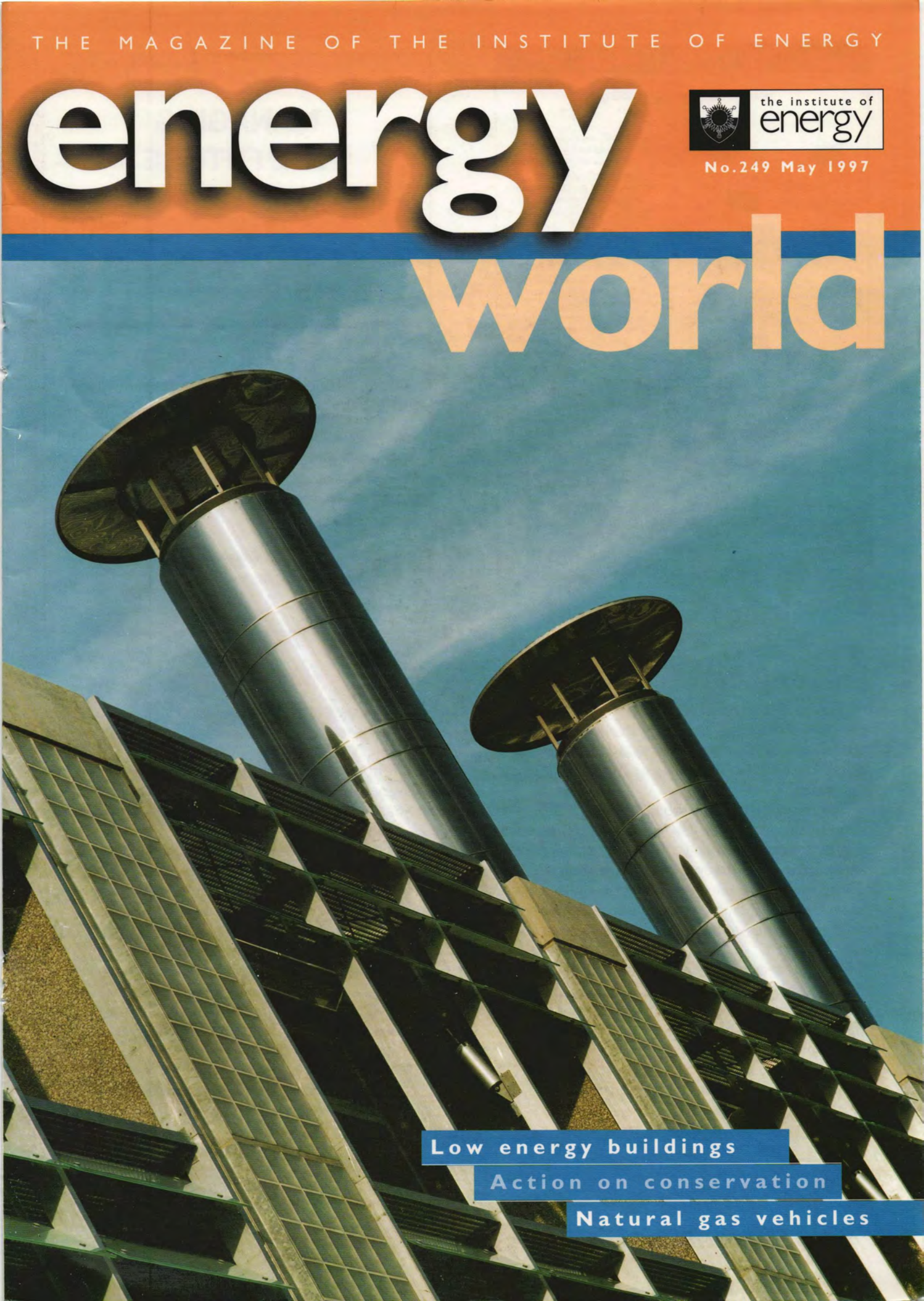
THE MAGAZINE OF THE INSTITUTE OF ENERGY

energy world

the institute of energy

No.249 May 1997



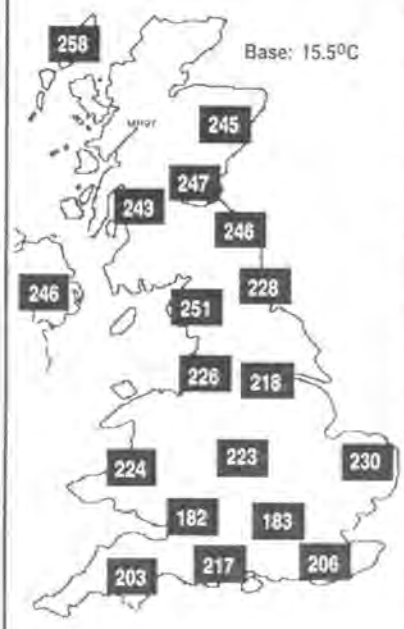
Low energy buildings

Action on conservation

Natural gas vehicles

DEGREE DAYS: MARCH 1997

Source: **Degree days direct**



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

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

Readers can get more information on the use of degree days from Vilnis Vesma, 8-10 Church St, Newent, Glos GL18 1PP (01531 821350)

http://vesma.com/ email: ddd@vesma.com

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. For governments to achieve their commitments of pollution reduction there must be better understanding of the combustion process amongst our 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 and 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.

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.

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 second of the UK courses will be run by FCTI for the International Kiln Association at the Forum Hotel, Cromwell Rd, London on 2, 3 and 4th June 1997.

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

THE MAGAZINE OF THE
INSTITUTE OF ENERGY

Contents

Published by
The Institute of Energy
18 Devonshire Street, London W1N 2AU.

Editor
Steve Hodgson
Tel/Fax: 01298 77601

Administration
0171-580 7124

Membership, and
Journal Subscriptions
Tel: 0171-580 0077 Fax: 0171-580 4420

Art Editor
Louise Collins

Design
Steven Stoner, X-Design
0181 948 2405

Advertisement sales
RGO Exhibitions & Publications Ltd
Pam Bourne Tel: 01424 883110

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

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

ISSN 0307-7942

COVER

Part of the new Environmental Building under construction at the Building Research Establishment's Garston site. The photograph shows some of the five external ventilation stacks faced with glass blocks and sited on the south face of the building. These allow stale air to rise naturally out of the building, helped by solar heating at times. Fans come into operation when natural forces are insufficient. The photograph also shows external, motorised fritted glass louvres which screen out solar gain from the south facade. The louvres are controlled automatically to follow the sun's movement.
(Picture by the BRE)

New foundations for impartial energy advice from the BRE

Roger Courtney, Deputy Chairman, Building Research Establishment

Keeping buildings warm or cool and providing their occupants with lighting, hot water and other services accounts for around half the energy used in the UK and half the nation's CO_2 emissions. So establishing a sound basis for decisions on energy use in buildings is a key means of addressing the limits on CO_2 production stemming from the Rio Convention. And with energy costing building users some £22 billion each year, it is a matter of prime financial concern for both firms and households.

Through studies carried out over many years, BRE has established that sound basis for energy use, its conclusions being incorporated in Building Regulations, professional codes, British and European Standards and its own publications. When the Government's decision to privatise BRE was announced, many fears were expressed that this might prejudice the objectivity and balance of BRE's work. Would its conclusions and advice be affected if, for example, a particular industrial interest were a major stakeholder in BRE?

A preparatory study carried out by PA for the Department of the Environment, which sought views from a wide range of building and construction interests, showed that in the view of the majority of respondents the best way of meeting these concerns was to create an ownership structure that ensured that no individual firm or sector could have undue influence on BRE and which in addition was non-profit-distributing.

The successful bid for BRE was strongly influenced by these findings. Members of BRE's management created the Foundation for the Built Environment, a non-profit-distributing company limited by guaranteed which will in due course have 100-150 members (in effect shareholders) from a wide range of construction and building owner interests, and from universities. Already, over 100 firms and organisations have indicated that they will become members of the Foundation. Members will be grouped into 'colleges' for the purposes of electing the Foundation's Council to ensure a balance of representation. BRE will conduct its research and consultancy activities as a wholly-owned subsidiary of the Foundation, with its trading surpluses passing to the Foundation for investment in research, educational activities etc.

What does this change mean for the future of energy-related programmes at BRE? First, BRE's move into the private sector does not mean that Government funding for research has ceased. DoE will continue to fund substantial programmes of research relevant to energy use, in support of both the Building Regulations and other more general environmental policy aims. So BRE's work on air conditioning systems, ventilation, lighting, energy targets and labels, energy modelling etc will continue - subject, of course, to changes in priorities introduced by a new Government. The Best practice programme carried out by BRECSU for the Energy and Environmental Management Directorate of DoE, which generates and disseminates targeted information on energy use, will also continue. Those who telephone the BRECSU Enquiries Bureau will still find help and information available, as they have done in the past.

Secondly, the new ownership structure ensures that the objectivity and independence of BRE's research findings and advice will be maintained. No insulation or control system, for example, will be favoured over any other, except on objective grounds supported by research. So professionals who have relied on BRE's publications previously may place equal reliance on them in the future.

Thirdly, though, the opportunities for developing new service for energy professionals are clearly enhanced. BRE is now an industry-owned body seeking to increase its income from the whole of the construction and building communities and freed from previous constraints imposed by the Government status on the development of the services that it can offer. Our declared mission is "to champion excellence and innovation in the built environment" and our knowledge and experience of buildings in use will be devoted to that end.

Through new cross-disciplinary Centres, such as a Centre for Sustainable Development, we shall be providing new entry points to BRE, enabling our energy-related expertise to be cross-linked with, for example, that on building materials and structures. Well-known BRE products such as the BRE Environmental Assessment Method (BREEAM) will be developed and enhanced to provide maximum assistance to professionals wishing to construct buildings to the highest environmental standards. We shall be taking a particular initiative to create close links with the growing number of building and facilities management professionals who are so crucial to decisions on energy use.

The wide support expressed for the Foundation has shown how the industry values BRE's impartial judgements and advice. Under its new ownership, and with a remit to provide the best possible support for design and operating decisions, BRE is now very much "open for business". I and my senior colleagues look forward to hearing from readers of *Energy World* how the knowledge base and expertise contained within BRE may be best deployed to your benefit.

Flying start for gas turbine

The Frame 6 turbine on board the Antonov 124 aircraft

Kvaerner Energy Limited, formerly John Brown Engineering of Clydebank, Scotland, has supplied a 38 MW Frame 6 gas turbine to a Kenyan customer in record time.

The order was placed in early December 1996 by the Kenya Power and Lighting Company, under a contract which stated that the plant was to be installed in only 10 weeks, far shorter than a typical simple cycle contract time of 6 months or more. Kvaerner Energy achieved full power to the grid on 23 January, less than 50 days after the contract award.

The turbine was built under and advance of order programme, and to ensure quick delivery, it was flown from Prestwick Airport, Scotland, to Mombassa. This was the first time a gas turbine of this size has been flown between continents.

An Antonov 124, the only aircraft in the world capable of handling the 100 ton load, was hired from the joint venture company in which Kvaerner's Heavy Lift Cargo Airline is a partner. The turbine is installed at Kipevu power station and uses distillate oil fuel.

Finns move into Budapest

A consortium consisting of Finnish power company the IVO Group and the Japanese Tomen Corporation have finalised the acquisition of 73.7% of the shares of Budapesti Eromu¸ Rt. The purchase price of the shares amounts to $47 million.

The contract comprises five heat and power generating plants and one district heating plant, which together produce about 250 MW of electricity and 2,500 MW of heat. IVO and Tomen intend to refurbish the existing heat and power plants and build new, efficient and environmentally benign power plants. The construction of the first new plant could begin during 1998. The entire program would require investments up to $450 million during ten years and would involve construction of four new power plants with total generating capacity of about 400 MW.

AEA Technology joins with Sumitomo corporation

Sumitomo Corporation and AEA Technology plc have formed a 50/50 joint venture nuclear services company in Japan. The new company, Summit AEA Corporation, started trading last month.

The company, which is being established as a kabushiki kaisha (a joint stock company of public corporation), will initially have 12 employees and will operate from a head office in central Tokyo with three staff in Osaka. It will offer a wide range of nuclear and related services in Japan, including management of ageing reactors, R&D for new materials, advanced instruments, TV systems and robots, special radioactive isotopes, services relating to decommissioning of old facilities, radioactive waste management and disposal, and advanced nuclear fuel cycle technology.

AEA Technology opened a separate company in Yokohama in July last year to handle its software, environmental consultancy and technology transfer business in Japan. This business, AEA Technology KK, will continue to operate under the management of the President, Nobuo Fujiwara, and Dr Juan Matthews.

BG consortium signs Trinidad production sharing contract

BG plc, Agip of Italy and Deminex of Germany have signed a production sharing contract with the government of Trinidad and Tobago to open up a new hydrocarbon province off Trinidad's northern coast.

The North Coast Marine Area contains the undeveloped Hibiscus, Orchid, Iris and Poinsettia gas fields, which have potential reserves of more than three trillion cubic feet of gas.

The consortium, With BG plc as operator, will immediately carry out further exploration activity in the area, which is 40 kilometres offshore and covers 230,000 acres. The primary market for North Coast gas is the potential expansion of the Atlantic LNG Company of Trinidad and Tobago's plant at Point Fortin. BG plc is a major shareholder in the company with a 26% shareholding. The $1 billion export plant, currently under construction, is scheduled to come on stream in winter 1998/9.

IEA reviews electric power sector in Asia

The electricity sector in Asia is undergoing dramatic changes in regulation, structure and ownership, according to the *Asia Electric Study* published by the International Energy Agency. These changes are being driven by the rapidly growing demand for electricity in Asian economies. Demand growth is likely to see Asian developing countries requiring more than one third of the world's total additional generating capacity up to 2010.

To obtain fuel for power plants many Asian economies' imports of energy will have to increase significantly, changing global energy trade patterns. The region's increasing dependence on energy imports will also have important implications for energy security, both for the region and globally.

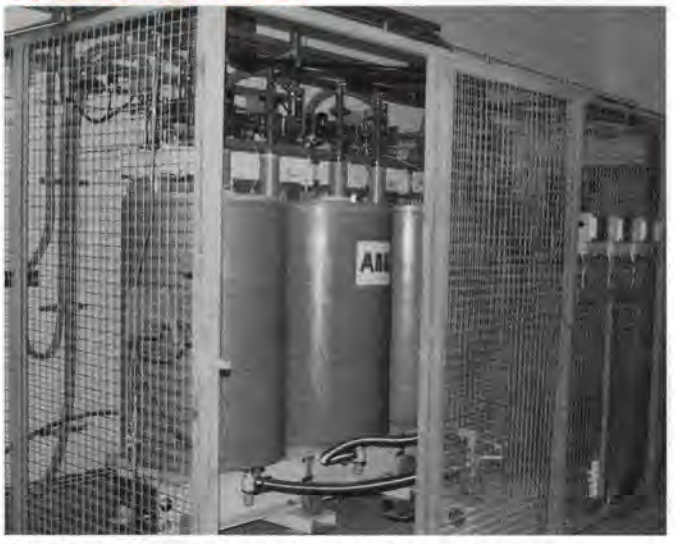
The Study takes an in-depth look at the electricity sectors of three important Asian countries: Indonesia, the Philippines and Thailand. Governments in these and many other countries have accepted that some level of private sector funding of power production is necessary if their demand for electricity is to be met. The most common option for private sector participation is the introduction of independent power production (IPP).

However, the increased competition in the market brought about by the presence of IPPs puts pressure on governments to reform the way their own utilities operate to ensure that they remain competitive. Increasingly, state-owned utilities are being restructured and corporatised. In many cases the long term goal is partial of complete privatisation.

The design of a stable regulatory framework is perhaps the key challenge to countries in the region.

A model of a run-of-river hydropower station to be built at on the River Aare in Switzerland. The new power station will replace the 100 year old canal power station of the same name located 300 m downstream. Two modern bulb turbines and a 2 m higher barrage will increase the electrical power output threefold compared to the existing station. The two geared turbines, each rated at 11.5 MW and able to handle 450 m^3/s of water, will be supplied by Sulzer Hydro. The power station will generate 115 GWh annually.

ABB first to connect superconducting transformer



The high temperature superconducting distribution transformer connected to the Swiss electricity grid.

ABB has successfully connected the world's first operational high-temperature superconducting distribution transformer, to the power supply network of the City of Geneva, Switzerland. The three-phase transformer has an output of 630 kVA and is designed to convert power from 18.7 kV to 420 volts. The equipment will now begin long-term performance monitoring under actual power grid conditions.

In November last year, ABB also installed the world's first commercially operational high-temperature superconducting "fault current limiter" for electric utility service, in a Swiss hydro power plant. This latest event marks a significant milestone towards the use of high-temperature superconducting transformers.

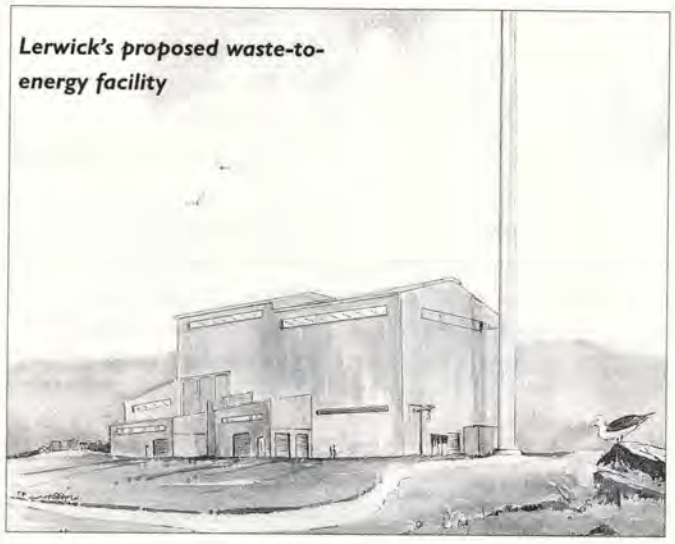
"As high-temperature superconducting (HTS) technology continues to improve, we expect it to become cost-competitive with conventional power transformer technology," said Craig Tedmon, ABB's Executive vice-president responsible for research and technology. "This development project will allow us to better quantify the efficiency and environmental benefits and prove the suitability of high-temperature superconducting technology for application to power transformers."

The HTS transformer takes advantage of a superconductor's unique ability to transmit electricity with no resistance when cooled below a certain temperature. By using HTS windings instead of copper, the transformer can be designed lighter, more compact, with much reduced energy losses. For both the coolant and the insulating fluid, the transformer uses liquid nitrogen - a non-flammable, non-hazardous substance.

Waste-to-energy scheme for Shetland

West Midlands based Birwelco Limited has been awarded a contract valued in excess of £9 million for the engineering, procurement and construction of an energy-from-waste facility in Lerwick on the Shetland Isles.

The facility comprises a single stream 3.3 tonnes/hour municipal solid waste incinerator complete with air pollution control equipment, designed to ensure full compliance with current legislation relating to emission levels. The plant will have the capacity to burn the Islanders' 20,000 tonnes of rubbish a year, plus several thousand tonnes of baled waste shipped in from the Orkney Islands Council and offshore oil industry. Heat energy produced from the facility will be utilised for a local district heating scheme.



Lerwick's proposed waste-to-energy facility

The mass burn technology for the project will be provided be Kruger SA, a Danish sister company of Birwelco.

Construction work on the contract is scheduled to commence this month and should then take 25 months to complete. A Birwelco specialist task force will be established, with its main focus of activities based on location in the Shetland Islands during the construction phase of the contract. Local contractors will be utilised as much as possible to bring employment, both short term and long term, to the Islanders.

Opencast mining plan to extract 5.3 million tonnes of coal

Plans for a mining operation which could produce 5.3 million tonnes of coal over a six year period, create 70 jobs and provide a major boost for the National Forest Initiative with the planting of over 300,000 trees, have been submitted to Leicestershire County Council.

RJB Mining, in seeking consent to develop the 204 hectare Thorntree opencast site near Coalville, have offered to forest landscape the nearby Coalfield North site, restore the South Leicester Tip and transfer its ownership of the route of the disused Coalville-Ibstock branch rail line to the Council.

The company say the Thorntree scheme will inject millions of pounds into the local economy, help maximise sales of deep mined coal and protect jobs.

Britain's largest coal producer, RJB has substantially scaled down original proposals made by predecessors British Coal, who in 1990, applied to extract 8.2 million tonnes over a 10 year period from a larger site then known as Coalfield West. That application was rejected despite being recommended for approval in the County Council's report to the Planning Committee.

Says RJB's Development Director John Gough: "Compared with earlier proposals, our scheme aims to recover a smaller tonnage of coal from a smaller area over a shorter period of time, with the prospect of an enhanced and extensive woodland restoration."

New Scottish power station will switch to gasification

GE Power Systems of the US has signed a turnkey contract with Fife Power Ltd of Scotland to provide an MS6001FA gas turbine, additional equipment and installation services for a new power plant in Cardenden, Fife, Scotland. In addition to the turnkey contract, GE will also provide plant maintenance services for six years. The total value of the two contracts is approximately £23 million.

After an initial period of simple-cycle operation, it is intended that the new plant will be converted to Integrated Gasification Combined-Cycle technology and will be Britain's first IGCC facility.

The Fife power station will be built at the former British Gas Westfield Development Centre in Fife. The centre is being transformed into the Fife Environmental Energy Park with the new power station, featuring the environmental advantages of IGCC technology, as the cornerstone of that effort.

The new power plant will begin simple-cycle operation on natural gas in mid-1998. Fife Power then plans to convert the plant to IGCC by using the British Gas/Lurgi gasification technology and fuel processing equipment already at the site, with syngas produced from sewage sludge as the primary fuel.

Global Energy of Cincinati, one of the partners in Fife Power, will supply the technology to produce clean syngas for the plant.

Nuclear generator makes first move into gas

British Energy and Elf Aquitaine, through its subsidiary Elf Exploration UK plc, have each acquired a 12.5% interest in Humber Power Ltd (HPL), the owner of the 1,260 MW combined cycle gas-fired power plant development at Stallinborough, South Humber.

The first phase (750 MW) of the South umber project is due to be commissioned shortly and the second phase (510 MW) is under construction and planned to be commissioned in 1999.

British Energy chief executive, Dr Robert Hawley said: "We have made it clear that our forward strategy will include investment in energy projects in the UK and overseas which offer real benefits to our shareholders and which help us to secure British Energy's future through a broadening of our generating base. The Humber project in an excellent start, taking us into gas-fired generation. Our operating subsidiary, Nuclear Electric, has also concluded a mid-merit electricity contract-for-difference with Elf."

HPL is a joint venture company owned by subsidiaries of Imatram Voima OY (IVO), the Finnish electricity utility, Midlands Electricity plc, the Japanese trading company, Tomen Corporation and ABB, the international engineering group.

Electric ceiling heating system wins award

The Nottingham Trent University has been commended in the East Midlands Electricity Business Energy Awards for its use of an all-electric heating system.

The 177 bedroom Blenheim Hall is a newly-completed hall of residence for students at the University. The three storey building is circular to minimise the external wall area and is of heavyweight construction so that is has a high thermal capacity to damp down swings in internal temperatures. Insulation has been generously applied in all building elements, and cavity fill wall insulation has been extended to below ground level to provide effective edge insulation to the ground floor slab. The insulated ground floor slab is supported above an unventilated floor void to provide additional insulation and the roof incorporates 200 mm of insulation above the ceiling finish.

Cold bridging, which can significantly reduce the thermal performance of a well insulated building, has been greatly reduced by eliminating masonry and by continuing insulation right up to window linings, lintels and sills.

Blenheim Hall at the Nottingham Trent University is all-electrically heated

To complement the energy efficient construction features, it was important that the heating system chosen should be responsive to both the thermal characteristics and to the characteristics and needs of the occupants.

The solution has proved to be a ceiling heating system, incorporating a flexible control strategy, which has been based on a 20% random room occupancy at any one time. Heating elements are fixed to battens above a plaster board ceiling, so that there are no wall-mounted appliances to obstruct the living space.

Heating takes place overnight, to bring the rooms up to a comfortable 21°C by 7.30 in the morning. For the rest of the day, room thermostats control at a set back temperature of 16°C. However, if the room is occupied and the more heat is required, the student can press a push button to return the control temperature, for that room alone, to the comfort level for a two hour period, after which it reverts back to the set back level. This would have been impossible with a centralised gas system, as it would have been incapable of providing such individual control.

When the fabric of the building is up to temperature following the early morning boost, its energy efficient construction ensures that the temperature decay is very slow, so that, only in the severest weather, is there a need for supplementary heating before late afternoon. Water heating for the building is also all-electric, with a hot water cylinder for every six bedrooms providing hot water for en-suite showers, wash basins and the kitchen sink.

Management takes BRE into the private sector

The sale of the Building Research Establishment to the Foundation for the Built Environment, created by the BRE management bid team, was completed in March. Already, around 100 leading firms, organisations and universities have agreed to become members. The BRE is a major centre for research into energy use in buildings, previously operated by the DoE.

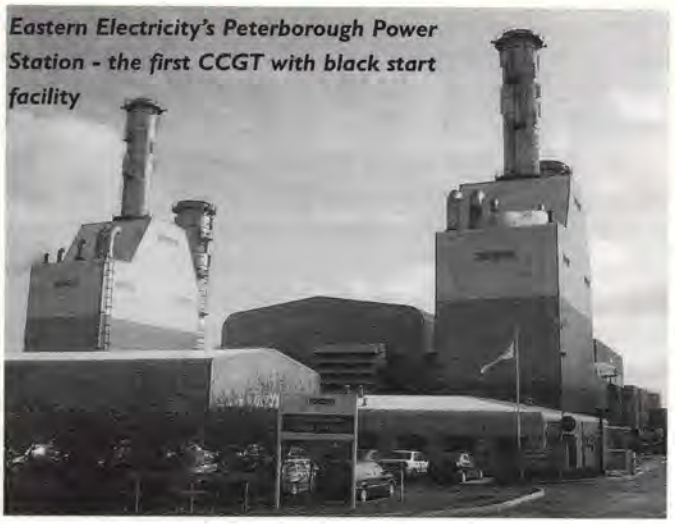
The price paid for BRE was £1.7 million, with the Government able to receive a further payment through 'claw-back' arrangements on future sales, reduced business rates and income from intellectual property. Funding for the sale came from Murray Johnstone Private Equity and Barclays Bank.

Speaking for the Bid Team, Roger Courtney said: "We are delighted that BRE's future has now been secured. By establishing the Foundation, we have ensured that BRE will be owned by representatives of the whole range of construction and building interests. This will guarantee that BRE remains independent and impartial in its research and advice. We look forward to building a successful future for BRE, serving a wide range of clients through our world class expertise and facilities."

BRE is the principal UK centre for construction research. Its turnover is £40 million and, on completion of the sale, it had 660 staff.

See also Viewpoint on page 2.

National Grid signs gas fired black start facility



Eastern Electricity's Peterborough Power Station - the first CCGT with black start facility

The National Grid Company has signed up Peterborough Power as the first combined cycle gas turbine (CCGT) generator to provide a black start service.

Black Start is an extremely rare situation which may be called for following a serious disturbance on the National Grid and Regional Electricity Companies' systems. It may be needed typically in times of severe weather when significant parts of the power system have been shut down causing loss of supply to both consumers and generators. An isolated power station would then need to use on-site auxiliary generation to re-start its main generating units, which is the black start service.

Although such occurrences rarely happen, disaster can strike. In 1987 the tail end of a Caribbean hurricane struck southern England, wreaking havoc and damaging high-voltage overhead power lines - widespread blackouts resulted.

It was the responsibility of the then CEGB to re-energise the system by instructing two power stations to re-start using their black start capability. The power was used to charge lines to other stations, so they could start, and to meet local demand requirements.

In the privatised world National Grid contracts power stations to provide black start facilities. To date this service has been provided by large conventional power stations (coal and oil) which used stand-by open cycle gas turbines (OCGTs) to start them.

However, as a result of changes in electricity generation patterns since privatisation, National Gird has embarked on an ongoing review of its Black Start policy to ensure that its portfolio of black start providers represents the present range of fuels.

In the unlikely event of a shutdown of the electricity system to which the station is connected, Peterborough Power will use a 3 MW diesel generator to start up its main CCGT unit.

Peterborough Power's manager, Bill Borough, said: "CCGTs can respond much more quickly than conventional plant. The gas turbines of the CCGT module can supply two thirds of its 360 MW output within 15 to 30 minutes, after reconnecting to the system."

Entech acquires FEC consultants

Energy management consultancy, EnTech, has purchased both the shares and the business of Oldham based FEC Ltd, making the company the largest independent energy consultancy in the UK, according to EnTech.

The acquisition of FEC, which was founded in 1966, will boost turnover by 40% and staff members to over 60, as well as extending EnTech's nationwide coverage by maintaining the offices in Oldham - now renamed EnTech Greater Manchester.

FEC bureau customers include Asda, Woolworths, Comet, Rolls Royce, Mothercare and VAG - all of which will now be served by the integrated EnTech/FEC bureau team. EnTech's customers now represent a combined consumption total of 20% of the UK non-domestic electricity and gas market.

Low energy building design - the EDAS

Funded by the DTI as a means to improve the energy performance of the country's building stock, the Energy Design Advice Scheme (EDAS) has been offering free and expert energy advice nationally to architects and other building professionals since 1992. Here, Eamonn Cronnolly of EDAS North reports on the sort of work the organisation has been doing, and the common problems encountered over the last five years. Two case studies complete the article.

Low energy building strategies fall into two categories - domestic and non domestic. For housing the SAP rating, now compulsory for new developments, provides a good guide to optimising energy saving. Broadly our homes should be well insulated with an efficient heating system and controls, preferably using mains gas as fuel.

With non domestic buildings strategies become more complex. It might come as a surprise to many that avoiding overheating is a more common problem than the provision of heating, in larger buildings. This is due to unpredictable solar gains from outside added to high internal gains from lights, electronic machinery and occupants.

Energy issues may be further divided into building fabric, the architecture - and services, the engineering. We have become accustomed to the view that energy and environmental design is a matter for the engineer - as mechanical bolt-ons to rectify the limitations of the building form.

This logic has led to the full air conditioned interior, with minimal intrusion from the micro climate outside, fully predictable and constant temperature, humidity and lighting, all centrally controlled. The result is not only a high energy building but for many occupants the lack of variation, contact with the outside and ultimately personal control leads to dissatisfaction which in extreme cases is manifest in a host of physical and psychological symptoms popularly known as sick building syndrome. It is unfair to condemn all air conditioned solutions and many 'unhealthy' buildings are not in this category. Nevertheless it is recognised that in a great many cases a low technology environment would be more suited in our moderate climate.

For example, currently acceptable energy strategies may be generalised as:

- design for natural ventilation
- design for daylight
- control solar gains and internal heat build up
- minimise fabric heat loss
- minimise ventilation heat loss
- energy efficient heating system
- low energy electric lighting and controls.

Note that five of the seven factors are determined by the design of the building fabric, and the energy consumed by the remaining two will also be determined by them. Passive design is a response to this - let the building as far as possible temper the environment.

Each building type tends to have a characteristic energy issue: schools will need high ventilation rates due to crowded classrooms; offices need solar and glare control, large industrial buildings often suit radiant heating of occupants rather than air heating: nursing homes will benefit from condensing boilers, leisure and pool buildings can often usefully employ heat recovery from extract air.

That said, as every architect knows, each project is unique. The office buildings we have looked at range from the all glass facade, deep plan with atrium to the small scale brick and domestic timber windows type. If an air conditioned solution is required we would recommend reducing cooling loads and find the best system. While a condensing boiler is very efficient, there will be situations where it is inappropriate. Air quality or noise may make natural ventilation unsuitable for example in a city centre art gallery. Renewables are ideologically sound but in times of cheap fuel clients are realistic about paybacks. We feel the strength of EDAS is that we provide advice tailored to the client's needs, and this includes the economic realities.

Our findings

EDAS North has been in operation for over three years. In that time we have answered almost 800 enquiries and completed over 400 consultations. The general lessons we have learned from this might be summarised as:

- A need for holistic design, with architect and engineer working together with a common goal. Architects tend to see U-values as the single factor under their control and often do not realise the actual energy implications of the forms they create.
- Environmental impact needs to be seen in total: schemes will often exhibit some low energy features but neglect more mundane issues - the clever stack ventilation but all the lights on: the out-of-town green corporate headquarters - with 2,000 car parking spaces.
- The earlier we are consulted in the design stage the more effective we can be.
- Low energy schemes need not cost more, sometimes costs are reduced with less plant.
- Simple robust solutions usually work best, or at least fail less dramatically.
- Innovative buildings inspire designers but the tacking on of a fashionable device is dangerous.
- Most commercial architects are pressured by time and budget constraints and consequently see the Building Regulations as a performance target rather than a legal minimum.

Feedback indicates that about 50% of our advice is implemented in the completed building. For the scheme nationwide this

experience

by Eamonn Cronnolly Dip Arch, Msc, architect and senior energy consultant at the Energy Design Advice Scheme, Sheffield

amounts to £18 million in energy savings since 1992. DTI figures put the resultant carbon savings from EDAS advice projected to 1999 at 1.3 million tonnes.

The future

While DTI funding for EDAS will terminate in March 1998 as originally planned, the DTI monitoring agents have concluded that *"there is a continuing demand for the service ..... customers considered EDAS irreplaceable because of its in-depth, project- specific answers"*. Regional centres are now involved in seeking means to ensure the continuation of what is agreed is a unique and successful service to the construction industry.

The basic need for the scheme should be evident from the case studies, but there is another need which EDAS is catering for. In the past few years we have seen the development and widespread application of technologies which have no track record in current practice: chilled ceilings for cooling, passive stack ventilation, translucent insulation materials, spectrally selective glasses for solar control, photovoltaic over-cladding to generate electricity. Our role is largely to assist on the appropriate applications of these technologies which are beyond the experience of both architect and engineer.

There is also increasing interest in the embodied energy or total environmental impact of materials and components in buildings. This is a growth area in terms of research dissemination, and for commercial reasons a very sensitive area.

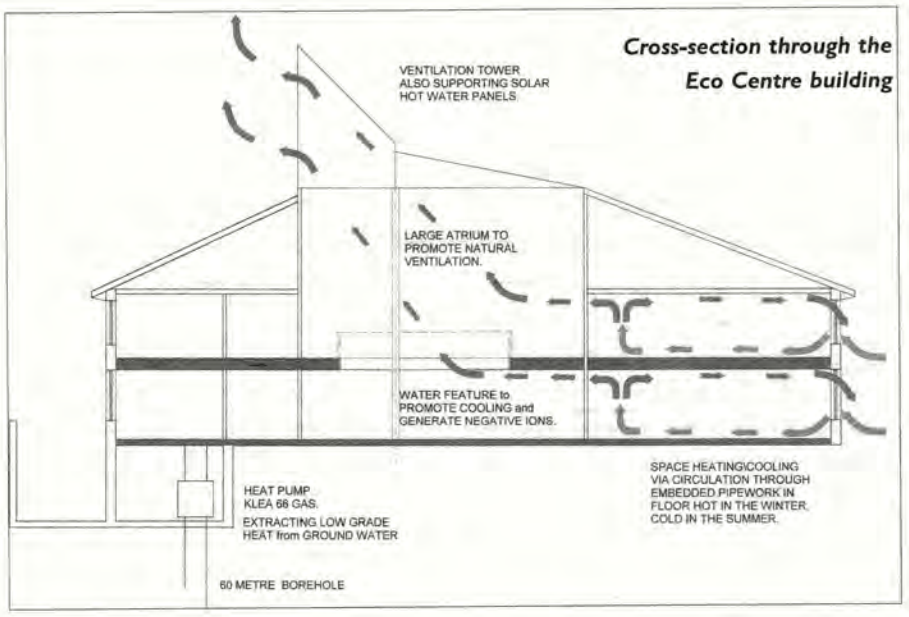
Green building technologies will also result in a reappraisal of conventions and even our regulations. The first case study shows the benefits of exposing the building mass by eliminating the office ceiling. This is slowly being integrated into current good practice against a long tradition of the ubiquitous suspended ceiling.

The second case features composting toilets with no mains drainage. This falls outside current Building Regulations and creates difficulties for a sympathetic local authority. A future problem for the planning authorities will be the rights of solar access for photovoltaic schemes where overshadowed by a neighbouring development.

Case study 1

Project: Office development at Exchange Brewery site, Sheffield
Client: British Land Ltd
Energy consultants: Oscar Faber Consulting Engineers
Initial consultation: June 1995
A large speculative scheme of commercial

Artist's impression of the development in Sheffield



Cross-section through the Eco Centre building

offices near the centre of Sheffield. The initial consultation identified natural ventilation as a possible strategy, though the plan depth was 15m deep - considered the working upper limit for cross ventilation. Cellular offices would be required at the perimeter.

EDAS carried out preliminary studies to assess the optimum facade glazing using a spreadsheet version of the LT Method. This suggested that a 33% glazing ratio produced the best energy performance and that little energy benefit was to be gained from providing an atrium.

A further study was undertaken using the BRE Admittance Method - a graph based model to predict internal temperatures given thermal mass and ventilation options. This model indicated that natural ventilation would result in an upper temperature of 25°C, with a daily swing of 8°C. This swing is beyond comfort limits and showed that natural ventilation would not be feasible for the proposed design.

A specialist consultation was considered the next step, using an appropriate expert from the EDAS register, in this case Oscar Faber. The purpose was to examine internal air flow and resultant temperatures for differing partition arrangements.

Targets set were a temperature range of 20-24°C and air velocity less than 0.15 m/sec. For summer these conditions were allowed to rise, as in naturally ventilated buildings people tolerate hotter conditions in summer - in this case up to 26°C and 0.25 m/sec.

Computational fluid dynamics, CFD, is a computer tool commonly used to model air movement in a simulated three dimensional space. Such a model was used with various window configurations since this would have an effect on natural air movement. Alternative floor and ceiling constructions were also modelled.

Results

The model predicted a temperature range of 26-28°C with a suspended ceiling. Air velocities of 0.25 m/sec would also create draughts in places.

However, by removing the false ceiling the thermal mass of the concrete floors could be exposed. This absorbed heat at peak temperatures with a resulting maximum of 25°C. Air velocities were also more acceptable. A sash window performed best in terms of air movement, bottom tilting was least satisfactory. Generally wind pressure alone was not adequate and air extract from the centre was proposed on hot days.

Case study 2

Project: Eco Centre, Jarrow
Client: Groundwork Trust South Tyneside
Architect: Carole Townsend, EarthSense
Energy consultant: Entek UK Ltd
Initial consultation: January 1994

EDAS were approached in January 1994 at concept stage for a zero energy office by this environmental agency. The offices of 1,500 m^2 would house the organisation but also provide lettable space for tenants of a green persuasion. The site was in Jarrow on the banks of the Tyne overlooking shipyards across the water. The scheme was intended to demonstrate that sustainable buildings are achievable with current technology.

EDAS prepared a briefing guide for design which attempted to balance a minimised energy demand against where possible a free supply. Going back to first principles suggested many no-technology solutions, for example, with sufficient insulation and appropriate seasonal clothing, the space heating should be minimal. With daylight for most of the working day and year, electric lighting can also be minimised. Design of the building form can ensure ventilation by opening windows and creating a solar chimney. Deciduous plants for shading will reduce overheating in summer.

On the supply side, solar panels can cater for the small hot water demand while the necessary power for equipment and supplementary lighting can be generated onsite with photovoltaic panels and wind turbine. This would be a minimal demand building with all energy supply from renewables.

In addition to matters of energy, wider environmental issues were considered, included recycling of waste water, composting of human waste and the use of recycled materials in construction.

Result

The building is now complete and occupied since November last year. The final scheme includes the following sustainable strategies:

Minimising energy demand

- high fabric insulation and air tight construction
- natural ventilation by passive stack and cross ventilation
- atrium as circulation space and solar chimney to aid stack ventilation
- working spaces with daylight
- deciduous summer window shading
- thermal mass in the fabric to reduce air temperature swings
- low energy light fittings

Renewable energy supply

- an 80 kW wind turbine to generate 100,000 kWh/year

Exterior view showing the solar chimney and panels, and the wind turbine

- geothermal energy from groundwater at 14°C, boosted with heat pump
- solar panels for water heating
- passive solar energy availed of in the heating season

Environmental strategies

- composting of human waste
- reuse of rain water and waste water for toilet flushing and irrigation
- roof of recycled aluminium
- non toxic paint finishes and fittings

Many recycled artefacts are put to novel re use. The trellis for growing shading plants on the south wall is fabricated from fishing nets, vehicle clutch plates and compressed plastic bottles. Lengths of railway track bolted together as a column support the atrium roof, the reception desk will be constructed from old washing machine drums complete with porthole lights made from the doors.

Photovoltaic panels were not affordable but may be added later. Only minor teething problems have been encountered and staff are comfortably in occupation. Energy consumption target is 75 kWh/m^2/year, compared to a conventional office consumption of 240 kWh/m^2/year (typical) and 125 kWh/m^2/year (good). EDAS are currently monitoring the energy performance of the building.

EDAS - HOW IT WORKS

The Energy Design Advice Scheme is a government funded initiative set up by the DTI as a means to improve the energy performance of the building stock. EDAS provides free independent and expert advice to architects and other building professionals involved in a design or refurbishment project. Originating in Scotland, the scheme went nation-wide in 1992 following UK commitments on CO_2 emissions at Rio.

EDAS offers a free initial consultation on the energy aspects of design proposals. The majority of schemes are new build but a substantial number are extensions or refurbishments to existing buildings. To make an enquiry, a phone call to the appropriate centre is all that is required. For a free consultation of up to one working day, there are a few criteria: schemes must be 500 square metres in area or more, and there must be an intention to build. Simple queries can be handled by a phone call but more often we are invited to look at the scheme in total. A site walkabout is essential for refurbishment schemes or where the location will have a specific impact on a design. For green field sites advice may often be given from drawings sent to the centre. Feedback may be immediate at the meeting and formalised in a report shortly after.

Each centre has the backing of a specialist library on environmental issues related to buildings. Where appropriate we can also carry out basic computer modelling.

Advice can cover space planning, building form and composition of the building fabric as well as the heating lighting and mechanical services. All building types are eligible - typically these will be housing schemes, commercial offices, schools and colleges, industrial, and leisure buildings. The scheme is monitored by an independent agent whose job is to ensure each centre achieves targets in terms of quantity and quality of consultation.

We can also refer a client to EDAS-registered energy specialists where appropriate. Typical specialist studies would include energy comparisons of alternative heating/ cooling systems and, increasingly, dynamic computer simulation of interior conditions for given scenarios.

EDAS has a remit to provide CPD seminars on environmental issues to the design team. These vary from a full day conference with several speakers and computer workshop, to free lunchtime seminars for medium sized practices on issues they request.

Contact EDAS through EDAS North at: The University of Sheffield, Floor 13, The Arts Tower, Sheffield S20 2TN. Tel: 0114 272 1140 Fax 0114 272 0676

The partnership energy conservation

Not well-known outside local authority circles, the 1995 Home Energy Conservation Act has had a major impact, requiring authorities to begin to think seriously about the energy performance of homes in their area. Now a grants programme called HECA Action has added to the momentum by awarding funding to innovative local energy improvement projects. Steve Hodgson reports.

Since the passing into law of the Home Energy Conservation Act (HECA) 1995 local authorities have an added duty - that of energy conservation authorities - responsible by law to prepare annual plans to improve the energy performance of *all* housing in their areas by 30%. Not necessarily to do anything specific about energy efficiency, but to devise a strategy, ie to survey homes, identify priority areas and design and select initiatives which would bring this improvement about. And the responsibility extends beyond local authority owned housing to all housing, regardless of its ownership, in the area.

The expectation, of course, was that such an exercise would focus minds sufficiently for action to at least begin. Powerful an initiative as the Act is, it does not identify or supply any funds by which cash-strapped local authorities can move forward. Indeed it is widely accepted that the vast majority of any money spent will come not from the local authorities but from private sector sources, either directly as homeowners are persuaded to act to improve their energy efficiency, or indirectly as public/private sector joint ventures begin work on publicly-owned homes.

Actually there is some public money involved - from HECA Action, an initiative aimed to stimulate the development of partnerships between householders, local authorities and the private sector. But HECA Action is quite different to previous grant schemes. In the words of its own promotional literature it aims to:

- pump-prime workable, innovative and sustainable energy efficiency strategies within authorities, and
- to build long-term networks and/or partnerships between authorities and private enterprise.

HECA Action is all about the brave new world in which public spending on energy infrastructure and energy efficiency is no more, of liberalised energy economies where even householders can choose their fuel suppliers, and of public/private sector energy service companies (ESCOs - see *Energy World* April 1997, page 8 for a utility perspective) selling energy services to local authority, housing association and private sector tenants as well as to owner occupiers.

Supporters of the ESCO model expect that, from next year when householders are able to choose their gas and electricity supplier, public/private sector partnerships will find ways for private sector finance and expertise to be used not just to sell fuel but to add energy efficiency and environment services to energy supply deals. They point to the successful use of private sector finance to build new, efficient energy systems which cut both energy consumption and pollution for industrial sites and large commercial buildings, as evidence that the ESCO model can be made to work for homes.

Under the first year of HECA Action, some 72 local authorities were awarded a total of £5 million by the Energy Saving Trust. But the Trust expects this investment to lead to a further £65 million of investment in energy efficiency across the country. The deadline for applications under HECA Action's second year support programme has just passed and this will be followed by a third and final year, each funded at £3 million.

First year winning schemes covered a very wide variety of initiatives, including energy advice via cable TV and the Internet, low cost loans for energy efficiency products and installations and education projects for schools. The key attributes of successful schemes, apart from the potential for replicability by other authorities, were innovation - especially in finding new ways to draw the private sector into the process, and sustainability - ie the establishment of a process which will continue beyond the initially funded period. HECA Action calls for authorities to bring private sector partners such as utilities, equipment installers, retailers and householders into the partnership, to invest in energy saving measures such as low energy appliances and lighting, heating controls, insulation and draughtproofing.

The emphasis on private sector finance is overwhelming, indeed for year 2 the initiative rejects potential schemes which do not demonstrate at least 30% leverage from the private sector on top of public sector support.

So how do HECA and HECA Action shape up compared to other initiatives designed to improve the energy efficiency of homes? The Building Research Establishment's Dave Barton, who is managing the BRE's effort on the scheme, says that despite the lack of new funding, HECA itself has been a big success and precipitated plenty of action. The Act has given energy efficiency in all tenures a clear focal point for local authorities, he says, and a high profile for the first time. As a result, HECA Action was immensely popular - and five times oversubscribed.

approach to for homes

Although some authorities were late in submitting their first reports, the 360 received have been assessed by the DoE, which has also sent feedback to each authority. Barton is clear that local authorities cannot carry out the work they have identified on their own - they need to work alongside local energy buying clubs and energy advice centres, building societies and installers.

An example is the bulk buying of cavity wall insulation. It doesn't cost an authority much to contact large numbers of homes offering discounted insulation, but working in these larger numbers can bring the cost per home down considerably. Householders are happy to have the work done cheaply, installers are happy to see customers lined up for them and the authority sees the energy performance of large numbers of home improve. Costs can be reduced by 50% and, having seen the concept work, installers are keen to form long term - sustainable - partnerships with local authorities to continue the work.

Another feature has been cooperation between authorities. HECA Action awarded funds to 37 projects, but these represented action in 72 authorities in all - 20% of the overall total. Local authorities have enjoyed getting together to bid for funding for joint projects - rather than the more usual competition for funds.

What sort of project won funding? Many of the winning schemes fell into a few categories:

- energy advice - lots of mobile advice units, eg parking outside the local DIY warehouse at the weekend to offer energy advice to people already about to do some work on their home
- bulk discount schemes - eg for compact fluorescent lamps and cavity wall fill
- loan schemes - from local authorities, via housing associations and charitable trusts and from building societies
- education - eg teaching packs for teachers to bring energy efficiency into the national curriculum. Croydon Borough Council paid to cover the absence of teachers who are away on energy efficiency courses.
- Business start-up - eg training long-term unemployed people in insulation measures and establishing a base market. Such training should allow the businesses established to be sustained long after the HECA Action funding has ended.

The BRE is now visiting the newly-established projects and starting to assess their effectiveness. According to Dave Barton, early signs are that the private sector involvement means that most schemes will deliver excellent value for money.

But can HECA and HECA Action make significant progress in bringing UK housing up to scratch? Something like 8 million people suffer from fuel poverty each year,

Cavity wall insulation - partnerships between local authorities and private sector installers can reduce costs and accelerate its take-up

according to energy action charity NEA, which campaigns for public money and fuel levies to be spent on alleviating fuel poverty. One estimate says that it would cost £50-100 billion to upgrade the UK housing stock significantly, a figure unlikely - to say the least - to be released by the new Government for this work. But HECA and HECA Action show, says Dave Barton, that a significant start can be made - by finding a way to target private sector funds, including householders' own money.

But this leaves the problem of the fuel poor - many of whom live in public housing. The challenge is to devise schemes to target private sector money to improve the lot of the fuel poor. This will be a particular priority for HECA Action in its second and third years.

Selling power direct to tenants

St Pancras Housing Association is using a 54 kWe CHP unit to generate electricity locally to supply electricity to the tenants of 95 of its flats in Camden Town, London, as well as supplying heating to the dwellings. The Housing Association's headquarters and ten commercial units at the site also benefit from lower energy costs.

The installation of the CHP unit was supported by a grant under the CHP Association's Residential CHP Programme, which is designed to demonstrate the viability and benefits of CHP in the domestic sector. The CHPA sees a great future for locally-based energy services companies post 1998 - generating and distributing energy using CHP and community heating systems and using the efficiency of these technologies to compete against established suppliers.

St Pancras HA received unanimous approval in a consultation exercise with the tenants to take on responsibility for their electricity supplies. Electricity to meet the base load requirement is supplied by the CHP unit, with the balance bought from a commercial supplier at bulk rates significantly below retail levels. It is anticipated that the electricity cost margin together with keenly priced electricity from the CHP unit will fund the payback of the CHP installation and the metering and billing system within 10 years.

Several local authorities and another housing association are thought to be planning to supply electricity to their tenants from 1998.

Energy savings the use of cooling

The Netherlands is rightly seen as one of Europe's leaders in the policy and practice of energy efficiency, so initiatives by the Netherlands Agency for Energy and the Environment (Novem) deserve to be studied closely. Here, Novem's Ruud van Heel describes a new scheme under which users of substantial cooling systems can be given advice on their efficient use. This article is based on a report originally published in the CADDET Energy Efficiency Newsletter.

Although energy used by cooling systems accounts for a significant part of many companies' overheads, many companies are still not fully aware that this expense can be reduced by as much as 35%. There are two main reasons for this. First, users of cooling systems tend to minimise risks by opting for a refrigeration plant with an excessively large capacity, and second, they are often not fully aware of the possibilities for optimising systems.

The Netherlands Agency for Energy and the Environment (Novem) wants to correct this situation by providing users with information about improving the efficiency of their plants. They recently set up a cooling advisory group for this purpose. The group will chart possibilities for optimising the energy efficiency of cooling systems and will disseminate the information gained to end users.

The energy used for cooling in the Netherlands amounts to a total of approximately 1,000 million kWh (around 2% of total energy consumption). A saving of about 5% can easily be achieved by good housekeeping measures, better maintenance, energy conscious operation, etc. For the Netherlands alone, this could amount to 50 million kWh, or the equivalent of about 16 million m^3 of natural gas.

Maintenance

Achieving savings does not necessarily require large investment. Above all, it is important to make optimum use of all the existing components in the cooling system and regular maintenance alone can lead to significant savings. The energy efficiency of the cooling system at its highest when the heat transfer is optimal and controls are set at the highest possible evaporation temperature. For optimum heat transfer, an evaporator must be clean both on the inside and the outside. An evaporator that is clean on the outside has:

- minimal icing up of cold storage cells, and
- minimal soiling by dust, dirt, etc.

The main benefit of cleaning the inside of an evaporator is to avoid oil deposits. As oil has a negative effect on heat transfer, cleaning the evaporators should be part of standard operations and of regular maintenance. Nowadays, oil washing systems can be applied to ensure that oil can no longer affect the evaporator operation. Condensers should also be regularly cleaned.

Energy consumption is most favourable when the temperature difference between condensation and evaporation is minimised. Research has revealed that energy consumption increases by about 2.5% per °C temperature increase. In the past, groundwater was often used for water-cooled condensers because it has a temperature of 10-12°C both in summer an in winter, guaranteeing a constant low condensation temperature.

Recently there has been a tendency to reduce the use of groundwater because of increasing environmental restrictions. Air-cooled condensers are now used instead, but these condensers have the disadvantage that condensation temperatures can become quite high in summer. On the other hand, use can be made of the low condensation temperature during the winter. Heat released into the atmosphere can be recovered. Calculations will indicate whether it is economically feasible to increase the condensation temperature so that more heat can be recovered. This depends on factors such as the price of electricity, the price of gas and the degree of heat recovery. It should be kept in mind that a higher condensation temperature means increased electricity consumption.

Compression heat

We can also utilise the heat that is released as a result of the compressor raising the temperature of the compressed gases. The temperature of these gases depends on the pressure ratio, the refrigerant, the compressor, etc. The heat of the compressed gases can be used, for example, for preheating process water or other process flows.

Air

The presence of even a small amount of air in a cooling system has a negative effect on heat transfer. Air can be introduced into the system:

- due to a compression pressure that is lower than the atmospheric pressure,
- while compressors are being repaired,
- when the refrigerant is being replenished.

Air will accumulate in the condenser because the condensed refrigerants cannot absorb it. This increases the vapour pressure in the condenser, so that the compressor must produce a higher pressure compared with an air-free system. Air at the condenser surfaces will also hinder heat transfer.

The influence of air can be seen from meters that indicate the condenser pressure and the temperature of the liquid that flows out of the condenser.

by optimising systems

by Ruud van Heel, Novem, the Netherlands

This liquid must not become under-cooled, because it is in balance with the vapour pressure in the condenser.

Another problem with air infiltration is the presence of water vapour which can increase the risk that the expansion valve will freeze up. A dryer is always necessary, particularly when refrigerants CFC-12 and HCFC-22 are used, as these do not mix well with water.

Air can be removed with an automatic air purger. This operates at the condenser where air and water are extracted in a vent pipe. Water is condensed at a cold surface and the air is periodically removed (purged).

Defrosting

Frost almost invariably forms on vapour surfaces, and if the ice layer becomes too thick, it will have to be defrosted. This will always require the supply of heat, in the form of:

- electric heating;
- hot compression gases from the compressor, or
- air from the cold storage cell.

The choice of the defrosting method depends on the type of cooling system. Optimum defrosting will strike a balance between the extra energy consumption resulting from ice formation and the energy consumption of the defrosting method.

The product factor

Often, in industrial cooling, too little attention is paid to the product being cooled. The rate at which a product cools is largely determined by the difference between the product temperature and that of the cooling medium (usually air). The cooling process is made easier by:

- faster air flow past the product,
- a thinner product,
- lower moisture content of the product,
- better thermal conduction co-efficient of the product,
- less insulation of the product (packaging).

Doors

Walls and doors must be effectively insulated to minimise heat influx. When doors are opened, cold air will rush outside at floor level at great speed, while hot air from outside will penetrate the cooling system through the top of the doorway. Moist air in particular represents a significant cooling load: the moisture forms a layer on the evaporator (the heat of solidification has to be produced by the cooling system) and the layer of frost on the cooler makes the cooling system work less effectively.

New equipment

Companies that are intending to replace their cooling systems should first consider the design of the new plant. Users tend to avoid risks and go for a conservative design, paying a lot of attention to investment costs and extreme conditions of use. Often, too little attention is paid to operational costs (such as maintenance and energy costs).

The design should above all be based on the highest possible coefficient of performance. In order to economise on energy, it is important to consider the cooling process over a period of a whole year. Companies in the Netherlands can request, by submitting a set of requirements, that specific attention be paid to the energy consumption of the cooling system.

Naturally, users must provide sufficient information about the operational situations that can be expected for the cooling systems. The list of requirements provided to suppliers of cooling systems should include the process details, the desired fractional load behaviour (in terms of capacity and operating hours), demands regarding stand-by-power, environmental requirements, requirements concerning energy consumption, maintenance requirements, control system, piping system, management aspects and safety requirements. Suppliers will then be in a position to provide a design for a cooling process and cooling system that is optimal both in terms of energy and the environment.

Heineken saves 35% electricity on cooling system

The central cooling system at the Heineken brewery in Zoeterwoude used to consume approximately 15,000 MWh a year. The system comprises three subsystems, each with their own temperature level: a 0°C system for cooling the brewing water, a -5°C system for removing fermentation heat, and a -10°C system for cooling alcohol water that replaces the refrigerant ammonia. Research revealed that the cooling system compressors were running for long periods at fractional load with low efficiency. By computerising the central cooling system and optimising the control strategy, a 35% annual saving was achieved: 5,500 MWh less each year.

The temperature was no longer regulated separately by the subsystems but with overall control for the entire cooling system. This control system, instead of using more compressors at low capacity, employs fewer compressors at full load, so that their efficiency is greater. The low-temperature levels are automatically adjusted to the required capacity. The number of pumps and cooling units are minimised without this detracting from the process conditions. All the circulation pumps at the brewing water coolers were removed, and at the condenser fans, the minimum condenser pressure was adjusted to the compressors in operation.

The total payback period for the project is less than two years.

Natural

the switch to a cleaner,

by Fred J Parker,
executive director,
Natural Gas Vehicle Association

Following last month's look at electric vehicles, Energy World now turns its attention to natural gas. Here, the Natural Gas Vehicle Association's Fred Parker discusses the merits of using a fuel that is plentiful and relatively clean.

When North Sea oil is just a memory, there will still be vast indigenous reserves of natural gas. So compressed natural gas (CNG) will be around for years to come and we need to understand its power and its potential.

In Britain, CNG is 96% methane compressed for ease of storage to 200 atmospheres (200 bar). The purity of our native gas supply is better than in some overseas locations, so it requires less processing between extraction and dispensing. Dessication and the addition of an identifiable odour are the basic requirements. It reaches the consumer by pipeline. This does away with the need for road tanker deliveries; saving on cost and the risk of accidents.

The medium pipeline pressure of up to 2 bar helps to stabilise compression costs at CNG refuelling stations. There are currently 16 of these around the country operated by British Gas with more privately owned 'gas stations' opening each month. The stations can often dispense and retail CNG to other vehicle owners in their neighbourhood, which gives extra revenue.

There are two means of refuelling: fast-fill and slow-fill. The first refuels a vehicle at much the same speed as for liquid fuel and the second refuels overnight - in about six hours. The latter requires less costly compression and is ideal for vehicles which return each evening to a depot.

Metering, charging, billing, including excise duty returns can be automated to the point that a small compressor could be installed in any home allowing a vehicle owner to refuel from his domestic gas supply and have his road fuel (and the appropriate excise duty) simply added to his quarterly gas bill.

Vehicles

There are over one million natural gas vehicles in daily use world-wide use throughout the world of which about 500 are in the UK. Most natural gas vehicles in Britain today are company-owned and belong to fleet operators.

Now that the tax on road fuel gas has been cut by 25 % (November 1996) there has been a rush to get NGVs on the road in Britain. This has been most evident among bus companies who now get a 100% fuel tax rebate for NGVs. But road haulage and distribution NGVs are on the increase with trucks and trailers up to 44 tonnes now in use. Light commercial vehicles such as small vans and Transits are equally popular and we shall soon see more gas-powered taxis thanks to initiatives and trials under way by London Taxis International and the Energy Saving Trust.

Companies keen to promote their green image were the first to turn to natural gas; prominent among these are The Body Shop and Marks and Spencer. Some local authorities are using CNG to run refuse collection vehicles. Among the first were Slough, Rugby, Merton and the Corporation of London. Even the Government car pool now has its own gas-powered Rover Sterling 827.

A few years ago it was common to convert existing petrol or diesel engines to run on natural gas. These bi-fuel vehicles can revert to liquid fuel at the flick of a dashboard switch if the driver is unable to reach a gas station. One benefit of conversion (retrofit) is that the fitted gas equipment - from tank to carburation - can be saved and re-fitted to new vehicles with old vehicles disposed of in their original state.

Nowadays, there is more demand for ready-made NGVs with original equipment manufacturers such as Vauxhall, Volvo, Dennis, Rover, ERF and Ford offering buyers bi-fuel or dedicated natural gas vehicles as a straight purchasing or leasing option.

Equipment

Similar developments have resulted in the installation of more refuelling facilities in recent months. A scheme called 'Gas Station' pioneered by British Gas in the summer of 1996 offers speedy construction, installation, operation, maintenance and management of a tailor-made refuelling station for fleet operators. They simply pay for the gas they use. By arrangement, they can retail gas to other NGV owners for added value.

Refuelling equipment ranges from individual slow-fill units - which automatically switch off when the vehicle's tank is full - to huge banks of gas cylinders which store the fuel at full compression ready for fast transfer to on-board storage via air-tight nozzles and couplings which allow no vapour to escape.

Storage of compressed natural gas on vehicles calls for the highest standards of safety. Tanks on NGVs are far safer than the flimsy fuel tanks on other vehicles which easily split or rupture in accidents spilling their fuel on the ground where it can ignite. Gas however requires a higher ignition temperature and will only combust within a precise gas/air mix.

gas vehicles-

more plentiful fuel

Only an armour-piercing bullet can penetrate a CNG tank and in the event of accident the gas disperses safely in the air.

Tried and tested high-pressure hoses and valves together with the latest electronic control unit-based fuel management systems ensure maximum performance, economy and safety.

Technology

Safety is at the heart of NGV technology. Task groups within the Association set and maintain strict standards. These include fuel composition so that drivers can be sure of consistent fuel quality and performance wherever they refuel across the country. Cylinder inspection and revalidation continues with all UK gas cylinders being checked every three years, as opposed to every five years in some other countries. The Association also represents the British Standards Institute on ISO and CEN committees for gas vehicle components and operations.

Research and development (R&D) among NGVA members continues to bring forward innovations and economies such as the development of catalysts to improve still further the excellent emissions characteristics of natural gas.

Compared with diesel or petrol (in brackets) natural gas vehicles eliminate sulphur and lead and emit virtually no PM10s (particulate matter over 10 microns). Nitrogen oxides (NO_x) are reduced by 80% (83%), carbon dioxide by 10% (24%) and carbon monoxide by 76% when compared to petrol - diesel emissions of CO are low anyway. Perhaps more significant is the reduction in emissions of benzene, a known carcinogen, down by 97% (99%). NGVs already conform to the new Euro 2 emission and noise regulations coming into effect this year and Euro 3 which will take effect in 1999.

Changes in tailpipe emissions for a typical bi-fuel car-derived van driven on gas assessed under real world driving conditions

Component	Reduction against petrol	Reduction agasinst diesel
Carbon dioxide	22-24%	10%
Carbon monoxide	76%	Natural gas and diesel both low
Nitrogen oxides	83%	80%
Non-methane hydrocarbons	88%	80%
Benzene	99%	97%
Lead	100%	not applicable
Particulates	N/A	eliminated
Sulphur	nearly 100%	nearly 100%

Source: NGVA

Components

Since gas transmission components are engineered to be leak-proof at 200 atmospheres of pressure (200 bar) there are no emissions during refuelling. This compares favourably with the loss of volatile aromatic hydrocarbons - such as benzene - which are released uncontrollably during refuelling with liquid fuels.

Secure tanks, hoses and valves all ensure that gas reaches the point of ignition without loss of volume or performance. Ignition of gas rather than a vapourised liquid is also more energy efficient and quieter - eliminating the noisy 'knock' and vibration that is so characteristic of diesel engines.

Even so there is a constant programme of development and innovation aimed at reducing the cost of components for vehicle refuelling and conversion - but without compromising on safety or quality.

Economics

Reducing costs goes hand-in-hand with devising and sustaining operational savings. The Association's recent success in facilitating a 25% cut in excise duty on road fuel gas is one of a range of fiscal measures for which we continue to lobby.

These - such as a cut in Vehicle Excise Duty (VED) - are aimed at rewarding clean fuel users and reducing the pay-back period for converted NGVs or those from OEMs.

For example a natural gas bus can cost £35,000 more than the ordinary version and operators such as Southampton Citybus, with 15 gas powered Dennis Darts on the road, now know how and when this cost will be recovered; by lower fuel costs, grants and incentives. "I believe that buses have an important part to play in improving the urban environment," says Ian Phillips, managing director of Southampton Citybus: "If they are to play this part to the full, they have to be seen to be clean, modern and pollution-free; which is what our new 'Eco-bus' fleet achieves."

Health

However, the real pay-off is in improved air quality and better community health as the use of NGVs becomes more widespread.

Those with respiratory ailments are particularly at risk from poor air quality. Some 40 children and 1,900 adults die as a result of asthma attacks each year and more than 100,000 are admitted to hospital. Vehicle emissions are a major culprit.

A recent study of bus drivers in Copenhagen concluded that they run a higher risk of developing cancer from air pollution. Preliminary results showed that nearly 500 out of 15,000 bus drivers suffered from lung cancer, some 60% higher than the national average, and that there was a correlation between the length of service and the likelihood of cancer developing; the longer the period of employment the higher the risk. "The increase in cancer among bus drivers may be attributable to carcinogens from diesel exhaust," said Aarhus University epidemiologist Herman Autrup, who led the research.

Environment

Improved public health is an evident benefit from switching to cleaner fuels such natural gas. But there are many other spin-offs which will improve the environment and save public costs into the bargain. The Royal Commission on Environmental Pollution reckoned that the environmental cost of road transport could be as high as £12.9 billion or 2% of gross domestic product.

Sulphurous exhaust emissions from liquid fuels turn to acid, destroying roadside metalwork and paintwork and requiring extra expense in maintenance or replacement. Cleaner fuels can save on the cost of cleaning or restoring public buildings made filthy by vehicle emissions. Vibration damage, noise and dirt from ordinary vehicles take a toll on the well-being and quality of life of us all while adding to remedial costs often borne by local authorities already hard-pressed to balance their budgets. The Gas Research Centre have expressed these social costs in pence per kilometre with the cost of diesel pollution at 2.6 p/km and unleaded petrol at 1.0 p/km. But the effect of natural gas vehicles is only 0.2 p/km in the urban environment.

However, this is not the only good news about natural gas vehicles. Having once trailed behind countries such as Italy with around 300,000 NGVs on the road, we are now able to offer our skills, vehicles and equipment to home and overseas markets and to take a leading part in initiatives such as the European Auto Oil II programme which will set emissions standards for the year 2005 and beyond.

Once there are a significant number of NGVs on the road in Britain there will be an immediate, measurable improvement in air quality, energy conservation and savings to the public purse. We already have the fuel, the equipment, the vehicles and the means to bring this about - sooner rather than later.

Refuse collection trucks were an early application for NGVs

Fred Parker is the Executive Director of the Natural Gas Vehicle Association,
11 Berkeley Street, Mayfair, London W1X 6BU. Tel: 0171 388 7598.
The Association is made up of gas supply companies, vehicle manufacturers, component makers, engineers, scientists and technologists together with experts in finance, marketing, legislation and taxation. Vehicle owners, fleet operators and local authorities are also represented.

One of Southampton's 15 gas-powered Eco-buses

Deferring the peak

By Francis Harper, BP Exploration Operating Company

Energy World has been the forum for a crucial debate among oil industry alumni on the likely future of world oil production levels, and particularly as to the date of the production peak (see Energy World June and December 1996, March 1997). David Jenkins, Chief Executive (Technology) for BP, added his view last December, but here is another view from BP's Francis Harper.

Colin Campbell's recent paper in *Energy World* (June 1996) is one in series of articles in which the author propounds his view that the world is fast approaching a discontinuity in oil demand/supply and that after year 2000, the world will enter a phase of inevitable production decline with clear implications for oil price and associated political-economic trends. There is much to agree with in Campbell's analysis. And yet, there are also clear arguments for supposing that his view is altogether too pessimistic. The main ones are those of the decline rate after peak production and, more importantly, the role of reserves growth in contributing to the overall resource.

Decline rate

Campbell does not discuss the derivation of his production decline curve but, from other publications, it is likely to be based on a constant depletion rate. This may not, however, be the best was to model it. The main exponent of the resource based approach to production forecasting, M K Hubbert, advocated the use of a logistic curve, with its implied symmetry, to model production. Campbell's preferred global decline rate is significantly shallower than the rise during the 1950s and 1960s and, as he himself notes, a steeper decline would defer the onset of decline. By modelling a logistic decline and retaining Campbell's estimates of 1750 Gb and 1.5% growth to production turnover, I can defer the date of this peak from his 2000 to 2006.

Reserves growth

Following an initial discovery, field reserves tend to grow due to reassessments of both the in-place hydrocarbons and the anticipated recovery factor. Campbell does not appear to recognise such growth as a separate resource category although its magnitude could be very substantial.

Based on Petroconsultants database (the same as that used by Campbell), the average volume-weighted oil recovery factor in the world is about 35%. Given the estimated original reserve estimate, this suggests that if the average recovery factor could be increased, an additional 40 Gb (somewhat less than a North Sea equivalent) would be added for each 1% rise in the global average. Such increases can clearly be demonstrated on a local basis.

In the case of BP, for fields where we have a 10 year track record, the average recovery factor in those fields has increased by 1% pa. In the series of estimates that have been made for UKCS fields as published in the DoE 'Brown Book', there are significant fluctuations but the fields show an average growth of about 30% during the 20 years after sanction. If the average initial recovery factor was 35%, then after 20 years the recovery would have grown to 45%, an average annual increase of 0.5%.

But this is still likely to be optimistic as an indication of the global average increase in recovery factor, since, if extrapolated, it would imply annual reserve additions of 20 Gb from this source alone. The world is currently consuming oil at about 25 Gb per year; the extent to which this is being replaced is debatable but most estimates are that replacement is currently running at close to 100%. I expect annual global additions from this source to total at least 10 Gb in addition to the ca. 10 Gb of annual discoveries.

Although growth is likely to come mainly from the bigger, older discoveries and hence to decline with time, it is still likely to account for a substantial part of the future global resource - raising the average global recovery factor to 40% does not seem unrealistic and would add 200 Gb to the world's oil reserves. Presumably, Campbell can only ignore the reserves growth contribution if he feels that such volumes are already captured in his field reserve estimates. But then he has still to reconcile this with a global average recovery of 35%.

If we were to accept most of Campbell's resource arguments but top up the global resource to the long-run industry consensus of 2000 Gb with reserves growth, then the date of production turnover could be deferred to 2010 or later depending on the rate of growth towards that peak and the rate of decline after it. If the more optimistic views that have been expressed on either reserves growth or undiscovered resource were to be true, the production peak would be pushed out even further, but Campbell is correct in pointing out that even a large increase of 500 Gb would not defer this peak for more than about 10 years.

Beyond 2010

The argument above has indicated that the date of peak production from the conventional resource can plausibly be deferred by at least 10 years from Campbell's estimate of 2000; but this should not be cause for complacency. Although energy efficiency and the renewable sources of energy can be expected to increase in the future, it is also probable that the demand for liquid hydrocarbons will continue to rise for many more years beyond 2010.

Particularly under the impetus of a rising oil price, we can expect the contribution from the non-conventional resource, (by which I mean primarily heavy oil, bitumen and tertiary recovery but also including gas conversion) to rise substantially. The potential resource is very large but its recovery will require substantial investment and long lead times. Even assuming conventional production will not peak before 2010, if non-conventionals are expected to fill the eventual supply/demand gap, the issues surrounding their future role need to be evaluated now in order to minimise a subsequent 'oil shock'.

Decommissioning
the legal and financial issues

Britain's nuclear industry is entering a new phase in which the decommissioning of existing power stations has begun at a time when no new stations are being built - or even planned. Including smaller installations, of a total of 44 reactors units which have produced electrical power since the 1950s, nine are now at various stages of decommissioning. These include three Magnox stations - both Berkeley and Hunterston A are now being decommissioned having been closed in 1988 and 1990 on economic grounds, while Trawsfynydd in North Wales closed in 1993. A future issue of Energy World will include an article on the decommissioning process itself, but here, John Bindon looks at the legal and financial issues around the subject.

Decommissioning of nuclear facilities is a lengthy and costly process which takes a reactor, fuel processing plant or other similar facility from its closure through to a state where the land is available for unrestricted alternative use.

It was not until the Sizewell B Inquiry in the early 1980s that questions concerning decommissioning began to come to the fore. At the Inquiry concerns were expressed on matters such as the volumes of radioactive waste, its transport and safe disposal, to matters of the environmental impact and the unrestricted use of land previously used as a nuclear site.

There were at that time many uncertainties, including of course the cost of decommissioning. Since then the nuclear industry has had to seek solutions to allow the adoptions of a safe, economic and strategic policy for coping with the nuclear plants as they are deemed no longer economic to operate and are closed permanently.

The decision over the timing of closure of nuclear power plants is taken, simply put, at that time when the cost of safely operating the plant exceeds the that of the cost of keeping it running economically. Of course, safe operation is the number one priority. The Nuclear Installations Inspectorate, whose role as an independent watchdog and regulatory body in the UK, ensures that the laws governing the licence to operate are complied with. Other countries have regulatory authorities which act in like manner.

In terms of life span of a nuclear power plant, a great deal of effort is being expended in understanding the technical problems associated with the ageing process. Many utilities are exploring ways to lengthen the life of their power plants by undertaking a raft of upgrading processes.

Power stations at their conception do not have a specific life ascribed to them. For nuclear stations, the pre-design stage sees the financial costings undertaken. For the Magnox reactors in the early 1950s and 1960s, the CEGB took an amortisation figure of 20-25 years. This has resulted in public misunderstanding on the matter of the life of a nuclear power plant.

The plants were designed to provide implicit margin of safety which would allow a working life in the order of 40 years. Although reactor technology has been developed and improved over the years since the early 1950s and 1960s, many of the older stations, such as Calder Hall and Chapelcross are still providing excellent performances and operating safely. As safety is an absolute priority within the industry, these older stations continue to operate by the adoption of strict maintenance practices and careful refurbishment so as to maintain a clear and safe operating boundary.

The legal position

The inventory of nuclear facilities is wide. It not only includes nuclear power stations, research reactors and reprocessing plants but extends to the difficult area of military establishments, submarine reactors, etc. There is a heterogeneous list of installations all demanding strict regulatory control over every aspect of their demolition.

When a new power station is designed, the law requires a number of legal requirements and consents to be obtained, together with the necessary planning procedures. Decommissioning operations on the other hand are controlled mainly through the Nuclear Installations Act 1965 and the Radioactive Substances Act 1960.

It is not entirely clear what legal requirements are necessary in the case of the demolition of a nuclear power plant. For example, the primary legal responsibility for carrying out decommissioning rests with the licensee of the plant. Liability for any damage is strictly laid down although the demolition of a power plant does not require the same procedures to be observed as when the plant was being planned. It appears that decommissioning does not represent a development, but such a view may lead to a number of ambiguities in law.

However, as more and more decommissioning of large scale plants becomes necessary, legislation will be required in order to make sure that there are standard procedures laid down, sensitive to any public concern over potential health hazards.

Finance

Accounting procedures vary from country to country, mainly because of national differences in not only the legal requirements but also depending upon whether the utility is state owned to in the private sector. Although uncertainties exist as to the manner in which provisions are

nuclear facilities -

by Eur Ing F John L Bindon

made for meeting the eventual cost of decommissioning, the industry is confident that the current arrangements and procedures now coming into force will provide a sound basis for confidence.

Accounting and taxation treatment varies from country to country. In some states, Canada and South Africa, the utilities do not have to make provisions for tax payments, while in other countries taxation is payable and therefore provisions for meeting these sums has to be made.

In the UK, pre-1990, an allocation was made by the CEGB for decommissioning costs and tax, as well as for spent fuel management. The CEGB was liable for taxation on profits although the electricity supply industry was treated as one entity. Year on year, the Electricity Council required the CEGB to make an appropriate contribution. In the year 1987/88, the CEGB showed in its annual accounts that it had made provision of £284 million for nuclear decommissioning and reprocessing and the resulting waste products. At the 31st March 1988, the accumulated provisions stood at £2,875 million.

By 1990 the ownership of the nuclear assets and liabilities had passed to two new state controlled companies, Nuclear Electric and Scottish Nuclear. As with the CEGB, any surplus funds accumulated had to be deposited in the public sector. These were not allocated to any specific purpose, such as decommissioning, by the Treasury.

By September 1992, annual accounts show that Nuclear Electric had £733 million invested. This sum of money deposited in the National Loans Fund, would in 1992 have met nearly half of all the nuclear decommissioning provisions in Nuclear Electric's accounts.

The practice of allowing investment of financial provisions by British state owned utilities in their business, is one which is also followed in France and Japan. There is, however, a requirement in the UK that a nationalised industry must deposit any surplus cash in the public sector as whole.

The situation is different in Sweden, Germany and the USA. In these countries the long-term nature of nuclear liabilities is provided for by what we know as segregated funds. Here the low risk nature of the funds in which the money is invested means that funds for decommissioning can be discounted at rates of 4 to 5%.

Segregated funds are independently regulated so as to ensure that the contributions, plus interest, are no more than sufficient to meet the estimated requirements. This then protects both current customers and future customers against having to pay more than a due share of any liability.

When British Energy plc was floated in July 1996, it was clear that the Government had decided that segregated funds were the best way of ensuring confidence in BE's subsidiary companies, Nuclear Electric and Scottish Nuclear. They would then be able to meet their decommissioning obligations and any other nuclear long term liabilities from such sources.

The structure and scope of the fund set up, with the agreement of the NII, has been the establishment of an independent trust fund company. This company will receive the funds, invest them and make payments when required. The Fund Company, described as Nuclear Generation Decommissioning Fund Ltd, received an initial payment of £228 million in aggregate from the two companies, based on their accumulated discounted decommissioning liabilities. Further contributions will be made on a quarterly basis, amounting to some £16 million annually.

Previously, the surplus monies retained by the Treasury and deposited within the National Loans Fund, allowed the money to offset the Public Sector Borrowing Requirement and so it was claimed that segregated funds would not be of benefit to the taxpayer.

The decommissioning of the first of British Energy's power stations is not expected to commence before the latter part of the next decade by which time a considerable amount of money will be available.

The Government's intention has been clear. The policy is to ensure that nuclear operators must secure funds for decommissioning, although the Government has accepted responsibility for certain liabilities of AEA and BNFL. The sell-off of the AGRs and PWR in July 1996 has left the Magnox stations requiring continued state support to take care of decommissioning. Magnox Electric plc, wholly owned by the government, will under the presently proposed policy have all assets and liabilities transferred to BNFL, again a wholly owned State company.

The costs of decommissioning all of Britain's nuclear installations as they become liable is seem to be of the order of £18 billion (at March 1992 prices). The technical aspects surrounding decommissioning are fairly well established and, since 1989, the UK has been building up considerable experience which will allow for greater public confidence in the future. It will also provide the industry with a platform from which to export this expertise overseas.

The financial provisions have been much more difficult to solve. It is of paramount importance that such work will not only be carried out safely and with due regard to current environmental policy but must reduce to a minimum any costs which may fall on the taxpayers, now and in the future. It is axiomatic that the industry will not be expected to raise electricity prices beyond what might be considered reasonable in order to finance decommissioning. Every effort must be made by the industry to reduce its costs through improved technology.

Government confirms commitment to UK engineering

Government commitment to the UK engineering profession has been reinforced with the signing of a Memorandum of Understanding between Government and the Engineering Council.

The MoU - signed by the then President of the Board of Trade Ian Lang, and Dr Alan Rudge, Chairman of the Engineering Council - clearly defines the respective responsibilities of Government and the Council in maintaining a robust, high-quality engineering profession for the public benefit and in the national interest.

Mr Lang has described engineering a "more than a vital economic sector, it is a discipline with a powerful impact on society." However, he believes, "it does not universally command the respect and recognition it deserves. This Memorandum of Understanding with the Engineering Council signals our common interest in maintaining a world-class engineering workforce."

The MoU establishes the Engineering Council, in partnership with the engineering institutions, as the principal voice of the engineering profession and the body recognised by the Government to speak on profession-wide issues. It also confirms Government backing for the Council to represent the UK profession on the international stage.

Engineering Council urges innovative thinking

The Engineering Council has urged the government to consider urgent and penetrating changes in the exploitation of technological innovation, if UK industry is to continue to complete successfully with other industrialised nations.

Giving oral evidence to a House of Lords Select Committee on Science & Technology, Brian Kent FEng, on behalf of the Council, explained that there was no shortage of innovative ideas springing from a strong UK science base, but that more focused investment and marketing was needed to bring the best ideas to the marketplace.

At the moment, government relies on a 'trickle-down' effect, resulting in large numbers of organisations each receiving a little funding - an approach which has nor encouraged optimum development of new ideas. The introduction of a system in which government grants were fewer but larger would reinforce success and increase the 'idea-to-product' conversion rate without increasing the overall funding budget.

Engineers on the march to raise their profile

Britain's quarter million professional engineers are on the march to rid engineering of its 'oily rag' image. A radical overhaul of the profession throughout the UK is putting engineers in the front line of the campaign to raise the profile of engineering and make it an attractive career choice.

An important element in the campaign is a new network of 15 regional organisations -Professional Engineering Institutions (PEIs) - which have been created to co-ordinate campaigns and programmes in their areas to bring closer together the profession, schools and industry.

The new structure aims to create joint ventures among local branches of the 39 professional engineering institutions and involving activities formerly organised by the Engineering Council.

The PEI network will coordinate a programme of events of direct relevance to engineers and technicians, support engineering and technology events involving schools and organise high profile events in their regions involving industry. Experts will have an engineering viewpoint on issues of concern to engineers and the public.

'Easier for women to go to moon'

Women have more chance of going to the moon than landing a boardroom job with a British engineering company, a Labour front-bencher has told an Engineering Council conference. Malcolm Wicks MP, the then Shadow Social Security Minister and Opposition spokesperson on family policy, was supporting a campaign to encourage more women to go into engineering careers. He was the keynote speaker at a national conference at Dudley, West Midlands, held as part of the Engineering Council's WISE (Women Into Science and Engineering) campaign.

Mr Wicks added: "British engineering has an international reputation, justifiably so, but it must be a serious concern that, despite improvements, so few women are entering the industry and reaching its highest levels. The modern question is how do we enable men and women to combine successful careers with successful family lives. At present too many men and women suffer from a care/career collision."

Marie-Noelle Barton, Manager of the WISE campaign, said that since its launch in 1984 the initiative had doubled the percentage of women engineering undergraduates: "Although this figure is now 14% there remains a significant imbalance, particularly at technician level. Industry really needs to address this as it cannot afford to ignore half the country's talent."

Events

May 1997

The energy industries and the environment challenge - strategies for cost-effective responses
Course, 19-21 May, Oxford, £985 + VAT
Details from Liz Gaida, The College of Petroleum and Energy Studies, tel: 01865 260214, fax: 01865 791474, e-mail: lizg@colpet.ac.uk

Regulation in a pan-utility environment
The Economist conference, 20 May, London, £540 + VAT
Details from Jackie Cottrell, tel: 0171 830 1177, fax: 0171 931 0228

Advanced steam plant
IMechE conference, 21-22 May, London. Details from, Susan Jones, tel: 0171 973 1294

Polish Energy Sector - matching investment and opportunity
Conference, 22 May, Warsaw, £899
Details from Euroforum, tel: 0171 878 6910, fax: 0171 878 6885

Technologies for activities implemented jointly
IEA Conference, 26-29 May, Vancouver
Details from Andrea Smith at the IEA, tel: 01242 680753, fax: 01242 680758, e-mail: andrea@ieagreen.demon.co.uk

Advances in computational heat transfer
International symposium, 26-30 May, Cesme, Turkey
Details from Dr Faruk Arinc, tel: +90 312 210 1429, fax: +90 312 210 1331, e-mail: arinc@metu.edu.tr

The World Sustainable Energy Trade Fair
Exhibition and conference covering renewable energy, waste-to-energy and sustainable transport, 27-29 May, Amsterdam
Details from European Media Marketing Ltd, tel: 0171 582 7278, fax: 0171 793 8007, e-mail: emml.demon.co.uk

June 1997

Energy liberalisation and sustainability
Seminar and conference by Friends of the Earth, 2 June, London
Details from FoE Trust, tel: 0171 566 1612, fax: 0171 490 0881, e-mail: joannaw@foe.co.uk

CIRED 97
Conference on electricity distribution, 2-5 June, Birmingham
Details from Sheila Griffiths at the IEE, tel: 0171 344 5472, fax: 0171 240 8830, e-mail: sgriffiths@iee.org.uk

Caspian Oil & Gas
Conference and exhibition, 3-6 June, Baku, Azerbaijan
Details from Spearhead Exhibitions, tel: 0181 949 9222, fax: 0181 949 8168, e-mail: caspian@spearhead.co.uk

Evaluating forecasting and managing energy price risk
Conference, 9 June, London, £649 + VAT
Details from ICOM Group Conferences, tel: 0181 642 1117, fax: 0181 642 1941, e-mail: anna@icompub.demon.co.uk

Power generation projects in central and eastern Europe
Conference, 9-11 June, Budapest. Details from IBC UK, fax: 0171 323 4298

Combustion & Emissions Control
Institute of Energy international conference, 11-12 June, Bath, £399 + VAT
Details from Louise Collins, IoE, Tel: 0171 580 0008 fax: 0171 580 4420. E,mail: lcollins@ioe.org.uk

Are we getting our energy efficiency act together?
Conference and exhibition, 12 June, Solihull
Details from the Council for Energy Efficiency Development, tel: 01428 654011, fax: 01428 651401

Oil markets over the next two decades - surplus or shortage?
Conference, 12-13 June, Paris
Details from Babs Howd at DRI/McGraw-Hill, tel: 0171 545 6212, fax: 0171 545 6248

Cogeneration in Europe
Conference, 12-13 June, Milan
Details from Euromanagement, tel: +31 40 297 4944, fax: +31 40 297 4950

SunDay
Annual celebration of renewable energy across Europe, 15 June, local events
Details from Mark Thornton, SunDay coordinator, tel: 0121 459 4826, fax: 0121 459 8206, e-mail: mark@tfc-bham.demon.co.uk

Power-Gen 97 Europe
Conference and exhibition, 17-19 June, Madrid
Details from Pennwell Conferences, tel: +31 30 265 0963, fax: +31 30 265 0928, e-mail: nel@pennwell.com

European Oil Refining
Conference and exhibition, 19-20 June, Cascais, Portugal
Details from WEFA Energy, tel: 0171 631 0757, fax: 0171 631 0754

Incineration principles and practice
Course, 23-26 June, Amsterdam
Details from the Centre for Professional Advancement, tel: +31 20 638 2806, fax: +31 20 620 2136

Electricity in Europe 97
Conference, 24-25 June, Berlin, £1099 + VAT
Details from ICBI, tel: 0171 915 5103, fax: 0171 915 5101

Electricity Pool pricing, trading & settlement
Conference, 25-26 June, London, £899 + VAT
Details from IIR, tel: 0171 915 5055, fax: 0171 915 5056

Diesel particulates and NOx emissions
Short course at the University of Leeds Department of Fuel and Energy, 30 June - 3 July, Leeds. Details from Jamie Strachan, tel: 0113 233 2494, fax: 0113 233 2511, e-mail: shortfuel@leeds.ac.uk

Gas turbine combustion
Short course, 30 June - 4 July, Cranfield, £930
Details from Mrs M Howard, Cranfield University, tel: 01234 754644, fax: 01234 750728

The Institute welcomes it's new President


Prof John Chesshire

On May 8th Prof. John Chesshire became the new President of The Institute of Energy taking over from Peter Johnson. John Chesshire's background reveals his vast knowledge and expertise within the energy field and there is quite clearly a theme of demand side management and a focus on energy users. This is well suited to the Institute as an area of interest which is growing quickly. The officers and staff look forward to working with the President to this end.

John Chesshire is an economist and Professional Fellow of the Science Policy Research Unit, University of Sussex, Head of the SPRU Energy Programme since 1986 and Associate Director of the UK Economic and Social Research Council's Centre for Science, Technology, Energy and Environment Policy.

His main research interests are;

- energy policy
- energy demand analysis and energy efficiency policy
- energy pricing & investment
- and electricity privatisation.

He serves on the Editorial Boards of the Business Economist, Energy Economics and Commons Select Committees; Energy (1979-1992), Welsh Affairs (1990-91) Employment (1992-93); Environment (1993-94); Northern Ireland Affairs (1995-96) and Trade and Industry (1995-97). The TISC inquiries related to

- the Future of Gas and Electricity Regulation and
- progress towards liberalising the UK electricity market in 1998.

John Chesshire has served as a member of the statutory Electricity Consumers' Council; and of the Energy Conservation Advisory Board of the IEA. He has acted as a consultant to the EC, EBRD, ECC, EEB, IEA, NAO, NEDO, OECD, UNEP and the Canadian, Swedish and UK Governments.

Elected a companion of The Institute of Energy (1988); Fellow of the Royal Society of Arts (1990); Council Member (since 1990) and Academic Vice-President (since 1995) of the British Institute of Energy Economics; Melchett Medallist, The Institute of Energy (1995); a Fellow (May 1996). Trustee, National Energy Foundation Chairman of Trustees of the Energy Action Grants Agency Charitable Trust.

TIES

For our 70th Anniversary why not treat yourself to one of our Institute ties, or purchase one as an ideal gift.

Due to the continued popularity of The Institute's ties, a new range is now available, in Silk/Polyester. The new single motif design is available in a choice of Blue, Burgundy and Grey and priced at only £12.00 inclusive of postage, packing, VAT and a donation to The Institute's Benevolent Fund.

To order please contact Derek Smith on 0171 580 7124, Fax 0171 580 4420 or email: djsmith@ioe.org.uk

Diary of Institute Events

May

INSTITUTION OF MECHANICAL ENGINEERS
Wednesday 21-Thursday 22 May
Advanced Steam Plant: New Materials and Plant Designs their Practical Implications for Future CCGT and Conventional Power Stations. To be held in London, in association with The Institute of Energy, member rates available. Contact Mr P George, tel: (0171) 973 1316

MIDLAND BRANCH
Thursday 22 May, 4.30pm
AGM followed by Works Visit to be held at the National Exhibition Centre. Contact Mr DEA Evans, tel: (01384) 374329

SOUTH WALES AND WEST OF ENGLAND BRANCH
Thursday 22 May, 10.30 am
"Energy Conservation and Environmental Aspects in the Operation of a Steel Re-heating Furnace" by W Lippiett of Allied Steel and Wire Ltd. To be held at ASW Conference Centre, East Moors Road, Cardiff and followed by a visit to ASW, Cardiff Rod Mill. Contact Mr B Mumford by 14 May 1997, tel: (01989) 562112

NORTHERN IRELAND
Wednesday 28 May, 6pm
AGM, to be held at the Transport Museum Cultra. Contact Mr P Waterfield, tel: 01232 364090

JUNE 1997

HEAD OFFICE
11, 12 June 1997
The Third International Conference on Combustion & Emissions Control to be held at The Assembly Rooms in Bath. The third of these highly successful conferences run by The Institute of Energy promises to provide an interesting setting for discussion on such topics as: Power Generation, Gas turbines, Process Industries, Biofuels, Refuelling Options, Pollutants and Novel Combustion Systems. Contact Maria Adams, tel: (0171) 580 0008 email: madams@ioe.org.uk

T&EA and NIE plc launch joint VQ pilot in Northern Ireland

Following the launch of the Standards for Managing Energy in Northern Ireland the Training & Employment Agency with Northern Ireland Electricity plc are sponsoring a Vocational Qualifications programme for Energy Managers.

Fifteen energy professionals and five assessors will undertake a series of activities in an integrated programme to achieve VQ units in Managing Energy and Assessor qualifications respectively. Two workshops have already taken place and in the next issue we will see evidence of them all in action!

The outcome of the pilot will be that the Institute will have a satellite site at Upper Bann Institute in Portadown with five qualified assessors to support and develop Irish VQ candidates who wish to achieve VQ units in Managing Energy. We also hope to see the first 15 Irish energy professionals obtaining their NVQ unit certificates in Managing Energy. We hope they will proceed and achieve the full NVQ which is planned for later this year.

As the only national centre this is an important step forward for the Institute and all those supporting the initiative. The steering group for the project includes the two sponsors, NCVQ Northern Ireland, and the Engineering Training Council. Watch this space for more news.....

The NEW Standards for Managing Energy

April 29 saw the launch of the New Standards for Managing Energy at an event hosted by the Lead Body, the Management Charter Initiative in London. At the event the MCI announced the results of a complete review of all their standards including the incorporated changes recommended in the Government's Beaumont report which made recommendations for the improvement of standards and vocational qualifications generally.

But do not panic as you flick through your current copy of the standards. The changes are concentrated on the use of language and presentation rather than altering the physical content of the actual standard. For those of you familiar with the standards, a major change is that key roles A, B & C have disappeared and been replaced with key role E. So all the units become E units. Within the new standards there will be nine E units forming the energy key role.

The Institute of Energy is keeping a close eye on the situation and working with its partners such as UODLE and SCOTVEC to make the transition as simple as possible for all involved. So if you have already achieved units or are working towards new ones don't panic - help is at hand from the Institute to support you through this period of change. If you have a CPD Manual you can expect to receive new and replacement sections in due course.

A final piece of news is that in June MCI will be launching the new Vocational Qualifications structure for all management standards and amongst those will be a Vocational Qualification level 4 in Managing Energy.

For further information keep your eye out for Institute News or the newsletter Fast Track. Alternatively contact the Institute's project and marketing office on Tel: 0171 580 7124, fax: 0171 580 4420 or email: madams@ioe.org.uk.

New Members

FELLOW

Mark Alexander Wyndham Baker, Magnox Electric plc, Glos.

Peter John Sydney Jenner, (transfer) William Battle Associates, Swansea

Andrew John Minchener, (transfer) CRE Group Ltd, Glos.

MEMBER

Stephen Daemon Andrews (transfer) Saunier Duval Eau Chande Chauffage, France

Melvyn Rook, Elf Exploration UK plc, Aberdeen

ASSOCIATE MEMBER

Trevor Frank Floyd, Tenby Consultancy Group, Birmingham

ASSOCIATE

Paul John Griffin, Ashurst Morris Crisp, London

David Peter Timothy Reynolds, Tim Reynolds Associates, Cambridgeshire

GRADUATE

Edward James Harford,

Stuart Anthony Edward Jones, European Marine Contractors, Surrey

Anna Elizabeth Williams, The University of Leeds, Leeds

Concessions on membership fees

RETIRED MEMBERS:
Minimum age 60 (any grade), pay a reduced fee of £23.95

EARLY RETIREMENT OR REDUNDANCY:
members may retain full membership on payment of half the normal fee for their grade of membership until the age of 60, whereupon the normal retired rate is payable.

Any member of any class (excluding Student and Graduate) may compound his/her subscription for life by the payment in one sum of a composition calculated as Council may dertermine. (Contact the Membership Officer for details).