

THE MAGAZINE OF THE INSTITUTE OF ENERGY

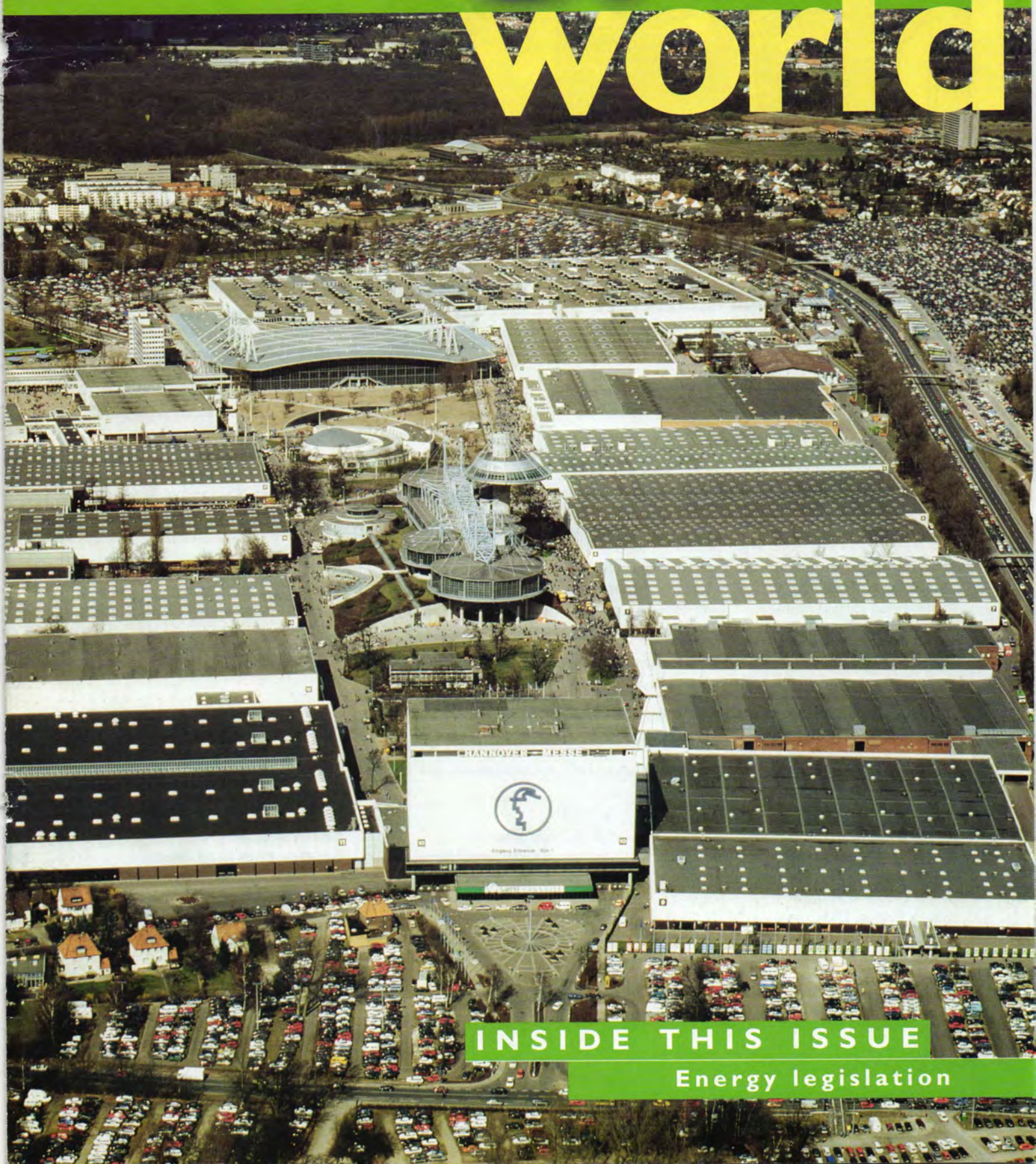
# energy



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No.237 March 1996

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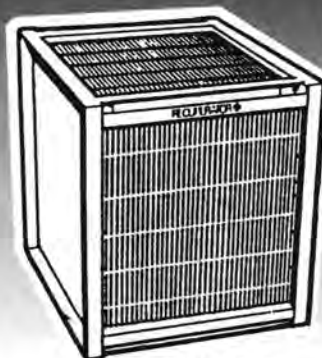


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Energy legislation



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**For further details, please contact:**

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## EuroFlam

### A European Programme for Access and Training on Large Scale Combustion Facilities

The EuroFlam Programme is a partnership between combustion research Institutes in Italy, United Kingdom and The Netherlands. It has the aim of equipping European scientists and engineers with the knowledge and experience to tackle combustion related problems in both industry and academia. The facilities offered cover a wide range of combustion equipment, instrumentation, laser diagnostics and CFD modelling.

This activity is funded under the EU Training and Mobility of Researchers programme. The financial support offered covers subsistence and travel for a six-month period at any one of Institutes.

Undergraduate and Post Graduate Students who require further information please contact Dr Griffiths in Room WB2.33. Also note that UK applications will be restricted to Italy and the Netherlands.

Applicants should write to the particular Institute for a full prospectus and application form. The individual addresses are listed below:

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The cover photograph shows the permanent site of the International  
Hannover Messe trade fair.

Photograph courtesy of Deutsche Messe AG





# WISE words

IN 1980 the Finniston Report was published, setting up the Engineering Council. It recommended also 'Efforts should be made within schools, engineering departments and employing organisations to encourage more women to enter careers in engineering through schools/industry liaison schemes, special bridging programmes and arrangements to assist women engineers to return to engineering work after a break from full-time practice.'

The Engineering Council, of which I was the only woman member, right from the start was determined to carry out that recommendation wholeheartedly. At the same time the Equal Opportunities Commission which I chaired, felt that literally half the talents of the nation were being neglected in the fields of science and engineering. As a result the WISE campaign (Women Into Science and Engineering) was set up jointly in 1984 and received enthusiastic backing from the Government, industry, universities, schools and colleges.

The momentum of the campaign has been upheld now for 12 years and has had considerable success. In 1984, 7% of first year undergraduates in engineering were women, and that has now risen to about 15% of all years throughout the UK. There are also more technician and incorporated engineers. The encouragement has to start early in primary schools, where otherwise girls may only work with soft materials and leave the mechanical and technological exploration to the boys.

A study carried out by the Engineering Council showed that five year olds thought that car repairs could only be done by men and only women should mend clothes. More seriously, 73% of boys and 66% of girls thought that scientists could only be men, showing gender stereotyping firmly established even at that early age. The Equal Opportunities Commission published *An Equal Start*, full of practical advice on how schools can combat these early prejudices.

There are now five WISE vehicles on the road, visiting schools all over the country, serving as mobile teaching centres and giving girls greater confidence in using technological equipment, and providing literature to encourage them to enter careers in science and engineering. Each year the Engineering Council publishes *Awards, Courses, Visits* showing schools and women of all ages the availability of initiatives countrywide to enable them to acquire technological knowledge.

In 1985, aware of the need for technologically qualified women to be able to carry out lifetime successful careers, and to combine happy and responsible family life with the exercise of technological expertise at work, the Engineering Council published its *Career Break* working party report. A video was also produced for the boards of companies, showing how important it is to develop 'family-friendly' policies to enable women to continue to contribute to their own and their family's prosperity, whilst bringing up their children. These policies were almost unknown at the start of the WISE campaign, but are now provided by most large companies. In the twenty-first century, they will need to be even more prevalent if scarce engineering skills are to be available to British industry.

As the Government stated recently in its report *The Rising Tide*: 'By the year 2000, Great Britain will have approximately 23.5 million women age 16 years or over: women will represent 46% of the civilian labour force. Demographic trends and changes in economic activity rates show that four-fifths of the projected net increase in the civilian labour force in Great Britain to the year 2006 will be women. The full potential of this expanded labour force needs to be tapped.'

'One area of particular importance in underpinning our economic competitiveness and quality of life is science, engineering and tech-

nology (SET). The Government in its recent White Paper *Realising Our Potential: A Strategy for Science, Engineering and Technology* acknowledges that women are the country's biggest single most under-valued and therefore under-used human resource.

I believe deeply in the fundamental importance of those statements in promoting the prosperity of our country. For far too long these careers have been regarded as a male preserve.

Changes in fundamental attitudes in society take several decades to become acceptable, especially in unfamiliar fields like these. We need a fundamental rethink if opportunities for girls are to be more equal. Too often engineering is put over as hard and mechanical. In fact the inventions of scientists and engineers have heated our homes, produced labour saving equipment and mechanical aids for the handicapped, life saving incubators for premature babies, aids to industry and medicine, to make our lives more healthy, comfortable and less dominated by drudgery and disease than they have ever been throughout history.

Young people, especially girls, are very environmentally caring. They often do not connect engineers with caring for the environment, which of course they must. The Engineering Council has issued a Code of Practice, and gives national prizes to encourage engineers to take account of possible environmental harm at the start of any major project, and plan for its elimination. Engineers who care about the environment and can innovate so that the necessary technological programmes are executed efficiently and economically, and lead to commercial success, will be very much in demand. All these ideas are rarely put over in schools, but need to permeate education so that young people, and especially girls, view engineering as a worthwhile and rewarding career, which will be of benefit to society and will ensure their own future prosperity.

Whereas when I entered the engineering profession I felt I was a pioneer, nowadays there are many successful women engineers in fields as diverse as electronic equipment and helicopter design, laying sewers, bridge construction, aeronautics, the gas and electricity industry, and the design of more efficient household and medical equipment. Engineering as a career is fascinating because it covers such a wide range of subjects. Successful engineers are called upon to solve a kaleidoscope of problems in practical and innovative ways, resulting in serving their customers better so that they come back and buy again, ensuring the firm's and the engineer's future prosperity.

It is possible now to invite young women actually carrying out this sort of work successfully to come and talk to girls in schools, so that they are presented with a realistic and attractive picture of the profession, and are encouraged to adopt it themselves. The Engineering Training Authority 'Insight' courses for 17 year olds do this most successfully, giving them a few days experience of work in a university engineering department and of problem solving in industry under the guidance of bright-eyed and bushy-tailed attractive young women engineers, enthusiastic about their jobs.

WISE is proving successful in encouraging girls to adopt these attitudes, and also in persuading industry to recruit and retain young women engineers. There is no doubt that the policy will contribute to the future prosperity of our country, as women engineers contribute important talents to our technological advance as UK Ltd, in a highly competitive commercial world. WISE has 12 years of success under its belt thanks to many allies in its campaign, but certainly still has a long way to go in encouraging more girls and women into our profession of engineering. The newly-established Engineering Council has adopted WISE amongst its future policies and will, I am sure, achieve success into the 21st century.

**Baroness Platt of Writtle**





## Glass key to safe disposal

A NEW form of glass that could provide safe long-term storage of plutonium from dismantled US and Soviet nuclear weapons has been developed by scientists at the US Department of Energy's Argonne National Laboratory.

The United States and former Soviet nations are grappling with how to dispose safely and economically of more than 100 tons of weapons-grade plutonium from nuclear weapons dismantled under the Strategic Arms Treaty.

One option being studied is to immobilise plutonium in a solid waste form, such as glass, and place it in a deep, underground repository.

Designed by Argonne scientist Adam Ellison, the new glass is made of tin, zirconium, silicon and alkali elements, such as sodium. Special neutron absorbers prevent the plutonium from undergoing an uncontrolled nuclear reaction.

The alkali elements help dissolve the plutonium. Tin, zirconium and silicon stabilise the glass's structure.

The glass melts at a relatively low temperature and dissolves more than 5% of its own weight in plutonium. It can hold high concentrations of scrap metals and resists reaction with water under storage conditions. To evaluate its behaviour over long time periods, the glass was exposed to hot, caustic vapours that simulate thousands of years of natural reaction in a few months.

Early results indicate that the glass does not readily break down to form new mineral products and that it firmly retains the plutonium, uranium and neutron absorbers. Additional tests and composition developments are in progress to confirm these conclusions.

Research on this glass waste form is funded by DOE's Office of Materials Disposition.

Argonne is operated by the University of Chicago as part of the US DOE's national laboratory system.

## EU-wide policy called for

THE European association of flat glass manufacturers (GEPVP) have called on member states, in an open manifesto, to save energy, reduce CO<sub>2</sub> emissions, as agreed at the 1992 Rio Conference.

Substantial employment could also be created by implementing an EU-wide policy to accelerate the upgrade of single-glazed windows to high-performance double glazing, over the next ten years.

The appeal came as a result of a study launched in February, prepared for DG XVII, authored by the Comité Permanent des Industries de Verre (CPIV) and the Fachinformationszentrum Karlsruhe (FIZ).

The study concludes that if all single-glazed dwellings were upgraded, this would save one billion GJ of energy per year — enough to provide all the energy for all the buildings in 11 cities the size of Brussels. This would also help to reduce CO<sub>2</sub> emissions by around 80 million tonnes.

Ryegrass grown at a Berkshire research station (pictured right) in soil from West Cumbria, UK, is the focus of an international research project. Scientists using different computer systems in six countries are trying to predict how the grass is affected by groundwater deliberately dosed with radioactive tracers.

It is part of the BIOMOVs II (biosphere modelling validation studies, part two) project to test models that calculate the transfer and build-up of radionuclides in the biosphere.

Ryegrass is grown for Nirex under carefully controlled experimental conditions at the Centre for Analytical Research in the Environment, run by Imperial College of Science, Technology and Medicine at Silwood Park, Ascot. Eight lysimeters — large outdoor concrete tanks — filled with soil are being fed from beneath with water containing accurately measured traces of seven radionuclides.

Scientists from Canada, France, Spain, Sweden, Switzerland and USA are participating in this part of the project, which began in 1994.

## Hydropower in the Himalayas

IT POWER have embarked upon a major new initiative to develop small-scale waterpower technologies for the Himalayan regions of India. The exploitation of waterpower is already well known to the villagers in these remote areas, because for thousands of years they have been using simple, wooden watermills (or *gharats*) to grind their grain and spin their prayer-wheels. There may be as many as 200 000 *gharats* in the Indian part of the Himalayas.

Although many villages now have a grid connection for their lighting needs, the majority of their energy requirements continue to be fulfilled by burning wood for cooking and heating. As a result of wood-burning over the centuries by a Himalayan population in India now exceeding 80 million, both the rain and pine forests have become seriously depleted, resulting in large areas of hillside becoming agricultural land or barren scrub.

In an attempt to bring a halt to such large-scale deforestation, the Global Environment Facility,

via the UNDP, is cost sharing a \$15 million project, to boost the development of mini-hydropower schemes in the Himalayas, so displacing the need for fuel-wood.

IT Power has been contracted to provide technical expertise for the watermills block of the project, examining approaches and technologies for upgrading traditional *gharats* to optimise their performance, and allow additional end uses, such as agricultural processing, electricity generation and water heating.

The so-called Hilly Hydro Project began in late 1995 with a conference in Delhi to discuss strategy for the three-year programme.

The project has the ambitious aim of installing 100 new, improved *gharats*, to act as demonstration systems for the wider dissemination of this technology throughout the hilly regions of the Indian sub-continent. The results of the programme will be applicable to other mountainous regions of the world.







## Compensation: Sea Empress disaster

COMPENSATION arrangements following the disaster of the Sea Empress were announced by the Department of Transport on 23 February.

The oil tanker ran aground off the South West Wales coast spilling half of its cargo before a successful salvage operation was completed.

Those who incur costs or suffer economic loss as a result of the oil pollution can claim compensation from the ship's Protection and Indemnity Club (insurers) and from the International Oil Pollution Compensation (IOPC) Fund, based in London.

The Protection and Indemnity Club, in this case the Skuld Club, will provide compensation for claims up to the limit of the shipowner's liability under the 1969 Civil Liability Convention. When claims exceed that limit then the IOPC Fund will provide further compensation up to a limit set in the 1971 Fund Convention.

The International Conventions are based on the principle of strict liability: claimants do not have to prove fault, but, of course, they have to be able to substantiate their claims and will have to be able to demonstrate that their costs or losses arose as a consequence of the oil pollution. Early and sympathetic consideration is usually given to claims relating to hardship.

The Skuld Club and the International Oil Pollution Compensation Fund will operate together in assessing claims and their representation will be available in Milford Haven. Queries should be referred directly, or to the International Oil Pollution Compensation Fund in London.

Queries on compensation should not be addressed to the Joint Response Centre. The Club and Fund's representative is Captain McDonald, c/o G S Kelway, Murray Crescent House, The Rath, Milford Haven SA73 3JR. Tel: 01646 694700

## Segregated nuclear fund

THE independent segregated fund being set up to cover decommissioning British Energy's nuclear power stations will be established on 31 March. It will come into effect on privatisation this summer.

Energy Minister, Tim Eggar, gave details on the scope and structure of the fund. He said: "The Trade and Industry Committee made several recommendations ... in particular, one recommendation was that the fund should be established and its trustees appointed as soon as possible. I agree and have set it up from 31 March. The process of appointing trustees is also well under way.

The fund will cover all the longer term post-closure costs of decommissioning British Energy's nuclear power stations and their sites, in accordance with decommissioning strategies agreed between the company and the regulator, the HSE's Nuclear Installations Inspectorate (NII). It will, therefore, include the post-closure costs related to the care and maintenance and ultimate decommissioning of any on-site long-term spent fuel storage facilities if they become part of a future agreed strategy. The scope of the fund has been agreed by the NII.

"The fund will be controlled by five trustees, three of whom will be appointed by the Government — including the Chairman. The selection process is underway. The Fund will be endowed with a large initial lump sum, paid by Nuclear Electric and Scottish Nuclear, reflecting the discounted value of their accrued historic decommissioning liabilities. Thereafter Nuclear Electric and Scottish Nuclear will make quarterly payments. All these amounts are under discussion, but the companies will be making provision for their contributions. The fund will seek to hold assets equal to 110% of accrued discounted nuclear station decommissioning liabilities. These arrangements will ensure that long-term liabilities do not fall to the taxpayer."

## Coal's concern over future electricity market

SIMMERING concerns about the future of the coal industry after 1998 when current contracts with National Power and PowerGen inherited by RJB Mining from British Coal expire, have surfaced in a plea by RJB's director of marketing development Colin Godfrey to Professor Stephen Littlechild, the electricity regulator.

RJB Mining, which was awarded the bulk of British Coal's deep mines at privatisation, is appealing to the regulator to end what it describes as a 'bias' against coal-fired power stations, and asks him to recognise that they are the most economic of all types of generation.

Calling for significant changes in the methods of payment to power stations, the company also urges an end to long-term gas contracts which give gas-fired power stations an unfair advantage.

Mr Godfrey's plea is the tip of an iceberg of concern which has been growing in mining circles ever since privatisation. There are fears that the industry will face a tough fight which may threaten its survival once the five-year contracts expire.

He says coal-fired stations are being locked out of the future electricity market, even though the competitiveness of British

coal has improved to the point where it is now able to meet the prices of gas and imported coal.

Electricity from the first generation of gas stations (owned mostly by the 12 regional electricity companies) is now half as dear again as power from coal stations, says Mr Godfrey. He calls on the regulator to impose a price cap to ensure that consumers get the benefit of cheaper coal-generated power.

After 1998, RJB insists that electricity from coal-fired stations will be down to 1.8p/kWh, based on the supply of coal at £1.25 GJ: gas generation would typically range from 2.5p to 2.9p/kWh.

Criticism was directed against the long-term gas contracts in January when it emerged that the National Grid came close to collapse at a time when British Gas had been exercising the terms of interruptible clauses and cutting off supplies at times of peak demand.

Mr Godfrey also warns against the insistence of the regulator that National Power and PowerGen sell off 6000MW of power station capacity. Although the move was intended to facilitate competition, he says, the main effect would be to keep prices artificially high.

## Gas competition trialled in SW

GAS industry regulator, Ofgas has recommended 29 April as the start date for competition in domestic gas supply in south west England.

The recommendation, to Tim Eggar, Energy Minister, followed a meeting of representatives of gas suppliers and TransCo, the transportation arm of British Gas.

Clare Spottiswoode, director general of gas supply, welcomed the deadline: "This meets the timetable set in 1993 by the then President of the Board of Trade, Michael Heseltine, who said that British Gas' tariff monopoly would end in April 1996.

Competition will be introduced in three stages. The first phase, this April, in Cornwall, Devon and Somerset, will involve half a million gas consumers. Already a number of independent gas suppliers have said they can undercut British Gas' prices by up to 25%.

Phase two, next year, will extend the first phase to include Avon, Dorset, East and West Sussex and Kent, and will include two million consumers.

By 1998 almost 19 million gas consumers throughout the UK will be able to choose their gas supplier.





## Product launch at ET 96

ET 96, the environmental equipment and management exhibition, will take place from 16-18 April in Hall 9 at the NEC in Birmingham.

To be launched at the exhibition this year on the Servomex stand will be the latest development of the Xentra 4900 analyser for continuous emissions monitoring. The range was first launched last year with carbon monoxide and oxygen measurement capability. The latest analysers can now be supplied to measure concentrations of sulphur dioxide and/or nitric oxide



The new four-gas analyser

as well, all in one compact housing.

The standard size 19" 3U enclosure houses a Servomex paramagnetic oxygen transducer plus any two of three miniaturised gas filter correlation infra-red transducers.

An important benefit of the Xentra 4900 is the large dynamic range of the transducers employed. Because of this, each transducer is capable of using both its measurement ranges at one time without switching.

Also to be featured at ET 96 are a range of high performance table top ozone generators, on the TTO exhibit (stand D024). These units, developed by Sorbios, Trailigaz' German subsidiary, are ideal for labs, pilot plants and small industrial applications. Their compact, low energy consumption designs combine high frequency technology and the use of ceramic dielectrics to generate ozone at high concentrations — up to 20% by weight.

## Training can help meet targets and save money

MEETING environmental legislation is not simply a question of installing low NOx burners, flue gas desulphurisation plants, electrostatic precipitators and so on, but also operating and maintaining this equipment.

The majority of atmospheric pollution arises from combustion processes, yet few engineers, technicians or plant operators receive adequate training in this respect. Combustion rarely features significantly in university engineering courses, whether they be chemical, mechanical or even environmental engineering courses. This is particularly surprising in view of the fact that combustion is fundamental to our industrial society. For governments to achieve their commitments to pollution reduction, there must be a better understanding of the combustion process amongst designers, maintenance engineers and operating staff.

FCT International faced the problem of the lack of combustion knowledge amongst engineers when recruiting, so developed its own in-house training courses covering the full range of combustion processes, including:

- physics and chemistry of combustion;

- flame stabilisation;
- combustion thermodynamics;
- pollutant formation and how to minimise pollutants;
- fuel and flame properties;
- combustion, heat transfer and process modelling;
- burners & equipment;
- controls;
- operation and maintenance;
- emissions monitoring.

As an in-house training course, it is geared to the application of the best knowledge to real industrial situations, rather than an academic approach. The full course can cover some 80 hours, compared with the one to five hours typically provided by university engineering and environmental management courses.

In the interests of the good of the world-wide community, FCTI has decided to make this course available to all. The course is developed in a modular format, so can be structured to meet the needs of particular groups of participants. Furthermore, it is tailored to the level of knowledge of the participants, thus recognising that the needs of the designers are quite different from that of the operators and maintenance staff.

In addition to providing the training necessary to meet the

requirements of environmental regulatory bodies, better training of staff concerned with the operation of combustion plant will result in substantial cost savings in terms of both operation and maintenance.

Increasingly, professional bodies recognise the need for engineers to undertake training well beyond that provided at college or university and in the first few years of industrial experience. This training or continuing professional development (CPD) is intended to maintain, update and expand the engineering knowledge to meet the engineer's current needs. The FCTI combustion course has been recognised by the Institute of Energy as contributing towards the CPD requirements of those working with heaters, boilers, flare systems etc.

The first of the open courses will be run by FCTI for the International Kiln Association at the Forum Hotel, Cromwell Road, London on 29-30 April 1996.

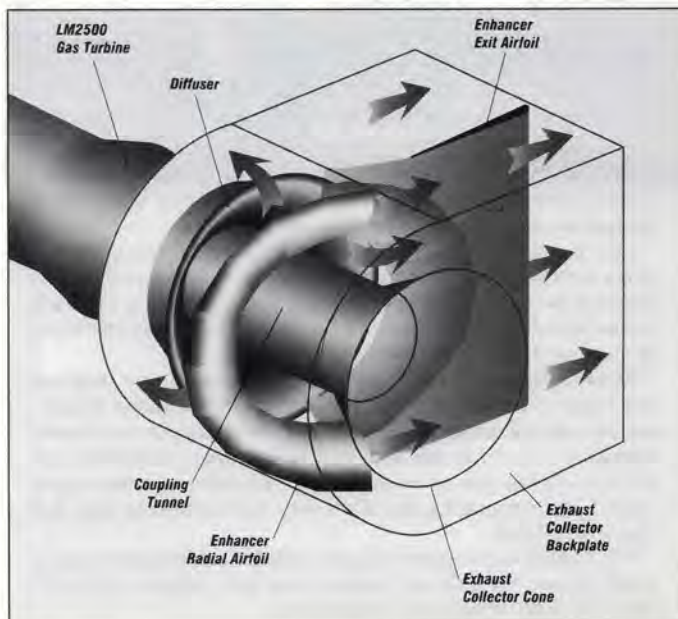
For further details on this course, see the enclosed flyer; or to discuss tailoring a course to your individual needs, contact: David Farr or Peter Mullinger at FCTI on 01494 450539.

## Flow enhancer improves efficiency and output

A FLOW enhancer from Stewart & Stevenson in Texas, USA, improves efficiency, increases power output, decreases heat rate, reduces noise and vibration as well as reducing back pressure in GE LM2500 aeroderivative gas turbines.

The three-dimensional, curved flow enhancer modifies the exhaust flow pattern and provides for a more even distribution of exhaust to downstream equipment.

The patented flow enhancer is available for both industrial and marine LM2500 packages, either on new equipment or as a retrofit.







## Project launched to improve gas management

AEA TECHNOLOGY, the international science and engineering business, has launched a joint industry funded programme, aimed at developing better reservoir simulations to optimise production from gas condensate reservoirs, an important source of gas in the North Sea.

In order to make the most out of these reservoirs, it is important that exploration and production companies select the appropriate number of wells to meet gas sales contracts and ensure as

much hydrocarbon as possible is recovered. Production problems typically occur when the pressure in gas condensate reservoirs is reduced as gas is extracted. In certain cases the pressure can fall below the dew point causing gas to condense to liquid, which can interfere with the gas flow, especially near to the wells.

The AEA Technology project aims to improve the accuracy of the reservoir simulations which are used to predict the extent to which condensate build-up will

impair productivity.

The Project, funded by the UK Department of Trade and Industry and eight major oil companies, started in 1995 and will run for three years. The work will be carried out at AEA Technology's Petroleum Engineering Laboratories at Winfrith in Dorset. AEA will perform numerical modelling and experimental studies of near-well condensate processes and provide more accurate models for use in reservoir simulations.

## Lifetime deal announced

BICC Thermoheat, part of international cablemakers BICC Cables, has announced a £multi-million lifetime contract with BNFL to supply products from advanced gas-cooled reactors (AGRs) across the UK.

The company, based at Hebburn in the north east, clinched one of the first contracts of its kind, and beat off a strong competitive bid from French-based Phillips Electronic Ltd.

The deal for the plant, which manufactures and supplies mineral-insulated thermoelectric and heating cables, brings to fruition months of preparatory work behind the scenes by experts who have designed and produced a purpose-made tube-sealed neutron absorber cable.

The contract will result in the building of a purpose-built facility at BICC Thermoheat.

Nick Morton, the company's general manager, said: "This is a well-deserved boost to the plant. We believe we have the unique blend of being part of an international company, while at the same time being able to offer the benefits of strong local and regional communications."

The Gadolinia units consist of a hermetically sealed, special stainless steel tube filled with a mixture of magnesium oxide and gadolinium oxide. The units, which are circular in shape, form part of the fuel assembly and give benefits of improved efficiency and longer lifespan for the fuel.

BICC Thermoheat has agreed a number of other arrangements to facilitate the contract to BNFL's requirements, including parent company guarantees, video conferencing facilities, EDI, single-point contact and guaranteed delivery times.

The products for BNFL will be manufactured at Hebburn, with contingency for production at BICC Pyrotenax Trenton in Canada, supported by cable stocks at BICC Pyrotenax at Prescott, Merseyside. BICC Thermoheat has existing contracts for BNFL.



AGEMA Infrared Systems has launched a new family of hand-held thermal imaging systems for condition monitoring.

Like its predecessors in AGEMA's popular Thermovision® 400 series, the Thermovision® 500 Generation sets new standards of performance for industrial thermal imaging systems. Typical users will include maintenance engineers in energy utilities, manufacturing plants, computer facilities and consultancies.

All products in the 'family' will be characterised by very small size and weight — small enough to be held and operated in one hand — and will take advantage of the very latest focal plane array detector technology, to offer major improvements in image resolution compared to existing systems on the market. A number of unique application features providing significant time and cost savings have also been incorporated.

For further information contact: AGEMA Infrared Systems, Arden House, West Street, Leighton Buzzard, Bedfordshire LU7 7DD. Tel: 01525 375660; fax: 01525 379271.

## Multi-media teaching aids

NEW multi-media teaching materials are available from the Open University, which explore the origin and geological setting of the different types of physical resources which can be extracted from the earth. In addition, the effects of their extraction on both the local and global environment are also considered.

The teaching materials are from the Open University's second level undergraduate earth sciences course: physical resources and environment. Covering a broad subject range, they focus on the scientific aspects of physical resource extraction, and consider current thinking on such issues as sustainable development, the polluter pays and intergenerational equity.

The materials comprise seven self-study workbooks, three audiocassettes and eighteen videos. They are relevant to teachers and lecturers in earth sciences, environmental studies, hydrology, energy, the built environment and natural resources.

Further information on these and other Open University teaching resources available can be obtained by contacting Helen Kerindi or Vicki Amos on 01908 261662, ext 229/230. Alternatively, write to the Marketing Department, Open University Educational Enterprises Ltd, 12 Cofferdge Close, Stony Stratford, Milton Keynes MK11 1BY.





# Compliance or the Courts

by Caroline May\*

THE CURRENT environmental regulatory framework in this country is enshrined in the Environmental Protection Act 1990 (EPA), which was a landmark for environmental regulation in that it adopted an integrated approach to environmental control. Before the Act there were separate Statutes covering individual environmental media, eg The Clean Air Acts 1986, Control of Pollution Act 1974 and various other Statutes dealing with water and land contamination.

The EPA differed in that in one Statute, it sought to encompass regulatory control of all environmental emissions to air, land and water. It enshrined the integrated approach to pollution control, under the systems of integrated pollution control (IPC) for the most polluting processes and air pollution control (APC) for lesser polluting processes.

Despite the UK's reputation as the 'dirty man' of Europe, our system of IPC provides a role model for the new Integrated Pollution and Control Directive (IPPC) in Europe which is aimed at enforcing integrated environmental controls and uniform regulatory standards across the whole of the Community. At the moment, various standards of enforcement apply in different countries, but the intention is that not only is an integrated approach adopted, but that a uniform enforcement system is put in place across the whole of the Community. There is some way to go before that is achieved as controls and enforcement methods vary widely from the efficiency of, say, Germany, to the more relaxed approach of Greece and Italy. This is currently of concern to many companies with pan-European operations and to overseas investors looking to forum shop for the best prospects and investor returns. Some of my clients complain to me that these differing standards of enforcement

**The following article is based on a lecture to the Institute of Energy and the Combustion Engineering Association in June 1995. Ms May went on to receive the Institute's Roscoe Prize for her paper. It examines the implications of current and anticipated environmental legislation for companies within the energy sector.**

are affecting markets and actually working against the creation of a level playing field. However, enforcement standards across the whole of the Community are moving in one direction . . . upwards, and it is no solution to suggest that standards should be uniformly lowered to redress the balance.

One thing that is certain, however, is that as far as environmental regulation is concerned, the tune is most definitely being called by Brussels. Despite the forebodings of Euro-sceptics subsidiarity has already been ceded. So you need to keep your ear to the ground in the UK and your eyes on Brussels. For example, the introduction of the new landfill tax next year owes more to the European Landfill Directive than it does to environmental concern on the part of the UK Government or the Chancellor's fiscal objectives. In the energy sector the imposition of emissions controls for, say, SO<sub>x</sub> and NO<sub>x</sub> arises as a direct result of European and not UK legislation. At EC level environmental regulatory control is set to increase with stringent standards being introduced for water and air quality and for waste disposal. In particular, they are considering the imposition of strict liability for environmental damage caused by waste. I will return to the impact of such legislation later on.

The EPA established two systems of environmental regulatory control, namely IPC and APC. Both systems require the operators of processes which fall under these systems to apply for authorisations from Her Majesty's Inspectorate of Pollution (HMIP) for IPC processes and Local Authorities for APC processes. There is a sliding time scale for applications, but when complete (during 1996) it is estimated that approximately 5000 industrial processes in the UK will fall under

IPC control (ie, the most polluting processes) and approximately 27 000 processes will fall under APC control (lesser polluting processes).

The IPC system deals with all emissions to air, land and water. It applies to prescribed processes and prescribed substances. These are set out in the surprisingly entitled 'Prescribed Process and Substance Regulations'. Basically, this system seeks to control the most polluting processes, which do not necessarily have to emanate from heavy industrial use. Light industrial processes which use or produce prescribed substances will also fall under the control of IPC eg, dioxins, PCBs and VOCs.

If such a process falls under the control of IPC it is necessary to obtain an authorisation from HMIP covering the operation of each component part of the process. This has caused problems in, for example, the chemical industry where a manufacturing process may involve a multiplicity of component parts. It has now been agreed that in certain industry sectors one authorisation will be sufficient to cover a number of component parts. An authorisation will govern not only process parameters, but also methods of operation, eg hours of working, personnel training and monitoring requirements for emissions and emission limits. HMIP consults with other regulatory bodies, as appropriate, in considering each process, eg NRA, WRA and/or HSE.

The most important aspect of the authorisation process is the fact that the authorisation, when granted, and all supporting documentation is placed on a public register. These registers are regularly checked by Greenpeace and other environmental pressure groups including local residents' committees. Increasingly, however, they are also being consulted by insurers and investors as environmental matters become commercially mainstream. The registers are seen as a starting point for information about a company's environmental standards and performance and therefore an authorisation application is perhaps the most important PR statement a company can make about its activities. For example, one of the requirements for holders of waste management licences is to show that they are 'fit and proper' persons to hold such a licence. A conviction shown on the public register is not the best way to demonstrate fitness and propriety. There are also certain shorthand techniques that are useful

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to know. For example, if a company has its own environmental policy, it is not enough simply to state the policy in the application, you have to state that the company will implement and enforce the policy, otherwise this will be the first condition imposed upon you when your authorisation is granted. This gives the impression that you are only implementing your own environmental policy because you are obliged to do so. All authorisations are subject to the BATNEEC condition.

BATNEEC stands for Best Available Techniques Not Entailing Excessive Costs, and should not be confused with CATNIP — Cheapest Available Techniques Not Involving Prosecution. Note the use of the word 'techniques'. This does not mean technology, but also includes management of the system, its operation and the training of those personnel who operate it. When introduced initially there was much concern in industry that the regulators would insist on BAT and would give little consideration to NEEC. In practice, the recession has had a levelling effect and it is now understood that NEEC can and should be taken into consideration when assessing BAT.

All applications are also subject to the BPEO criterion and must show that the Best Practicable Environmental Option has been chosen to minimise the impact of the operation of the process as a whole on the environment. The BPEO was overshadowed by BATNEEC in the early days, but is increasingly coming into its own.

The Environment Bill also introduces the concept of a cost-benefit analysis. If this passes into legislation it is likely that the concept of BPEO will develop to take economic factors into account as part of the overall assessment of the process.

The Local Authority deals with emissions to air only. Separate controls are in place for emissions to water, ie the NRA controls consents to discharge to water. The WRA controls waste management licences introduced under the Waste Licensing Regulations 1994.

These waste offences under Section 33 of the EPA mark the introduction of a differing standard of proof for environmental offences, as they involve an element of culpability for the inactive, as well as for those who transgress authorisation discharge standards themselves. You can now be liable under waste offences if you 'knowingly permit' an offence to take place. You can be liable for the actions of others as well as your own actions. For example, if you operate an incineration process, the fly ash created puts an obligation upon you as a producer of waste to ensure that ash is transported safely (by an authorised carrier) and disposed of appropriately (by a site authorised to accept such waste). Similarly, if your process produces waste oils, you are responsible for ensuring

that the oils themselves are treated, kept or disposed of safely. This is a significant extension of the usual principles of liability that have applied, to date, in English law.

The new waste controls are a precursor to likely developments at EC level. As previously mentioned, the EC is considering the imposition of strict liability at civil law for environmental damage caused by waste. If introduced this would mean that if your waste caused environmental damage, whether or not it was your fault, you would be liable in damages. This would have significant impact upon environmental litigation in this country and would encourage Plaintiffs to bring claims secure in the outcome. The result of EC deliberations is not unknown (they have swung one way and then another since the debate began). However, if introduced, the impact upon commercial transactions in the UK and indeed upon all land management, will be significant.

## Enforcement

It is important to remember that regulatory controls under the Environmental Protection Act 1990 are subject to criminal law. Prosecutions for breaches of the Act can be commenced in either the Magistrates Court (for lesser offences) or the Crown Court (for more serious offences). Offences are usually judged by the seriousness of the environmental impairment concerned. In the Magistrates Courts fines of up to £20 000 per offence may be levied. In the Crown Courts fines are unlimited. In addition to fines, in most cases, individuals can find themselves liable to penal sentences of up to six months in the Magistrates Courts or five years in the Crown Court.

It should be stressed that such sanctions are used rarely, only where there has been a wilful or reckless disregard for the law. At least one company director was already detained in an open prison for failing to comply with the terms of his Waste Management Licence. He earned a six months' prison sentence for failing to dispose of special waste at a suitably licenced facility and most notably in breach of guidance provided by the Waste Regulation Authority. It should be remembered that this penalty applies not only to executive directors but also to non-executive directors, shadow directors or managers. Anyone who constitutes the 'controlling mind' of the company can be liable.

The fact of a conviction would, of course, have a damaging impact on your personal liability, but also upon the commercial performance of the company and its ability to obtain investment and insurance.

In the case of an incident involving multiple minor polluting incidents, overall sentencing is likely to be assessed by considering the overall impact of total emissions to

the environment. However, it should be remembered that up to the statutory maximum can be awarded for each offence and be multiplied for each day the offence occurs. For example, if pollution occurs from say, storage of leaking oil drums, the fine can be assessed on the basis of each individual drum and be multiplied for the number of days each drum is leaking.

Shell UK Ltd still hold the dubious honour of having received the largest fine to date in the UK of £1 million for the fracture of a pipe under the River Mersey estuary which led to a significant oil spill.

Greenpeace and other environmental pressure groups regularly check the public registers and have signalled their intention to bring private prosecutions against the directors of the 500 companies identified as the most polluting, as a way of encouraging improvement in their environmental performance. As if this was not enough, the real sting in the tail comes from the availability of an order for clean-up costs. A polluter can be ordered to clean up the pollution complained of or the regulator can do it and charge the cost to the polluter.

In the Shell example which I referred to, the fine was £1 million but the total clean-up bill to Shell was £7.1 million. In the event of a major polluting incident, any fine is likely to be dwarfed by the clean-up costs. This enforcement remedy alone has the most potential for far reaching commercial consequences of any feature of the EPA. It involves not just the polluter, but their shareholders, financiers and insurers. Most major litigation in both UK and US has arisen from disputes between insurers and the insured as to potential liabilities for clean up costs. Companies who anticipate that they may be liable for such costs will have to make an appropriate provision in their accounts, which is likely to have a significant impact upon that company's financial performance.

Other remedies available under the EPA include obtaining an injunction from the Court in circumstances where environmental damage is occurring and cannot be compensated for by an award of damages. In addition, the regulators may serve enforcement or prohibition notices requiring recipients to take specified actions to comply with their authorisations or obligations under the EPA or to prevent them from actions which may lead to environmental impairment.

The most unusual heads of claim for civil actions for environmental damage are brought in the torts of negligence, nuisance, trespass and what is known as the rule in *Rylands v Fletcher*. The latter involves the escape of a substance brought onto land for a 'non-natural user' which subsequently escapes and causes damage to neighbouring land. This principle may be affected by developments with regard to strict liability





currently being considered at European level.

The Environment Bill proposes the creation of a single Environment Agency which will bring together all the current regulatory bodies under one roof, eg, HMIP, NRA and the WRA, only the Health & Safety Executive and the Drinking Water Inspectorate will remain outside the new Agency. It remains to be seen how the Agency will work in practice and whether it will be sufficiently funded to enable it to be effective. We must wait and see. In terms of manpower and resources at the moment the NRA is the glamour organisation with HMIP in the Cinderella role. It is anticipated that in the new Agency the NRA will predominate, at least in the early stages, but internal organisational issues may mean enforcement objectives will be on the back burner for a short while, but that the Agency may then emerge more focused and a more effective enforcement Agency.

One of the most important aspects of the Bill is that it changes the approach to the clearance of contaminated land. This is an extension of the polluter pays principle and becomes the owner pays principle, but steps back from the previously proposed Contaminated Land Register which the Government now accepts as unworkable.

The Environment Act 1995 provides that local authorities shall consider whether any land within its area of authority meets the new definition of contaminated land provided under the Act:

- 'Contaminated land is land which appears to the local authority in whose area it is situated to be in such condition, by reason of substances in, on or under the land that:*
- (i) significant harm is being caused or there is a significant possibility of such harm being caused; or*
  - (ii) pollution of controlled waters is being, or is likely to be caused.'*

Note that in so far as land is concerned the harm must be 'significant' whereas for controlled waters, any pollution is sufficient under the definition.

In circumstances where land or water is adjudged to be contaminated, the Local Authority will consider (following guidelines yet to be issued by the Secretary of State) the cost involved in requiring the land to be cleaned up and the seriousness of the harm or pollution in question. The land is required to be cleaned up on a suitable for use basis, and so a consideration of the usage of the land is also relevant.

In circumstances where the Local Authority considers action is appropriate it will give notice to the new Environment Agency (where appropriate); the owner and/or occupier of the land; and 'the appropriate person' under the definition provided in the Environment Act 1995:

*'The appropriate person is the person who*

*caused or knowingly permitted the substances, or any of the substances, by reason of which the contaminated land in question is such land, to be in, on or under that land.'*

Broadly speaking therefore, the appropriate person will be the polluter or someone who 'knowingly permitted' the pollution to occur.

The Bill indicates that the 'appropriate person' is most likely to be the owner or occupier who will assume primary liability for the contamination of their land. Unless the land has become contaminated by a definite act on the part of the tenant, a remediation notice will, most likely, be served upon the 'owner'. An owner is defined as anyone who actually owns the freehold of the land or is entitled to receive rent from it and would include mortgagees in possession. This definition already causes alarm to banks who may take a secured charge over property and to Trustees and/or Receivers who may find themselves, by virtue of carrying out their professional duties, to meet the definition of 'owner'. Receivers have now gained some protection in that they cannot become liable as owners when carrying out their professional duties, save in circumstances where they have been personally negligent. Secured lenders have argued hard for the same protection, but despite much debate in both the Lords and Commons this has not happened. Banks in particular remain alarmed at the prospect of liabilities arising from secured lending. This one issue of liability arising from contaminated land, is likely to dominate all commercial activity in land transactions when the new Bill becomes law. The position of secured lenders dominated discussions about the new Bill in the early debates in Parliament. However, the Bill also provides that before serving a remediation notice the Local Authority must carry out a cost/benefit analysis of the work required to be done. This second aspect has dominated more recent debates and has caused alarm to environmentalists and to 'owners' alike. Until proper detailed guidance is produced (the Act envisages that it will be) it is difficult to assess this proposal properly.

After notification, a three-month consultation period follows to see if it is possible to draw up an agreed programme for clean up of the land. At the end of the three-month period the Local Authority will issue a remediation notice, statement or declaration which will then be placed on the public register. A statement is issued when agreement has not been reached between the parties. A notice will be issued where agreement has not been reached but the Local Authority still requires action to be taken (ie, it is a form of enforcement notice). A declaration will be issued where the Local Authority has formed the view that no action is required and will

set out the reasons why. All forms of notice where work is required will set out a timetable for the works and details of the cost.

No new appeal mechanism has been put in place as the Bill currently stands and so it remains to be seen if, in future, local authority decisions on contaminated land will find their way before the Courts as challenges are made as public law issues.

The commercial consequences of environmental legislation are becoming apparent. The use of environmental audits is becoming increasingly commonplace and insurers are increasingly making pre-policy enquiries about environmental liabilities before issuing policies. The financial implications are apparent in that environmental liabilities or potential liabilities will increasingly be used as negotiating weapons in determining purchase prices in acquisition and disposal situations and in asset valuations. Investors and venture capitalists are also increasingly aware of the potential impact of environmental liabilities upon a company's financial viability.

Ultimately, environmental regulatory controls are set to tighten and increase both at UK and EC levels. Increasing public awareness of environmental issues and of the potential side effects of polluting incidents will ensure that media interest in the environment remains high. Developments at EC level with regard to strict liability may involve an enormous change in the legal burden required to ensure prosecution, thus giving access to the various enforcement remedies which I have discussed. It is not anticipated that, even if introduced, this burden will be imposed retrospectively and therefore is unlikely to give rise to US style Superfund liabilities. In commercial transactions, it seems likely that environmental disclosures will assume even greater significance as both companies and insurers look at the adequacy of those disclosures made. For companies operating potentially hazardous processes identifying and defining environmental liabilities will become increasingly important. In commercial transactions the use of environmental warranties and indemnities will become increasingly commonplace as both vendors and purchasers will wish to minimise their liabilities both for their own actions, and increasingly those of others with whom they have become commercially involved.

## Post script

Since this lecture was given, the Environment Bill of 1994 has become the Environment Act 1995 (it passed into law on 19 July 1995). The new Environment Agency is due to be operational by April 1996 with a new chief executive, Ed





Gallagher (formerly head of the NRA). The Act has established a new Air Quality Strategy in addition to the new regime for assessing contaminated land set out in the paper. The guidelines for assessment of contaminated land are still awaited and it is as yet uncertain as to how the new regime will work in practice. The new law has projected contaminated land to the forefront of all commercial activity involving the buying and selling of land. The financial sector is increasingly concerned about the possibility of incurring liabilities from secured lending. It remains to be seen how the regime will actually work in practice, but one thing is certain, environmental issues and contaminated land in particular will be at the forefront of commercial activity for the foreseeable future. □

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# The European internal market in electricity

*an overview by Robert Tudway\**

IN DECEMBER last year the Commission approved a White Paper on energy policy. It highlights competitiveness, security of supply and environmental protection. The White Paper contains a framework for future action, based (in the context of regulation of the electricity supply industry) upon the following factors:

- market integration within the Community;
- internationalisation of costs (particularly with regard to competitiveness and environmental protection);
- the external dimension (a coherent approach to energy matters with the Community's major partners); and
- security of supply.

There remains in particular the question of access rights and the compatibility of France's single-buyer model not only with the essential objectives of the proposals but with the provisions of the EC Treaty relating to competition and freedom of movement and the right of establishment.

That there is currently no European energy policy is clear but the Maastricht Treaty on the European Union at least includes 'measures in the spheres of energy' as now being within the activities of the Community (in Article 3{t}) at least giving some further legal basis to the Commission's endeavours.

The electricity industry poses particular practical and legal difficulties in integrating the divergent systems of electricity generation and supply across the Member States of the European Union. It clearly makes no sense at all to have an open and competitive European Internal Market in which the prices paid for and the general availability of elec-

**The author looks at the development of the internal market in energy in the EU, and the influence upon it of EC legislation such as the Transparency and the Transit Directives.**

tricity varies considerably from one Member State to another. The effective long-term development of the Common Market is at stake, if that is not achieved.

There is a wide disparity in the size of systems of Member States, from large producers with a net annual production of 100 000 GWh per year, medium-sized systems of the Netherlands, Belgium, Austria, Finland, Denmark, Greece and Portugal to the much smaller systems in Luxembourg and Eire as well as isolated systems within Member States such as the Hamburg or Berlin systems in Germany, the Crete system in Greece or the Canadian system in Spain. Some are fully integrated, monolithic state owned systems (such as France) in contrast with more liberalised systems such as Sweden and the Netherlands.

It is arguable that one of the primary reasons why the liberalisation exercise in the UK was a success was the fact that there was concurrently a cheap supply of gas that made the construction of new CCGT (combined cycle gas turbine technology) an attractive proposition for new and existing generators. It remains to be seen whether or not access conditions in the Commission's proposals will result in such new competitive generation activity without a similar incentive.

The Commission expects this trend to continue throughout the Community and yet it is estimated that the Community's dependence on external supplies of natural gas will rise from 40% at present to 60% by the year 2000, as the Commission points out in its March 1995 Working Paper in response to the November 1994 Council meeting.

The French and the UK markets typify the wide disparity between the nature of electricity markets in the Community. However, a

number of countries are now following the UK in the process of privatisation and deregulation. Indeed, two of the new members of the Union, Finland and Sweden, already have liberal regimes and the Dutch, the Portuguese and the Germans are more or less following suit.

The Commission has adopted a three-stage approach to the deregulation of the electricity markets in the Community.

Stage 1 concerned the adoption of Directive 90/377/EEC on the Transparency of Gas and Electricity Prices for Industrial End-Users ('the Transparency Directive') and Directive 90/547/EEC on the Transit of Electricity through Transmission Grids ('the Transit Directive').

The Commission has reported back on the success of the Transparency Directive, which paints a mixed picture on the extent to which Member States are in full compliance with the Directive. The Directive aims to give industrial end-users data on charges imposed by electricity utilities to their particular sectors, which is seen as an essential pre-requisite for establishing an open competitive market in electricity.

The Transit Directive obliges Member States to take measures to facilitate the transit of electricity between high-voltage grids on the basis of non-discrimination and provides for notification of interconnections or as the case may be complaints to and investigation by the Commission in the event of any refusal by a Member State which cannot be justified on objective grounds. The Transit Directive is seen as an essential precursor to the establishment of a genuinely free European electricity market. Clearly, if the European market is not connected up in this way, any supposed right for a consumer to take a supply of electricity from an external source would be academic. The Transit Directive should also be seen in the context of the growth internationally of interconnected grids. The grids of more than 50 countries are now interconnected. In Europe, there is already an established network of grids coordinated by the Union for the Cooperation of Production and Transmission of Electricity. It has been reported that the countries of mainland Europe own 14% of the world's generating capacity. Little con-

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sideration has been given, however, to the influence of such external factors on the development of the EU Internal Market and the extent to which it will be able to compete on such a global market. It is well known that European consumers pay significantly more than their US counterparts for their energy consumption and it can be argued convincingly that part of the reason for this is the lack of competitive influences.

The main development in the EU's external energy policy was the signing by the European Community and other countries in Europe on 17 December 1994 of the European Energy Charter. The Treaty covers such areas as the alleviation of market distortions and barriers to free competition, the transfer of technology and cooperation, the transit of electricity materials and products, transparency and investment. There are correlative provisions dealing with dispute settlement. As such, this initiative can be seen as part of an overall cooperation between Eastern and Western Europe alongside such other programmes as Synergy, which provides support, training and provision of information for projects in Central and Eastern Europe.

Stage 2 relates to the present proposal for a directive on the internal market in electricity, to which reference is made below.

Stage 3 has been reserved for a time in the future when a considered analysis can be made on the success of the above Directives in breaking through the markets and further action becomes appropriate. In other words, the Commission is taking a necessarily cautious approach in recognition of the undoubted difficulty in achieving competition policy objectives while ensuring security of supply and the long-term stability of the market, although some would inevitably argue that even this pace is too ambitious given the obstacles involved.

Set against the security of supply is the perceived necessity to bring the electricity industry into line with the development of the Internal Market and competition policy and the EC's principles of freedom of movement for goods and services and the right of establishment.

It follows that third party access/single buyer is at the heart of the tension between maintaining a secure system of supply and yet opening up national grids to pan-European competition, without which there can be no effective internal market in electricity. There are a number of variants to third-party access, from the Commission's original proposals for a system of licensing to negotiated access rights with the right of appeal to the maintenance of an internal monopoly under the French single-buyer model. The latest amendments to the Commission's proposals under the French and Spanish presidencies have already

placed much greater emphasis on the security of supply concerns as opposed to market liberalisation, to the extent that it is debatable whether or not the final outcome will achieve in reality any of the main concerns of competition policy.

A number of issues have been argued, at least in principle, following the Energy Council meeting in June 1995, although any progress has been overshadowed by the distinctive lack of progress on the arguments surrounding third-party access (TPA) and the French proposals put forward in October 1994 for the parallel introduction of the single-buyer model (SBM).

The points of principle which have met with some accord relate to the liberalisation of electricity generation, the unbundling of accounts (that is, the separating of accounts as between generation, transmission and distribution activities provision for the operation and management of transmission and distribution networks and the recognition by the Commission and Member States of requirements of security of supply and public service obligations. The difficulty is how these principles are translated into framework. The TPA and SBM models are fundamentally different.

By contrast with TPA, SBM retains a complete internal monopoly and a system whereby all purchases of electricity from an external source go through the single buyer. In effect, the single buyer has a purchase and sales monopoly, where the electricity can only be sold to the single buyer for integration into the system. The consumer remains the customer of the network and the electricity bought from the external supplier (at a price less than the usual tariff) is resold to

the network at more or less the tariff price less transmission charges. The network then concludes a further agreement with the foreign provider and the transaction is deemed to take place at the frontier. Although it would be discriminatory and therefore contrary to EC law to apply different transmission charges, it is not clear from the SBM proposals what controls there could be on pricing structures that make external supplies economically unviable, except for a system of transparent published tariffs and arbitration.

The main justification for the SBM is that it is best suited to maintaining security of supply and performing the public-service obligation, which, it is argued, would be compromised by the introduction of competition in the form of TPA. The SBM is also concerned with the issue of long-term planning and the perceived problem of investment 'grid locks' ensuring a return on investments and with enabling an effective policy on controlling electricity demand and the protection of the environment. Does the UK experience bear this out? Many might say not and that the issue, in reality, is Gallic protectionism.

The whole thrust of the Commission's approach in relation to electricity is to reconcile the arguably irreconcilable. Even the minimum requirements to achieve compatibility of regulatory systems in the EU look as if they will be rejected. If the French SBM view is accepted, then regardless of the sentiments towards a single market in energy which are basic to the White Paper, there is likely to develop a two speed internal market in energy. □

## The author

Since qualification Robert Tudway has practised in the area of company and commercial law in the firm of Waltons & Morse in the City of London, where he was a partner from 1977 to March 1995. In April 1995 he became a partner with Nabarro Nathanson.

He has advised on a wide variety of commercial and corporate transactions, and has been involved in advising interests in the electricity supply industry since 1984.

On privatisation he was responsible for advising one of the RECs on their individual interests, and has since advised on a wide variety of interests within the ESI. He has acted in relation to a number of electricity generation schemes, particularly in the renewable sector, and has advised independent power producers and trade associations in the industry.



He is co-author of *Electricity: Law & Practice* (Sweet & Maxwell 1992), and has contributed to *Halsburys Laws of England* on reorganisation of the ESI.

Mr Tudway has in addition published articles and papers on electricity supply law, and has considerable lecturing experience in this area.





# Energy is big business at the Hannover Fair

*A background report by Lewis Tozer*

EUROPE'S annual industrial spectacular, the Hannover Industrial Fair, will be host to 7221 exhibitors from 65 countries when it opens for business on 22 April 1996.

Of the total 318 500 square metres of exhibition space, 62 100 will be devoted to energy and environmental technologies. Add to this the area taken up by building services and lighting and the total becomes 130 000 sq m: a massive 41%. In terms of numbers of exhibitors in these categories, namely 2430, they represent a formidable 33% of the total.

Turning to the overall number of exhibitors, 7221, and listing the numbers appropriate to the leading participating European countries, as would be expected, Germany leads with 4225, followed by Italy with 300, France and Switzerland 220 respectively, and the UK and Spain, each with 200. The United States, this year's featured 'partner country' with 260 exhibitors will occupy 4 045 sq m. Interestingly, the UK's 200 exhibitors will occupy rather more at 4119 sq m.

## Pride of place

Giving prominence to a partner country is a regular point of emphasis at Hannover Fairs. Next year's Fair will give pride of place to the UK, a distinction that has been a long time coming, not because of reluctance on the part of the German hosts but because of home grown, unimaginative political posturing. The reluctant British have finally accepted the invitation, because 1997 is a year with particular significance — the Fair's Golden Jubilee.

Dr Juergen Oesterhelt announced the UK's Department of Trade and Industry's decision during a London reception for businessmen, industrialists and representatives of major institutions at a reception in London in February. Ambassador Oesterhelt said the invitation to Britain was a special tribute to what he called the 'high level of economic and commercial farsightedness' which led

the British Government — in an effort to help Germany rebuild its economy — to support the setting-up of the first Hannover Fair in 1947. Prof Klaus Goehrmann, chairman of the fair's management board, also addressed the meeting and paid tribute to British foresight in creating what was to become a world leader. So much for the sentiment.

Because the Hannover Fair attracts some 300 000 visitors who expect to be able to see and compare the latest developments which are coming to the market in the different technology sectors, exhibitors have to respond to the challenge, not only in terms of their exhibits but also in their ability to impart information to a discriminating audience. Forums dealing with international topics, and seminars at which leading manufacturers present tutorials covering their current developments, are well received by enthusiastic audiences. Visitors are not, therefore, likely to be disappointed. It is difficult to recall a significant innovation, particularly in

the diverse technologies that energy embraces, which has not made its international debut at Hannover. One can cite, for example, areas such as new materials, design concepts, and the development of components and systems, all of which have created desirable spin-offs for improving the production and use of energy.

Prominent among the many interesting structures at Hannover is the 'solar tankstelle', a 42.5 metre high array of solar cells with a maximum output of 15 kW.

During a fair, and there are many apart from the Industry Fair, the solar 'gas station' supplements power taken from the public supply network and is used to recharge batteries of electric buses which provide speedy, quiet and environmentally friendly transport for visitors within the exhibition complex. Outside exhibition times the electrical energy is converted to alternating current and fed into the local 400/230 volt distribution network.



The magnetbahn at Hannover Industry Fair.

PHOTOGRAPH: AEG





A fascinating development that has captured the imagination of transport buffs and been featured prominently at recent Fairs is magnetic levitation. It has been presented as the ideal solution to two different types of problem, namely, a universal mode of transport for personnel, equipment and haulage in mines, and as the answer to providing high-speed train services in the fairly near future. Although the two applications meet fundamentally different needs, their mode of operation is similar — they float along rather than roll. Electronically controlled magnets support and control the vehicle and a linear motor propels and brakes it with the complete absence of mechanical contact. Moreover, the drive motor is not to be found in the vehicle itself but in the track.

### Reduced energy consumption

On the underside of the track, stator packs with drive windings are installed in which an electromagnetic, travelling field is produced. The travelling field, in combination with the supporting magnets, propels the vehicle forward and brakes it when the polarity of the current is reversed. In its high-speed, 350-500 km/h, train manifestation it is apparently named TRANSRAPID. Tests have confirmed that at 400 km/h for example, TRANSRAPID is no noisier than a present-day intercity train travelling at 200 km/h and with the advantage of a 30% reduction in energy consumption.

TRANSRAPID has been thoroughly checked out and approved by the German Railway authorities as well as by the Federal Government which has approved the construction of a new TRANSRAPID line between Hamburg and Berlin. How nice it would be to have TRANSRAPID for the new high-speed Channel-London link — and onwards to ... !

Stand alone technologies belong to a past era. Innovations mature from widely dispersed roots and often find possibly overlapping applications. Thus diversity and affinity mirror the intimate, shared relationship which exists between energy, buildings and the environment. It is no coincidence therefore that at this year's Hannover Fair, this underlying relationship will be emphasised.

The justification for this arises from a meeting in March 1995, shortly before the Environmental Summit in Berlin and coinciding with the Hannover Fair, when 14 trade associations representing the main sectors of the German economy gave an undertaking to the German government that they would adopt a self-imposed duty to protect and improve the environment. Accordingly a target was set to reduce CO<sub>2</sub> emissions by the year 2005 by 20%. Guenter Rexrodt, Federal



PHOTOGRAPH COURTESY OF DEUTSCHE MESSE AG  
The solar tankstelle, 42.5 meters high, with a maximum output of 15 kW.

Economics Minister, particularly welcomed the move because 'investment measured in several billion Deutschemarks would be released.'

To avoid decrees and other government impositions, such as energy or carbon taxes, the participating associations are required to report the measures taken and the results achieved biennially. The preferred measures are: energy efficiency improvements, improved gains from heat recovery, multiple uses of process heat, increased CHP using diesel or gas engines, a sharply accelerated take up of renewable energy sources, and the use of comprehensive energy management

systems.

According to German sources, the annual management costs of a building fall between 10% and 20% of the total investment. After a few years, operating costs also mount up and can begin to exceed the original cost of a building. Taken over the life of a building, German estimates indicate that construction costs amount to only 20%, while operation and energy costs can, in comparison, reach 60%. On this basis, it is argued, there is immense scope for reducing operating and energy costs by the use of building management systems. □





THE ENERGY from waste conference year got off to a good start with the national conference of the Energy from Waste Association, allied with ETSU to produce an important two-day event.

Twenty speakers addressed the conference, but I will concentrate on those areas of interest to members of the Institute of Energy, and on papers that significantly increased our stock of knowledge, or made a useful contribution to the debate.

The timing of the conference was very nicely judged, coming a month after the publication of the White Paper *Making Waste Work: A Strategy Waste Management*. The full title: *Beyond the Myths: achieving a more effective and sustainable integrated waste strategy from household and commercial waste*, though lengthy, does express the thrust of the debate. The myths in question can be stated in Orwellian terms as the theme: 'recycling — good; landfill and incineration — bad', beloved on environment fundamentalists. This wisdom is increasingly challenged.

The hierarchy of waste management options, devised a few years ago, said waste should be minimised, reused, recycled in that order; only when these possibilities were exhausted could one contemplate recovering energy from waste (EfW) or landfilling it. Until recently this went largely unchallenged. Last year conference speakers continued to pay lip service to this hierarchy, but argued that energy from waste should be moved up the ladder to rank equally with recycling. The Government's Consultation Draft *A waste strategy for England and Wales* published last year, retained its ill-defined 25% recycling target, but stated: 'recycling is not a waste management option to be pursued at any cost.' It devoted as many pages to EfW as it did to recycling.

As early as June 1994, the House of Commons Environment Committee, in their second report on recycling, said: 'We are convinced of the fundamental preferability of waste reduction at source. Re-use and recovery (of both energy and materials) are the next best options. The relative merits of energy and materials recovery, however, are finely balanced and will depend very much on circumstances.' This year has begun with the primacy of the hierarchy under concerted attack at this conference, led by none other than the Secretary of State for the Environment, John Gummer MP, in his keynote address.

The concept of 'sustainable development' was central to his Government's strategy on waste, said Mr Gummer. We should not pass

# Integrated waste strategy and other musings

Conference report by R G Loram

our problems on to future generations as our Victorian forebears had done, he said (a bit unfair — the Victorians built the first energy from waste plants!). In a telling passage, Mr Gummer said he was asked in the EU to adhere strictly to the old hierarchy, with EfW at the bottom. However he believed that if it was possible to reuse and recycle waste economically that was fine, but energy recovery was often the best use of waste, and we should interpret the hierarchy in the context of individual situations. Waste strategy had to be framed in an agreed European context. The Germans had gone off on their own on recycling packaging, and had merely caused problems elsewhere. It must be ensured that the pursuit of recycling did not create auxiliary problems. (What price the Packaging Directive?).

The second speaker, Dr Peter White of Proctor & Gamble, in his paper on 'Integrated Waste Management' described hierarchy as being in the past, and said its application was limited because it had little technical or scientific justification. Neither did it compare different combinations of options and did not address economic costs. His view was that a system of integrated waste management (IWM) was needed which would be large-scale, market orientated and flexible. This would enable it to cover a range of management options whilst allowing for changes in the market. To help implement this system Dr White looked to 'the emerging environmental management tool of lifecycle inventory (LCI)', which endeavours to quantify the environmental, material and economic inputs and outputs of a commodity during its whole lifespan. A LCI model for municipal solid waste (MSW) exists in a recently published book. But even a 362-page book will not, apparently, tell you which is the best IWM, but can provide the data on which such a decision should be made. The system can come unstuck when one tries to put values on the outputs affecting the environment — trying to quantify the unquantifiable.

Terry Coleman of the Department of the Environment presented a paper entitled 'The DoE lifecycle assessment (LCA)' surely we could agree on a single title — 'programme', and showed how LCA fits into the overall framework of decision making in waste management, and what role it might have in the future. Mr Coleman added that LCA was,

however, only a tool, not a decision maker in itself. One is left wondering how useful a tool it is if it is incomplete. He also insisted that the hierarchy should be flexible.

The role of recycling in any waste strategy was one of the main topics addressed by Prof Andrew Porteous of the Open University. He gave a practical demonstration of recycling by reusing papers presented to other conferences, but his message bears repetition Prof Porteous maintains that it is almost certain that paper recycling is of no benefit to the environment, and may well be detrimental. It is practised for economic reasons. Comparatively little of the plastics from the municipal waste stream are suitable for recycling, and it has yet to be shown if there is any environmental benefit commensurate with the extra cost involved. Any likely recycling scenario is not going to seriously affect the quantity of waste available as a fuel, nor its quality. Indeed, enhanced recovery of glass and metals will improve the quality of MSW. He went on to describe how clean a combustion process a modern EfW plant is when operating to and below the HMIP limits. He added: "hopefully the same level of improvement will be obtained from trucks, coal and oil-fired furnaces — we can but dream!"

The conference included three international papers. Kjell Eriksson spoke about 'The Gothenburg Solution'. In Sweden's second largest city, 80% of all buildings are connected to the community heating network, making it the largest district heating scheme in Sweden. Most of the heat for the year-round base load is supplied by the 300 000 tpa mass-burn EfW plant, whose highly efficient flue-gas cleaning system includes four absorption heat pumps, extracting heat from sewage works discharge, and waste heat from two local refineries. 70% of total heat demand in the city is met by EfW and heat recovery. The remaining 30% is accounted for by detached houses rounds the outskirts, supplied by natural gas or electricity. The EfW, supplying 25% of the city's heat demand, consumes all the city's domestic and commercial refuse, supplied by six transfer stations.

The word from Germany was brought by Dr Ing G Lautenschlager. It is sometimes mistakenly believed that landfill has been banned in Germany, but this far from the case, with 602 landfill sites. 320 are in what





was East Germany, where there are no EfW plants or incinerators at all. The 282 in West Germany are unevenly distributed. Areas where landfill is restricted have the greatest number of EfW plants, with Bayern burning two thirds of its MSW, Schleswig-Holstein 50% and Nordrhein-Westfalen 40%. The city states of Bremen and Hamburg burn 100% and 75% respectively. Germany has a total of 52 incinerators processing 10 870 tonnes a year, and serving 30% of the population; they all recover energy.

What of the German approach to recycling? In legal terms this is enshrined in the *kreislaufwirtschafts-und abfallgesetz* — which translates as the circulating economy and waste law. The idea behind it is for manufacturing industry to work hand-in-hand with the waste management sector. The basic principles behind this are the avoidance of waste production, in particular by lowering the quantities produced and lessening the risk of damage caused; recovery of materials and energy; and disposal of non-reuseable waste by treating or disposing of it in an environmentally acceptable manner.

The *kreislaufwirtschaftsgesetz* rules that all waste must be sorted at source. This is already done efficiently with paper, glass and scrap, and to a growing extent, vegetable waste. The calorific value of non-reusable waste has been steadily increasing as inert materials and wet waste have been sorted out, and it will probably continue to do so.

Politically, materials recovery is often given preference to the waste-to-energy alternative. A clear indication in Germany being the recycling of plastics. At great cost it is attempted to condition the plastic mixed with household waste, or combined with other materials such as paper or metal. Rarely does the quality come up to that of the raw material. The cost of oil recovered from plastics is about 30 higher than the cost of crude. So for economic reasons alone it is expected that plastic materials will be used as an energy source. Even the ultra-green Germans are learning to live with reality.

The Federal Government has introduced new regulations regarding landfill, to come fully into force by 2005, allowing only the most innocuous waste to be landfilled. Since the scope for recycling is limited, Dr Lautenschlager indicated EfW capacity will have to increase by 150%. Some 50 to 60 new large plants are to be started in the next six years. It is little wonder that the Germans are trying to persuade the rest of Europe to adopt its 17 BImSchV emission standards!

'The Danish model' was the title chosen by Suzanne Arup Veltzé of the Danish Waste Management Association. The Danish Waste Strategy, published in 1992, to cover the period 1993-97 aimed at a target of recycling 50% of waste by the year 2000. Ms Veltzé claimed this target is already being

met, with the remainder being split: 23% to incineration, 26% to landfill. This sounded rather high, and it transpired that the 50% figure includes not only an 80% recovery figure for construction waste, but 71% recycling of sewage sludge. The figure for household waste is currently 9%. Biogas from waste is classed as recycling but not incineration.

Denmark's 2.3 million tpa of household waste, and 2.5 million tpa of general industrial waste (GIW) is handled by the 274 local community authorities who are banded together into 34 joint municipal waste disposal companies. The majority of the household waste and part of the GIW is burned in EfW plants, which supply 40% of the country's district heating needs. Recently built plant is required to generate electricity as well. Taxes are levied to pay for waste management, and used to implement the strategy. Incineration with energy recovery is taxed at 160 DKr/te (£18.50/te); incineration without energy recovery at 210 DKr/te (£24.25/te); and landfill at 285 DHr/te (£33/te).

Gov Eduljee of Environmental Resources Management gave a précis of a report, due to be published shortly, on research into the environmental risk assessment of dioxin releases. The study considers pathways by which dioxins can be taken up by the human body. The background and incremental exposure to local populations from an MSW incinerator were calculated, as was total uptake. A 250 000 tpa EfW plant emitting 1 ng/m<sup>3</sup> was used as an example: "The results of the assessment indicated that, for the hypothetical maximum exposed individual (HMEI), the total incremental intake of dioxins as a result of exposure to representative incinerator emissions amounted to an increase of approximately 1-5% to the background dose. However, site-specific exposure were on average a factor of 10 lower . . . highlighting the need for site-specific assessments."

In both cases, both the background dose and the total of background dose from the incinerator emissions were below the tolerable daily intake (TDI), set by WHO, and endorsed by the UK Department of Health, of 10 pg/kg body weight/day. This really ought to silence the squawking of the protesters, but I don't suppose anyone in the waste disposal business will be holding their breath.

Kurt Carlsson of ABB Fläkt Industrie AB in his paper 'Emission control for EfW plant' produced tables of figures from Sweden and Switzerland — both with moderately high concentrations of EfW plants — demonstrating the small proportion of overall atmospheric pollution caused by EfW incineration. He gave a run-down on all current flue gas cleaning systems, and it was striking how little development there has been over the past

three or four years, purely because of the efficiency of existing designs.

Panel discussion on the whole were rather disappointing, considering this was a good opportunity to identify issues for the EWA to take to the powers that be. Ray Palin, the Association's director had such an issue in mind when he asked the final day's panel if they thought emission limits should continue to be reduced. Prof Porteous replied that the disparity between stricter limits for EfW plant than for conventional large combustion plant could not be highlighted too often.

Ash disposal — the subject of the final paper — provoked considerable discussion, as few countries seem to be finalised their approach. There appears to be an international consensus that bottom ash from mass-burn incinerators is innocuous if the boiler fly ash and flue gas cleaning residues are kept out of it. The heavy metals will be concentrated in these streams, which is why there is concern as to disposal methods adopted. Even so heavy metals will be mainly in the form of stable oxides, which research has shown do not readily leach out, though they may if attacked by acids. The panel agreed that ash monofill was preferable to disposal with other wastes: here it might be noted that domestic waste landfills are normally mildly alkaline.

There was also agreement that research was needed into the stabilisation and solidification of fly ash and flue gas cleaning residues.

This was a useful conference covering a wide range of topics within the EfW theme, and it showed that the DoE, at least, is on the side of the EfW angels. What the EWA now has to do is to address the energy side of the equation and find out what is supposed to happen after NFFO 4. The past two or three months have seen a very different pattern of electricity pool prices from those prevailing in previous months. Does this indicate that generators are taking a more rigorous look at the pricing of plant that is called into use for winter weekday peaks? The NFFO scheme is aimed at bringing renewable energy prices down to the market level — but what is the market price?

The mass-burn EfW plants are already out on their own unless they are operating a CHP scheme, and the economics of those is more complicated than the DTI seem to think. Unless it is possible to latch onto a base load for the maximum economic amount of heat, the electricity production is going to fluctuate with the seasons. Malcolm Chilton, chairman of EWA raised the question of how the extra electricity would be contracted and paid for. □

*Copies of the papers will be available from the end of March from ETSU, tel: 01235 433525 or fax: 01235 433131.*





THE BRENT SPAR is unique, not only because of the exceptional events of last summer: it is a unique structure for which the main dismantling options require an exceptional feat of civil engineering, according to Graham Dunlop, a senior project engineer on the Brent Spar Decommissioning Project, speaking at a conference in London in February.

Speaking on the subject of 'Why is Brent Spar Unique' at the Institute of Petroleum conference, *Minimising the Impact of Decommissioning*, Mr Dunlop said the Spar posed unprecedented challenges for Shell, as well as an opportunity to learn and change. The measures now being taken in its search for a solution could become illustrative of a new way of doing business. With initiatives for a new contracting process and a wide-ranging, international consultation, Shell was striving for the goal of a new stage in the regulation of business activity.

## Dimensions

The Brent Spar's technical features are now well known, said Mr Dunlop, but he was not convinced that there was a real understanding of the full extent of its dimensions, and what these meant as regards moving the structure.

"The Spar is like an iceberg" he said, "Most of its bulk, mainly the six huge storage tanks, is beneath the water's surface. At 14 500 tonnes, the Spar weighs nearly as much as 2000 double-decker buses, it is longer than a football field floating on its end, and its huge tanks displace 66 500 tonnes of water — a capacity that means they could hold the equivalent of almost four Big Bens. Apart from the waters north of Orkney, most of the North Sea is too shallow to accommodate it."

Because the Spar was different from any other installation in our waters, it had to that extent never represented a precedent for the disposal of other structures, the large majority of which would be brought ashore and dismantled. Shell Expro's original thoughts had been to return the Spar to shore, but the more this was studied, the more difficulties were uncovered.

"Herein lay — and lies — the fundamental issue," said Mr Dunlop. "Removing the Spar from the water or even just raising it higher, without posing undue risk to people or the environment, requires an exceptional feat of civil engineering."

# A new way of doing business

**Despite the apology from Greenpeace, following their misleading campaign last summer against deepwater disposal of Shell's Brent Spar installation, Shell have learnt a number of lessons from the incident. The overriding wisdom to emerge from the affair is that consultation — as wide-ranging as possible — is almost always a good thing. Shell told of their experiences at a conference in London earlier this year.**

"While Spar is robust and fit for the purpose for which it was designed, the most up-to-date calculations of its structural strength under various stresses have shown that the original installation process cannot readily be reversed. Raising it up out of the water in its vertical floating position, or attempting to rotate it to the horizontal, both pose a significant risk to its structural integrity. This is mainly due to its intrinsic design, and to the need to maintain, during movements of this kind, the balance of internal and external pressures which stop the tanks walls from buckling and imploding. This challenge is further complicated by the fact that two of the Spar's six storage tanks were damaged during operation. Any future solution will have to balance benefits carefully with these risks."

## Earlier studies

With these constraints in view, detailed studies two to five years ago had established deepwater disposal as the Best Practicable Environmental Option (BPEO) for the Spar, a near-unique solution for which only a few other UK installations would potentially be candidates.

The Spar was not by any means the 'toxic time bomb' alleged. Its deepwater disposal would have had negligible impact on the marine environment, confirmed by independent experts and supported in consultations. The integrity and professionalism of the original Shell inventory was later endorsed in the further independent audit by Det Norske Veritas. In comparison with deepwater disposal, the safety risks in terms of fatalities during onshore disposal would have been six

times greater.

However, due to the exceptional events of last summer, outrage had arisen from a deeply-rooted belief in the principle of 'clean seas'. Shell had abandoned the deepwater disposal plan, and begun an open, wide-ranging initiative to find a solution to match or better deepwater disposal, with the central features of consultation, dialogue and high profile public examination. The challenges of finding a disposal solution for this unique installation remained, but Shell was committed, with the help of others, to meeting them.

"We have received 400 letters," said Mr Dunlop, "proposing many imaginative solutions for the Spar. They have ranged from removing topsides to shore for use as a training facility to creating a fish ranch with the submerged tanks, or in some way using its dimensions to harness wave power and generate electricity. In many cases these ideas have come unsolicited from individual members of the public and have proved truly stimulating and encouraging as we set out on the new way forward."

A unique contracting process underpinned the search. "Typically, a company invites contractors to bid for a specified solution. But in the case of Brent Spar, Shell does not know what the final disposal option will be. So the process consequently requires contractors to compete to find and develop the best solutions. We will then award the implementation contract to whoever has developed the BPEO. This process will harness not only the expertise of the major contractors with all their different resources, but also the integrity of the many entrepreneurs who have already contacted Shell." □





THE NUCLEAR industry has a clear need to manage and operate all its activities to the very highest standards of safety. At the same time, the operational work undertaken must ensure that the availability and reliability of its installations are maintained to levels of excellence, commensurate with the regulatory and legal requirements imposed. From a competitive viewpoint, the nuclear facility must seek to reduce its operating and maintenance costs to the lowest achievable.

Nuclear power installations are immensely complex pieces of plant and large capital intensive projects. It follows that the highest operating load factors must be sought over the planned lifetime of the installation to maximise the return on the capital incurred. Of paramount importance is safety and this for the industry is the overriding factor.

To match these objectives demands the use of very sophisticated technology and equipment. Maintenance procedures must be adopted which offer a high degree of skill at the work place, aimed at reducing down time, so as to produce the lowest overall running costs.

Remotely operated handling equipment was introduced initially into the nuclear industry to reduce exposure of personnel to ionising radiation, thereby facilitating plant operation. In Britain, problems associated with the early Magnox reactors saw the need to address the affects of steel oxidation. The Magnox stations designed in the 1950s and 1960s were intended to be maintenance free. However, as problems arose, the task of in-reactor working was found to be impossible without the use of remote equipment. The earliest application addressed successfully a number of problems. Over the 35 years that have elapsed since the 1950s, a whole range of techniques, equipment and practices have come to the fore. This has enabled nuclear installations to be more efficiently operated while at the same time increasing the level of safety.

# Remote techniques for hazardous environments

by Eur Ing F John L Bindon

Advances in remote technology have been assisted by the swift developments which have occurred in electronics, computing, sensing and actuation. In particular, the development of high quality TV cameras, lighting and associated equipment has made great strides forward towards achieving exceptionally high clarity of vision. The inventiveness of the handling gear involved has also been exceptional. The advances have enabled plant operators to carry out detailed inspections and repairs to equipment, often under very severe conditions, such as high radiation levels, confined space, limited access and in hostile environments.

In general remotely operated handling systems must be matched closely to the task which means that a whole range of equipment may be necessary to service fully a particular installation.

The use of robots is not restricted to operating plants. Their application covers a wide spectrum of work, including the use of remote equipment for the dismantling of closed nuclear facilities, power plants, reprocessing facilities, together with the management of radioactive wastes. The devices currently being utilised are both of the stationary and mobile type and their development has led to their use in other industrial applications. These later vary from construction, tunnelling/excavation, dismantling, firefighting and in transmission line repair. The robots' availability for utilisation covers a huge range of applications, although their main advantage is where the environment is

hostile and hazardous.

Over the past ten years, a number of conferences have taken place on the subject of robotics for the nuclear industry. The British Nuclear Energy Society (BNES) held their first major event in 1988 and then again in 1993. It is appropriate that 1996 will see another international conference being organised by the BNES. It will take place on 29-30 April at the Hinkley Island Hotel in Leicestershire.

This latest event is designed to be an intensive two-day integrated conference supported by an exhibition. The scope has been widened to cover all industries where remote techniques are required to combat hazardous environments. The conference is to focus on six main areas:

- robotics;
- inspection;
- operation and maintenance;
- repair and refurbishment;
- decommissioning;
- waste management.

Non-nuclear applications will be discussed, such as the use of robotics in the field of the oil, petro-chemical industries and in non-industrial work, such as medicine. All of the presentations will provide a forum for the widest interaction of knowledge, experience and discussion which will be shared beneficially amongst the delegates.

The event is sponsored by the Institution of Electrical Engineers, Institution of Mechanical Engineers, Institution of Nuclear Engineers and the European Nuclear Society.

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## An invitation to THE INSTITUTE OF ENERGY ANNUAL LUNCHEON

Monday 22 April 1996  
Langham Hilton

**PRESIDENT:** Mr D G Jefferies CBE FEng  
**PRINCIPAL GUEST AND SPEAKER:**

John Battle MP  
Shadow Minister for Energy  
**LUNCHEON:** 1.15 pm

**RECEPTION:** 12.30 pm  
**PRICE OF TICKETS:** £56.40 (£48.00 + VAT)

Applications for company tables and individual tickets may be requested direct on 0171 580 7124 or fax 0171 580 4420. Numbers will be limited and early application is advisable.  
**Note:** Tables are round and accommodate 10 or 12 persons. Every effort will be made to keep smaller groups separate but it may be necessary to share tables.

## Conference: Restructuring the electricity and gas markets: the new scene

ORGANISED by the Institute of Energy, this conference will provide delegates with a unique opportunity to hear and debate the key energy policy issues with this high profile gathering of market leaders, many of whom have been influential in bringing about the current environment.

While organisations within the electricity and gas markets seek to stabilise and strengthen their positions, competition grows stronger as the market becomes increasingly diverse. Dynamic combinations of management, strategies and alliances are emerging to

cope with the restructuring of the market place and the emergence of the reconfigured utilities.

This conference will examine and debate some of the future policies that key market players see as vital to the successful development and progression of the energy markets into the next millennium.

Speakers will be David Jefferies CBE FEng; Professor John Chesshire, Ed Wallis, John Devaney, Ian Blakey, Cedric Brown, Sir Philip Jones CB and Chuck Whitney.

## Calling NVQ candidates

Heard of the recently launched Standards in Managing Energy? Wondered how you could meet this standard? The Institute of Energy is setting up workshops to guide you through the process of obtaining an NVQ unit in managing energy. If you would like to be one of the first candidates to obtain NVQ units in managing energy, telephone Louise Evans immediately to reserve your place. Tel: 0171 580 7124.

## Challenges and solutions — IGE AGM

*GAS challenges and solutions — the future* has been chosen as a theme for the Institution of Gas Engineers' Annual Conference, to be held at the Harrogate International Centre on 16 and 17 May.

The conference speakers include some of the biggest names in the business. Sir David Simon, chairman of BP, will deliver the keynote address, followed by Clare Spottiswoode, director-general of Ofgas. Cedric Brown, chief executive of British Gas, joins these and a host of high powered contributors, while parallel sessions will provide the opportunity to develop two distinct themes of business and technology.

Senior figures from independent gas companies, CORGI, TransCo, HSE and SBGI will speak on topics affecting individuals,

companies and markets in the UK.

A newly created Awards Breakfast has been arranged for Friday, 17 May. This new dimension to the annual conference not only allows IGE winners during the last year to be presented with their awards, but will also provide a platform for John Battle MP, shadow minister for energy, to explain the role of the gas industry under a Labour government.

Time has been allowed in the conference programme for delegates to visit the Gas 96 exhibition, which will take place alongside the conference in the Harrogate International Centre. The exhibition will bring together manufacturers and suppliers from all sectors of the gas industry and delegates are automatically registered to attend during its open hours.

## Obituary Paul Tate

A FUNERAL service for Paul Tate, who died suddenly at the age of 80 on 21 January, was held at Mansfield Crematorium on 25 January and attended by many friends from the Institute and the former National Coal Board.

Paul graduated as a chemical engineer before the war, and worked initially as a chemical engineer before joining Powell Dyffryn Technical Services and the Ministry of Fuel and Power. While with the Ministry, he was involved in helping the Berlin power stations to continue operating during the time of the Russian blockade.

He joined the National Coal Board in 1952, initially as head of the Fuel Efficiency Service, responsible for the improvement of energy use in all its forms. Many of the hundreds of boilers in use at that time were fitted with mechanical stokers, and Paul wrote and published a book on their use and maintenance. Throughout his career he took a major role in the training of boilerhouse staff through his involvement with the City and Guilds Institute.

In 1959 he moved to Nottingham to set up in the East Midlands Division a new technical branch for the NCB Marketing Department. He was widely respected within the NCB and by their numerous customers for his sensible and practical advice on the use of coal in boilers and furnaces.

Before his retirement in December 1980 he became closely involved in the development of new and improved equipment for handling and burning coal through his work with the Coal Research Establishment, where again his practical knowledge was enormously helpful.

Paul was a Fellow of the Institute, which he joined in 1946. He was elected to the committee of the East Midlands Branch in 1963, and was Branch Chairman for the year 1969-70. He continued to serve on the Branch committee for many years, and in 1971 joined the Membership committee, on which he served for 25 years.

Paul will be greatly missed by his family and many friends. Our sympathies go to Lillian, Isobel, Anna and the grandchildren.

**Last month you were made aware of the National Standards for Managing Energy in which the CPD Manual in Managing Energy was cited. We would like to make you aware that this interactive, user-friendly development tool in managing energy is available from the Institute of Energy. For more information contact Louise Collins, tel: 0171 580 7124.**





## New members

### Fellow

**Paul Christopher Darley**, MAN GHH (Great Britain) Ltd, London  
**Peter Wilkinson Barnes**, Amoco House, London  
**Anthony Charles Proctor**, F C Foreman & Partners, Manchester

### Member

**Andrew John Baker**, R Curry Ltd, Bristol  
**Thomas Butterfield**, Kent County Council  
**Colin James Deller**, Hamworthy Combustion Engineering Ltd, Dorset  
**Martin Harrick**, Rosyth Royal Dockyard, Fife  
**Marian Kempson**, ECD Architects & Energy Consultants, London  
**Shek Ping Leung**, Environmental Protection Department, Hong Kong  
**Martin John Littlewood**, ABT (UK) Ltd, Southampton  
**Eric James Maddison**, Belfast City Council, Belfast  
**Michael Phillip Anthony McCann**, BET MS, Surrey  
**Stephen Andrew McDonald**, Chilworth Technology Ltd, West Yorks  
**Michael Iain McDonald**, Mid Glamorgan County Council, Pontypridd  
**Dr Graham Andrew Mills**, University of Portsmouth

**Sean Francis Milsom**, E J Milsom & Associates, Middlesex  
**David Christopher Monkman**, British Aerospace Military, Lancashire  
**Stephen Paul Nickell**, Northern Ireland Electricity, N Ireland  
**John Andrew Parsons**, British Gas plc, Loughborough  
**William John Peter Richie**, Babbie Electrical & Mechanical, Glasgow  
**Peter Rolton**, Rolton Services Consultants, Northants  
**John George Tout**, DTEO, Salisbury

### Associate members

**Stephen Paul Adams**, Rust Consulting Ltd, South Glamorgan  
**Paul Bridge**, Thermelek Engineering Services Ltd, Derbyshire  
**Terry Charnock**, North Trafford College, Manchester  
**Peter Connolly**, North Trafford College, Manchester  
**James Howard Gaston**, Nigen — KPL, N Ireland  
**Alexander Rak**, Tameside Metropolitan Borough Council, Lancashire  
**John Alan Robinson**, Castlereagh House Control Centre, Belfast  
**Tony Willox**, Royal Mail, Anglia

### Associate

**Geoffrey Bates**, Leck Patrick Dairies Ltd,

Co Armagh  
**Thomas William Brown**, Amec Process & Energy, Aberdeen  
**Daniel Watt Clark**, Prudential Portfolio Managers Ltd, London  
**Anthony John Dolding**, The Natural History Museum, London  
**Martin David Haworth**, Singleton Birch Ltd  
**Steven John Harrod**, Corral Montenay Ltd, Hampshire  
**Brian Duncan Jones**, Foster Refrigerator (UK) Ltd, Norfolk  
**Seamus Kelly**  
**John McCready Hill**, Musgrave Park Hospital  
**Mark McCluskey**, Lurgan Fibre Ltd, Co Armagh  
**William Nutley**, Electricity Supply Board, Eire  
**Jamal Mahmoud Nazzal**, Leeds University  
**Neville Alan Phillips**, Energy Management Swansea APC, Swansea  
**Darren John Shiels**, Ernst & Young, Birmingham  
**Ian Stewart Tabron**, BICC Cables Ltd, Liverpool  
**Keith Torrie**, Ethicon Ltd, Edinburgh  
**Peter William Vallance**, Lucas Diesel Systems, Suffolk  
**Ian Stuart Walker**, Woodcote Industries  
**Gareth David Woolmington**, Kellogg Co of GB Ltd, Manchester  
**Stephen John Wright**, R H P Bearings

WITH energy forming one of the key aspects of a business where real cost savings can be made, a brand new event, Energy Resource '96, offers a positive route to buying fuel more competitively and using it more effectively.

Already thousands of enquiries have been received for tickets to this major new exhibition, which will take place in Hall 10 of the NEC, Birmingham from 16-18 April.

An impressive line up of exhibitors will be offering a wide range of energy solutions. They include leading utilities such as Business Gas, Seeboard and Mobil Gas; major service companies such as Corral Montenay and McKinnon Clarke and leading forms in energy technology such as Viessmann, Honeywell Controls, Nedalo, Ecolohem and MDC. Combined heat and power also features prominently with leading companies in this field exhibiting at Energy Resource including National Power Cogen, Centrax Ltd, Combined Power Systems, Dale Power Systems and Startekno.

Products and systems on show include measurement metering and monitoring equipment, building management systems and controls, heating and ventilation, lighting and lighting controls, and boiler/combustion systems and controls.

## Good response to new energy exhibition

A key feature of the Energy Resource '96 exhibition lies in a comprehensive series of expert energy briefings of major interest to managers, energy buyers and engineers alike.

Covering 11 separate subjects, the briefings will take place in the well equipped Concourse Suite, each briefing lasting a minimum of one hour and featuring top speakers from the UK and overseas.

Sessions one to four, on 16 April, will feature briefings on combustion efficiency, the future for the competitive fuel markets; benefits of outsourcing energy service; and efficient steam systems.

Session one on combustion efficiency will feature four speakers who will look at increasing environmental legislation and demands on budget, and will explore how you can improve both the financial and environmental performance of your boilers, as well as considerations for new plant. Session two on the future for competitive fuel markets will examine developments and likely options for users in the immediate future, particularly on prices, availability, choice of supplier and choice of fuel. The third session

will be used to discuss the questions of real benefits, contract energy management, lighting and plant maintenance. Session four explores steam as a flexible option; the design of efficient steam systems; reduced emissions from energy efficient combination plant and water treatment and its effect on boiler operating costs.

Wednesday 17 April features sessions five to seven: covering neural networks for energy production, distribution and management; negotiating lower fuel costs; and CHP — a sustainable energy strategy. The final day, Thursday 18 April, concludes with sessions eight to 11. These will cover educating staff in reducing energy waste; reducing emissions from combustion plant; monitoring and metering for effective management and control and effective facility management.

Each briefing costs £55-£75 per delegate. For a full conference programme and individual timings and costs are available from Peter Holloway Associates, Allen House, Boltro Road, Haywards Heath, West Sussex RH16 1BP. Tel: 01444 458080; fax: 01444 441630.





## Management options

**'Safety and engineering aspects of spent fuel storage' Published by IAEA, 1995, 445 pp.**

Amongst the many important topics affecting nuclear power and its fuel cycle is the vital question of spent fuel storage. Matters surrounding this subject go to the core of the future of the nuclear programme. This topic invokes the concern of the public at large, and although experts agree they have three excellent management options, these are by no means accepted universally.

This book which is a collection of some 50 papers presented at an IAEA symposium in October 1994. Despite the fact that the book comes more than one year later, the contents are informative on most aspects of current practice.

The total amount of spent fuel accumulated worldwide up to the end of 1994 was 155 000 tonnes of heavy metal, of which about 60% is stored in facilities awaiting either reprocessing or final disposal. This total is about 20 times the present available annual reprocessing capacity. Further the accumulated total is expected to reach over 300 000 tonnes by 2010. The first geological repository for the final disposal is not likely to be ready before 2010. Therefore, interim storage facilities are where primary spent fuel will be stored in many countries for the next 20 years.

It is important that all countries should address this subject continuously, despite the industry's belief that present storage technologies can provide adequate protection to the population and the environment.

The book's contents cover a range of papers describing spent storage programmes currently in operation in a range of countries across the world. One section provides 15 commentaries on present day technology, while another section examines the regulatory/licensing conditions in seven countries of Europe, including the Eastern bloc.

A recommended book for those engaged in this vital aspect of the work in the nuclear industry.

*Eur Ing F John L Bindon*

## A clear-eyed look

**'UK Industrial and Commercial Coal Markets' by Malcolm Rainbow and David Price. Published by McCloskey Information Services Ltd, 1996, £350.00.**

If McCloskey Coal Information Services did not already exist, someone would have to invent it.

Long gone are the days when a nationalised coal mining monopoly had the resources and financial support to carry

through continuous and wide-ranging market surveys, backed up by its own teams of internationally respected economists, which could guide the investment deliberations of an entire segment of British industry.

Today, with the fragmentation of coal into unequally distributed lumps, all competing for a shrinking market, the need for accurate information regarding market trends, customer intention and a clear overview of the energy market as a whole, is of greater importance than ever before.

The latest market survey, by Malcolm Rainbow and David Price, is probably the most clear-eyed look at coal's industrial markets we have seen for some time.

And, in parts, it shows a pretty stark picture.

Since 1990 volumes of UK industrial and commercial sales have fallen 34%, despite only a slight decline in overall energy consumption. Yet at the same time the numbers of suppliers into the industrial markets has grown. British Coal's successors have been joined by importers and independent miners, and pits which were closed or scheduled for closure by British Coal have been resuscitated and now help to create an oversupply in the industrial market of 2 million tonnes — or 30% of the available coal.

While the authors warn that, in energy in particular, it is folly to place too much reliance on a single set of numbers or the extrapolation of a trend, their general view is that the oversupply will continue and together with the aggressive competition from rival fuels, prices measured against the benchmark of power station fuel prices will remain highly competitive at least until 1998. The end of supply contracts to the generators which RJB Mining inherited from British Coal and which expire in 1998, will have a fundamental effect on market structures throughout the industrial sector. It will certainly have profound implications for the size of the mining industry, and for the prospects of coal importers and other producers.

However, imported coal is at present less of a worry to UK producers than in the recent past. International steam coal prices have risen by 40%, while the house coal market, targeted by most importing traders as their primary source of revenue, is now in a very poor state, perhaps not least because retail customers have become progressively dissatisfied with the lack of consistency that they had relied upon from UK-mined supplies. Whatever the reasons, importers have found their resources squeezed beyond endurance and are returning to await better trading conditions.

The main worry remains the continuing challenge from alternative fuels. Rainbow and Price point to the gas offers now being made to large buyers ranging from £0.95-£1.20/GJ, as being at levels that most coal

producers would find themselves struggling to match.

Their overview is that very competitive prices will prevail in the UK unless and until the current tendency to overproduction is eliminated. That factor, more than anything else, will keep out most foreign coal except where quality and not price predominates. That in turn will ensure that UK coal will hold and could possibly gain in the industrial and commercial markets.

That position will persist as long as the overproduction, and as long as environmental issues do not become too onerous.

*Peter Heap*

## Succinct presentation

**'Postulational and Statistical Thermodynamics' by Y V C Rao. Published by Allied Publishers, New Delhi, 1996, 377 pp, US\$24.00.**

This text is a sequel to two previous books by Professor Rao on which the reviewer has previously reported. This is intended for senior undergraduate and post-graduate students. The author assumes that the reader is familiar with the traditional text based around the classical macroscopic view of the performance of the heat engine, hence the first chapter is a summary of the definitions from his *Introduction to Thermodynamics*. He intends to make the link with the 'newer' microscopic or statistical thermodynamics, which when the reviewer was a lad, was the province of the mathematical physicist.

The first six chapters cover postulation. Chapters two to four (equilibrium criteria, the energy maximum principle and thermodynamic potentials). Chapter five covers Maxwell relations and Jacobian methods, and chapter six deals with the stability of thermodynamic systems. Statistical mechanics have to be applied in the real world of thermodynamics because of the large number of variables which have to be taken into consideration. Chapters seven to fourteen cover respectively: the concept of quantum mechanics, mechanics of assemblies, fluctuations and equivalence, ideal gases, chemical reaction equilibrium, monatomic crystals, Bose-Einstein statistics and Fermi-Dirac statistics.

Understandably, many fiendish partial differentials abound throughout, ameliorated by the fact that they are clearly presented and aided by the nomenclature at the back of the book. The author is to be congratulated for the succinct presentation of many difficult concepts in a cohesive and easy to read manner. The book is well illustrated with 72 worked examples, 201 problems with numerical or short word solutions, 67 diagrams and 14 tables.

*Nigel Gwyther*





## Spirit of enthusiasm

'Renewables are ready: people creating renewable energy solutions' by Nancy Cole and P J Skerrett.

Published by Chelsea Green (USA), 1995, 256 pp, £15.95. UK distributors Images Booksellers & Distribution Ltd, The Wells House, Holy Well Road, Malvern Wells, Worcs WR14 4LH.

THE Union of Concerned Scientists (UCS) is a group based in the US and founded in 1969 to advance responsible public policies wherever technology plays a critical role in our lives. The UCS is a national alliance between some leading US scientists and over 80 000 citizen members. One of the authors, Nancy Cole, is the UCS director of public outreach while P J Skerrett is a former high school science teacher, now a writer.

The book is clearly aimed at the non-technical citizen in the US who is concerned about broad environmental issues. It gives many examples of how the renewables have been used in communities and individual dwellings throughout the US. Among examples cited are the city of Austin, Texas, now a national showplace for energy conservation and various applications of the renewables, the use of wood-burning stoves, windpower, solar heating and solar homes, and photovoltaics in the Hopi and Navajo national reservations. The book is illustrated with some black and white photographs and a few simple diagrams.

There were a few elementary mistakes with units in the text. A watt is one Joule per second or 0.001341 horsepower, not 'slightly less than one thousandth of a horsepower'. They are confused too about the difference between heat and power. Having defined the British Thermal Unit correctly, they spoil it with the statement that a watt is 'just over three thousandths of a BTU'.

Some of their history is also incorrect. French inventors did not build any engines powered by solar-generated steam in the seventeenth or eighteenth centuries.

However, scientific correctness was not the main aim of the book, which was to encourage others to follow the example of many of their fellow enthusiasts and get involved in similar real renewable projects. This spirit of enthusiasm certainly pervades the text and even experienced practitioners will find something to interest them in this cheerful work.

*Dr Cleland McVeigh*

## Thought-provoking and stimulating

'Business and the Environment'

Edited by Michael D Rogers, advisor

to the Science and Technology Studies Unit, European Commission, Brussels. Report on a workshop held at the Institute for Prospective Technological Studies in Seville. Published by Macmillan Press Ltd, London and St Martins Press Inc, New York, 1995, 358 pp.

THE book has 18 papers presented at the workshop together with short, edited question-and-answer sections, which presumably represent the main matters arising from the discussion sessions. Unlike many workshops covering several days (this one lasted three) there does not seem to have been a final session, drawing together the main conclusions and identifying "avenues for further work" which the editor identifies as one of the aims of the meeting.

Although the workshop was run by an organisation set up by the European Commission, in addition to papers from Europe there are important contributions from Japan, USA and Australia.

The titles of the sessions give a feel for the wide scope of topics covered: international perspectives, environmental management, technology (a disappointingly small section with just two papers on the best available technology concept and industrial waste management), towards sustainability, the role of financial institutions and the role of the regulators.

There is inevitably a wide range of styles and readability. So the volume is probably not intended to be read from cover to cover. It is quite good for dipping into, but also as a useful reference volume and here the index allows the reader to follow a subject as dealt with in several papers.

A reviewer can only draw attention to some of the points which attracted his or her interest. A point which will probably shock many environmentalists is from the discussion on the last paper in the book. In the USA where enormous sums are being spent on cleaning up contaminated sites 'up to 80%' are legal fees. Linked to this was a paper on a bank's interest in environmental matters. Clearly a company's ability to meet environmental legislation will affect its ability to attract investment. So banks — the author was representing the Nat West Bank — has to have expertise which can check a company's status on waste management and emissions. There have been cases where the lender could be considered to have shadow director status of a company in legal trouble and have to meet a share of a fine or even pay for site clean-up. The law here and elsewhere seems to require tidying up.

There has been a tendency for large companies to move from 'end of pipe' add-on strategies which are seen as reactions to legislation to a more strategic approach make

the whole manufacturing process incorporate changes which reduce emissions and wastes by strategic planning. Such an approach can lead companies to more profitable operation and higher profits. In addition to the economic improvement a 'green' public image can enhance demand for a company's products.

Few companies will be as lucky as ARCO in California, who faced with increasingly stringent emission limits for vehicles set out to provide motor fuels which were better than their competitors allowing them to increase their share of the market and to establish a green image.

Although large companies can incorporate environmental restrictions into their long-term strategies, small organisations have problems. They cannot afford to have specialist directors or to be able to carry out studies for their future plans. Even large companies are tending to change from in-house expertise to employing outside agencies. But the company is still responsible for meeting the regulations and executives — certainly in the US — can be sent to jail for breaking the law.

The situation in Japan is of particular interest. In the early 1970s there was a great concern about atmospheric pollution, leading to worrying levels of asthma, and the highly polluted state of the Inland Sea. The power of public opinion brought about strict regulations on air and river pollution that had profound effects on Japanese industry. Although there were dire predictions on the effects on the economy, by the early 80s, in spite of strict limits on wastes and emissions, Japanese industry had changed their designs and processes so that the companies were more profitable than ever. There was a combination of public opinion, challenging legislation and, eventually, industrialists enthusiasm which brought about a green miracle in Japan.

The combination of scientists, lawyers, industrialists and economists at such a workshop provides material which is both thought-provoking and stimulating. Environmental legislation must affect all engineering processes, particularly those involving energy. Using it to make plants more efficiently and more profitable can lead to a greener and more prosperous future.

*Norman G Worley CEng*

## Recently published

'1996 NSCA Pollution Handbook'

Edited by Loveday Murley, published by National Society for Clean Air and Environmental Protection, Brighton, 525 pp, £26.95. Available from NSCA, 136 North Street, Brighton BN1 1RG. Tel: 01273 326313





## CPD courses

THE Centre for Energy Studies at the South Bank University are currently preparing material and a programme for two CPD short courses titled *Energy Management in Buildings* and *Low energy design strategies*.

Both courses are to be delivered at Masters level with full accreditation for awards towards continuing professional development (CPD) hours and CAT points towards MSc qualifications. Each course will run for a period of five to six days, not necessarily in succession, to provide a flexible and manageable schedule for delegates attending. Upon successful completion of a particular course the delegate will be awarded with 30 hours CPD, total annual requirement as suggested by most institutions, together with a certificate of exemption of this unit on an MSc energy and engineering and MSc facilities management course at the South Bank University. This initiative is part funded by the EPSRC which allows the courses to be delivered at a 40% discount. The attendance fee for a complete course is £300, with individual courses attendance at £75. It is envisaged that the course will commence in July 1996. A special launch, date to be confirmed, will present full details of the individual courses, answer particular queries from interested parties and act as a forum for course registration.

Course syllabus, launch programme and further details for the courses are available on request from Peter Keavney, Centre for Energy Studies on 0171 815 7606.

## Top technician in industrial electronics

THE SEARCH is on to find the UK's top technician in industrial electronics.

Nominations are invited now for the 1996 Top Technician competition, which recognises excellence among technicians working in industrial electronics. Cyril Hilsum, chairman of the top technician board, said: "It is essential for the UK electronics industry that our technicians match in skill those of our overseas competitors. It is the aim of the organisers and our industrial sponsors to encourage effective training and education, thereby raising standards and making the UK even more competitive."

The competition is being organised jointly by the Institution of Electrical Engineers (IEE), the Institution of Electronics and Electrical Incorporated Engineers (IEEIE), the Engineering Training Authority (EnTra) and the Federation of the Electronics Industry (FEI) with the backing of UK Skills, the standard-setting body for national skills competition in the UK.

The contest will be a challenging test of theory and practical ability. It is open to people under 22 who have achieved a relevant qualification and completed a period of training as an electronics technician.

The closing date for entries is 30 April 1996. In July regional competitions will take place in Northern Ireland, Wales, Scotland, and the North and South of England. Winners from the five areas will participate in the National Final which will include a practical project carried out at the Electronic

Components Industries Fair (ECIF) in September.

The national winner could be chosen to go forward to the 1997 International Youth Skills Olympics to be held in Switzerland next year.

The winner of last year's competition, Matthew Swift of British Aerospace, represented the UK at the Skill Olympics in Lyon in October, and was awarded a Diploma for his outstanding performance.

Information on the 1996 Top Technician competition is available from: Sarah Stewart, IEE, Michael Faraday House, Six Hills Way, Stevenage, Hertfordshire SG1 2AY.

## Young Woman Engineer 1995

PAMELA WILSON, 29, from St Annes on Sea, Lancashire was announced as Young Woman Engineer of the Year in January. She was presented with the coveted award by Prue Leith OBE, chairwoman of the Royal Society for the encouragement of Arts, Manufactures and Commerce, at a special ceremony held in London.

Pamela, who originates from Belfast, was a runner-up for the award in 1992. She is a senior avionic systems engineer with British Aerospace, Military Aircraft Division, Warton Aerodrome, Preston, and a graduate member of the IEEIE.

## West country student prize launched by Square D

LEADING electrical distribution equipment manufacturer Square D is sponsoring a prize for the most outstanding electrical engineering graduate taking a new electrical services module at the University of the West of England in Bristol. The module, introduced this year, is part of the electrical and electronic engineering course for a BEng honours degree. The prize will be presented at the Faculty of Engineering's graduation ceremony.

Consisting of a cash award, together with an appropriate gift, the prize is designed to encourage students to pursue careers in building services. The prize will therefore be awarded to a student who opts to take the new electrical services module, which covers the design, selection, erection and verification of electrical services systems in buildings.

Square D will offer other forms of help to students during their course, including presentations and tours at the company's HQ and manufacturing facility in Swindon.



A keen student hoping to win the prize for the most outstanding electrical and electronic graduate, at the University of the West of England, Bristol.





## March

### Energy & Resources Law '96

12th biennial conference on petroleum, minerals, energy and resources law, 24-29 March, Prague. Details from International Bar Association, 271 Regent Street, London W1R 7PA. Tel: 0171 629 1206; fax: 0171 409 0456

### LPG: a clean and efficient motor fuel

Conference, 27 March, London. Details from LP Gas Association, Alma House, Alma Road, Reigate, Surrey RH2 0AZ. Tel: 01737 224700; fax: 01737 241116.

### Sources of Environmental Information

2 x one-day training workshops, 27 March and 31 May, London. Details from David DuBuisson, The British Library, Science Reference and Information Service, 25 Southampton Buildings, London WC2A 1AW. Tel: 0171 412 7470; fax: 0171 412 7497.

### Electricity Settlement & Trading Arrangements

Conference, 28-29 March, London. Details from Ben Gallienne, Customer Services Manager, IIR Ltd, 6th Floor, 29 Bressenden Place, London SW1E 5DR. Tel: 0171 915 5055; fax: 0171 915 5056

## April

### Sorghum for energy and industry

First European seminar, 1-3 April, Toulouse, France. Details from: Claire Charonnat, INRA Station de Bioclimatologie, F-78850 Thiverval Grignon, France. Tel: +33 1 30815555; fax: +33 1 30815563.

### The 1996 IChemE Research Event

Conference, 2-3 April, Leeds. Details from: Conferences and Courses, Institution of Chemical Engineers, Tel: 01788 578214; fax: 01788 560833.

### Hydrocyclones '96

International conference, 2-4 April, Cambridge. Details from: Dr J Svarovska (Mrs), FPS Institute, 8 Carlton Drive, Bradford BD9 4DL. Tel/fax: 01274 546276.

### Central & Eastern European power industry forum

3-4 April, St Petersburg. Details from: PennWell Conferences & Exhibitions, P O Box 9402, 3506 GK Utrecht, The Netherlands. Tel: +31 30 26 50 963; fax: +31 30 26 50 928.

### Gas Turbine Technology

Course, 10-12 April, Amsterdam. Details from The Center for Professional Advancement, Oudezijds Voorburgwal 316A, 1012 GM Amsterdam, The Netherlands. Tel: +31 20 638 2806; fax: +31 20 620 2136.

### Sustainable energy for the future

Seminar, 12 April, Cheltenham. Details from The Watt Committee on Energy, Burlington House, Piccadilly, London W1V 0LQ. Tel: 0171 434 3988; fax: 0171 434 3989.

### The American Ceramics Society's 1996 annual meeting and exposition

14-17 April, Indianapolis, USA. Details from The American Ceramic Society, P O Box 6136, Westerville, OH 43086-6136, USA.

### Renewable Energy Conference & Workshop

14-18 April, Cairo, Egypt. Details from NREL, PV Division, 1617 Cole Boulevard, Golden Co 80401 - 3393, USA. Tel: 303 384 6600; fax: 303 384 6604.

### High Performance Ceramics

Short course, 15-19 April, Guildford. Details from Mrs Margaret Morgan, Short Course Organiser, Department of Materials Science & Engineering, University of Surrey, Guildford, Surrey GU2 5XH. Tel: 01483 259378; fax: 01483 259508. e-mail: M.Morgan@surrey.ac.uk

### Systematic engineering design and failure analysis

A Masters level, five-day course, 15-19 April, Cambridge. Details from: Miss Kim Smith, Course Administrator, University of Cambridge Programme for Industry, 1 Trumpington Street, Cambridge CB2 1QA. Tel: 01223 332722; fax: 01223 301122.

### Dependence modelling and risk management

Course, 16-17 April, Cambridge. Details from Claire Derbyshire, Course Administrator, University of Cambridge Programme for Industry, 1 Trumpington Street, Cambridge CB2 1QA. Tel: 01223 332722; fax: 01223 301122. e-mail: ccd21@cus.cam.ac.uk

### Energy Resource '96

Expert briefings and exhibition, 16-18 April, Birmingham. Details from Peter Holloway Associates, Allen House, Bolto Road, Haywards Heath, West Sussex RH16 1BP. Tel: 01444 458080; fax: 01444 441630.

### Heavy fuel oil — an essential element of the industrial fuels portfolio

Lecture by Mike Drew, 17 April, Cheltenham. Details from the Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Tel: 0171 636 1004; fax: 0171 255 1472.

### Auditing in NAMAS laboratories

Course, 17 April, Leatherhead, Surrey. Details from Vicky Prior, Course Organiser, ERA Technology Ltd, Cleeve Road, Leatherhead, Surrey KT22 7SA. Tel: 01372 367000, ext 2313; fax: 01372 377927. e-mail: conferences@era.co.uk

### Trends in Explosion Research

Discussion meeting, 21-24 April, Aberystwyth, Dyfed. Details from The Department of Physics, University of Wales, Aberystwyth, Dyfed SY23 3BZ.

### Hannover Messe '96

International trade fair, 22-27 April, Hannover. Details from Arnold Rustemeyer, 25 Hurst Way, South Croydon, Surrey

CR2 7AP. Tel: 0181 688 9541; fax: 0181 681 0069.

### Environmental Management

Conference, 22 April, London. Details from David Lazare, IIR Ltd, 6th floor, 29 Bressenden Place, London SW1E 5DR. Tel: 0171 915 5055; fax: 0171 915 5056.

### The Nuclear Fuel Cycle

International two-day conference, 23 April, London. Details from Sarah Ashmore, IBC Technical Services Ltd, Gilmoora House, 57-61 Mortimer Street, London W1N 8JX. Tel: 0171 637 4383; fax: 0171 631 3214.

### Understanding heat treatment

Three-day course, 23-25 April, Birmingham. Details from the Course Administrator, Wolfson Heat Treatment Centre, Aston University, Aston Triangle, Birmingham B4 7ET. Tel: 0121 359 3611, ext 5212; fax: 0121 359 8910.

### Energy and Transport

Colloquium, 23 April, London. Details from The Watt Committee on Energy, Burlington House, Piccadilly, London W1V 0LQ. Tel: 0171 434 3988; fax: 0171 434 3989.

### Institute of Physics Annual Congress

23-25 April, Telford. Details from: Graham Balfour, The Institute of Physics Congress, 76 Portland Place, London W1N 4AA. Tel: 0171 470 4800; fax: 0171 470 4848.

### Oilnex '96

Exhibition, 24-25 April, Aberdeen. Details from: Richard White, Management Events Ltd, P O Box 351, Hook, Hants RG27 9YY. Tel: 01256 762460.

### Nuclear Transport Systems

2nd international conference, 24-25 April, London. Details from: Sarah Ashmore, IBC Technical Services Ltd, Gilmoora House, 57-61 Mortimer Street, London W1N 8JX. Tel: 0171 637 4383; fax: 0171 631 3214.



**An invitation to**  
**THE INSTITUTE OF ENERGY ANNUAL LUNCHEON**  
Monday, 22 April, 1996  
Langham Hilton

**PRESIDENT:** Mr D G Jefferies CBE FEng

**PRINCIPAL GUEST SPEAKER:** John Battle MP  
Shadow Minister for Energy

**RECEPTION:** 12.30 pm

**LUNCHEON:** 1.15 pm

**PRICE OF TICKETS:** £56.40 (£48.00 + VAT)

Applications for company tables and individual tickets may be requested on the form below. Numbers will be limited and early application is advisable.

**Note:** Tables are round and accommodate 10 or 12 persons. Every effort will be made to keep smaller groups separate but it may be necessary to share tables.

The list will be closed on 8 April, 1996, and commitments will not permit refunds on cancellations received after that day. **Names of guests** should accompany the application for tickets where possible, but must in any case reach the Institute not later than **12 April** for inclusion in the printed list.

**Wines.** All wine orders must be placed direct with, and paid to, the hotel, and can be made in advance through the Banqueting Manager of the Langham Hilton (tel: 0171 636 1000)

**ANNUAL LUNCHEON 1996**

**TO:** The Secretary  
The Institute of Energy  
18 Devonshire Street  
London W1N 2AU  
(Fax No. 0171 580 4420)

(to be completed by the Institute)

Date received:

Ticket number(s) issued:

Please send me ..... tickets for the Annual Luncheon on 22 April at the Langham Hilton, Portland Place, London W1. I enclose a cheque for £ .....

**The names of my guests (with Designation/Affiliation for guest list) are:**

(Block letters, please)

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.....  
.....  
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Your name (Block letters, please) .....

Address .....

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.....Telephone number.....



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