



The magazine of The Institute of Energy

Number 228 May 1995



## Energy World Yearbook 1995

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**Events** 

#### COVER

The front cover shows gas boosters for a CHP scheme. Photograph by courtesy of Belliss & Morcom.

#### VIEWPOINT

## The scandal of fuel poverty

THANKFULLY, for the majority of fuel users in the UK, our only taste of how difficult life can be without the benefits of fuel is occasional and mercifully brief. To be without heating, hot water or lighting at all through appliance or power failure for even a short time, however, reminds us of how vital access to fuel is in our climate and with modern day standards of hygiene.

The scandal of fuel poverty is that for a substantial minority, a third of UK households — up to 8 million — are unable to meet comfortable and healthy standards of warmth in winter. This makes us unique amongst West European and North American countries, many with a colder climate than ours.

In the households of the fuel poor, people must battle on as best they can. They either avoid debt by tolerating the cold; are warm, but in debt to their supplier; or despite debt, are still cold; or deny themselves other necessities to achieve warmth. As if to compound this misery, the poorer the household, the higher the proportion of income which must be spent on fuel.

The National Right to Fuel Campaign was formed back in 1975 in response to record levels of fuel disconnections and rising hardship experienced by low income households as a result of big increases in fuel prices. Our membership is broad based and includes consumer and pressure groups, local authorities, advice agencies, trade unions, insulation businesses, energy efficiency manufacturers. We are entirely independent, and rely on affiliations and donations for our funding. Sadly, there is still much to be done to alleviate the misery of fuel poverty in the UK.

We recently organised a conference to consider the alarming findings of the Watt Committee Report on Energy (no 30 *Energy Efficiency and Affordable Warmth.* The Watt Committee is a non-partisan, independent organisation. Professor Thomas Markus, editor of the report says: "Fuel poverty is not just a winter problem. Our report suggests that those living in cold homes in the winter suffer the consequences all year round. The Home Energy Conservation Bill, currently going through Parliament is a crucial first step in coping with this problem, however the Government must accept responsibility for developing an integrated policy that considers housing, the environment, health and social security issues and upon which legislation to eradicate fuel poverty can be based. Currently, this is totally lacking but without it, any measures will be piecemeal in their effects on fuel poverty".

The consequences of fuel poverty are unimaginably severe. Having to live with winter cold exacerbates chronic illnesses, and is the cause of acute conditions such as pneumonia and hypothermia. Cold leads to condensation and mould which not only destroys the fabric of homes, furniture and possessions, but has also been shown to be the cause of a range of illnesses from children's asthma to psychological conditions. It is estimated that the cost to the NHS of the treatment of cold and damp related illness is £1 000 million each year. In addition, because many of these households can only afford to heat one room there is obviously an effect on family and social life which goes far beyond inconvenience. For example, it has a damaging effect on children's educational attainment and development.

Ultimately, there is the disgraceful fact that in our so-called civilised society, on average 35 000 more Britons die each year in winter compared to summer. We should all be ashamed that this figure is far higher than in any other comparable country.

The National Right to Fuel Campaign wants more than the usual knee-jerk reactions to each life-threatening cold snap. Our objectives include:

• a capital investment programme to radically improve the energy efficiency of low income homes through effective insulation and heating systems;

• a lead Government Department to coordinate and implement fuel poverty policy;

 a Statutory Code of Practice to ensure that genuine difficulties with fuel bill payment do not result in disconnection;

 appropriate heating benefits for those whose income levels are insufficient to provide affordable warmth where they live;

 energy efficiency grants extended to the full range of heating and insulation measures;

• improvements to both building and environmental health standards in energy efficiency to achieve affordable warmth;

 legal protection to avoid regressive taxes and unfair increases in price which adversely affect low income households;

• legal accountability for both fuel suppliers and landlords to protect poor households wherever their practices exacerbate fuel poverty.

The Watt Committee estimates that the cost of raising the standard of dwellings of all low income households to a level where they can afford warmth is around £1 250 million each year for 16 years, and recommends a mixed strategy of action. In addition, income maintenance of £5 to £3 per week (depending on climatic severity of the location) throughout the six-month notional heating period is required. Ultimately, this support would taper off as the investment programme proceeded.

That's a lot of investment. But set against the £1 000 million spent each year by the NHS treating condensation-related illness, or British Gas's pre-tax profit of £1 250 million last year, or the annual revenue raised by 8% VAT on fuel, which will exceed £1 250 million, it is certainly more affordable than fuel is now for eight million households.

Millions of pounds are being spent on the introduction of competition in the gas industry, and there is no indication yet — certainly no guarantee — that this will improve the lot of the millions of fuel poor in the UK. Indeed, cost reflective pricing is likely to deal low income households a further blow.

Must we continue to ignore the tragedy of unnecessary deaths and other damaging effects of fuel poverty on our society? Is a warm. dry, well-lit home for all really too much to expect in the UK in 1995? We are hopeful that the all-Party Parliamentary Warm Homes Group can make some progress in this area at last. We'll carry on campaigning — and if you can help, please contact us.

#### **Fiona Robertson and Michael King**

Chair, The National Right to Fuel Campaign



#### Opening Euro energy markets 'essential'

THE liberalisation of gas and electricity markets must remain at the top of the agenda in Brussels if Europe's businesses are to compete successfully in world markets, according to the CBI at a conference in Brussels.

Peter Agar, CBI deputy director-general, said: "The completion of the internal energy markets in Europe must be the key objective of EU energy policy. Opening markets to competition will bring real benefit to EU customers, allowing companies the freedom to shop around. This will particularly benefit large users, such as the chemical, steel, glass and paper industries, for whom energy costs have a major bearing on their commercial success".

Mr Agar was speaking in Brussels, where the CBI Energy Policy Committee had earlier handed in its response to the European Commission's Green Paper For a European Energy Policy, published in Janaury of this year. While welcoming the refocussing of the debate on energy policy, the CBI paper expresses concern that the opening up of energy markets is not given top priority. "In addition to the competitive benefits, liberalisation will also improve security of supply and encourage efficiency in both energy generation and use. The CBI agrees with the Commission that the interests of the consumer should be protected with some form of transparent and non-discriminatory public service obligation but, as the UK has shown, this is by no means incompatible with having a competitive market."

The CBI's paper also argues that the Commission already has the necessary powers to enforce competition in energy markets, and to organise cooperation between members states on energy issues generally. Therefore its desire to include an Energy Chapter in the revision of the Maastricht Treaty is inappropriate.

#### Sight savers

A DONATION of £90 000 has been made towards Sight Savers International's river blindness prevention programme in Nigeria.

The first of three £30 000 donations was made in by Attock Oil International in December 1994, and the new funding will be matched by Sight Savers International. This new donation will unable the charity to extend its river blindness prevention work based in Kaduna, into Sokoto and Kebbi states.

The new programme will focus on the distribution of the preventative drug Ivermectin, and will also provide training for local staff and an outreach vehicle.

#### UK minister calls for end to energy subsidies worldwide

THE UK Secretary of State for the Environment, John Gummer, called for a comprehensive commitment to reducing greenhouse gas emissions, at the International Framework Convention on Climate Change in Berlin at the beginning of April.

"An agreement on a figure in the range of five to ten percent below 1990 levels by 2010 would seem to be a credible and achievable outcome of the negotiating oprocess we are about to launch. Anything less will not live up to our global responsibilities today, nor meet our children's needs tomorrow.:

He told the convention that it

was not just a partnership between nations. "In the UK private enterprise, innovation and privatisation have played a major part in achieing our targets. Government has to set a framework which allows the private sector to make its full contribution. It is now time to examine internationally more closely, whether tackling climate change effectively is consistent with high levels of subsidy to the energy industries or indeed with their public ownership. Our policies and measures will ensure that we more than meet our commitment to return emissions of CO2 and other greenhouse gases to 1990 levels by the year 2000."

#### Stockholm presentation by King of Sweden

THE Royal Swedish Academy of Engineering Sciences has bestowed its Axel Ax:son Johnson Lecture medal award on Janos M Beer, Senior Fellow, Professor Emeritus of Chemical and Fuel Engineering at the Massachusetts Institute of Technology. The medal was presented to Prof Beer by H M Carl XIV Gustaf, the King of Sweden, in a ceremony at the Academy in Stockholm, following Prof Beer's lecture Fossil Energy Utilisation, environemntal challenges and technology *responses*, on 21 March. The international medal is awarded every three years 'for outstanding constribution to the engineering sciences in the service of mankind'.



Three of the largest monoethylene glycol regeneration units ever manufactured, awaiting transportation from the UK to the Troll Onshore Gas Processing Project in Bergen, Norway. In accordance with strict Norwegian regulations concerning minimum emissions, the units ensure maximum protection against pipeline corrosion.

#### HOME NEWS



#### OFFER mediates

The director-general of electricity supply, Prof Stephen Littlechild, has settled a dispute between British Steel and the National Grid Company (NGC) about the terms of its connection agreement to NGC's transmission system.

NGC had propsed that British Steel accede to the multi-party Master Connection and Use of System Agreement. British Steel disputed the need to sign this, and questioned the level of NGC's connection charges for its pre-vesting and post-vesting connection assets.

Prof Littlechild has decided that British Steel should not be required to sign the multi-party Master Agreement, however the two parties should discuss the terms of a bilateral agreement to cover connection to and use of the NGC transmission system.

On connection charges the director-general said that he would accept NGC's basis for charging for pre-vesting connection charges, but would restrict the overall increase for the years 1991/2 and 1992/3 to a nominal 10%. This would result in a reduction of about £445 000 in the total charges payable by British Steel.

In the particular case of disputes about post-vesting connection charges, the licence requires the director-general to set a reasonable rate of return. Bearing in mind that NGC's risk is reduced by the guarantees it requires from British Steel for the provision of termination payments, the director-general took the view that 6% was an appropriate rate of return in this case. This, and other modifications, would result in a reduction in British Steel's charges in each of the years 1992/3 to 1995/6, totalling about £336.000.

Prof Littlechild said that from 1 April 1997, NGC should adopt a more transparent method of revaluing its assets by using the retail price index. He said that customers should be given the option of making a capital contribution to reduce their connection charges.

#### Pilot plant proves technology

A £44 million project which has successfully demonstrated technology to produce high grade petrol and diesel fuels from a wide range of coals, has had a  $\pounds$ 1.2 million cash injection ftom European Commissioners to assist in the completion of the pilot plant work.

The coal liquefaction plant at Point of Ayr in North Wales has been funded by British Coal, the UK government, the EC, Ruhrkohle, Amoco and Exxon. The EC, which has supported the project since 1985, have recently signed a new contract which brings their total contribution to £14.4 million.

The contract has enabled the project to carry out additional tasks involving the development of certain key parts of the technology, a demonstration run between January and May 1995, and the production of the outline design of a demonstration scale plant.

These three tasks, which will

#### BS 7750 for NE stations

TWO of Nuclear Electric's power stations have become the first electricity generators to receive official British Standard recognition of the environmental management systems. In a special ceremony at Hartlepool power station, Secretary of State, John Gummer, presented Hartlepool and Heysham 2 with the new British Standard BS7750 environemtnal management certificates.

Ray Hall, NE's executive director for operations, said: "Two years ago we introduced BS7750 into the company to help to manage all our environemtnal effects - from radiological discharges, to waste production, natural resource consumption and land management. We also made a commitment that all parts of the company, including operational and decommissioning power stations, research facilities, etc would work towards the achievement of BS7750.

be completed towards the end of the calendar year, will bring the UK development programme on coal liquefaction to a successful conclusion. The plant will be decommissioned in June, and unless efforts to find another use in private ownership for the extensive facilities on the site are successful, it will subsequently be demolished.

The liquefaction pilot plant project at Point of Ayr was approved in 1984, with construction starting in 1986. The liquid solvent extraction process used is capacble of producing high grade gasoline and diesel fuels from a wide range of international coals. The technology is owned and the project managed by the Coal Technology Development Division of British Coal, and its development has received widespread international interest, particularly among oil companies in Europe, the USA and Japan.

#### Shorter interval for Business Gas

OFGAS has consented to a oneoff request from Business Gas, the commercial and industrial supply arm of British Gas.

The request was to reduce the interval between changes to its interruptible prices from 28 days to 14 days. The prices were last changed on 1 April. This consent enabled Business Gas to introduce a new interruptible price schedule on 15 April.

The shorter interval enables Business Gas to respond to what has become a fast moving market, and it will still allow all eligible customers time to take advantage of the new price offer.

In March Ofgas published a review of the competitive gas market. It required BG to satisfy four conditions before the need to price according to published schedules could be suspended. Ofgas is awaiting a response from British Gas on these proposals.

## Pool elects chairman

The electricity Pool has elected Richard Rigg as its new chairman. He has been elected for a 12-month period, and will chair the Pool's executive committee, which supervises the operations and development of the electricity Pool.

Mr Rigg succeeds John Roberts, chief executive of MANWEB as chairman, and will work closely with Andrew Claxton, the newly-appointed chief executive of the electricity Pool.

Richard Rigg is a director of Peterborough Power since September 1994 (a whollyowned subsidiary of Eastern Generation Ltd, part of the Eastern Group. He joined Peterborough Power as general manager in April 1991, and is presently responsible for setting up the operations and maintenance of Eastern Generation's new 340MW CCGT power station at King's Lynn in Norfolk. He previously worked with GEC-Alsthom Signalling in the UK, and GEC Turbine Generators in South Africa, following an engineering career in the British Army.

## Privatisation completed

THE privatisation of British Coal's mining business has now been completed with the sale of Annesley Bentinck Colliery to Coal Investments plc.

Coal Investments have acquired Annesley Bentinck Colliery, which has been on care and maintenance since February 1994, for a nominal consideration of £1. The company takes over British Coal's substantial liabilities (estimated at about £4 million) at the colliery, for example in relation to site restoration when production ceases.

In order to minimise the ongoing costs currently being incurred by British Coal, the Government will pay Coal Investments a contribution of up to £27 000.

## Partners powering on

THERE is a growing concern that power generation should use its fuel as efficiently as possible, both from a economic and an environmental point of view. Combined heat and power is a technology well in tune with the times. Correctly applied, it may offer substantial reductions in energy costs, increased independence and the added security of on-site generation, and a reduced impact on the environment.

CHP technology is well established, and in the UK it is now attracting keen interest from industrial and commercial energy users.

National Power Cogen is a specialist unit within National Power set up to serve the growing market for CHP. It provides a service ranging from initial consultation to plant funding, installation and operation. Typical clients for such a process are the chemical and petrochemical industries, paper and board, food and drink, manufacturing industries and large industrial users - basically any company that has a continuous requirement for electrical power and heat.

#### Unique pricing package

Backed by its parent company, National Power Cogen is able to offer larger electrical users, from 50 million kWh per year upwards, a flexible and unique pricing package, which includes full project funding.

National Power Cogen has successfully concluded several deals in the UK and is also working alongside National Power International on cogeneration opportunities overseas.

In December 1994, Lindsey

Oil Refinery Ltd, the UK's third largest refinery installation signed a 10-year deal to buy electricity and steam from a CHP plant to be built at the Killingholme refinery. Lindsey Oil Refinery Ltd are jointly owned by Fina plc and Total Oil Great Britain Limited.

National Power Cogen will build, fund and own the £21 million CHP plant, and will provide back-up and top-up electricity as part of the deal. Lindsey Oil Refinery will operate the plant on a day-to-day basis under National Power's guidance.

The gas turbine will produce approximately 38MW of electricity and the auxiliary fired boiler is designed to produce 140 tonnes of steam/hour. It should achieve an overall efficiency in excess of 80% compared with around 36% for a conventional large coal-fired power station and around 55% for a combined cycle gas turbine power station. As such it will use substantially less fuel than conventional methods of generating electricity and steam separately and emit significantly less gases associated with the greenhouse effect.

Jean-Michel Chamoux, General Manager of Lindsey Oil Refinery said "This contract emphasises our commitment to improving our environmental performance while at the same time making a sound business arrangement. We are acknowledged as being one of the most advanced refineries in Europe, and this investment is further commitment to support that reputation." The plant is due to be operational in 1996.

National Power Cogen's largest operational plant is at the major European paper products company, Aylesford Newsprint Ltd, site in Kent. The £20 million scheme meets Aylesford's current electricity and steam requirements. Hot exhaust gases from a 38MW gas turbine are used to raise steam in a heat recovery steam generator. Additional firing brings the level of steam produced up to 120 tonnes/hour, and the thermal efficiency of the plant up to around 85%.

It is said that the sign of a satisfied customer is one who comes back for more. In 1994 Aylesford signed a second CHP deal to cope with a further expansion of its paper making activities. Phase 2 will see the installation of a second boiler rated at 80 tonne/hour. This steam, along with the steam from the boiler in Phase 1, will generate a further 20MW of electricity by means of a steam turbine.

#### Coming back for more

Another customer who has come back for more is Albright & Wilson Ltd. Its first contract was for a £3 million CHP scheme at the company's site at Oldbury in the West Midlands. The 3.7 MW plant provides Albright & Wilson with around 31 million units of power a year which is sold at a discount throughout the contract term. An overall efficiency of around 77% is achieved through to simultaneous production of 9 tonnes of steam/hour. The second, and larger contract was signed in April 1993; a 9MW CHP plant at Whitehaven in Cumbria. This is based on two 4.5MW machines each with 11 tonne/hour waste heat boilers. The plant was opened by Jack Cunningham, MP, last year. George Burns of Albright & Wilson stated "We have a high commitment to improving our environmental performance. This is a major environmental investment, which also helps to control our energy costs."

Other CHP contracts for National Power Cogen include Lancaster University, where state-of-the-art gas turbine technology supplies a large proportion of the University's heat and power requirements. The 4.5MW plant for Sterling Organics, was opened by Professor Ian Fells last year, and is currently operating at its site in Dudley, Northumberland. National Power Cogen are also installing a 2 x 4.5MW CHP scheme at the leading tissue manufacturer, Jamont UK, in South Wales. This plant will be capable of producing 40 tonnes of steam/hour. An additional 16 tonnes/hour boiler also forms part of the scheme.

There are as many combined heat and power solutions as there are sites able to benefit. A successful CHP scheme is one which has been thoroughly researched, and designed specifically for its site. Economic factors are unique to each site, as are the legal and regulatory issues involved. In short, maximising the benefits of industrial CHP requires specialist skills and knowledge in many fields.

National Power Cogen personnel, backed by the resources of National Power plc, have a wealth of experience in tailoring schemes to suit the customer's needs.

To find out how a CHP scheme might benefit your organisation, contact Tony Thompson at National Power Cogen's Birmingham office, on 0121 702 1133; or Gareth Evans at the Radlett office on 01923 8599559.

#### R&D

## The PASSYS project

ENERGY consumption for the operations of buildings remains of the greatest importance: almost half of the primary energy use in Europe is for heating, cooling, lighting and ventilation of buildings. Many techniques, designs and products have been developed to reduce the energy consumption of buildings, while maintaining the level of comfort, and hence reducing the emission of harmful pollutants and greenhouse gases.

So-called 'passive' solar systems try to reduce heat loss, and at the same time maximise the use of solar gains, when available and useful, providing optimal thermal comfort for a minimal energy cost. A number of these technologies and systems were developed in the 1970s and '80s, but although a lot of research was carried out, no coherent and unambiguous results were available for the different technologies. It was felt that the lack of well-defined, scientifically relevant and commonly accepted evaluation tools was the major reason for this situation.

In an attempt to increase the confidence in energy conscious and passive solar building products and evaluation techniques, the European Commission Directorate General XII launched the PASSYS project (PAssive Solar components and SYStems testing) in 1986 as a concerted research action.

At the start the project's major objectives were to set up a European network of high quality outdoor test centres for the evaluation of the thermal and solar performances of building components; and to develop accurate and attractive test methods. It also aimed to increase confidence in the detailed simulation tools, and to contribute to the development of simplified design tools.

During the first phase of the project, PASSYS 1 (1986-89), seven countries (belgium, Denmark, France, Germany, Italy, the Netherlands and the UK) were involved, and nine test centres were set up. At the end of PASSYS 1, important progress was achieved, but this was still insufficient for practical use. However, it was felt that good chances for success were available, and moreover, that the outcome of the work would be relevant, not only for the so-called passive solar components, but for all type of During several EC-initiated research projects in the field of solar energy applications in buildings, a unique test environment was set up for the characterisation of the thermal and solar performance of building components. 35 PASSYS test cells are now operational at 14 test sites all over Europe, with common equipment applying a common test procedure.

building components.

A second phase, PASSYS II, was launched in 1989 and ran until 1993. Three more countries (Greece, Portugal and Spain) joined the project, and some additional objectives were defined. These included the study of the possibilities of roof testing, and the collaboration with corresponding activities in the framework of CEN, the European Standardisation Committee, in order to shape the PASSYS results as close as possible to the needs of the building industry.

During PASSYS II the work regarding simplified design tools and model validation and development has been finalised. However, the test sites are still being improved, and test methods developed further, namely in the framework of the COM-PASS and PASLINK projects (1992-95).

PASSYS has produced new developments, and a number of valuable tools and services are now at the disposal of the building professional: whether for an engineer, an architect, a researcher, a product designer or a manufacturer.

PASSYS has several services on offer to the building professional. Product evaluation and development of the thermal, solar or general behaviour of a certain component is tested under real-weather conditions, but in a highly-standardised environment. This produces information regarding transmission losses; use of solar gains; and the component's thermal inertia. The evaluation of the thermal and solar performances is done by using so-called identification methods, which are also foreseen for the in-situ measurement of the thermal performance of building components, according to a new CEN standard.

Besides these direct results, the collected data sets can also be used for other purposes. This can be the case when you intend to evaluate the performances of a particular component in a real building. Such evaluation is normally done by using detailed simulation tools. However, it is not evident to have the required confidence in these results. The PASSYS data sets can be used for such a confidence check. They allow a comparison between the measured values in the PASSYS cell and the predicted results by the simulation tool.

As part of PASSYS II, a database of welldocumented, high-quality data sets has been prepared. Such sets can be used for general performance checks of simulation tools. In the case of a new product development, it is of course important to compare simulation and measurement results for a test involving this component.

Once agreement is reached between measurement and simulation results, confidence in the simulation tool increases, leading to simulations with the given component in a real building. This procedure is called 'scaling and replication'.

The result of the whole approach is that, on the one hand, a reliable performance evaluation under real weather conditions is made and, on the other, more confident predictions for the performances in real buildings will be possible.

In the past, model validation was often limited to a direct comparison between the measured and the calculated results. During recent years, the concept of model validation has been thoroughly studied. In the framework of PASSYS, a coherent and complete procedure has been developed. During PASSYS II, the activities were concentrated on so-called whole model validation. The primary objective was the development of the approach, the second was its application to the software package ESP-r.

Since the start of the project, the PASSYS test centres have been continuously improved. At present, the combination of the equipment available, the quality assurance procedures including regular calibration schemes, the available test methods and the experience of the test site staff, guarantee a unique testing environment for outdoor testing. As mentioned before, assisting in product development and evaluation is an important application of the PASSYS test facilities; the PASSYS test cell is also an important tool in any experimental research in building physics.

One such application is the collection of data sets allowing a comparison between measured and simulated data in the context of software checking. At the PASSYS test sites, all the required measurement equipment is available for checking most of the thermal simulation models.

#### R&D

An example of another type of research application is the study of the specific phenomena such as the effect of undercooling of building components due to clear sky conditions at night, condensation problems and daylight performance.

The estimation of the heating requirements of buildings, in general, is not performed by detailed dynamic simulations. In most cases, a simplified evaluation tool is more likely to be used. In the PASSYS project, the activities have been concentrated on the improvement of a so-called correlation-based, simplified design method. In essence, the main part of the work is related to the estimation of the availability and the appropriate use of the internal and solar gains. It is evident that in winter most of these gains are usable. However, during certain mid-season periods, they will lead to higher internal temperatures than the setpoint temperature, and therefore to a lower use of these gains. In a correlation-based method, a steady-state gains to the steady-state losses and of the thermal inertia of the building, These utilisation curves are derived from the analysis of a whole range of detailed simulations.

In the context of the EC Building Product Directive, the European Standard Organisation (CEN) started the preparation of a European standard for estimating seasonal heating demands in 1989. PASSYS actively contributed to the preparation of this standard. A software package called PASS-PORT has been developed as a practical implementation of the method. It calculates simply the monthly heating demands of buildings, according to the European standard, as well as to more detailed PASSYS algorithms.

#### New developments

An operational structure linking the PASSYS test sites has been set up in the form of a European Economic Interest Group (EEIG), called PASLINK. The group aims to keep track of the common high quality assurance between sites, and to share new developments and findings. An accreditation procedure for both existing and new test sites is



being developed.

The PASLINK EEIG acts as a legal body, encompassing European test centres involved in outdoor thermal testing, not only those set up under PASSYS. The group is based at the Belgium Building Research Institute, Violetstraat 21-23, 1000 Brussels.

Within PASSYS a test environment and a test procedure has been developed for the thermal and solar performances of mainly vertical building facade components. During the PASSYS project a test cell has been developed, with identical features as the original PASSYS test cell, but with the additional possibility of testing roof components. Therefore the roof above the cell's test room is removable. Such test cells are installed at the PASSYS test sites in Greece, Italy, Spain, Portugal and Belgium, and recently in Finland. Known as the COMPASS project, it began in 1992 with the aim to develop appropriate test procedures for roof components.

One of the main areas of research inside this project is the development and study of an improved test cell envelope, the so-called Pseudo Adiabatic Shell (PAS). In PAS the heat loss through the test room envelope is accurately measured, and the temperature of the walls can be directly controlled by electrical heating foils, in order to minimise heat losses. This enhances the capabilities for testing by a much shorter test duration, and provides a much higher degree of accuracy in the results. After a prototype construction and experiments at the BBRI test site in Limelette, Belgium, the PAS system is being applied at the other COMPASS test sites.

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#### R&D

## **Forward with foresight**

by Johanna Fender

THE Technology Foresight Programme is coordinated by the Office of Science and Technology (part of the Cabinet Office), with panels working in fifteen different agriculture. sectors: natural resources and environment: chemcials; communications; construction; defense and aerospace; energy; financial services; food and drink; health and life sciences; IT and electronics; leisure and learning; manufacturing, production and business processes; materials; retail and distribution; and transport.

The purpose behind the programme is to help those in business, engineers and scientists become better informed about each other's efforts, by bringing these communities together in networks to help identify emerging opportunities in markets and technologies. The results of the Foresight programme will inform decisions on spending by Government and industry.

Five reports from the Fortsight panels were published at the end of April, among them the reports on energy and on transport.

#### **High priorities**

The energy report highlights nine 'high priority opprotunities' for energy products and services as being:

 high hit rate exploration techniques for oil and gas, to increase accuracy of field identification through improved acquisition, integration, analysis and interpretation of geophysical data;

• increase oil and gas yields from hydrocarbon reservoirs, by more accurate characterisation and improved simulation, better drive and production technologies;

• decommissioning of redundant nuclear facilities, involving the safe and economic disposal of redundant facilities, minimising non-recyclable waste;

• photovoltaic power generation at competitive cost, via development of thin film materials suitable for low cost production and installation;

 'clean coal' power generation, involving demonstration of new technologies in three main areas: stack-gas cleaning, coal combusApril saw the publication of five of the Technology Foresight reports, among them energy and transport. These should be seen not as final reports, but as 'agendas for action', and point out the likely direction of future R&D in the various sectors.

tion and gasification;

• combined cycle units for gas power generation, requiring improvements in components in increase the combined-cycle efficiency to 60% with natural gas;

• low emission power units for transport, encompassing a range of technologies based on engine design, but including fuel handling and fuel quality sensors;

 greater efficiency, energy-intensive industrial processes;

• greater energy efficient buildings from both build and retrofit, including better adaption to human behaviour as well as a range of new technologies.

Key recommendations from the transport panel include:

 the informed traveller: designed to provide integrated real-time information, ticketing, booking and payment facilities seamlessly across all passenger transport modes;

• the foresight vehicle: designed to stimulate the UK automotive supplier base to produce vehicles which satisfy increasingly stringent environmental requirements while meeting mass market expectations for safety, performance, cost and desirability;

 clear zones: designed to provide a focus for the many disparate activities related to creating more livable urban centres.

The Transport panel also identified a number of priority technologies for each mode of transport, and from these highlighted the following technologies, common across all modes:

· high strength, lightweight materials;

safety critical systems;

 fuel efficient, low emission power plants and energy recovery systems;

quieter vehicles;

accurate location systems;

 pattern processing and recognition technologies,

The transport panel believes that the distinction between access and travel is key to understanding the development of the transport sector, and they urge that research priorities should reflect the systems nature of transport, and the important impact that interfaces have on transport system effectiveness. Accordingly they recommend that the Research Councils and Governemnt Departments consider certain specific research priorities, such as understanding why people travel; improving public awareness and education in order to raise the level of the transport debate, and to develop better models of transport systems.

#### New money

Chairman of the Foresight Panels have been appointed to the executive committees of the Research Councils, and the OST is cohosting a number of dissemination events.

Launching the reports in London, Minister for Science, David Hunt, said: "We have already taken account of the initial findings of Foresight in the allocations to the Research Council for this financial year. I set aside 5% of the Science Budget — some £67 million in this year alone — to reflect emerging strategic priorities from Foresight."

The ongoing nature of the programme was heavily emphasised, with the reports representing an agenda for action. Further development is needed, it was acknowledged, before the reports result in actual research, nor indeed are they final reports.

The philosophy behind the programme is that fundamental research is fragmented, and would benefit from the establishment of an independent centre of excellence and the building of collaborative links leadings to joint ventures. The programme anticipates that the Research Councils and relevant Government Departments should reflect the findings of the panels, and to this end the Energy Foresight panel welcomes opportunties to discuss with Councils and Departments how best to take forward their recommendations.

It is also anticipated that the embryonic networks established so far should be expanded further into industry, the Institutions and trade associations, and strengthened, with the aim of establishing a national consensus on key target areas.

#### REDUCING EMISSIONS

THE levels of NOx emissions from conventional burners, previously used to heat crude stock in production of oil-related products, do not comply with EC regulations due to come into force in 1997. In order to meet these, and the even more stringent regulations laid down by some EC countries, Airoil-Flaregas Ltd embarked upon a planned programme of development, taking a range of burner types and developing each until it met the required emission levels. Meeting these levels was the objective, but, in practice, it has been established that the installed burners are performing well within specification, which means, in the case of NOx emissions, well below the permitted levels. Noise, too, has been reduced to what might be described as 'user friendly' levels.

The staged air principle was applied to burners, both of the natural and forced draught oil and gas fired types. Whereas with conventional burners the air is introduced from a common source, into both the primary and secondary zones using a common damper to adjust the airflow, the staged air technique requires the combustion air to be separated into primary and secondary flow regimes.

The primary air is mixed with the total quantity of fuel producing a fuel rich flame which is both relatively cool and deficient in oxygen, conditions which inhibit NOx formation. Secondary air is introduced downstream of the primary flame zone at which

# Staged air for ultra low NOx

by Robert J Wilcox IEng MIEE\*

Part of the Hamworthy Group of companies, Airoil Flaregas embarked on a programme of upgrading conventional burners to comply with EC regulations on NOx emissions. Not only have they succeeded in meeting EC regulations, they have gone beyond current requirements. Managing director, Bob Wilcox, tells the story.

point combustion is completed in an environment which is sufficiently cool to limit thermal NOx production.

The staged air principle is widely known but, in the burners under discussion, has been developed to a level in their design which enables almost all statutory NOx emission requirements worldwide to be met and, as we shall see, exceeded. This has been made possible by the design of the components which influence the primary flame zone to generate extremely good stability under fuel rich conditions. Also, the staged air does not re-enter the flame until well beyond the primary fuel rich zone.

The main influence on NOx is the primary air quality as a percentage of stoichiometric; decreasing the primary air decreases the NOx. The limit of NOx reduction is achieved with the onset of flame instability and is accompanied by pulsation. This phenomenon is a function of the upper flammability limit of the fuel gas mixture, ie, the higher the upper flammability limit, the lower the primary air can be reduced. Therefore, when dealing with gas mixtures containing increasing percentages of hydrogen, it is possible to compensate for the expected increase in flame temperature by reducing the primary air percentage so that no increase in NOx levels result. When fired with refinery gas the NOx emission levels of the natural draught staged air burner, for example, taking into consideration the variation of hydrogen levels in the gas, are shown in Figure 3.

A relatively short flame is desirable and this can be achieved by decreasing the primary air percentage but, as previously stated, it is necessary to decrease the primary air in order to decrease the NOx emissions, so longer and more luminous flames are the

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Left: Figure 1: Cross section of natural draught gas-fired staged-air burner. Right: Figure 2: Cross-section of forced-draught gas and oil-fired staged-air burner.

#### REDUCING EMISSIONS

norm where NOx levels are critical. The flow pattern in the flames of a natural draught gas fired burner and a forced draught combination gas and oil fired burner are shown in Figures 4 and 5 respectively.

Gas mixtures containing large quantities of inerts (eg, N2, CO2) require higher primary air percentages and no decrease in NOx levels result, as would be expected with conventional burners. The forced draught staged air burner, for example, when operating on fuel oil with a varying nitrogen content produces NOx emission levels as shown in Figure 6.

The levels anticipated with, for example, 80% hydrogen rich gas are within the range 72 - 95 mg/Nm<sup>3</sup>. However, at the Scanraf Refinery in Sweden, burners of this type are achieving ultra low emission levels of 50mg/Nm<sup>3</sup>. Fitted to two vertically-fired vacuum heaters, each supplied with 15 burner assemblies, they are operating at 10% excess air in ambient conditions when firing 80% hydrogen rich gas. Over a range of 3/1 turn down they are capable of firing, without any adjustments, on refinery gas, from lean through to hydrogen rich.

At the Shell Dansk Refinery in Denmark, 216 burners of the same type, but physically smaller in size, are mounted in a series of heaters. These are operating on 10% excess air in ambient conditions when firing up to 60% hydrogen rich gas. According to Figure 3, these should be achieving NOx emissions levels within the range 76-87mg/Nm3. In practice these levels are less than 70mg/Nm3. In both cases a level of 100mg/Nm3 was specified. Although the burners at Shell Dansk are physically smaller, their size does not have any bearing on the emission levels. The slightly higher levels recorded here result from a different burner/heater relationship.

A number of other factors influence the production of NOx and these have to be taken into consideration and compensated for as far as possible. Both furnace temperature and excess oxygen in the combustion air can effect levels and, as far as forced draught burners are concerned, those which take in combustion air, which is heated via a flue gas heat exchanger, are very efficient, but



Figure 3: NOx predictions v refinery gas/hydrogen volume ratio for staged-air burner

they do emit higher levels of NOx, due to the air pre-heat effect. In the case of the burners under discussion, siting is not a factor as they are designed to operate in petrochemcial fired heater applications, either vertically, horizontally or down fired. This is an advantage inasmuch as the heater vendor designs the system and the burner manufacturers design the burner configuration to suit.

As mentioned earlier, the burner noise at the Scandanavian refineries is now at 'user friendly' levels. Conventional burners of the type discussed are noisy, and this was taken into consideration when developing the new models. The answer was an attenuated windbox and, in order to achieve the desired results, dynamic flow model studies were carried out to determine and optimise the airflow patterns in both approach ducts and the windboxes themselves.

The tests took place in accurately scaled plexigals models of the full size plants. Flow insulation was achieved using water in which were suspended polystyrene spheres. By illuminating the model in various planes with a columnated light it was possible to identify any flow irregularities and turbulence. Quantitive measurements were made, by means of air flow tests, in which the same model was fitted with orifice plates and pitot static probes. From this an accurate polar diagram of velocity head profiles was used to determine the optimum splitter arrangement to ensure consistent mass and peripheral air flow to all burners.

The burners at both Shell Dansk and Scanraf are installed in the resulting windboxes and, in both cases, the noise levels are less than 80dBA measured at 1 metre from source. For the record, these burners are capable of operating at duties of between 0.75 and 7.5 million Kcal/hr and will burn a wide range of gases and fuels in combination whilst maintaining flame stability.

Whilst the NOx emissions at Scanraf, for example, have been reduced by 50% by applying the staged air technique to natural and forced draught burners, some excellent performances are being achieved by natural draught self inspiratory wall type burners, to which a fuel staging principle has been applied. These are being used in furnaces designed and manufactured by a leading Danish company. Units are already in operation in a number of European refineries where they have reduced the NOx levels of ethylene cracking furnaces by around 40%.

These burners are designed for radiant wall process heaters where the proximity of the furnace tubes give a minimum forward flame projection and uniform radiant heat distribution. Unlike standard burners of this



Left: Figure 4: Flow pattern in flame of natural-draught staged-air burner. Right: Figure 5: Flow pattern in flame of forced-draught staged-air burner.

#### **REDUCING EMISSIONS**

type, in which fuel pressure inspirates combustion air using a venturi principle, the low NOx versions utilise a reduced percentage of the fuel gas in to the venturi which is specifically designed to give uniform inspiration. The remaining gas is then injected into the burner flame through four secondary injectors creating a gas-rich zone within the flame. The overall excess air level for the burner, under normal operating conditions, is between five and 10%. At the ethylene cracking furnaces where these burners are currently in operation they are achieving less than 100mg/Nm<sup>3</sup> NOx (corrected to 3% O2).

The noise factor, too, was taken into consideration during the development of these burners. A primary air silencer has been incorporated which has resulted in a significant reduction in the noise levels which, at the ethylene cracking furnaces, are around a comfortable 82dBA.



Figure 6: NOx predictions v increasing nitrogen content of fuel for staged-air burner.



Figure 7: Natural draught self-inspiratory radiant wall-type burner.

#### ENERGY EFFICIENCY

## Controlling compressors to minimise parasitic losses

BELLISS & Morcom is a company within the Rolls-Royce Industrial Power Group, specialising in the design and manufacture of reciprocating compressors. When used to raise gas pressure to a controlled level suitable for use in an engine or gas turbine, efficiency over a wide range of potential flow and conditions, is an important consideration. A reciprocating compressor is, by its very nature, an efficient compressor of gases. This article describes some of the ways in which Belliss & Morcom have sought to control their compressors, thereby minimising system parasitic losses.

A reciprocating compressor handles the medium to lower end of possible fuel gas oil-free gas compression, preferable for turbines, is readily provided, although with some gases it is necessary to use oil lubrication in order to protect the compressor from corrosive elements within the gas stream. The compressors are simple in principle and can accommodate a wide variation in suction and discharge duties. It may even be possible to accept extreme changes by on-site modification to the cylinder configuration, although this is only really practical where such changes are fairly permanent.

The reciprocating compressor is usually a crosshead type with double-acting cylinders providing a compression cycle above and below the piston. This design characteristic lends itself to a simple form of capacity control. By holding open the inlet valves of one end of a cylinder throughout the compression cycle, no compression actually takes place and no effective power is used. By unloading cylinder ends in sequence it is possible to achieve up to seven-step control. This simple step control is particularly effective in minimising parasitic power losses when the fuel gas flow is variable or the inlet pressure changes over sort periods of time. A refinement of this method of capacity control is stepless reverse flow (SRF). The gas volume entering the compressor is reduced, to match required volume, by holding the inlet vale open for a controlled and variable proportion of the compression stroke. Some gas is allowed to escape before the valve closes and compression occurs in the normal manner. SRF is analogous to fuel injection in a vehicle engine, only the required volume of fuel (or with SRF, gas) being used in the cylinder.

As a reciprocating compressor's absorbed power is almost directly proportional to the gas compressed at any given inlet and discharge pressure, SRF is one of the most efficient methods of capacity control. Other advantages are the maintenance of constant pressure ratios across all compression stages, irrespective of capacity, better control of temperatures, smaller piping and surge bottles, extended valve life and extended equipment life in general. Although initial cost can be high, substantial savings in running costs can be achieved where part-load running is frequent. Before adopting this method a study of the whole generation system is recommended in order to establish the likely payback period. In Belliss & Morcom's experience it is, not unsurprisingly, more cost effective on larger compressors, but as their compressor sizes go to 1 MW and above, real cost savings can be significant.

#### Variations

A relatively inexpensive variation of SRF is clearance pocket regulation, although power saving, while still significant, is less than with SRF. Volumetric efficiency, the ratio of intake volume to swept volume, is varied by the provision of clearance pockets which are opened or closed by the control system to vary capacity while maintaining constant volume. By connecting the pockets to the cylinder for a varying length of time a stepless capacity control is achieved.

One of the simpler methods of capacity control is discharge pressure bypass. With this method any excess capacity is diverted from the compressor's discharge back to the inlet via a suitable aftercooler and bypass valve. It is a relatively inexpensive and effective method of control, frequently used where operating conditions are relatively stable. A very significant drawback, however, is that the absorbed power of the compressor remains unchanged even if most of the gas is being recirculated. If variable conditions exist this is rarely the most economical control method, but has a place in the array of options if the overall power absorbed by the compressor is relatively small and capital costs are a more important consideration than running costs.

Speed variation is an extremely efficient form of capacity control for reciprocating compressors, power reduction following capacity reduction fairly closely. Some care is required to ensure sufficient flywheel inertia and lubricating oil pump capacity at the lower end of the speed range, as well as avoiding mechanical resonances at any point in the speed range. Although an attractive and apparently simple form of capacity control, the current cost of speed control equipment for electric motors is relatively high, frequently making this a less attractive option of capacity control when examined in detail.

A final, relatively inexpensive, form of capacity control is throttle control. At the compressor's inlet a throttle valve reduces the inlet pressure in response to a reduction in capacity requirement. Although initially inexpensive, this type of control suffers from two major drawbacks. Firstly, the power reduction is not directly proportional to capacity reduction. Typically a reduction to 55% of full load capacity only results in a reduction of absorbed power of about 70%. Secondly, of the supply gas pressure is only marginally above atmospheric pressure then the suction pressure reduction, following inlet throttling, could result in air entering the system and posing a potential hazard.

To match a more demanding requirement it is always open to combine different methods of control. The initial cost of installing more than one control system, however, tends to be higher than the cost of employing only a single system, making payback of original expenditure through enhanced energy savings meet a high bill.

With their wide experience, at home and abroad, Belliss & Morcom believe that their expertise and equipment can have a significant difference in whole life costs.

#### ENERGY IN BUILDINGS

A UNIQUE benchmark of environmental quality for new homes was launched in April by the Minister for Energy Efficiency, Mr Robert Jones, MP. Known as the Environmental Standard award, it will make it easy for discerning buyers to select a greener home. And it will give developers of quality homes the edge in a highly competitive market.

For discriminating consumers, environmental performance is becoming an essential component of quality. This trend is reflected in their choice of products such as washing machines and cars, and is now an important factor in their choice of housing. These buyers are looking for homes that contribute less to global warming, are less wasteful of natural resources, and ensure the health and comfort of their family.

These qualities are often difficult for people to judge for themselves in a housing development, and for the developer to communicate. The Environmental Standard award provides them with a reliable and easily recognised benchmark — they will know that all the homes on a site that has won an award have matched or exceeded a demanding set of standards for good environmental practice.

Award-winning developments will be identified by flags bearing the distinctive black and green Environmental Standard logo, and provided with matching sets of stickers and leaflets. Each site will have an official signed certificate, with copies available for individual homes.

The Standard is the latest member of the successful range of the BREEAM environmental assessment schemes developed by the Building Research Establishment. It builds on the experience gained in operating the earlier scheme for new homes and now contains recent scientific knowledge and appeals to a broader sector of new housebuyers.

The Environmental Standard award was created in collaboration with leading developers which specialise in quality housing. It is being managed by BRE and its development was steered by Admiral Homes, Hassall Homes, Laing Technology Group, New Age Homes, Taywood Homes, Hastoe Housing Association and South London Family Housing Association. Sponsors have allocated sites to be assessed for awards, and will provide their customers with comprehensive details of the scheme.

The award covers a full range of environmental factors, including global issues such

Head of Environmental Assessment, Building Research Establishment

#### May 1995

# Homes for a greener world

by Paul Bartlett\*

An Environmental Standard was launched in April, and is a development of the successful BRE Environmental Assessment Method (BREEM) targeted for the homes sector. BREEM is aimed at reducing the environmental impacts of buildings, which account for 50% of the UK's annual carbon dioxide emissions.

as emission of carbon dioxide, and a number of local site and indoor issues. For each housing development, individual issues are assessed and credits given if the environmental performance is satisfactory. To gain an award the development must gain a total of 12 credits, six of them mandatory, out of a possible maximum of 22.

All developments submitted for the award are assessed at the design stage. Assessors will be licensed by BRE, and BRE will ensure high standards of quality control through rigorous auditing.

For developers already building to good practice standards, achieving an award is unlikely to add costs, apart from the small charge for the assessment, typically about £500. BRE is confident that this will be more than offset by the increased volume and speed of sales that the award will bring.

Developers that achieve exceptional standards of environmental performance on an award-winning site can enter the Homes for a Greener World competition, to be held next year. This will involve submitting one or more houses for further detailed assessment at an enhanced standard to win a national accolade. Winners will be selected in a number of categories.

The Environmental Standard will also bring benefits to housing associations and other social housing providers and their tenants. Environmental performance is at least as important in this sector as for owner occupiers, and achieving affordable warmth is one of the main aims in developments for low-income tenants. Associations that gain an Environmental Standard award for their scheme are likely to have a head start in the increasingly fierce competition for funding.

The Environmental Standard award enables developers to go beyond the requirements of legislation and regulations, and to demonstrate to buyers that their homes attain even higher standards. It gives a market value to environmental performance for the first time. It goes hand in hand with the revised Building Regulations, which come into force in July. The new Approved Document to Part L underpins the Government's aim of continuous improvement in the energy efficiency of new housing.

The Approved Document introduces a Standard Assessment Procedure to obtain an energy rating which, in a single calculation, can be transformed to a prediction of carbon dioxide emissions. This makes it easy to discover whether the design will pass the carbon dioxide criterion for the award.

Concern about the environment is a driving force in many decisions taken by today's consumers. But the impact of buildings on the environment is often not fully recognised, nor the contribution that good building design can make to reducing these effects.

The use of energy in buildings accounts for half the UK's annual production of the greenhouse gas carbon dioxide emissions (as defined in the documents supporting the Standard) is one of the credits that must be gained to win an award.

Buildings are also responsible for substantial emissions of the gases which cause ozone depletion, largely HCFCs and CFCs. These gases are used as blowing agents for foamed insulants, and another mandatory credit is for all insulants in the construction to have low ozone depletion.

Wood is important globally as a natural renewable material. The award specifies that all solid timber and timer panel products must be from managed, regulated sources or

#### **ENERGY IN BUILDINGS**



re-use timber. Another mandatory credit is for installation of storage containers for recyclable household waste.

Many airborne pollutants are found indoors, including formaldehyde, wood preservatives, other VOCs, living organisms, particulates and fibres. The final mandatory requirement is for minimum formaldehyde emissions, treatment of timber only when necessary and always done industrially prior to use, no asbestos, and no added lead in paint.

In addition to these six mandatory credits, designs can gain optional credits in a range of global, local and indoor issues. Global issues include use of recycled material in the roof and walls, demolition materials for fill and hard core, low energy lighting, and timber frame construction.

Local issues focus on the way the site has been developed. Credits are also given for two features which economise on water use — WCs with a purpose-designed low volume flush and provision of rainwater butts.

The indoor issues that can gain optional credits are a minimum of airborne loose fibrous insulation material, provision of a house log book, and meeting BS daylight criteria in the kitchen and habitable rooms.

The choice of issues covered by the award and the criteria required for the award of credits were made in consultation with BRE experts and reflect views from the construction industry, energy and water organisa-



tions, professional institutions, environmental groups and DOE.

The designs for six new developments have already been assessed and granted the first Environmental Standards awards. The sites and the developers are Kestrel's Copse, Rowans Road, North Baddesley, Hampshire — Taywood Homes; St Mary's, Dallow Road, Luton — New Age Homes; Willow Ridge, Buckingham — Admiral Homes; Richmond Gate, Milton Keynes — Admiral Homes; Mill Lane, Carshalton, Surrey — South London Family Housing Association; Alsa Leys, Elsenham, Essex — Hastoe Housing Association.

The Standard is being managed by BRE, and its development steered by Admiral Homes, Hastoe Housing Association, New Age Homes, South London Family Housing Association and Taywood Homes. Sponsors have allocated sites to be assessed for Awards, and will provide their customers with comprehensive details of the new Award. A range of display material has been designed to maximise the impact among homebuyers.

Fred Taggart, chairman of the South London Family Housing Association, commented: "For years housing associations have been at the forefront of the improvement in environmental standards because they know that good design is an investment in the future, cutting costs over the lifetime of the home.

"Because they provide homes for people on the lowest incomes, running costs are a priority, not just the regular domestic bills for heat, light and water, but things like the cost of transport to work."

"Achieving the Environmental Standard will help housing associations ensure they have built in these advantages into their homes."

• More details about this scheme can be found in the report Environmental Standard — Homes for a greener world published by CRC Ltd, price £15.00.

## **Energy from the rooftops**

by D C Jones Energy Equipment Testing Service, University of Wales, College of Cardiff\*

CARDIFF University has designed and built two solar energy roofs as a result of a DTI-sponsored feasibility study.

The roofs generate electricity and heat water from sunlight via solar photovoltaic panels, photovoltaic laminates, glass laminates and tiles. This study was carried out in consultation with the Centre for Alternative Technology (CAT) at Machynlleth, and consultant architects, INSCAPE of Bristol. A purpose-made aluminium extrusion section was developed with increased strength and gully sides for integration of the various roofing materials.

The first roof was built for Brooks



Built for Brooks University, this first roof combined pv panels, a hot water collector and two skylights.

#### **ENERGY IN BUILDINGS**

University, Oxford. It combined a 4kW photovoltaic panel with 4m<sup>2</sup> hot water collector area, and two skylight windows built into a universal aluminium extrusion frame. The photovoltaic modules and the hot water collectors occupy an entire side of the roof. The electricity generated from this roof is directly connected with the national grid supply.

The second roof was built at Loughborough, again in collaboration with CAT, and with Richard Watson & Partners, Architects, London. This roof forms a covered walkway between offices at the Whittle Hill farm in Loughborough. It generates 3.6kW peak power from photovoltaic modules which cover an area of 21.8m<sup>2</sup> and coloured glass laminates which cover an area of about 34.8m<sup>2</sup>.

Radiation and temperatures of the roofs will be constantly monitored. Photovoltaic reference cells and ambient temperature sensors have been placed at various positions on the roofs with a continuous data logging system. Excess electrical power from these roofs is fed to the national grid.

The work has received the support of the Energy Technology Support Unit (ETSU) of the DTI, which has identified this technology as 'promising'. The DTI and the EU are joint-ly providing £850 000 towards the building of a solar energy study centre in mid-Wales. Bruce Cross and his team at Cardiff have been contracted to build the solar centre's roof, which is expected to generate about 10 000kWh a year, and will be the biggest integrated photovoltaic roof in the UK The building's heatload will be a quarter of that for a similar-sized conventional structure.



Bruce Cross and his team have received funding from ETSU and the DTI. The technology has been identified as 'promising'.



The roof at Loughborough, built in collaboration with CAT and Richard Watson & Partners, Architects.

#### WIND ENERGY

### Off shore applications for wind power

IN 1994 the consultancy department of the Centre for Alternative Technology (CAT) at Machynlleth in Mid Wales, was approached by Amoco International with a view to exploring the potential use of renewable energy technologies as an energy source for their North Sea gas rigs.

Initially two key production engineers from Amoco visited CAT's 40-acre demonstration site for a brainstorming session, and to brief CAT's consultants on the design specifications of their new generation of lightweight un-staffed rigs. This led to a proposal for a three -month consultancy project, which would result in a full system specification.

The first stage was an energy efficiency survey of the rig, and the resulting programme outlined procedures which could reduce energy requirements by at least 50%. The next stage was an examination of the available energy resources, and the renewable technologies most appropriate to the new rigs. This lead on to developing the most promising solutions to the point of a full feasibility statement, and system performance and design specifications. This gave Amoco the information it needed on how the various types of wind turbine currently available on the world market would perform in the harsh conditions of the North Sea.

The wind energy generation predictions were made by Dulas Engineering Ltd, a company set up by CAT in 1982 with a view to designing, producing, installing and promoting renewable energy systems worldwide. Ten years of North Sea wind data was collated from meteorological records, and fed into a computerised spreadsheet containing wind turbine generator characteristics. The resulting cost benefit predictions were encouraging, and were distributed for assessment throughout Amoco. A combination of the increased energy efficiency and the input from the renewable sources could reduce the expensive refuelling visits from every 12 weeks to every six months. In June 1994, Amoco announced a commitment to embark on a pair of pilot projects, involving two of their rigs.

These pilot projects entail fitting a pair of 5kW wind turbines to two of Amoco's new energy efficient rigs. The machine most appropriate to Amoco's needs was the French Vergnet GEV 5 horizontal axis machine. These turbines will start generating at any wind speeds above 4.5 meters per second, reaching optimum production at around 12 meters per second. Their five-metre bonded Controversy continues to rage around the environmental impact of wind farms, with both their noise and visual impact coming in for considerable criticism. A project undertaken by the Centre for Alternative Technology demonstrates an application that avoids both of these problems: offshore wind power.

wood laminate blades have a special epoxy resin protection system for coping with the North Sea's highly corrosive marine environment.

The nerve centre of the installation is Dulas's new 'LCS' load control system. This will ensure that the rig's energy system operates automatically and reliably. Energy generated from the wind is stored until needed in a set of deep-cycle, maintenance-free lead acid batteries, fixed below the deck of the rig. The Dulas LCS system monitors the state of charge of the main lead acid storage battery, and issues appropriate signals to connect or disconnect the main loads, issue alarm signals, and initiate the starting and stopping of back-up diesel generators. The state of charge is determined by measuring the current flowing in and out of the battery once a second, and either incrementing or decrementing a counter by the appropriate number of amp seconds. This counter is called to give a percentage state of charge, limited to 0% for a fully discharged battery, and 100% when fully charged.

The eyes of other major oil and gas producers are keenly focused on Amoco's flagship project. In order than both the financial



The single leg design gives significant advantages over conventional well head platforms. The use of wind turbines will save on day-to-day operating costs.

#### WIND ENERGY





The AMOSS mono-towers being set into position, and a close-up of the structure (right).

and energy savings can be fully assessed, Dulas Engineering have also been contracted to use their experience of renewable energy monitoring to produce a custom-designed microprocessor-based energy monitoring system. This will tell Amoco how much energy has been produced and consumed for the duration of the project. It will also give important data used to assess the performance of the wind turbines under the extremely turbulent conditions found on such North Sea rigs. This recorded data will also be used to check the accuracy of the original energy predictions, and allow savings on future rigs to be predicted with an even greater degree of certainty.

The data logging system samples all incoming signals at two second intervals. It utilises a battery-backed data storage module, an optically isolated computer interface for serial communication with IBM-type PCs, and a custom made printed circuit board for signal conditioning between transducers and data logger. At the end of each hour, the data is processed and written to the data storage module. Data processing includes conversion of signals to engineering units and calculation of the hourly mean. The data logger has a real time clock, and the date and time is included with each data record. The capacity of each storage module is 236 days. Data may be collected either by downloading the storage module to a computer on site, or by replacing the used storage module with an empty one and reading the storage module off site using a mains-powered computer interface.

This marriage between renewable energy and the fossil fuel industry demonstrates that the need for conservation and improved energy efficiency has become a major priority for the oil industry. The project marks the acceptance of wind power as a player in the world of off-shore energy production.  $\Box$ 



A computerised impression of how the Amoco Minimum Offshore Supporting Structure – AMOSS — will look with the wind turbines in place.

#### NUCLEAR WASTE

ON 23 February 1995 the first shipment of vitrified waste started its journey from Europe back to Japan under the terms of the contracts signed between the Japanese nuclear utilities and the French nuclear fuel cycle company, Cogema.

A flask has been designed and purpose-built for the event and one of a fleet of specialist ships from BNFL, Cogema's UK counterpart, selected for the transport. These ships have a safety record second to none in the world.

The shipment complied with all relevant national and international regulations governing its movement. The ship is tracked by satellite monitoring equipment at all times during the six to eight week non-stop voyage, and has a permanent communications link with the companies involved. The crew are all fully trained and experienced in carrying nuclear cargoes.

#### Vitrification

Nuclear fuel spends about three to five years producing energy inside a nuclear reactor before it needs replacing. Once removed, reprocessing of that nuclear fuel recovers the 97% of reusable material for recycling, and separates out the remaining 3%, which is waste. To deal with this waste, the nuclear industry has developed a process called vitrification.

This process involves mixing the waste with molten glass and pouring it into 1.3 metre high stainless steel containers. As the molten material cools, the waste becomes locked into the solid glass shape. Independent nuclear experts around the world believe this is the best and safest method of treating, transporting and storing the waste.

Flasks which carry nuclear material around the world are massive steel structures and regularly weigh over 100 tonnes each. Transnucleaire, a subsidiary company of Cogema, with more than 20 years' experience of flask design, has designed a flask for the return of vitrified waste which meets all international and national criteria. It can carry up to 28 containers of vitrified waste and each flask, when fully loaded, will weigh 112 tonnes.

The flasks are subjected to the most rigorous tests laid down by the international standards of the IAEA, which are designed to ensure containers can withstand the worst credible accident scenarios without releasing any radioactive material.

These include two 'drop' tests — one on to a solid unyielding surface, and the other on to a steel spike. These surfaces are made from reinforced concrete and steel and are

## From Europe to Japan



PNTL's ships have a safety record second to none.

built so they do not move when they are hit by the flask.

These tests are far more demanding than staged incidents. As an example, in 1984 in the UK, a 140-tonne locomotive, travelling at 100 mph was driven into a flask which had been placed on the track in its most vulnerable position. The flask received only minor superficial damage, the train was destroyed.

#### The regulations

The ships which carry the nuclear flasks around the world are owned by a BNFL subsidiary, Pacific Nuclear Transport Ltd (PNTL), a company with over 20 years' experience in the business. In that time they have transported nuclear material more than three million miles by sea without a single incident resulting in a release of radioactivity. In 1993 the International Maritime Organisation (IMO) introduced updated regulation for ships carrying nuclear cargoes. All the PNTL fleet has received the highest classification, and are regarded by the regulators as among the safest ships afloat.

All the flasks which carry nuclear material have to meet the rigorous standards set by

the IAEA, and must be licensed accordingly by national regulations. The ships must also conform to the IMO standards. The flasks in this instance have been certified for safety under Japanese and French regulations. The shipment must also comply with the regulations of the Japanese Ministry of Transport, and the necessary British and French regulations.

The authorities concerned with the safety and security of the vessel decided not to announce the route taken, but the voyage took between six to eight weeks, and arrived at Mutsu-Ogawara in Japan for onward transport to the interim store at Rokkasho-Mura.

Claims by anti-nuclear organisations that the shipments contained as much caesium as was released from Chernobyl in 1986 are totally irrelevant. It does not matter how much caesium there is in the vitrified material, but how much can be released.

In fact, the highly active nuclear material is incorporated in, and forms part of, the matrix of solid glass. Even if the glass could become directly exposed to the sea, the leach rate of this special material in water is extremely low, and any radioactivity could not be detected more than a few feet away.

#### INSTITUTE NEWS

#### **Branch Events**

#### May 1995

#### S Wales & West of England

Friday, 19 May, 10.30 for 11 am. 22nd Idris Jones Lecture, presented by John Collier FRS FEng, Chairman of Nuclear Electric. The role of nuclear power in a changing world' Applications to Mr D H Mustoe, 20 Park Court Road, Bridgend, Mid Glamorgan CF31 4BW. Free admission, but tickets must be applied for. Luncheon costs £8 per head.

Contact: Mr S Wilce, 01454 201101.

#### Merseyside sub section

Thursday, 26 May, 5.30 pm Sub section AGM. Consolux 78 Mount Pleasant, Liverpool. Contact: Mr E Curd, tel: 0151 231 3617

#### Mid May — Mid June 1995 S Wales & West of England

Trip on the paddle steamer 'Waverley' departing Penarth Pier and meeting up with members from the West of England at Avonmouth for a trip under the Clifton Suspension Bridge *Contact: Mr S Wilce, tel: 01454 201101* 

June 1995 S Wales & W of England Friday, 16 June Annual Lunchtime Lecture — CRE Group Ltd, Cheltenham. To be advised. *Contact: Mr S Wilce, tel: 01454 201101* 

#### North Eastern

Friday, 23 June Joint meeting with the Institution of Chemical Engineers. To be advised. *Contact: Mr A W Potts. tel: 01679 712861.* 

#### October 1995 North Eastern

Tuesday, 24 October, 6 pm Joint meeting with the Institution of Chemical Engineers. 'The work of CRE Group Ltd', Mertz Court, University of Newcastle. Tea & biscuits in the Buttery. *Contact: Mr A W Potts, tel: 01670 712 861* 

#### November 1995 North Eastern

#### November (date to be confirmed) Dinner dance. To be advised.

Contact: Mr A W Potts, tel: 01670 712861

#### December 1995 Headquarters

**3-5 December — two-day event** 2nd International Conference on Combustion & Emissions Control, Commonwealth Institute, London W8. Contact IoE HQ, Tel: 0171 580 7124.

#### Sustainable development initiative: a global warming strategy

PAST President of the Institute of Energy, Professor James Harrison, brought together a comprehensive gathering of group affiliate members and industry representatives as a continuation of his efforts to spearhead the Institute's activities on sustainable development.

At the Institute's London offices, members of the meeting, already well versed on the consequences of global warming, discussed the implications for industry of the outcomes of the recent Berlin Conference of the Parties to the Framework Convention on Climate Change.

The Department of the Environment, Nuclear Electric, British Gas, PowerGen, the Electricity Association, SWEB, BP, ICI Klea and the Energy Efficiency Office were amongst some of those organisations discussing the initiative.

Four main areas were briefly discussed, as those decisions which most affected industry.

1 The confirmation of the process by which Governments would continue to report on the implementation of their commitments, in particular their reporting on present and future emissions and the plans for the reduc-

(continued on page 20)

#### Sustainable development — a headline theme

AS THE Institute of Energy goes for green, Louise Evans reports on the recent activity amongst members on the theme of sustainable development.

Following this, one of the Institute's main themes, the Northern Ireland branch held a very successful conference earlier this year.

The one-day conference was held in Bangor, and sponsored by North Down Borough Council, B9 Energy and the Department of Economic Development. with a wide cross section of delegates attending. Sectors represented included local government, environmental groups, electricity generators, educational establishments and commercial companies. With an audience in excess of 100 people, speakers from Greenpeace, Friends of the Earth and the University of Ulster represented just part of an extensive and thought-provoking programme, opened by UTV environmental correspondent, Brian Black.

Issues covered topics including energy efficiency, future transport policy, sustainable development and waste minimisation



were raised during the day. Institute of Energy chairman for the Northern Ireland branch, Andrew McCrea said it been a great success: "It was superb and we had a great turn out". Pictured above, from left to right are: Roger Hickman, Friends of the Earth; Susan O'Brien, deputy mayor of North Down; Jeremy Leggett, Greenpeace; and Andrew McCrea, N I Institute of Energy.

#### INSTITUTE NEWS

tion of greenhouse gases to 1990 levels by the year 2000. Countries have agreed to submit their national plans to international scrutiny, comment and criticism. The UK now has an energy plan which must be defended at an international level.

2 Present commitments on greenhouse gas reductions are not adequate and a protocol will be negotiated to increase the commitment of industrialised countries. This will be agreed by 1997 and enforced in 2000. Mr Gummer has said that a reduction of 5 to 10% should be achievable.

3 A pilot phase to begin of joint implementation of commitments. As this issue still causes much debate no direct credits would be given and no-end date was fixed.

4 January 1996 would see a workshop for debate on how non-governmental organisations from all sectors could contribute to the Convention.

Dr Ken Gregory of Hoskins presented an interesting statement on the state of the science of global warming, with comment on the diversity of opinion of its impact and timescale. Dr Frank Shephard introduced to the meeting ways in which the USA and Canada in particular had already established schemes whereby their industries could claim credit for joint implementation projects. He also highlighted the various problems associated with the process, but it was thought that the wide scope of the discussion allowed for British Industry to examine if their overseas activities could be recognised as contributing to the objectives of the Convention.

A positive but cautious approach was agreed for the way forward as a conclusion to the meeting and in September 1995 another meeting will be arranged to develop this approach.

If you as a member of the Institute would like to be actively involved in any of the Institute's major themes, we would more than welcome your participation. To remind you, the themes are: SUSTAINABILITY, LIFE CYCLE ANALYSIS, INTERNATIONALISA-TION, CONVERGENCE AND ENER-GY MANAGEMENT.

This is YOUR Institute and we always welcome your participation. If you would like to get involved in the various activities, or simply want to know more, please write to: Louise Evans, Projects Manager, The Institute of Energy, 18 Devonshire Street, London W1N 2AU.





PHOTOGRAPHS: JOHN BAKER

President David Jefferies CBE FEng welcomes the guests to the Institute of Energy's annual luncheon (above). Guest speaker Tim Eggar MP, speaking to the Institute for the third time in 18 months: "Perhaps I should get a season ticket, or even a rebate on my allotted speaking time" he quipped.



THE Energy Minister Tim Eggar MP was the guest speaker at the Institute of Energy's annual luncheon in April.

Dismissing the elusive 'feelgood factor', Mr Eggar stressed that the UK economy is growing fast, driven by exports "As a trading nation we need to look outward, to markets which are becoming increasingly global; but we also need to look inward, to ensure that our internal systems are working well."

Greater efficiency and customer orientation in the energy sector he attributed to privatisation. Competition has led to reduced costs and significant price reductions, while advances in metering has the potential to give consumers greater control over what they use and when.

Mr Eggar referred to the opening up of the entire energy market to competition in 1998 — "the Big Bang". The results, he anticipated, would be yet lower prices, and a wider range of available services: "Nothing concentrates the mind like the knowledge that your customers have somewhere else to go".

On the subject of European energy markets, he was critical of the French "whose nationalised monopolies hate the idea of competition". On the question of third party access (TPA) to gas and electricity networks, the French are proving to be a fly in the ointment. They have proposed a 'single purchaser model', giving monopoly companies a stake in all transactions. Declared unlawful, it is now believed that a modified version can coexist legally with TPA.

Mr Eggar criticised the recent EU Green Paper on Energy Policy as "the kind of amorphous thing which is so often produced when you are trying to please everybody." Although he was pleased with what it had to say on subsidiarity and the role of the market in determining energy policy. He was less happy that issues such as security of supply and environmental protection were viewed as supranational, and could therefore justify intervention on a Community level. Nor did he like the suggestion that national policies should aim to converge. He hoped that eventual White Paper would focus on liberalisation being fundamental to improving efficiency.

As an example of how good UK industry is at adapting in the face of competition, he cited the oil and gas industry's cost reduction initiative CRINE. Continuing low oil prices were beginning to threaten the future development of the UKCS, but cooperation has overcome the problem, with non-adversarial partnerships, with common objectives, sharing both the risks and the reward. "The coming millennium will be an interesting time in the energy sector" he concluded. When isn't?

#### **BOOK REVIEWS**

#### Informed overview

'Alternative approaches to pollution control and waste management' by Janis D Bertstein, published by The World Bank, Urban Management Programme, Washington, 1993, 66pp.

THE book gives an overview of the most common strategies and policy instruments, eg. regulatory and economic, that are used to achieve pollution control and waste management objectives in both developed and developing countries.

The publication is divided into two chapters. The first discusses the two main approaches to pollution control and waste management, namely command-and-control and economic strategies. Governments have tended to use the former, as it gives the regulator a reasonable degree of predictability about how pollution levels will be reduced. A three-page table describes the various regulatory and economic instruments and their advantages and disadvantages. The second chapter discusses applications of these instruments as they apply to surface water pollution control, ground-water protection, air pollution control, solid waste management, and hazardous waste management. Examples are given from both developed and developing countries on how the instruments have been used, with some results. There are over 60 references cited, the great majority being from works published since 1988.

The report is described by the author as a background study forming part of a series of World Bank working papers to develop an overall report on strategic options for urban environmental management. Although it was primarily directed to policy makers at all levels of government, it gives an informed overview of all the main issues which could be particularly helpful for those wishing to enter the field or to get an appreciation of these regulatory and economic instruments.

Dr Cleland McVeigh

## Up-to-date, convenient reference work

#### 'Nuclear Reactor Engineering' fourth edition by Samuel Glasstone & Alexander Sesonske. Published by Chapman & Hall.

THIS work is published in two volumes: Volume I — Reactor Design Basics, and Volume II — Reactor Systems Engineering. It provides a broad but detailed coverage of nuclear energy principles, amply illustrated by practical descriptions of applications in the design and operation of nuclear power plants. The first volume concentrates on the fundamentals of nuclear energy, while the second explores the applications of more advanced topics.

Samuel Glasstone, the senior of the two authors, died in 1986, but his co-author was stimulated to ensure that this fourth edition of the original work became readily available. Both volumes have been extensively revised and updated, with new material being added on reactor safety, risk analysis, regulation, fuel performance, waste management and the operational aspect of nuclear power plants. Computer applications and emerging new design strategies are also included in this edition.

Glasstone is a classic reference work in the field of nuclear energy. As such, it must be text book material for all students, and others in the subject of engineering and scientific disciplines in nuclear energy. Nuclear power plants have become much more complex since the days of the first edition of this work with an accompanying growth in support technology.

To assist in an understanding, the two books contain set work for the student. These problems appear at the end of each chapter, save the last three, which cover topics such as power reactor systems. All problems can be solved by hand calculation, although it is realised that many students will wish to undertake work based on their computer studies.

Vol I covers the scientific basics of nuclear energy with the subject matter ranging from fission, radioactivity and reactor kinetics to sections dealing with materials.

Vol II builds on the seven chapters contained in the first book by investigating a range of topics, such as the current state of the art for reactor systems, computer applications, energy transport and fuel management. There are also chapters covering current designs and a number of potential innovations of plant and equipment.

The two volumes come highly recommended, and will serve as did the former editions as a convenient and up-to-date reference work for all engineers involved with nuclear power.

Eur Ing F John L Bindon

#### Wide ranging content

#### 'Energy Storage for Power Systems' by A Ter-Gazarian. Published by Peter Peregrinus Ltd, Volume 6 in the Energy Series of the Institution of Electrical Engineers, 232 pp.

ONE of a series on energy topics from this publisher, this volume surveys the wide range of technologies available for energy storage, analyses the role of storage in matching electricity demand and supply and the way storage systems can be integrated into electricity networks. The book only covers the electricity industry and not the technologies associated with gas, district heating or the oil industry.

The author, Dr Ter-Gazarian, is Russian and, after many years in the Department of Power Systems of the Moscow Power Engineering Institute, is now working on Russian utility decentralisation, presumably a process not dissimilar to privatisation. Although the author is Russian, the English style is idiomatic and pleasant to read. Each chapter has a comprehensive list of references and suggestions for further reading.

The first part of the book analyses the role of storage and the specification of what a storage system has to do. One possibility is storage in the form of heat by the user, and in Germany this amounts to a quarter of electricity demand. Electronic systems can be used to optimise the actuation.

The main part of the book covers in some detail the technical aspects of the storage systems. Thermal energy storage can be employed in the power station with the first dating back to 1929 in Berlin.

Flywheel storage, used too for machinery and transport, could profitably employ composite materials such as carbon fibre epoxy resins.

Apart from thermal storage, the most widely adopted method is pumped hydro. The British Dinorwig installation is outstandingly versatile and successful. It can contribute 1320 MW to the grid in 10 seconds.

Compressed air storage is likely to increase in importance as it can be used for gas turbines. It receives a detailed analysis. Installations at Huntsdorf in Germany and McIntosh in Alabama are described.

Electrochemcial storage is an active field of research for transport applications. There is a rather perfunctory section on fuel cells.

Other technologies offer promise but remain speculative at present. They include hydrogen and other synthetic fuels, capacitor electrical storage which is of interest in Russia, and super conductor magnetic storage.

Any storage system has to be weighted against the alternatives and its economics assessed. In most countries all of the available pumped storage capacity has already been utilised.

This book illustrates the enormous range of energy studies, involving mechanical, chemical, electrical and electronic engineering. The author has a wide ranging knowledge and experience enabling him to cover the whole field.

Norman Worley

#### **READERS' LETTERS**

#### Look to the future

WITH reference to R G Loram's 'Viewpoint' article on the third renewables order (*Energy World*, January/February 1995), I quote: "the method used was to purloin a small part of the non-fossil fuel levy imposed to provide a fund from which to subsidise nuclear power, and use it for paying premium prices for renewable energy". To regard the non-fossil fuel levy as being for the sole purpose of subsidising nuclear power is surely 'being economical with the truth' and even a 'terminological inexactitude'.

If we look at the energy situation which we are bequeathing to our descendants, then investment in renewables, and eliminating energy waste is the only responsible strategy. We must not leave them deposits of plutonium and other dangerous artificial radioactive elements, nor structures which they have to dismantle with no benefit to themselves. Moreover, it has been calculated that if one takes account of all the fossil fuel used to mine and separate uranium, to build and maintain nuclear power stations, to place all wastes in places which are safe in the long term, and to dispose of worn out powers stations, then this adds up to more than the electricity produced.

Oil will be comparatively scarce in 100 years' time, so our roads will be used only by buses and local distribution lorries, while rail transport of goods and people will predominate. Even before oil becomes scarce, it is vital that the world use of fossil carbon should come down to about one third of the present figure of some 7 billion tons oil equivalent/annum, because it is now certain that the greenhouse effect is real. However this is no reason to burden our descendants with caches of plutonium. It is like saying that one should avoid bronchitis by having stomach ulcers!

Professor M W Thring (SFInstE) Brundish, Suffolk

#### Advanced sealing technology

IN the course of my work in the CEGB research and development division I have been closely associated with the performance enhancement of power station regenerative air heaters (ref: Operation and Performance of Power Station Rotary Air Heaters by B Chojnowski, P Chew, Proc. IFCE/Inst of Fuel conference on heat exchangers, Paris 1971). Also I have been responsible for managing the performance tests on operational air heaters fitted on 500 MW units at Fawley and Eggborough power stations. I was therefore most interested to read the article 'Advanced sealing technology for rotary regenerative heat exchangers' in the January/February issue of Energy World.

The reported advances made by Howden in the development of the VN sealing system for rotary regenerative heat exchangers are to be commended. What is particularly attractive is the apparent simplicity of the VN system, since they are no moving parts, but it is a pity that more factual information is not presented. The stated leakage drift from 6.6% to 8.6% between major outages (for up to three years), is a remarkable achievement. My recollection is that in the past the typical leakage rate values were 6% to 20% for main air heaters and 20% to 40% for mill air heaters, depending on heat exchanger design, plant age and method of operation — base load, part load, shift operation. Consequently I wonder whether the VN system is specifically intended for the newer plants intended for base load operation, since on-load adjustment is not possible.

It is perhaps worth adding that while in the UK the development of a sensor-driven sealing system is no longer considered to be attractive. I understand it is continuing in other parts of the world. I believe that in Germany, Rothemulhe have developed and are installing automatic sealing systems on their rotary regenerative heat exchangers which are sensor driven. They are claimed to be highly reliable. Such systems are inherently more flexible, since on-load adjustment is catered for , and consequently the sealing system responds to the changing plant operating conditions. Is the author of the article aware of the other system, and if so would he care to comment on the respective merits of the two systems?

B Chojnowski Eastleigh, Hants

#### Calling all former students ...

AS THE alumni relations officer at the University of Strathclyde I have responsibility for fostering and developing good relations between the University and its former students. Much of the work involves tracing lost alumni, and with this in mind I would like to use media, such as *Energy World* to issue a call to all former students of the University of Strathclyde, West of Scotland Commercial College (1915-1955), Scottish College of Commerce (1955-1964), Royal College of Science & Technology (1956-1964) and the Royal Technical College (1912-1956) If you attended any of the above, and would like to receive the University's alumni magazine *Interface* please write to:

Lorna J Baird Alumni Relations Officer University of Strathclyde Glasgow G1 1XQ Telephone 0141 552 4400, ext 2414.

Lorna J Baird Glasgow

#### Without demand there can be no supply

READING the Institute's magazine, one would be justified in believing that only the supply side of the energy exists! However, simple rules of commerce dictate that for there to be a business, there has to exist side by side both supply and demand. Here surely is a much neglected area that offers an excellent opportunity for the Institute to expand its membership, its status and influence.

Energy is of ever-growing interest and concern in the domestic, commercial and industrial sectors. It is fast becoming more and more linked with environmental issues such as global warming. This is a huge area of interest so far relatively untapped by the Institute of Energy, an area where the Institute should be leading the way by raising awareness, promoting debate and disseminating information.

Buildings and systems designers (architects and engineers) have a professional and a moral responsibility to consider energy efficiency; to adopt and promote energy efficient solutions and technology; to raise awareness of the impact that buildings and their use has on the environment. There are thousands of potential members out there, many already members of existing professional bodies.

The Institute of Energy needs to change emphasis if it is to survive and grow. To start with how about publishing an energy policy statement for the UK?

Are there any liked minded members out there, and if so, what do you propose to take us forward into the next millennium?

**R I Taylor** (*Member*) Hitchin, Herts

The editor replies: This very topic was raised at a recent Publications Committee meeting at the Institute, and it is planned to redress the editorial imbalance in future issues. We have in the past covered the subjects mentioned by Mr Taylor, but admittedly with insufficient regularity. On the subject of an energy policy statement, any offers?



#### Young engineers essay competition

TO mark its 50th anniversary in 1996, the Commonwealth Engineers' Council (CEC) is running an essay competition for young engineers from all the Commonwealth countries. The overall winner will be invited to attend the 50th anniversary conference in London in March 1996, expenses paid, to present the winning essay.

The subject of the essay is to be **The Young Engineers' Role in Sustainable Development.** It must be written in English, and be not more than 2000 words in length. Entry is open to all members, associates members, graduates and students of the Nominated Bodies of the Engineering Council who are under 30 years of age on 1 September 1995.

Entries should be submitted to: The CEC Essay Adjudication Committee, The Engineering Council, 10 Maltravers Street, London WC2R 3ER, by no later than 1 September 1995. The authors of the three best entries from the UK will be invited to London, expenses paid, to present their essays. The UK winner, chosen on the basis of essay and presentation, will be entered for the overall competition.

The overall winner will be announced soon after 1 December 1995.

#### **CPD** at Bournemouth

THE PHILOSOPHY of continuing professional development (CPD) is widely accepted as essential in today's constantly changing commercial environment. It helps professionals strive to maintain, improve and broaden their knowledge and skills and also develop the personal qualities necessary in their working life. It also encourages the individual to take greater authorship of their development, so that their evolving career needs are met.

Therefore, whilst CPD must encompass specialist knowledge it also concerns itself with developing a broader range of competencies. It is within this broader field, specifically in the areas of marketing, communication and management that Bournemouth University is interested in offering courses. These courses, as far as is practicable, would be tailor made to suit the individual.

Anyone interested in prospective courses, contact Elizabeth Crawford, Bournemouth University, MAPR, Weymouth House, Talbot Campus, Fern Barrow, Poole, Dorset BH12 5BB, telephone: 01202 595282.

#### New director general, Engineering Council



Mike Heath CB CBE CEng, became director general of the Engineering Council on 1 May.

#### Checking those qualifications

THE pan-European professional engineering organisation, FEANI, has come to the aid of personnel chiefs who need to check the academic backgrounds of professional engineers from other European countries.

FEANI, the European federation of national engineering associations, is making available the FEANI Index. This publication lists the accredited degree courses in 22 member countries: Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, The Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the UK. It also provides a description of the educational system in each country, spelling out the composition and duration of each course and the awards made by each establishment.

M Pierre de Boigne, secretary-general of the Paris-based FEANI, said: "The Index is now considered as the unique, comprehensive and reliable reference for engineering education in Europe. It is a 'must' for any company planing to employ professional engineers from another country. Its strength lies in the fact that the information is supplied, on a regular basis, by the national engineering associations in the 22 member countries.

The Index costs FF950.00, or FF120 for each country section, from Ingrie, 3 Rue de Colonel Moll, F-75017, Paris, France. Mike Heath, CB CBE CEng, a former major general, has been appointed as the new Director General of the Engineering Council. He succeeds Denis Filer, CBE FEng, who retired at the end of April.

Mr Heath was commissioned from Sandhurst into the Royal Electrical and Mechanical Engineers, and gained a BSc in electrical engineering.

His most senior army appointment was director general of equipment support, controlling a staff of 20 000. In this post he had responsibility for the reorganisation and integration of mechanical and electrical engineering for the army. Before his retirement in September 1994, he was a member of the executive group responsible for defence expenditure in the MOD.

Aged 54, Mike Heath is a fellow of the IEE and a fellow of the Institute of Management.

Sir John Fairclough, chairman of the Engineering Council said of outgoing Mr Filer: "we owe him a debt of gratitude."

#### Spicing up science

TECHNOLOGY and science are not being taught in an exciting or challenging way to capture the interest of girls.

This was the general view expressed by girls in a competition organised by the Engineering Council's Women Into Science and Engineering (WISE) campaign, and the Office of Science and Technology

In the competition, aimed to celebrate the tenth anniversary of WISE, girls aged 14 to 18 had to present essays on why the UK needed more women engineers, and how to attract more girls and women into science and engineering.

An analysis of the essays showed that encouragement for young girls to take science and technology subjects was often not forthcoming from teachers. Many girls wished there were more science and technology teachers with the ability to teach their subjects in an inspiring way.

The main image of engineering companies, as seen by girls, was that they are maledominated, and made little provision for the needs of women engineers who might wish to combine a career with bringing up a family. It was suggested that to attract more women of the right calibre they needed to change this image.

Many girls suggested that more interesting and informative programmes should be made to get across the role women scientists and engineers are now playing in industry.

A shortage of role models was another point noted often in the essays.

#### **EVENTS**



#### **Rural electrification with** renewable energy technologies: policy options & strategies

International seminar, 21-26 May, Southampton, Details from International Seminars Department, The British Council, 10 Spring Gardens, London SW1A 2BN. Tel: 0171 389 4264; fax: 0171 389 4154.

#### The North Sea 1995

Conference, 22-23 May, London. Details from The Conference Division, Lloyd's of London Press Ltd, One Singer Street, London EC2A 4LQ. Tel: 0171 250 1500; fax: 0171 253 9907.

#### Understanding electricity production economics

Course, 22-24 May, Oxford. Details from CPS, tel: 01865 250521: fax: 01865 791474.

#### **Energy efficiency: domestic** grants

Seminar, 23 May, Peterborough. Details from the Council for Energy Efficiency Development, P O Box 12, Haslemere, Surrey GU27 3AH, Tel: 01428 654011; fax: 01428 651401.

#### International Caspian oil & gas

Conference & exhibition, Baku, Azerbaijan. Details from Spearhead Exhibitions Ltd, Ocean House, 50 Kingston Road, New Malden, Surrey KT3 3LZ. Tel: 0181 949 9222; fax: 0181 949 8186/8193.

#### Strategies for clean electricity generation

Course, 25-26 May, Oxford. Details from CPS, tel: 01865 2500521; fax: 01865 791474.

#### Sunrise

Introductory seminar, 30-31 May, London, Details from Peter Beacock, Dept of the Built Environment, University of Northumbria at Newcastle, Ellison Building, Newcastle upon Tyne NE1 8ST. Tel: 0191 227 4722; fax: 0191 227 3167.

#### Management techniques

One-day seminar, 31 May. Preston, Details from Lorraine Watling at ETSU, tel: 01235 4320014; fax: 01235 436461.

#### The energy industries & the environmental challenge

Course,, 31 May - 1 June, Oxford, Details from CPS, tel: 01865 250521; fax: 01865 791474.

#### June 1995 **Oil Project Finance**

Conference, 5-6 June, London. Details from John Bridges, IBC Financial Focus, tel: 0171 637 4383; fax: 0171 323 4298.

#### **ASME Turbo Expo '95**

40th gas turbine & aeroengine congress, 5-8 June, Houston, Texas. Details from IGTI. ASME, 5801 Peachtree Dunwoody Road, Suite 100, Atlanta, Georgia 30342-1503 USA.

#### Marichem Asia '95

Conference, 7-9 June, Singapore. Details from London RAI, Glen House, 200-208 Tottenham Court Road, London W1P 9LA. Tel: 0171 436 9774; fax: 0171 436 5694.

#### Lighting modelling in architecture

One-day seminar, 8 June, Maidenhead, Berks, Details from Mrs M Bartholomew. **BEPAC** Administrator, 16 Nursery Gardens, Purley on Thames, Reading RG8 8AS, Tel & fax: 01734 842861.

#### **UMEX '95**

Utilities management exhibition, 6-7 June, London. Details from Richard White, Management Events Ltd, P O Box 351, Basingstoke, Hants RG27 9YY. Tel: 01256 762460; fax: 01256 7661224.

#### The gas industry ... global growth

132nd AGM of IGasE & conference, 12-13 June, Newcastle upon Tyne. Details from Rex Cooke, IGasE, 21 Portland Place, London W1N 3AF. Tel:

0171 636 6603; fax: 0171 636 6602

#### The exploration & produc-

tion of oil & gas in the FSU Conference, 13-14 June, London. Details from Philippa Giles, Business Seminars International Ltd, tel: 0171 490 3774; fax: 0171 490 2362.

#### Oil markets: any chance of a price recovery? When?

Conference, 13-14 June, London. Details from Conference Organiser, DRI Europe, Wimbledon Bridge House, 1 Hartfield Road, London SW19 3RU. Tel: 0181 543 1234; fax: 0181 545 6248.

#### **Electricity: strategic** responses to competition

Conference, 14-15 June, London. Details from AIC Conferences, 2nd floor, 100 Hatton Garden, London EC1N 8NX. Tel: 0171 242 2324; fax: 0171 242 2320.

#### Structuring of the Nordic



#### electricity industry

2nd annual conference, 15-16 June, Helsinki, Details from Monique Quant or Nicola Coslett, IBC Financial Focus Ltd. 57-61 Mortimer Street. London W1N 8JX, Tel: 0171 637 4383: fax: 0171 323 4298.

#### Fuel choice for power generation

Two-day forum, 21-22 June, London. Details from IIR Ltd. 28th Floor, Centrepoint, 103 New Oxford Street, London WC1A 1DD. Tel: 0171 379 8040; fax: 0171 412 0145.

#### **Construction Design &** Management Regulations

Course, 23 June, London. Details from Alison Murphy, Mid Career College, P O Box 20, Cambridge CB1 5DG, tel: 01223 880016; fax: 01223 881604.

The Electricity Workshop Short course, 3-7 July, Oxford. Details from The Registrar.

CPS, tel: 01865 250521; fax: 01865 791474. DEGREE DAYS: MARCH 1995

#### 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 wa (such as a stopped timeswitch or an open isolating valve).

Readers can get more Information on the use of degree days from Vilnis Vesma, 17 Church Street, Newent, Glos GL18 1PU (01531 821350)

O Vilnis Vesma, 1995. Note: the figures given here have been calculated to correspond as closely as possible with those published by government sources. However, because of differences in observing stations, close agreement cannot always be guaranteed.

## ENERGY W@RLD

The magazine of The Institute of Energy

During the second half of 1995, Energy World will cover the following topics:

JULY/AUGUST Life cycle analysis SEPTEMBER Sustainable energy technologies OCTOBER Energy issues in transport NOVEMBER District heating DECEMBER Energy in Europe

The Institute's publications committee is currently considering topics for the ten issues of Energy World in 1996.

If you have any suggestions of topics for possible inclusion in the 1996 editorial features calendar, please send them to:

> The Publications Committee c/o The editor Energy World, The Martins East Street Harrietsham Kent ME17 1HH tel/fax: 01622 850100

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