of supply and regulation. He covers those uncertainties which can have such a dramatic impact on long-term investments. How far can the Government disengage itself from regulatory issues? Also, today we face the inevitable consequences, requiring all the energy utilities to make this subject a priority interest in their corporate strategy.

The six questions posed by the nuclear review are presented under a separate chapter heading. In seeking to provide possible answers, the author outlines a range of potential advantages which could result in the freeing of the nuclear utilities from state interference. Nuclear Electric has over the past four years shown itself to be truly competitive. Within the space of the next financial year, the company will no longer be dependent on tax payers' support. Obviously the nuclear industry has potential risks, albeit small, but it is felt that an optimum balance could be reached whereby some of these liabilities would be transferred from the state to the private sector in an acceptable form.

Mr Boyfield's report is to be recommended. Government ministers, MPs and political organisations could take up some of the guidelines suggested as a basis for their views on the nuclear industry. The points raised and debated in this report are ones that will help strategists make sound and logical decisions so as to preclude further long debate about our nuclear future.

Eur Ing F John L Bindon

# Potential for future research

'Nitrogen in coal' by Robert M Davidson.

#### Published by IEA Coal Research, London, 1994, Perspectives Report No IEAPER/08, £40.00.

NITROGEN is probably the least studied of the main elements in coal, but recently it has gained more attention. Therefore, this review of the literature by Robert Davidson of IEA Coal Research is a timely publication.

The review commences by examining the total amounts of nitrogen present in coal and the analytical methods for determining it. Except in rare cases, the nitrogen in coal is bound into the organic matter of the coal, and is generally not rank dependent. Interest in this subject has grown since it was realised that the emission of nitrogen oxides, nitric oxide and nitorgen dioxide, contribute to acid rain and photochemical smog formation, while nitrous oxide is a greenhouse gas and also acts indirectly in the depletion of stratospheric ozone.

After a thorough review of the literature (supported by over 100 references) the author concludes that advances in coal combustor design have led to the abatement of emissions of nitrogen oxides resulting from the oxidation of nitrogen in combustion air. This means that the major source of nitrogen from coal combustion is now the nitrogen in the coal. Currently, research is being directed at relating the nitrogen content of the coal to the emissions of nitrogen oxides. As yet, no simple correlation has emerged, although the conversion of coal-nitrogen to nitrogen oxides shows some rank dependence.

There appears to be potential for further research in this subject.

Andrew W Cox

#### **Renewed emphasis**

'Daylighting in buildings' Published by University College Dublin Energy Review Group for the European Commission Directorate-General for Energy (DG XVII).

THE EUROPEAN Union Commission Directorate-General for Energy (DG XVII) has been concerned in the past through the Energy Projects Demonstration Scheme, and at present through the THERMIE programme, to promote innovative energy technologies. Among other aims of the THER-MIE programme it disseminates information on energy technologies for four areas: solid fuels, renewable energy, rational use of energy and hydrocarbons.

In recent years there has been a renewed emphasis on seeking to optimise the use of daylighting to displace electric lighting particularly in non-domestic buildings. This is partly provoked by concern regarding the environmental impact of electricity production and the probability that it will eventually be fully reflected in the price of electricity; and partly by a desire to have light, cheerful interior spaces in buildings.

This short 24-page text seeks to be a primer as to best practice in daylighting design, as well as providing an introduction into innovative strategies and components. The scope ranges from roof lights and atria through to an overview of a range of innovative glazing systems, transparent insulation, light shelves, reflectors, light pipes and light ducts. Artificial lighting and integrated controls are also discussed briefly as are the problems of retrofit and available design tools. The booklet concludes that nine case studies including two schools, a university building, a health centre, four office buildings, a prison and a museum located in France, UK, Spain, Italy, Germany, Portugal. Ireland, Denmark and Greece. Short reference lists and a brief and idiosyncratic biography are also provided, which seek perhaps to achieve an equitable Euroepan representation of authors, rather than readily accessible, recognised texts.

The presentation of this book is excellent, and it forms an appropriate initial introduction to the field. Jargon is avoided, and internal and external colour photographs of the case studies have been chosen. The book should include those readers involved in building design to give careful attention to the new possibilities afforded in this area. Further reference should have been made to other texts if appropriate expertise is to be gained for the successful implementation of a building strategy in other than the simplest building forms.

Professor Brian Norton

# EVENTS



#### September 1994

#### Creating value through improved strategic deicision making in upstream oil & gas

Two-day executive briefing, 28-29 September, London. 27-28 October, Amsterdam. Details from Lucinda Middleton on 071 637 4383; fax: 071 631 32114.

#### Electricity distribution review & new regulatory developments

Conference, 28-29 September, London. Details from IIR Ltd, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD. Tel: 071 379 8040; fax: 071 412 0158.

#### Electricity & gas metering

Conference, 30 September, London. Details from IIR Ltd, Industrial Division, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD. Tel: 071 412 0141; fax: 071 412 0145

#### October 1994

#### Innovative techniques for minimising the risk of environmental liability for pollution

Conference, 3 October, London. Details from Christine Rickards, Bookings Dept, IBC Legal Studies & Services Ltd, Gilmoora House, 57-61 Mortimer Street, London W1N 7TD. Tel: 071 637 4383.

#### Industrial wastewater minimisation & treatment

Conference, 3-4 October, London Details from IIR Ltd, Industrial Division, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD. Tel: 071 412 0141; fax: 071 412 0145.

#### New approaches to environmental protection and management in the oil and gas industry

Short courses, 4-5 October, Aberdeen; 31 October - 2 November, Algarve, Portugal. Details from Barbara Rae, Conference Administrator, CEMP, 23 St Machar Drive, Old Aberdeen AB2 1RY. Tel: 0224 272483; fax: 0224 487658.

# Energy in business — the competitive future

Free seminars, 4 October, Winchester; 5 October, Heathrow; 12 October, Newcastle upon Tyne. Details from ESTA, PO Box 16, Stroud, Glos GL6 9YB. Tel: 0453 886776; fax: 0453 885226.

#### **IOCE '94**

Conference & exhibition, 4-6 October, Aberdeen. Details from Spearhead Exhibitions Ltd, Rowe House, 55-59 Fife Road, Kingston upon Thames, Surrey KT1 1TA. Tel: 081 549 5831; fax: 081 541 5657.

#### Site investigation for contamination sites and clean-up technologies

Conferences, 5-6 October, London. Details from Amanda Wright, IBC Technical Services Ltd on 071 637 4383; fax: 071 631 3214.

#### Cogeneration policy in Europe — unlocking the potential

Conference, 6 October, Brussels. Details from COGEN Europe Secretariat, 35 Grosvenor Gardens, London SW1W 0BS. Tel: 071 828 4077; fax: 071 828 0310.

#### International conference on radiation dose management in the nuclear industry

9-11 October, Windermere, Cumbria. Details from Rachel Coninx, The Conference Office, British Nuclear Energy Society, 1 Gt George St, London SW1P 3AA. Tel: 071 839 9807; fax: 071 233 1743.

#### An oil company's balance sheet after FRS4 and FRS5

Seminar, 10 October, London. Details from Mrs Christine Copues, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Tel: 071 467 7104; fax: 071 255 1472

#### 3rd international symposium on Structural & functional gradient materials

10-12 October, Lausanne, Switzerland. Details from FGM 94, Dr N Cherradi, Swiss Federal Institute of Technology of Lausanne, Materials Dept, LMM, CH-1015 Lausanne, Switzerland. Tel: +41 21 693 29 15/50; fax: +41 21 693 46 64.

#### Offshore pipeline engineering level 2

Course, 10-13 October, London. Details from Nadia Ross, tel: 071 637 4383.

#### European Wind Energy Association conference & exhibition

10-14 October, Thessaloniki, Macedonia, Greece. Details from The Organising Office Triaena EWEC '94, 24 Har Trikoupi Str, Athens 106 79, Greece. Tel: 3609511 15; fax: 3607962.

#### Energy management in small and medium-scale industries

Course, 10 October - 11 November, Maastricht, The Netherlands. Details from The Course Administrator, Technology & Development Group - VOK, University of Twente, P O Box 217, 7500 AE ENSCHEDE, The Netherlands.

#### Combined heat and power

Conference, 11-12 October, London. Details from IMechE, tel: 071 222 7899.

# Waste water management for industry

Three-day course, 11-13 October, Manchester. Details from Amanda Wright, IBC Technical Services, tel: 071 637 4383; fax: 071 631 3214.

#### **Slurry Handling**

11th Warren Spring Laboratory course, 12-13 October, Harwell, Oxfordshire. Details from Course Organiser: Dr Neil Alderman, AEA Technology, Harwell, Didcot, Oxon OX14 0RA.

#### The future of incineration for waste destruction

Conference & exhibition, 12-13 October, Hinckley, Leics. Details from Shirley Ellerbeck, CEA Conference Office, Allen House, Boltro Road, Haywards Heath, West Sussex RH16 1BP.

#### Modern battery technology

Short course, 12-14 October, Amsterdam. Details from The Center for Professional Advancement, P O Box 1052, 144 Tices Lane, East Brunswick, New Jersey, USA 08816-1052. Tel: 908 238 1600; fax: 908 238 9113.

#### Natural gas: trade & investment opportunities in Russia and the CIS

Conference, 13-14 October, London. Details from Karen Sotnick, The Conference Unit, RIIA, Chatham House, 10 St James' square, Lonfon SW1Y 4LE.

#### Avoiding air conditioning costs by operation and design

Course, 15 October, Egham, Surrey. Details from Mid Career College, Cambridge 0223 880016

# Energy saving — the people approach

Conference, 17 October, London. Details from The School of Business and Industrial Management, Caxton House, Wellesley Road, Ashford Kent TN24 8ET. Tel: 0233 622101; fax: 08823 324100.

#### Data management and storage

International seismic seminar, 17 October, London. Details from Seismic DMS Seminar, Themedia Ltd, P O Box 2, Chipping Norton, Oxon OX7 5QX.

#### 6th Coal Science conference

17-19 October, Newcastle, Australia. Details from the conference secretariat on +61 49 299434; fax: +61 49 29959948.

#### November 1994 Prospects for clean coal technology: a contractors' meeting

1-3 November, Nottingham. Details from Ms Carol Johnstone, Event Manager, Building 153, ETSU, Harwell, Oxfordshire OX11 0RA. Tel: 0235 432383; fax: 0235 432923.

# RECRUITMENT





# Combined Combustion Capabilities

HAMWORTHY COMBUSTION DIVISION have designed, manufactured and installed combustion equipment worldwide for many years. Included in our impressive portfolio are oil, gas, coal and multi fuel burner systems for the commercial, industrial, marine and power generation industries. Hamworthy Heating is a market leader in the supply of heating equipment for commercial and industrial buildings.



The acquisitions of Peabody Engineering and Airoil Flaregas in the U.K. and Peabody Engineering Corporation in the USA has increased the Group's product range and expertise.

Our research and development activities are supported by one of the largest oil and gas firing test facilities in the world. This enables us to maintain the high rate of product development necessary to meet the current demands on performance. As environmental pressures increase, the ability to recover the maximum usable heat from fuel whilst generating the minimum of pollutant becomes ever more important.

All group products now incorporate the benefits obtained from the commitment to long term Research and Development and enable us to offer a range of equipment capable of maintaining low levels of NOx, CO, particulates and excess air.

To find out more contact: Hamworthy Combustion Division Fleets Corner, Poole, Dorset BH17 7LA. Tel: 0202 665566. Fax: 0202 665333. Telex: 41226 (HELCD G).





