ENERGY WORLD

The magazine of The Institute of Energy

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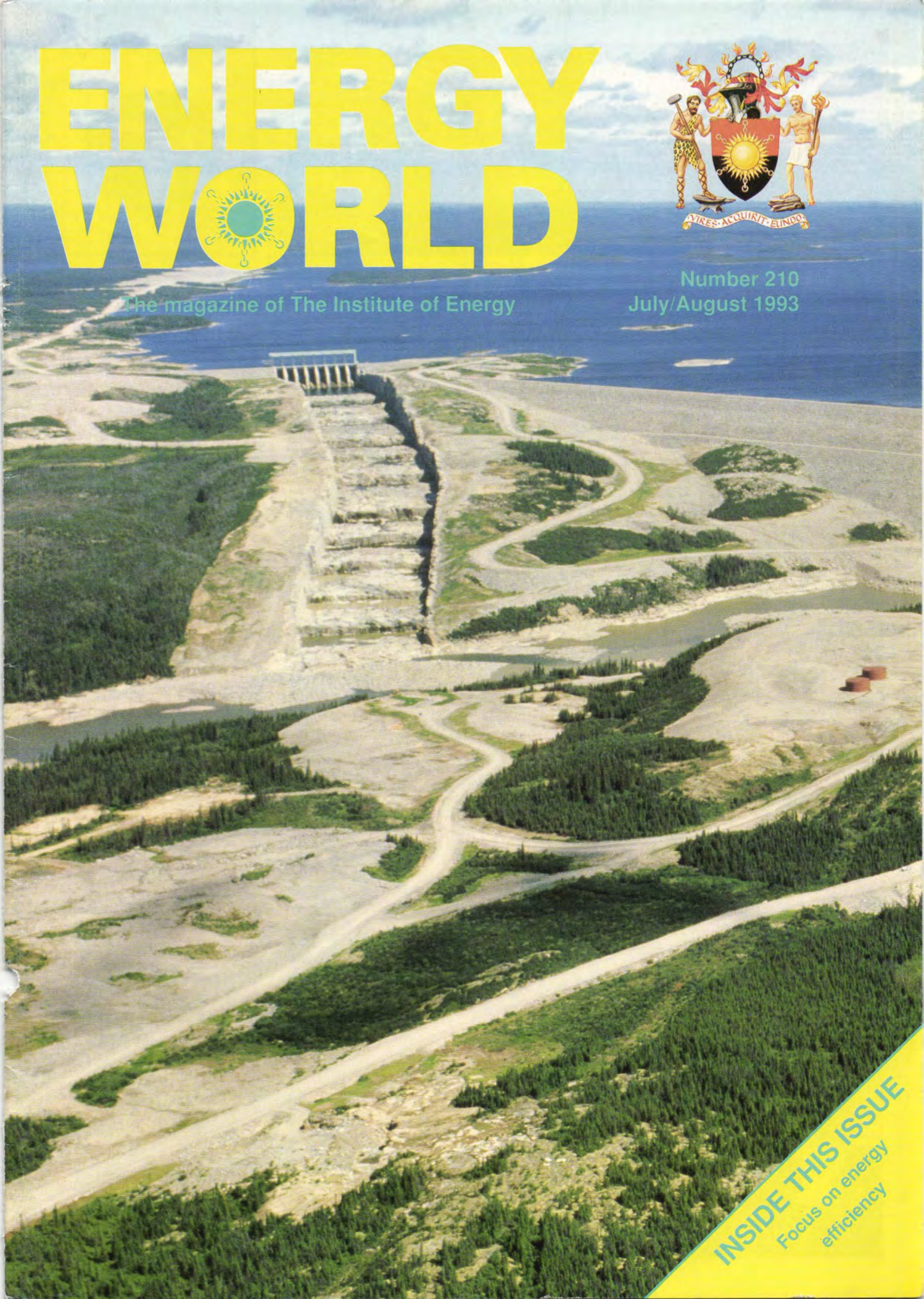

INSIDE THIS ISSUE

Focus on energy efficiency

National Power is now
generating more power from less fuel.
Just like that.

Abracadabra. More power from less fuel. Tens of thousands of tonnes less fuel last year alone. No trickery, statistical or otherwise, and nothing up our sleeves. We've simply improved the energy efficiency of our power stations and offices with the help of two very attractive assistants - Investment and Technology. More than two and a half million pounds is being spent improving the efficiency of Didcot power station. And energy saving projects at our offices in Swindon have reduced our energy usage by a third. In fact all of our energy saving projects are currently saving us money. A lot of money. Drum roll please. Several million pounds every year at the last very long count. Then there's the environment. A subject everyone's keen on. Thanks to our more efficient power stations, we're already reducing emissions of all the main gases associated with acid rain. In truth we're continually trying to find ways to produce power in cleaner and more efficient ways. As Britain's largest supplier of electricity, it's not only in our interests to do so. It's also in yours. It may be a cliché, but we really are a hard act to follow.

National Power.
Ahead of
current thinking.

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CONTENTS

COVER

On the front cover this month is the reservoir of La Grande 2, part of Hydro-Quebec's Phase 1 of the James' Bay project, in Canada. In 1990 the three power stations of Phase 1 — La Grande-2, La Grande-3 and La Grande-4 — generated nearly half the total hydro electric output of the company's system. Only visitors to La Grande can comprehend the scale, walking the length of a dam or a powerhouse machine hall: after walking for some time the visitor will get the impression of being no closer to the end. Hydro-Quebec's energy efficiency policies are outlined in a feature on pages 10-12 of this issue.

Energy management — an overview

OPPORTUNITIES for achieving improved standards of energy efficiency may be readily identifiable when specifying and constructing a new building or when carrying out various levels of refurbishment work. However, in a time of difficult economic conditions, many organisations are compelled to defer such major investments, with the result that energy efficiency will be ignored until times are better.

The importance of energy efficiency in financial terms can be overlooked, particularly if energy budgets are considered in relation to company turnover. When operating conditions are difficult, an energy spend of 1 or 2% of turnover may not seem like a high priority area for senior managers' attention. Such a view overlooks the importance of energy spend as a controllable cost, probably one of the largest in many organisations. If energy spend is considered in relation to profits or provision of services, then a very different view of priorities may emerge.

Energy is a resource that needs to be actively managed. Experience shows that for most buildings not already subject to effective energy management, it should be possible to identify savings of up to 10% through simple initiatives at little or no cost. Further savings can then be achieved for modest and often highly cost-effective investments.

Energy management is the process of gaining and then maintaining control over energy consumption. The benefits of energy management are: lower costs and increased profits or improved provision of services; improved staff working conditions; and less environmental impact.

Energy management should not be considered as a technical specialism, it simply requires good management practices. The lead and the direction must come from the top if an organisation is to develop and successfully implement an effective energy management policy. This is the driving influence behind the Making a Corporate Commitment campaign (MACC), an initiative from the Energy Efficiency Office to encourage the senior management of all UK businesses to make a corporate commitment at board level to responsible energy management.

The Building Research Energy Conservation Support Unit (BRECSU) has recently managed the production of two important publications for the MACC campaign. These are the 'Chairman's checklist' and the 'Executive Action Plan' which seek to motivate the most senior levels of management to implement effective energy management policies. These documents are now supported by two further publications which provide guidance to those who are actively involved in implementing these policies. These are General Information Report 12 *Organisational Aspects of Energy Management* and General Information Report 13 *Reviewing Energy Management.*

In developing the guidance on energy management, it has been found that an assessment matrix provides a quick, easy to use and effective way of identifying the current state of energy management in an organisation, and of focusing on those areas in most need of attention. Energy management performance can be assessed under the three headings of 'policy', 'structure' and 'resources'. For most organisations the assessment will not be even, the high points will indicate where the current effort is most sophisticated and mature, the low points where it is least advanced. This can be very helpful in identifying priority areas for action.

Properly organised, energy management will provide both the co-ordinated approach and the tools which are needed to reduce energy consumption. Effective energy management will make a vital contribution to improving corporate performance and reducing environmental impact.

For a copy of the BRECSU Best Practice programme publications, contact Enquiries Bureau, Building Research Energy Conservation Support Unit (BRECSU), Building Research Establishment, Garston Watford WD2 7JR. Tel: 0923 664258; fax: 0923 664787.

David Warriner
BRECSU

Europe's farmers 'could produce 2 million bpd' energy equivalent

EUROPEAN farmers have the potential to produce as much energy as that obtained from North Sea oil, by growing industrial crops on land lying idle under the EC set aside regulations. But a lack of coordinated, collaborative research and investment by the private sector is hindering progress, and farmers are better off collecting the set aside subsidy.

A recently published report on the prospects for industrial crops claims that European multinationals are, at best, waiting, or at worst, disinterested, in capitalising on farm-originated fuels and energy sources. In Japan and the USA such initiatives are already underway.

In France some progress is being made with industrial ethanol made from sugar beet, mixed with petrol as an octane enhancer for unleaded petrol.

Rape methyl ester (RME) from rapeseed oil offers an alternative to diesel. Production is going ahead in Austria, Germany, Italy and France, with the aim of replacing diesel in public transport in urban areas. The UK is evaluating RME for urban buses in just one city, but there are no plans for production.

The EC has an annual budget of 50 million ECU for biomass research, but none of the projects can be expected to make full scale economic operation for at least seven years.

Consultant Bruce Knight feels that no real progress will be made until there is input and lateral thinking from pure and applied scientists from many disciplines, from molecular biologists to engineers.

For further details about the report, *New Horizons for Industrial Products from Arable Farming* published by Bureau European de Recherches, call (32 -2) 736 00 88, or fax: (32-2) 732 12 61.

Large v small scale energy route for Nepal

A MASSIVE dam project, financed by the World Bank is threatening to overwhelm the developing small-scale hydro power industry in Nepal, according to *Intermediate Technology News*.

Intermediate Technology (IT) has been working to develop what they see as an appropriate energy policy to meet the needs of local people, and has been drawn into the debate over the 'Baby Arun' scheme.

Arun III is three times the size of the largest power generation scheme in the country, and will cost one and half times Nepal's national budget. Neither the Nepal Electricity Authority (NEA) nor the government has the capability to take on so large a project, requiring funding from abroad.

IT claim that by investing in smaller schemes using local capability more power could be produced more quickly. Using Nepali expertise at NEA and local private power companies they estimate 25 to 30 MW of hydro power can be added to the grid every year. With sustained growth over the next ten years this figure could be as high as 100 MW per annum.

A strengthened hydro industry will also enable micro and mini hydro schemes to flourish in rural areas, without needing connection to the national grid, giving a boost to local economies.

The threat of the zebra mussel

THE ZEBRA mussel *dressena polymorpha* is creating problems for North American power utilities in the Great Lakes area.

Recently arrived from the Mediterranean Basin, this small mussel colonises inlet pipes of industries drawing cooling water from the lakes and adjacent rivers. Amongst the utility plants affected are two host sites for clean coal technology demonstration projects.

The mussels attach themselves to all exposed surfaces of power plant cooling systems, and if allowed to accumulate on freshwater inlet pipes will slowly narrow the pipe diameter, eventually clogging it.

In their larval stage the mussels pass through freshwater intake screens, behind which they colonise. Eventually the mussels form a 'mat' of around 20-30 molluscs, which are the perfect size to block the water flow in a condenser tube. This can increase back-pressure on the turbine, causing it to shut down.

An additional problem is that the mussels also improve the water clarity, encouraging the growth of algae, which can further foul the freshwater intake screens.

The tremendous growth rate of the zebra mussels was demonstrated at the Monroe (Michigan) power station of Detroit Edison. In the first year of their appearance, screenhouse cleaners scraped a wheel barrow full from the intake water screenhouse walls. Two years later, cleaners collected around 23 cubic meters of the molluscs within a six-month period.

Several successful methods have been devised for mitigating and controlling the mussels, including thermal treatment — the most available option; chemical treatment, which causes embrittlement and the detachment of the mussels; mechanical treatment, using a high-pressure hose; and anti-fouling coatings, like silicones, to which the mussels find it difficult to attach themselves.

Research is currently underway to further control these aquatic pests. Utilities are keeping a close eye on the problem, as it appears that the zebra mussel is spreading to other sites.

Aid for safety improvements

THE EUROPEAN Bank for Reconstruction and Development (EBRD) will provide a 24million ECU (approx £19 m) grant for safety upgrading at the Kozloduy nuclear plant in Bulgaria.

The project is fully supported by the Bulgarian government, which has indicated its intention of closing down these units by the end of 1998.

The Nuclear Safety Account was set up at EBRD in March this year to enhance safety in high risk nuclear plant, such as the VVER Model 230 and RBMK Chernobyl-type reactors.

Unequalled development

TRADE Minister, Richard Needham advised delegates at a recent conference in London to target the Asia Pacific Rim for energy exports.

Mr Needham claimed that rapidly growing economies and "entrepreneurial spirit" in the area are generating an unequalled rate of development.

"If these economies are to achieve sustainable levels of growth, a guaranteed supply of natural resources and power is essential ... it is up to you to see the opportunities and make the most of them."

Energy experts join Indo-British initiative

A PANEL of energy experts have joined forces to guide the development of new trading opportunities with India, as part of the Indo-British Partnership Initiative (IBPI).

The power generation and transmission and energy development sector steering group, which includes representatives from British Gas and National Power, will develop action plans aimed at improving trade and investment in the energy sector.

This is one of five sector steering groups set up by the IBPI. Their work will include identifying opportunities for trade and investment, to strengthen links between UK and Indian companies.

Further delays for THORP cost jobs and profits

THE Department of the Environment's decision in June to further extend the consultation period into British Nuclear Fuels' (BNFL) Thermal Oxide Reprocessing Plant (THORP) has resulted in the loss of 1700 jobs at the Sellafield site.

BNFL announced the redundancies following Environment Secretary John Gummer's statement to the House of Commons on 28 June. With reference to the HMIP and MAFF reports on the THORP facility, he said: "A substantial number of the responses raised questions as to the justification for the operation of THORP, and therefore whether that part of the site's total discharges arising from this plant should be allowed ... These questions were not dealt with by the (HMIP and MAFF) Inspectorates because of the wider issues raised. In these circumstances ... I propose that there should be a further round of consultation."

The 1700 jobs to go follow 600 workers already laid off as a result of the eight-month delay experienced so far.

BNFL claim existing delays have cost the company nearly £50 million and their profits are being reduced at a rate of £2 million per week. THORP has secure orders worth £9 million, more than 50% from overseas. 1600 tonnes of used AGR fuel from UK reactors is already in wet storage at Sellafield, awaiting reprocessing.

No legal justification can be made for the delay, according to BNFL, as the need for THORP was established at the planning stage.

Tougher control

PROF Stephen Littlechild of OFFER has proposed tightening price controls for the RECs, by increasing the X factor from zero to two. This control will be focused on the franchise customers (under 100kW), giving the RECs greater incentive to compete.

Prof Littlechild also feels that this measure will contribute to energy efficiency by removing the artificial incentive to sell more electricity, requiring the RECs to spend £1 per customer on new efficiency schemes.

The Teeside gas processing plant (pictured above) on Seal Sands was officially opened in July by Ray Kaskel, president and chief operating officer of Enron International. The plant will process around 300 million cubic feet of gas per day, producing 700 tonnes of liquid petroleum gas (LPG). The plant provides a vital link in the chain to convert North Sea natural gas to power and steam at Teeside power station, the world's largest gas-fired CHP plant, which began commercial operation at Wilton in April this year.

Call for coherent approach

AT THE end of June, Prime Minister, John Major, received a list of actions from an eminent group of scientists. The signatories insist the Government must undertake these actions if it is to produce a satisfactory framework for energy and environment, so desperately needed in the UK.

Among the signatories are Sir John Houghton, chairman of the Royal Commission on Environmental Pollution, Dr Andrew Warren, director of the Association for the Conservation of Energy, and Lady Archer, chairman of the National Energy Foundation.

The list of actions represent the conclusions of a recent Environment Foundation seminar, and call for an information programme to increase public awareness of the need for energy efficiency, stringent environmental standards in the UK, EC and OECD countries, and government stimulation of the domestic market for renewable energy.

In addition the letter calls upon government to encourage industry to develop technical solutions for export which are micro-economic and specific to the importing country, allowing for local, small-scale, decentralised power and distribution systems.

The scientists call for partnerships between OECD countries and the developing world to provide information and training, and to develop regional advice centres. The World Bank should be persuaded to take responsibility for advising developing countries on the differential efficiency of rival technology systems.

On a national level the signatories call for a cross-party consensus on strategic environmental aims and objectives. They also expressed concern at the 'piecemeal' approach to energy supply issues, with separate coal, nuclear and renewable energy reviews.

On the issue of global warming the letter calls for clearer targets for sustainability of emissions reduction.

On the subject of Building Regulations, the signatories ask for a significant improvement in energy efficiency, and recommend the responsibility for the Regulations should be separated from the construction industry, and transferred to the Departments of Environment and Trade and Industry.

The formation of the Energy Saving Trust is seen as a welcome development, and it is recommended that its revenue base be enlarged by direct government subsidy.

The list of actions concludes with a request for better educational material to support the National Curriculum, as it feels CREATE does not have the resources to undertake this essential task.

Name change for REC

AS FROM 8 July, South Wales Electricity has changed its trading name to SWALEC. The change reflects how the company has developed since privatisation, it claims.

SWALEC's chairman, Wynford Evans, explained "We've decided to change our trading name because we are now an *energy* company — involved in power generation, gas marketing and other activities which fit in well with our main electricity business. We no longer restrict ourselves to operating in South Wales. We will work anywhere in the UK where there is profitable business. For example, our electrical contracting business now maintains street lights in Scotland.

"But it is not a new name, its what we have been called within the electricity industry for many years.

The changeover to SWALEC has been timed to be carried out at the lowest possible cost. Their familiar logo will remain, as will the company's green corporate colours. The change coincides with a new look electricity bill.

The former Secretary of State for Energy, the Rt Hon Lord Wakeham pays tribute to the crew of Nuclear Electric as he sets sail from Southampton. On board the winning yacht in the world British Steel Challenge (pictured right) are, from left to right: Chay Blyth, veteran yachtsman; John Collier, chairman of Nuclear Electric; John Wakeham and John Chittenden, skipper of the winning yacht, and master mariner. The 130 volunteer crew were amateurs, with the exception of the skipper, who had raised nearly £15 000 each to join the Challenge.

Nuclear Electric **sailed to victory on 23 May, after 28 000 miles and 151 days at sea, winning the world's toughest ever yacht race by a margin of just 70 minutes.**

Casting off from Ocean Village Marina, Southampton, Lord Wakeham said "Pitted against nine other identical yachts this was always going to be a race of skill, stamina and sheer determination.

"Highly professional leadership, safe and steady progress and, above all else, teamwork, won the day. Both the crew and the company are to be saluted."

Coal performs well in hostile conditions

FURTHER pit closures in addition to those earmarked by British Coal in their closure programme announced last October are inevitable without a transformation of the market, British Coal chairman Neil Clarke said when he presented the Corporation's annual report for 1992/3.

In spite of phenomenal increases in productivity — up from 5.31 tonnes per manshift to an all-time high of 6.34 tonnes in just twelve months — continuing downward pressure on costs, and a massive restructuring of the industry, Mr Clarke said that the only way to maintain the present size of the industry was even greater productivity increases and further reductions in costs.

Even though the productivity increases were continuing (performance at the present time, he said, was running at another 25% above the same period last year) further readjustment was inevitable in order to balance supply with the reduced demand under the new electricity supply agreements.

It was inevitable, he said, in view of future lower volumes of business that provision for restructuring and other costs had resulted in a bottom line loss for the year ended March 1993. Exceptional items totalling £1021 million resulted in a net loss of £588 million, compared with a profit of £185 million the previous year. Operating profits for deep mines were £341 million, up £127 on 1991/2, reflecting a 7% reduction in colliery unit costs and a 20% reduction in overhead costs.

Contracts were agreed at the end of the financial year with National Power and PowerGen for sales of 40 million tonnes in 1993/4, and 30 million tonnes a year in the subsequent four years. This constitutes a drop in sales of a massive 25 million tonnes in the first year.

In Mr Clarke's view, the political events following the announcement of the closure programme last October and the Government's subsequent White Paper have served to make the industry's future prospects more complex. Until it was possible to predict a settled pattern of supply and demand, there was no way of knowing what future closures may be necessary.

In a tribute to the performance of workers still in the industry, Mr Clarke said: "The workforce which achieved such impressive results in a period of considerable uncertainty is not one which lacks competitive spirit or good morale. They all know that the survival of our mines depends on consistently high performance."

● *British Coal Corporation Annual Report and Accounts 1992/3* price £6.50, available from British Coal Public Relations Dept, Hobart House, Grosvenor Place, London SW1X 7AE.

Trawsfynydd to close

NUCLEAR ELECTRIC announced the decision to close the Trawsfynydd nuclear power station in Snowdonia on 20 July.

The decision followed discussions with the HSE Nuclear Installations Inspectorate. The station had been shut down, but fully staffed, since February 1991, when it was discovered that the usual aging process of the pressure vessels was more advanced than would have been expected.

Nuclear Electric insist that there are no implications for their other six operating Magnox stations, as the design of the Trawsfynydd reactor is unique.

Parts of the Trawsfynydd pressure vessels are subject to significantly higher rates of neutron irradiation than those of NE's other four Magnox stations with steel pressure vessels

The implications for the 490 station staff are being considered by the company as a matter of urgency, and the station will now be prepared for decommissioning.

Chairman, John Collier said: "I am very sad that we had to take this decision. Trawsfynydd has been a reliable, safe and efficient power station, providing electricity and employment in North Wales for over 25 years. We were committed to restarting it as long as it had a viable role to play in our commercial future. We had established a revised safety case and believe strongly in it. But the NII is a tough regulator, and it has become clear that we cannot satisfy their further questions without what we consider a disproportionate diversion of company resources."

While shutdown and fully staffed, NE estimate that the station has been losing them some £50 million per year income from electricity sales. Mr Collier added: "The station would be hard pressed to earn enough income from the market over the remainder of its life to cover its costs ... and we have reluctantly come to the conclusion we must close the station now."

Demand-side management

Holyhead 'Power Save' project

by Peter David Benstead

Earlier this year an entire Welsh community took part in an energy saving campaign. The lessons learnt could have a tremendous impact on the UK as a whole, helping us to become a more energy efficient nation.

THE HOLYHEAD 'Power Save' project is, to the best of our knowledge, the largest demand-side management exercise that has ever been undertaken by a regional electricity company (REC) in the UK.

The £500 000 project, which has received support from the European Commission's SAVE (specific action for vigorous energy efficiency) initiative, is being piloted by Manweb plc. Manweb's aim is to reduce an entire island's electricity demand by 10.5%, which equates with one megawatt.

Before explaining the project and its potential benefits in detail, it is important that I describe some of the background to the scheme, and why we have become involved.

Since public supply of electricity began, the sales and marketing plans of electricity companies have been based upon maximising the utilisation and efficiency of generating capacity. The then boards envisaged a continuing growth in demand for electricity and the continued investment in generation. In our newly privatised form, maximising the efficient use of electricity remains a key objective, however the continued investment in generation has been called into question.

One method of achieving the efficient use of electricity is, we believe, demand-side management. The premise behind which is that the utility should try to manage demand for its product, rather than investing in new generation or distribution.

However, demand-side management is not totally new. It has been in existence in the UK for many years in one form or another, eg Economy 7 and time of day tariffs. However, what is unique about Holyhead is that the load is not being moved from one time period to another, it is, via a range of energy efficiency measures, being reduced.

It does however beg the question: 'Why should a regional electricity company try to reduce the demand for its own product?' Especially when it cannot benefit from saving investment in generating capacity, and since its profitability is closely linked to the volume of electricity it distributes.

In the case of Holyhead the answer is simple: we believe that it is cost effective to do so.

Holy Island, on which the town of

Aerial view of Holyhead, showing the ferry port and railway station.

The author

Peter Benstead has been with the electricity supply industry for 16 years. He is currently the Manager — demand-side management for Manweb plc, based at their head office in Chester.

Prior to taking up this position, he was the domestic market development manager, and has held various posts within the commercial department. Before joining Manweb he worked as a sales controller for Norweb, based in Kendal, Cumbria.

He has previously written articles for Electricity UK and has been invited to speak at the 2nd International Energy Efficiency and DSM conference, which is be held later this year in Stockholm, Sweden.

Holyhead is located, was chosen because its electricity supply link with Anglesey lends itself to careful, detailed monitoring. It is supplied by two 33 000 volt transformers, and the demand is being monitored every half hour. This enables us to identify any change in energy consumption quickly. It also ensures that whatever we spend on the project, we will know exactly what is being saved. Although the island lends itself to ease of monitoring, it has also been chosen for sound commercial reasons. If the continued growth in electricity consumption continues at its present rate we may have to reinforce the network within five years.

The project commenced in December 1992, and was launched at the Holyhead Towards 2000 conference. The conference was attended by His Royal Highness The Price of Wales, who welcomed Power Save as "a very substantial and worthwhile project". He also added: "I look forward to hearing of its success as it develops, and hope that more of this type of environmental project will be undertaken."

It was important for the success of the project that the whole community was involved. To achieve this we appointed a project co-ordinator, Graham Slatter, who has been working closely with the local authorities and other commercial organisations within the area. Manweb's local shop in Holyhead and The Holyhead Opportunities Trust premises (a local charity) became focal points for the project. All staff involved with the programme were fully briefed and given special training in energy efficiency, using the recognised City and Guilds qualification.

The Holyhead Opportunities Trust, which was established to help regenerate Holyhead economically, socially and environmentally was an ideal partner in the exercise. They consulted the installation of the domestic measures and acted as a local link for us.

The project, covering the whole of Holy Island, offers a range of measures to each group of customers. Domestic users, who account for 51% of the total electricity consumption of the target area, are being given particular attention. This attention is aimed at creating an awareness of energy efficiency, and a range of subsidised offers are being used to achieve this.

We began with a major press awareness campaign. Including newspaper inserts and direct mail. The Manweb promotional caravan was completely refitted showing a range of energy efficiency measures. It then toured the area for 13 weeks, ensuring that as many people as possible had the opportunity to talk to us. To make it easier to take up offers, Mercury Communications assisted with the installation of a freephone number: 0500 240 240.

Each domestic customer was offered two low energy lamps, for 70p each instead of the usual retail price of around £10. A free tank lagging jacket was on offer to those who used an immersion heater as their main source of water heating.

Xmas lights in Holyhead — plenty of scope for efficiency measures among MANWEB's commercial customers.

Low-cost draughtproofing and loft insulation, both at highly subsidised prices were made available to electrically heated homes and were installed by the nearest Neighbourhood Energy Action approved installer, ensuring a high standard of installation.

Domestic appliances became the next target. They accounted for 20% of the domestic electricity consumption. A cash rebate scheme for those who traded in their old electrical appliances for a range of new more energy efficient models was made available. The range of appliances not only included refrigeration, which is the subject of a national energy labelling scheme, but also a selected range of laundry and dishwashing appliances.

Domestic customers were offered two low energy light bulbs for just 70p each. Not surprisingly the uptake was high.

To maintain an overall high awareness in the domestic sector, we organised a 'Switch It Off If Not In Use Night', when all domestic customers were encouraged to switch off all unnecessary lights, any television playing to itself, etc. To further enforce this we got the local secondary school to take part in an energy-related project. The students were asked to perform an energy audit of their own homes. On the day of the exercise the average consumption reduced by over 200kW.

Our smaller commercial customers were also eligible for the low-energy lamp and tank insulation jacket offers. But, in addition they were offered free energy audits, which have identified that savings are to be made in refrigeration, lighting and heating. This advice was further reinforced at a series of local workshops, concentrating on the areas identified (eg high efficiency, high frequency lighting).

There are relatively few industrial users of electricity on Holy Island. But what there are vary from the production of aluminium powder to the manufacture of toys. We therefore needed to take a more individual and tailor-made approach. To achieve this, we offered each industrialist an in-depth energy audit of their premises, using the services of Manweb Energy Consultants Ltd and March Consultancy. A variety of energy saving projects were identified as a result.

These projects included the refit of electrical motors, additional metering to allow closer correlation of electricity usage with output, power factor correction and energy effi-

cient lighting. The identified measures have the potential of saving local industry thousands of pounds per annum.

Cost effectiveness and sustainability are the two key points of any demand-side management exercise. An important element in demonstrating cost effectiveness and sustainability is to be able to monitor present consumption and usage patterns in detail and to compare them with the usage and consumption patterns of before the programme commenced.

To ensure that this was possible, we, as part of the detailed programme, conducted an extensive face to face market research exercise amongst 600 of our customers, and installed measuring equipment at a wide range of commercial and industrial premises.

We are now entering the stage of evaluating the project, and the first signs are very encouraging. The response of our customers has varied from market to market. The domestic and industrialist have been very receptive to our proposals, but the response from the commercial market has to date been disappointing. However, we are still very confident of achieving our target reduction of one megawatt.

The project will continue to be monitored over the next two years, with particular emphasis on next winter, in order to achieve a meaningful comparison with existing records. RAF Valley, Anglesey's air force base, is providing us with the meteorological data so that our figures can be weather-corrected for a true comparison.

HRH The Prince of Wales at the official launch of the Power Save Project. Speaking at the Holyhead Towards 2000 conference he welcomed the scheme as a "substantial and worthwhile project".

I am keen to stress that this is a trial, a totally new concept. The information and experience that we have gained and will gain from this project, is invaluable to us. It will assist us greatly in understanding our customers and their attitudes to energy efficiency. Although the main implementation stage of the project has now been concluded, we still have a few measures to install in the industrial sector.

We will be maintaining our energy awareness campaign and are looking at ways to further increase energy efficiency, possibly by the promotion of energy efficient products in the most economical way possible. ❑

Energy efficiency —Quebec style

by Jean H Ouimet

Ninety-five percent of Quebec's electricity is generated by hydro plant, greatly reducing the region's potential greenhouse gas emissions. This has partly been achieved by the electrical utility, Hydro-Quebec's long-standing energy-efficiency programme, encouraging consumers to switch from the use of fossil fuels to benignly-generated electrical power. By reducing customers' bills through efficiency measures, the company has increased its share of the market.

THE CANADIAN hydro electric utility, Hydro-Quebec, produces one principal product: electrical power. Its sales and capital investments account for 5.6% of the Province of Quebec's GDP. Nevertheless, in pursuit of its policy of bringing energy consumption under control and saving energy Hydro-Quebec is persuading its various clients to buy less of the very product the utility was established to produce.

Why? Because for Hydro-Quebec, energy efficiency has become an energy resource in the same way hydro power, nuclear energy and natural gas are.

Although the price of electricity in Quebec is among the lowest in the world Hydro-Quebec has been promoting energy saving to its customers for the last thirty years, in both the home and in industry. In the 1960s, when electricity prices were higher than those of other energy sources, energy-efficient appliances and electric systems were a matter of commercial survival.

Energy efficient water heaters were introduced at the start of the 1970s, as were Sentinelle lamps, the most energy efficient lamps for street lighting then available. The 'Medallion' house, a quality seal, provided a showcase for electrical installations. The seal showed customers that electrical installations complied with strict quality criteria and made the most efficient use of electricity. In the 1970s Hydro-Quebec launched the 'Novelec' quality seal, which certified a house was properly insulated and heated. In 1981 Hydro-Quebec committed itself to 'Energain Quebec' — a programme to improve domestic energy consumption.

By the beginning of the 80s, Hydro-Quebec was looking into load management and had launched, among others, its dual energy programmes: first for homes, and then for commercial, institutional and industrial customers. At the same time, interruptible power programmes for more rational energy use were launched, along with the first phase of the utility's electrotechnology assistance programme.

Major problems: major remedies

The beginning of the '90s was marked by the appearance of the first tangible consequences of the globalisation of markets. Growth still had to be ensured despite universally difficult economic conditions, global competition and environmentally-dictated restraints on development in industrialised countries. Hydro-Quebec and its partners tackled this challenge by perfecting their biggest energy efficiency project ever. Hydro-Quebec took upon itself the mission of convincing Quebecers that modifying behaviour and habits when it comes to energy and thereby cutting down on consumption, would be a major, necessary factor in ensuring their future wellbeing.

Despite their cheap energy, Quebecers still use less per capita than Americans.

In 1992 Hydro-Quebec's revenues reached £3.53 billion, from sales of 144.6 billion kWh. The utility purchases nearly £1.3 billion worth of equipment and services annually, and directly provides more than 28 000 jobs. In 1992 its capital investments reached £2.1 billion and its research and development budget, at almost 2% of its annual sales, ranked sixth among all Canadian companies.

Hydro-Quebec's service area is the territory of Quebec, which at 594 806 sq miles is Canada'a largest province in terms of land area. Of a total of 80 generating stations, 53 are hydro electric and supply 95% of the system's power. The remaining 5% is generated by 27 stations: one Candu nuclear power plant; one oil-fired plant; three gas turbine plants; and 22 small diesel units supplying remote locations.

Table 1: Comparison of residential rates, major N American cities

Canada City / rate	US City / rate
Charlottetown 10.66	San Francisco 15.45
Toronto 8.79	New York 15.31
Vancouver 5.74	Boston 12.81
Montreal 5.66	Chicago 10.88
Winnipeg 5.39	Miami 8.76
	Seattle 3.47

Rate = the average price in Canadian cents per kWh for 1000 kWh of residential market consumption, 1 May 1992.

Ambitious objective

In the final decade of this century, energy efficiency is at the core of Hydro-Quebec's development. The utility's development plan submitted in late 1992 to the Quebec Government, its sole shareholder, affirms that the whole of Quebec society is called upon to take part by participating in the many ambitious objectives of the energy efficiency programmes. The target is to save some 9.3 TWh per year, starting in the year 2000. The accumulated reduction in demand between 1990 and the year 2000 will reach 43.6 TWh.

The objective was established as follows. The technical and economic potential of energy-conserving measures, those deemed to be both feasible and cost-effective, accounts for 27.6 TWh. Hydro-Quebec will assume on average 60% of the costs of the measures chosen, in addition to the costs related to marketing measures. Customers will therefore have to assume the remaining 40%. Studies show that it is reasonable to assume that 34% of this target of reduced consumer consumption can be achieved over a period of 10 years when such a price support applies.

According to projections, this would be the most cost-effective subsidy rate ever. A higher rate would be very costly, as well as indirectly encouraging people to waste energy, which would counteract the basic objective. In addition, the costs of facilities that

would be required to produce a comparable amount of electricity is the upper limit that must on no account be exceeded.

Moreover, these objectives should be attained without affecting the comfort of Quebecers or the competitiveness of their companies.

The marketing challenge currently facing Hydro-Quebec is unusual, but corresponds exactly with the aim of Hydro-Quebec, which is as follows: "The utility's objective is to generate electricity and carry out research and promotion related to electricity, energy transformation and conservation and allied fields."

Hydro-Quebec's efforts follow five main lines, which vary in prominence, depending on the particular objectives targeted:

- further awareness of the potential benefits of energy efficiency through information, advertising and promotion. The purpose is to support the energy efficiency measures and enhance their impact on customers;
- provide commercial support and technological development through R&D, demonstration, experimentation and training. The purpose is to tailor the measures to the specific requirments of each market;
- provide financial assistance, appropriate to the nature of the measures and consumer response to the products concerned. The objective is to encourage customers to adopt energy efficiency measures;
- offer differential charges with a larger range of options. The purpose is to ensure a more accurate reflection of supply costs for each category of customer so as to influence their behaviour;
- regulation: have the authorities promulgate standards, laws and regulations for the saving of energy. The objective is to provide even-handed support for energy-efficiency initiatives. The promotion of quality seals for equipment with higher standards of energy efficiency than those required by law runs in parallel.

The author

Following his graduation from Montreal's Ecole Polytechnique in 1955, M Ouimet worked for a number of years as a consulting engineer in the fields of mechanical, electrical and energy engineering. He co-founded and served as Senior Associate of Scharry, Ouimet prior to its merger with Le Groupe LGL. As Executive Vice President of the latter firm, he oversaw all mechanical, electrical and industrial engineering activities, as well as energy management. In 1990 M Ouimet became President and General Manager of SNC+, energy auditors, where he remaining until joining Hydro-Quebec. He is a former President of the Association of Consulting Engineers of Quebec.

Table 2: Price of electricity worldwide, comparing Quebec & industrialised countries, residential sector, in Canadian cents per kWh

Country	Rate
Germany	14.8
Denmark	8.1
United States	9.3
Toyko, Japan	29.73
Norway	6.5
New Zealand	5.7
Sweden	8.3
Quebec	5.3
UK	14.16

This price corresponds to the average unit revenue from electricity sales (excluding Japan, where only Toyko is cited) and does not include sales tax.

Sources: International Energy Agency, Hydro-Quebec, Electricity Association, The Toyko Electric Power Co.

Implementation

The success of the energy efficiency project requires a commitment from all Hydro-Quebec's customers. The utility relies on active participation by groups of customers and intermediaries, ie all those who can influence consumer decisions, including builders, product designers, manufacturers, distributors, retailers, professional bodies, consumer associations and the media, both general and specialised. The utility counts on Quebecers' active participation in the energy efficiency programmes and new consumption patterns designed to reduce use of electricity. All these programmes are in keeping with the framework of the Quebec government's energy efficiency strategy, in effect since 1992.

The 'Ecokilo' programme is an interesting success story. It has attracted more than 50% of customers solicited, twice the response rate the same programme achieved in Ontario and the US. With this programme, customers complete a questionnaire on their individual consumption habits and return it to Hydro-Quebec. They then receive a detailed report on their individual energy consumption together with suggestions on how to reduce it. As a premium, two low flow tap aerators, a refrigerator thermometer, and at the customer's choice, either a timer or a low-flow shower head are sent with the report. The Public Lighting Conversion Programme is aimed at all Quebec municipalities. The three-year programme provides for the payment of financial assistance for technical and economic studies and the replacement of existing lamps by sodium lighting.

Achieving the energy saving objective will require some Canadian $3 billion in investment from Hydro-Quebec and its partners during the targeted period. Hydro-Quebec will assume about two thirds of this amount, two billion Canadian dollars, and participating customers will invest the remaining one third, one billion Canadian dollars. Financial assistance is mainly organised in a way that ensures that the investment can be recovered within a reasonable time.

In the long term, the effect of the benefits associated with energy saving will be neutral on electricity costs for all Hydro-Quebec customers. The benefit for Hydro-Quebec will come largely from the reduction in sales for which the marginal costs of production would be higher than the revenues forecast.

The energy efficiency project also has attractive economic spin offs. Between now and the year 2000, expenditures to save energy will support 35 400 direct and indirect jobs as measured in person-years. In addition, unlike the construction of major projects, the economic spin offs from these expenditures will be distributed throughout Quebec.

Current programmes

PAEB: Programme analysing the electrical efficiency of buildings. This involves assessing how efficiently energy is used in buildings of under 10 000 sq m that require less than one MW of power. In addition to the analysis, the programme offers the following services: recommendations for improving the performance of each energy source; evaluation of the cost of implementing the suggested measures; evaluation of the cost-effectiveness of these measures and the time required to recoup the necessary investment.

Financial assistance for the purchase of

Table 3: Per capita energy consumption, Quebec & major industrialised countries in tonnes of oil equivalent

Country	Rate
Sweden	3.18
Norway	3.82
Japan	2.33
US	4.97
EC	2.36
UK	2.49
France	2.40
Belgium	3.32
Germany	3.05
Quebec	**4.76**

high-performance electric motors. This programme enables companies to: reduce the power used and the amount of electricity consumed by electric motors; increase the total efficiency of motors; reduce the electricity bill for the whole life of a motor.

Lighting efficiency programme. This enables companies to reduce their electricity bill; maintain or improve the quality of their lighting; benefit from financial assistance from Hydro-Quebec to cover as much as 50% of the investment (not including labour costs).

SPVC: Programme providing electrical analysis of pumping, ventilation and compression systems and related initiatives. This enables industrial firms to benefit free of charge from studies evaluating the energy efficiency of pumping, ventilation and compression systems to a maximum of Can$20 000; benefit from financial assistance when they implement the energy-saving measures for which the investment recovery period is too long; and substantially reduce their consumption of electricity.

Assistance programme for the implementation of electrotechnologies — phase III. This programme, which focuses particularly on economic development as well as promoting energy efficiency, allows industrial firms to benefit from many specialised services. Hydro-Quebec expertise and technical and financial assistance can make them more competitive and improve the quality of their products. Financial assistance from Hydro-Quebec is also available for the implementation of the chosen electrotechnology, and loan guarantee with the lending institution.

Public lighting conversion programme. This enables municipalities to benefit from financial assistance to cover up to 75% of a technical and financial study conducted with the aim of converting their whole lighting system by installing sodium vapour lighting. They receive a financial contribution when they carry out the conversion.

Programme to improve the energy efficiency of industrial processes. This programme enables major industrial companies to benefit from various services, such as free evaluation of processes to determine whether they can be improved; financial assistance with draft design studies and financial contributions towards the modernising of processes.

Programme to improve energy efficiency in Hydro-Quebec buildings. This programme consists of various energy-saving measures in Hydro-Quebec's own buildings, resulting a reduction in electricity consumed of 88.4 GWh, or 34%. This is in spite of the fact that three quarters of these buildings were built according to high standards of energy efficiency.

Managing consumption

Turning now to the consumption management portion of the energy efficiency project, Hydro-Quebec's residential customers can take part in the new dual energy programme, which combines electricity as the principal heating source with another fuel used at peak times, so as to maximise the efficiency of each source. Customers in the CII market (commercial, institutional and industrial) can also take advantage of a commercial dual energy programme, allowing for the sharing of the electricity consumption of participating companies during peak periods or periods of shortage. In addition the interruptible power programme promotes peak period reduction of the electricity demand from the major industrial customers participating in the programme. In exchange for a special rate, some 40 energy-intensive firms have agreed to suspend certain activities for a given number of hours in order to reduce electricity demand, if necessary. Hydro-Quebec has acquired particular expertise in load management and, in this field, stands out even among the most forward looking North American electric utilities.

New time-of-use rates will soon be offered to residential and industrial customers.

Starting in 1993, Hydro-Quebec will offer its customers the possibility of participating in increasingly integrated approaches to energy efficiency. A total quality approach will characterise planning, operational rationalisation, and the setting up of programmes to achieve objectives at the lowest cost, while maximising customer satisfaction.

Each new programme will be of the generic type. This will allow for the programme application procedures to change according to market and energy conditions as revealed by the annual impact study.

Quebec enjoys a rather special energy situation. The province produces nearly all the energy its needs from its hydro-electric resources. The reliability, low cost, safety and environmental friendliness of hydro electricity make it one of the most appealing forms of renewable energy available today.

The advantages of hydro electricity and the quest for the greatest possible degree of energy self-reliance have led Quebecers to replace fossil fuels with electricity for many purposes. Today, electricity accounts for 40% of Quebec's energy use, a figure that has doubled in just twenty years, while the role of fossil fuels has diminished from 40% to 20% during the same period. This energy choice has resulted in dramatic reductions of greenhouse gas and acid-rain causing emissions. The export of Quebec power to neighbouring provinces and US states has helped reduce these emissions elsewhere too.

Hydro-Quebec has chosen energy efficiency as a resource that enables it to balance supply and demand in the long term. It relies on consumption management to deal with peak periods on its power system. In doing so, it is acting in accordance with sustainable development as recommended by the World Environment Commission.

The resulting economic spin offs for Quebec are substantial. The scale of the project, the importance of its objectives and the large number of interested parties mean that the energy efficiency project is a major one for the whole of Quebec society. In addition to generating and transmitting the electricity required by Quebecers at the lowest possible price, Hydro-Quebec's mandate is to contribute to the economic development of Quebec.

While Hydro-Quebec's energy conservation programme was originally conceived in line with its mandate from the Quebec Government, the expertise acquired has applications throughout the world. Hydro-Quebec is now actively engaged in marketing its skills and forming joint ventures worldwide through its subsidiaries, Nouveler Inc and Hydro-Quebec International. ❑

Table 4: Hydro-Quebec and customer energy conservation expenditures

Energy conservation initiatives	Expenditures 1991—2000 (1992 $ billion)
Hydro-Quebec expenditures	
support activities	0.45 (£0.23)
programmes	1.52 (£0.79)
Total, Hydro-Quebec	**1.97 (£1.02)**
Participating customer expenditures	1.01 (£0.53)
TOTAL	**2.98 (£1.55)**

Energy technology centre

EFFICIENT energy utilisation is only achieved when the way energy is used is carefully and precisely matched to the needs of the customer.

This is the prime aim of Midlands Electricity's energy technology centre. The centre, which has been recently refurbished and extended, now supports MEB customers in the domestic, commercial, environmental and industrial market sectors.

Midlands Electricity (MEB) has provided technical support for industrial customers for many years. This support extends from information services to demonstration and application development work.

The development facility, originally set up in the 1960s, is still unique among the regional electricity companies. Its current development stems from the decline of the Midlands steel industry in the 1970s, when the fall in electricity demand spurred MEB to actively promote electroheat throughout the engineering, ceramics and glass sectors.

In 1988 the energy technology centre extended its facilities to cover a wider spectrum of electroheat, investing in new equipment and facilities for drying, metal melting, finishing and coating and heat treatment.

The latest development, highlighted by the new name 'energy technology centre', now extends MEB's customer technical support facilities into space heating, air conditioning and building energy management. This has been achieved by the addition of new air conditioning plant, a variety of metering and domestic heating appliances, sophisticated computer-aided design facilities, building energy management systems (BEMS) and remote monitoring facilities. The remote monitoring is applied to the MEB's own building and selected development projects working in cooperation with a wide range of customers, including public services customers, such as the City of Birmingham.

At the same time the electroheat facilities have also been updated to include an extensive range of infrared heating systems, induction heating equipment, and new heat treating methods, including demonstration units for plasma technologies and fluidised bed heat treatment.

The energy technology centre's philosophy is essentially a practical one to help MEB customers apply electrical technology in an effective and efficient way.

Over the years, the staff at the centre have developed electroheat processes and associated plant to enhance existing technology and apply new technologies to MEB customer production processes. Since 1970 over 6000 customers have used the centre to help them apply proven techniques in innovative ways, to improve quality, cut costs, speed the production process and enhance working conditions. As a result, the centre has acquired an international reputation, especially in infrared and air knife technology.

Since their privatisation, the regional electricity companies (RECs), have diversified their business operations. Midland's Electricity have further developed their range of electroheat services to commercial and industrial customers with the extension and refurbishment of their energy technology centre.

The centre has also been heavily involved in collaborative development work with many academic institutions, including the Universities of Strathclyde, Birmingham, Aston, Staffordshire and Imperial College, London. There are ongoing programmes in association with Ceram Research, EA Technology and other industry-orientated research and development organisations.

Special air knife rig, designed for food drying, seen here drying carrots. The rig allows potential users to prove the technique before commissioning designs for full scale equipment.

The range of practical work carried out by the energy technology centre (ETC) extends from assessing paint covering systems to finishing textiles, metal melting methods or food processing.

One ETC project, carried out with Tomkinsons Carpets of Kidderminster, helped the customer achieve annual process savings of £41 500 for an investment of £70 000. In this instance the ETC identified dehumidification drying as a cost effective solution to Tomkinson's drying problems, and put them in contact with JCN Ltd. JCN then helped Tomkinsons design and build a 1.5 tonne capacity low temperature (50°C) double insulated drying chamber. The chamber design included four 16.5 kW dehumidifiers with forced ventilation at 7 m/second provided by twelve 450 mm fans with a combined rating of 3 kW and a total load for the installation of 69 kW.

The system allowed Tomkinsons to dry large batches of wool after dyeing using low cost electricity at night. Quality was radically improved, 're-dyes' and rejects were virtually eliminated, labour costs were reduced, and the working environment was much improved. The combined efficiency benefits produced annual process savings valued at £41 000. The system was so effective that Tomkinsons built an additional, identical chamber. The new system cut total annual direct energy costs by £8000 to give an annual energy saving on the drying process of 61%.

One of the centre's special areas of interest is the air knife. The ETC helped D'Or Produce of Dorstone, Herefordshire, to revolutionise potato preparation by introducing air knife technology. A 44 kW air knife system is used by D'Or to help prepare 15 000 tons of potatoes each year to meet the highest standards of Britain's supermarkets.

Another typical project was the introduction of an infrared tunnel oven, which cut KMF Precision Sheet Metal's cycle time for powder curing by 66%, improved quality and working conditions in their paint shop at Stoke on Trent.

Energy efficiency is a high priority in all application areas, and the ETC includes metering, control systems, engineering and computer-aided design facilities to help achieve energy efficient solutions. Comprehensive advice is also on offer, as well as assistance with customers' R&D and new product development programmes.

Environmental engineering

The energy technology centre has its own air conditioning and mechanical ventilation, incorporating the latest zone control and energy management. BEMS at the centre can carry out remote monitoring of MEB's own buildings.

The centre has the latest methods of home and office heating, humidity control, ventilation, hot water and hygiene services and other cost-effective ideas for comfort.

The environmental engineering section of the ETC is able to demonstrate many new, energy efficient concepts of electric heating, and heat pump and heat recovery technology. These include the MEB's new divisional offices at Stoke on Trent, which received an Office of the Year Award in 1992; the MEB headquarters building at Halesowen, and an innovative heat pump development project for the City of Birmingham.

Equipment at the centre allows customers to see how applications of insulation, controlled ventilation, interactive control and heat recovery systems can play an effective role in new building design.

Computer-aided design facilities can asses system performance to produce accurate predictions of capital and running costs for buildings and manufacturing processes. This enables customers to select the best design and applications so that they can achieve total energy efficiency.

The ETC's production engineering section covers pollution control and management, surface cleaning, preparation and coating, drying and induction heating. It can demonstrate a variety of clean-up technologies. These include venturi aeration, which treats effluent to reduce organic contamination and its biological oxygen demand; the Chemelec Cell which extracts heavy metals from process liquids; and the U/V ozone techniques which purify water without using chemicals.

The centre also demonstrates technologies designed to eliminate pollution at source, by using intrinsically clean material and technologies. Processes available include the application of ultrasonics technology, and the cleaning processes which enable water-based liquids instead of organic chemicals to be used for degreasing components, infrared systems for curing water-based paints, and U/V curing techniques, which avoid the use of solvents.

Surface preparation

A complete facility has been designed at the centre to prepare metal and plastic products for painting or coating. Complete finishing systems, including warm air, abrasive cleaning, spray painting, infrared curing and U/V curing, can be demonstrated and applied to a variety of products, extending from foods to ceramics and metal components.

Part of the high temperature process hall at MEB's energy technology centre, showing a fluidised bed furnace and a high temperature process furnace.

Equipment includes flatbed and tunnel ovens specially manufactured in a modular style so that they can be effectively applied to a variety of customers' samples in a production environment.

Demonstrations of the air knife, a technique pioneered by MEB, take place at the centre. There are also demonstrations of dehumidification drying, microwave and radio frequency drying and curing. Some of these cover drying techniques which have cut costs by a factor of ten, 20 or even more.

Many electrical techniques can be used for a variety of different applications, at different stages in the production process. The centre can use induction heating to cure coatings, heat treat or melt metals and heat liquids. A full range of working equipment can be used to demonstrate this inherently clean and precise method of process heating, ranging from small scale precision techniques to practical systems for large metal components.

MEB's centre can also advise customers on the choice of induction and resistance furnaces designed for production scale metal melting for iron, aluminium and specialised alloys. Full scale resistance melting furnaces are used to demonstrate the advantages of non-ferrous electric melting. Heat treatment facilities include advanced techniques such as a fluidised bed system and plasma nitriding, together with a variety of other furnaces to heat metal and ceramics to temperatures up to 1800°C.

Equipment at ETC uses state-of-the-art control technology in a wide range of different applications, to demonstrate the advantages of electroheat in maintaining product quality, reducing operational costs and achieving energy efficiency.

Accuracy of information is vital, and the ETC features all the latest methods of metering, from the basic domestic meter to sophisticated computer-based systems. The metering system can provide local or remote readout and data storage to meet large customers' needs for cost information throughout their businesses, so that they can achieve effective energy management.

A databank is maintained, covering all aspects of energy management. MEB technical staff can search national and international databases on behalf of customers for products, systems and technologies which may solve operational problems, improve energy efficiency or reduce costs. They can also provide information on the availability of grants and allied financial advice.

MEB's energy technology centre breaks new ground with its emphasis on commercial and domestic technical support, and the weight it gives to computer-aided design and building management. Over the years the company has concentrated on high levels of technical support to achieve both increased electricity sales and higher energy efficiency. This policy has produced real benefits for both the customer and the energy supplier, and will continue to do so into the next century. ❑

Hungary's energy situation

— potential for renewable technologies

by Jenniy Gregory MCIM ACIM

IT Power recently undertook a study on the energy situation in Hungary, and identified a number of potential applications for renewable energy technologies. Jenniy Gregory explains their findings in detail ...

AS THE countries of Eastern and Central Europe move towards western-style market-based economies, restructuring their energy sectors and controlling the intensity and efficiency with which industry uses energy have become paramount.

Energy consumption is higher in these countries than the majority of OECD countries. However, cheap fuel available through the COMECON trade agreement is no longer available. Importing expensive fossil fuels to power inefficient industries has imposed a spiral of increased debt burden on these emerging economies.

One measure being implemented to try and curb the high and inefficient use of energy is to decrease the intensity of industry, either through closure or by improving their energy efficiency. Another action being undertaken and supported by the World Bank is to reduce subsidies both to the industrial and domestic sectors. However, increased energy prices have sent shock waves through the economies, decreasing energy demand in the short term and resulting in the closure of many energy-intensive industries. At the same time, there have also been reductions in foreign trade (higher price of exports), and an overall short-term decrease in social wealth.

To minimise the medium to long-term implications of higher energy prices, all forms of generation need to be considered. This assessment should include all external costs, environmental concerns (such as air, ground and water pollution), and the sustainability of proposed power generating sources. In doing this, national governments of the region necessarily need to consider renewable energy technologies, such are now beginning to be utilised in Western Europe.

The countries of Eastern and Central Europe have the potential to utilise renewable energy technologies, the economics and viability of which are influenced by regional climatic and infrastructure variations. In Hungary a first-step study has been undertaken to ascertain the potential of renewable energy resources, and further analysis is planned.

A study for the European Commission, undertaken by IT Power of the UK, looked at the potential for solar energy technologies in Hungary. Research showed that Hungary has the potential to use solar energy to generate electricity, and to provide hot water for both domestic and industrial applications. Regionally, it has a wind resource which could be harnessed for electricity generation; there is a large potential for biomass technologies to provide energy from both agricultural and domestic (landfill) waste; and the existing geothermal resource couldbe more fully exploited.

This report also analysed the possibility of manufacturing renewable energy technologies locally, and concluded that there existed a wide range of local technical expertise, which would be complimented by technical exchange from Western European to Hungarian firms.

Energy consumption

Hungary is energy intensive by western standards, with consumption per capita in 1991 being comparable to the level of Japan — despite much lower GDP per head. However, the economic outputs of Hungary and Japan are widely divergent.

This energy inefficiency is a result of the development of heavy, energy-intensive industry, inefficient thermal building techniques and heating systems, inefficient power generation, and lack of price incentives to curb energy wastage. One of the contributory factors to this high energy requirement was brought about primarily by the supply of cheap and plentiful oil and gas from the former Soviet Union.

The government of Hungary has commenced a programme to increase energy efficiency. Measures include the removal of energy subsidies; implementing electricity charge rates which discourage consumption at peak times; closing energy-inefficient factories (notably those in the iron and steel industries); reducing the reliance of foreign imports; liberalising energy prices to reflect international values; and passing on increased energy costs to the consumer (previously these were absorbed by the state-owned electricity utility and not reflected in consumer energy costs).

In 1990 total electricity consumption was 39.5 TWh, up 4% from 38 TWh in 1985. Over the decade to 1990, consumption increased on average by 2.6% per annum, although consumption in 1990 was down 2.7% on 1989. It decreased further in 1991 to 37 TWh, and is expected to have fallen another 2 TWh in 1992. The trend towards decreasing consumption of electricity is expected to continue until 1993, when it is predicted to bottom out, then increase by 1-3% per annum.

In April 1993, MVM, the Hungarian Power Company, released details of its future power generating strategy to the year 2000. This predicts three possible rises in demand: the lowest scenario is a demand increase to 37 TWh/yr (roughly corresponding to 1991 levels); the middle scenario is for 40 TWh/yr (equivalent to 1990 demand); and the high scenario would see an increase in

The author

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demand to 45 TWh/yr.

However, consumption may increase more rapidly than predicted, especially after the year 2000, for a number of reasons.

Domestic sector: increased living standards and higher disposable incomes will lead to an increase in energy requirements. Consumer goods such as large refrigerators, washing machines and clothes dryers, air conditioners and appliances are already making an impact on energy demand.

Commercial sector: increased office automation (computers, photocopiers, etc), and the increased need for professional offices will add to the energy load, especially if these offices are not energy efficient.

Industrial sector: although large, unprofitable, energy inefficient industrial complexes are being closed, a substantial increase in joint industrial ventures with western companies and the establishment of other industrial complexes will significantly increase demand.

There are a number of energy conservation programmes underway, many of which are sponsored by outside bilateral aid agencies. These are in the industrial and domestic sectors, such as the Danish audit of residential and industrial buildings, and the Finnish audit of the glass industry. A Canadian study has shown that energy efficient measures could substitute for most future power plant construction and save the country $100 billion — however, only a small proportion of this would be possible if there were no government support.

The Energy Centre, funded jointly by the government and the EC, opened in 1992. This is an information point for both industry and the general public on energy matters, particularly energy efficiency and renewable energy. It can also provide training courses on such topics as energy management, institution building and technical issues.

The Italian energy department, ENEA, was appointed as the European Commission DG XVII OPET (Organisation for the Promotion of Energy Technology) in Hungary. Their remit is to promote energy technologies, including renewable energy and energy efficient demonstration projects within the country.

Current sources and trends

Almost half of Hungary's energy supply requirements come from, indigenous sources. In 1989, around 95% of the oil, gas and electricity import requirements came from the former USSR. Since 1990, this supply has been substantially reduced, mainly due to decreased reliability of supply, requiring Hungary to find alternative supplies of more expensive sources of energy. This has had significant repercussions for the economy. Since January 1991, Hungary has also had to switch its terms of trade with Russia to hard currency. These fuel imports now represent a major use of hard currency and an increase in national debt.

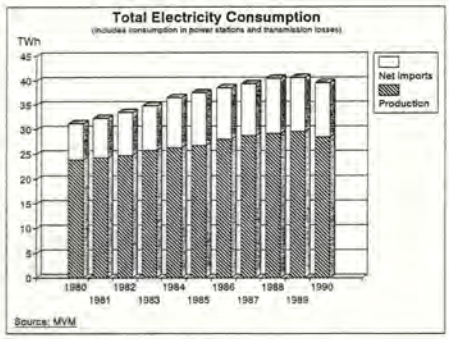


Fig 1: Total electricity consumption.

In 1990 Hungarian power stations produced 28.4 TWh of electricity, while 13.3 TWh was imported. Imports of Soviet crude oil have dropped from 6.3 Mt to 5.3 Mt for the same period, with a further decrease expected in 1992. Oil is used both as a refinery feedstock and for power generation. Total projected domestic output of crude was 1.9 Mt in 1992. The Adria oil pipeline from the former Yugoslavia, the umbilical cord which connected Hungary with non-Soviet energy markets, remains closed due to the war.

Indigenous supplies of natural gas are supplemented by imports, including from Romania. Gas-fired power stations are currently being favoured as the new short-term energy source to satisfy demand after connection to the European gas grid is achieved later this decade.

In 1990, nuclear energy production accounts for 13.7 TWh, conventional thermal power stations 13.4 TWh and hydro power 0.18 TWh.

The MVM strategy for local production by the year 2010 calls for the creation of an additional 7000 MW of new generating capacity, with an appropriate three-way split between hydrocarbon, nuclear and coal. At the same time, around 2600 MW of inefficient and polluting capacity will be decommissioned.

To the year 2000, MVM plans to install 750-900 MW of natural gas-powered turbines (primarily in combined cycle plants in district heating stations); 150-750 MW of oil-fired steam and gas turbine units (primarily for peak purposes); 300-400 MW of coal-fired power stations (using fluidised bed burners); and 150-300 lignite-fired plant.

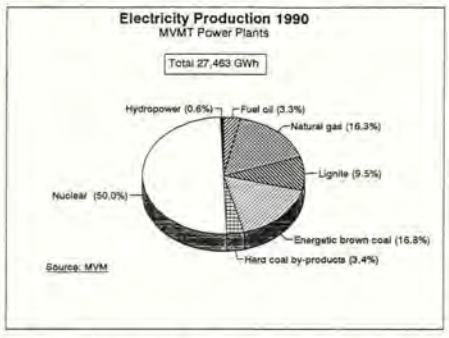


Fig 2: Electricity production 1990 (MVMT power plants)

After 2000, additional coal and lignite plants are expected to come on line, and nuclear power plants currently being commissioned are expected to become available by 2050.

This additional planned generating capacity represents a major investment in the country's energy sector, but is only enough to satisfy the lowest demand scenario.

Hungary is expected to be connected to the UCPTE (Union for the Coordination of Production and Transmission of Energy) grid in 1994-5, which will provide regular access to electricity which is in addition to approximately 200 MW available from Hungary's traditional Eastern European suppliers. The Eastern & Central European CMEA (Council for Mutual Economic Assistance) grid, unlike UCPTE, is the largest grid system in the world. However, it is firstly an economic network. As such it reflects fuel and energy production, rather than equilibrium of supply, and its structure has helped facilitate the current problems of Russian and Ukraine domination.

In Hungary, coal is used for generating electricity, with coking and industrial heating providing significant markets. There is 100 Mt of economically-recoverable hard coal and 3650 Mt of brown coal/lignite. Hungarian coals are usually high in ash and sulphur content, and there are geological conditions prevalent which make mining difficult and expensive. There are also environmental costs, associated with the production of energy from these low calorific coal sources, though work has been done to reduce sulphur emissions. The largest coal-fired power station is the Pecs plant, located in the south of the country, which generates 245 MW. Imports of coal are high, due to the high costs associated with domestic production. To reduce increased importation and domestic mine closures, the government directed MVM to buy Hungarian coal at a set higher price.

The capacity of the Paks nuclear power station, north of Budapest, is 1760 MW. Hungary has been debating the future of proposed additional nuclear reactors. The 1993 MVM strategy paper proposes that, if the middle demand scenario (referred to earlier) becomes reality, nuclear power would produce 22 TWh in 2010, and increase of 62.5% over present production (and 2005) at Paks. The proposed reactors would cost approximately one-fifth of Hungary's external debt, which could weaken Hungary's economic position, create environmental problems in

the disposal of the waste, and take over eight years to commission.

Hydro-electric power generation plays only a small role in Hungary (total 40 MW capacity). In 1992 Hungary cancelled its work with Czechoslovakia on the Gabcikovo/Nagymaros twin barrage project on the Danube because of environmental concerns. Hydro electricity generation is primarily located in the North-Trans-Danubian and Northern Hungary regions, and the possibility for large power plants in the country is restricted.

Role for renewables

Renewable energy technologies currently contribute around 2% of Hungary's energy supply, primarily from hydro sources. The remainder is generated from biomass and geothermal energy. The Hungarian Ministry of Trade and Industry has a strategy to increase the contribution of renewables from 2% of the national energy mix to 5-6% by 1995. Whilst it is anticipated that biomass and geothermal hold the most short-term potential, solar and wind technologies are also being considered.

The solar applications with the most immediate application fall into two categories: industrial and autonomous domestic and agricultural sites. One of the major international market applications for photovoltaics is for powering telecommunication systems, such as microwave stations, radio repeaters, monitoring and signalling equipment and other remote applications. Another major market for photovoltaics is cathodic protection for oil and gas pipelines and bridges.

Europe already generates 1000 MW of electricity from wind turbines, such as these in The Netherlands.

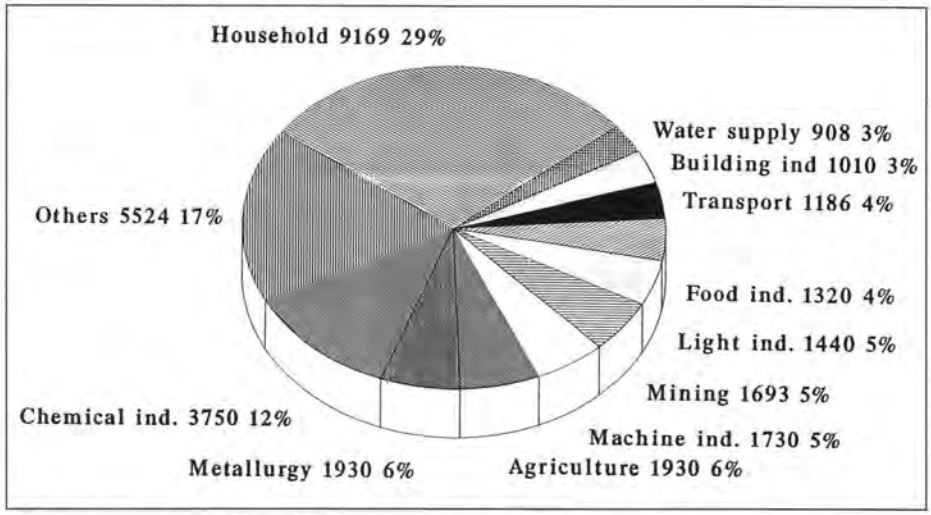


Fig 3: Consumption of electrical power by sectors in 1990 (GWh)

Source: MVM

Photovoltaic modules and tiles integrated into the building facade are an emerging technology in Western Europe, Japan and the USA. These applications have the advantage of providing additional generating capacity without pollution or requiring the allocation of extra land. Large-scale, grid-connected centralised photovoltaic power plants are undergoing R&D and demonstration in countries such as Switzerland, Germany, the USA and Japan. However, this technology is not yet ready or economic for implantation as a major generating source.

There are many areas in Hungary where the connection of holiday homes, autonomous farm buildings and other structures to the grid is uneconomic. Photovoltaics could provide less expensive and more reliable power supplies in these situations.

Solar hot water systems have a long history in Hungary, but with only small market success to date, primarily due to the traditionally cheap electricity prices. However as the price of energy rises, these could become increasingly competitive.

The agricultural sector in Hungary employs around 18% of the population, the second largest sector in the country. The government's programme is to encourage small private ownership of land previously owned and managed by state enterprises. This is creating small allotments, often without power or access to running water, and creating new power-related demands for the area, such as stock watering and irrigation, house supplies and agricultural applications. Solar, biomass and biogas technologies could be applicable in these situations.

As with energy efficient technologies, there has been little direct support from the government for renewable energy technologies and applications. There is no *significant* national programme for R&D (an earlier programme to develop solar hot water systems has been substantially reduced), and there is no incentive to encourage the adoption of such technologies over traditional energy supplies in situations where this could be appropriate.

Likewise, the international funding organisations, such as the World Bank and the European Bank for Reconstruction and Development, have not backed any project (excluding large-scale hydro) which include renewable energy technologies. This is despite the support by national governments, particularly in Western Europe, Japan and the USA.

The Hungarian Ministry of Trade and Industry is responsible for the country's EC PHARE programme, which gives assistance for economic restructuring in Eastern and Central Europe. It funds improvements in energy planning, efficiency, supply and demand, environmental improvement and diversification of supply. In the area of renewable energy, geothermal and biomass demonstration projects are currently under

2.5kW grid connected PV array integrated into roof, Switzerland.

consideration, and major assessment of renewables is proposed. Programmes are also planned or underway in the coal sector, in energy conservation, and a district heating pilot programme has been set up in Baranya County.

The International Solar Energy Society holds its biannual world conference in Budapest from 23-27 August this year. More than 1000 delegates and experts in solar energy from around the world will attend. In addition there will be a major exhibition of renewable energy equipment and applications. Support for the conference is from many sources, including the Hungarian government.

In 1996 Budapest will play host to the World Expo. Renewable energy technologies will be there, in operation, powering at least one site and possibly more.

National energy strategy

The government's national energy strategy calls for a reduction of environmental and health damage resulting from wasteful burning of fossil fuels; expansion of investment in efficiency and cogeneration and the identification of new sources of energy.

Changing the reliance on gas and crude oil from Russia and the Ukraine, and connecting to the European oil, gas and electricity grids is a priority area. Restructuring and privatisation of the electricity industry, in line with the government's economic strategy has already been initiated.

The government is currently looking at all energy alternatives to increase its indigenous production of electricity. The reduction of CO_2 emissions and other pollutants are important elements in their future energy strategy. However, short-term economic considerations are a priority at this stage. International support is needed to encourage fuller development of environmentally-benign and sustainable energy technologies.

There are a number of major challenges facing the energy sector in Hungary. Hungarian industry depended on cheap energy from the former USSR to keep it competitive with the west. Higher costs, antiquated technologies and decreased competitiveness are now in prospect. The traditional reliance on imported fossil fuels and the increasing debt burden place an urgency on improving both energy efficiency and diversifying supply.

New construction in the shorter term is orientated to gas, as CCGTs can be installed in two to three years and are less expensive than coal or nuclear plant.

In 1994-5 Hungary will be connected to the Western Europe UCPTE grid, thus providing regular and increased access to supplies of electricity. This will require further exchanges of hard currency.

Renewable sources of energy could be introduced as a supplement to Hungary's energy mix. This would be complimentary to the government's existing programme to encourage energy efficiency. The use of photovoltaics integrated into buildings and installed in applications autonomous from the existing grid, solar hot water systems, wind turbines, biomass generators and landfill gas production could contribute to the energy security of the country in the medium and longer terms. Existing technical and manufacturing expertise within Hungary could be utilised to manufacture products for both the local market and for export.

However, these renewable technologies and applications need to be fully supported now, both by the Hungarian government and international financing institutions. ❑

FGD at Ratcliffe

THE COUNTDOWN has begun to first operation of a £250 million plant which will eventually be able to remove 90% of the sulphur dioxide (SO_2) emissions at PowerGen's 2000 MW Ratcliffe on Soar power station.

Early next year the first unit at the giant flue gas desulphurisation (FGD) plant, which occupies a 12.5 hectare site, will begin operation. The remaining three units will be completed by 1996.

So why is PowerGen investing so heavily in this vast chemical plant which is so often dubbed 'gas scrubbing equipment' by certain sections of the media?

The answer lies in the company's commitment to ensure that its operations are managed to conform with the increasingly stringent standards required by European and UK law. This commitment is being taken seriously with a total investment of around £1.5 billion on new and existing plant which will improve the company's environmental performance.

Combustion of any fossil fuel, whether in a power station or any other system such as a domestic boiler or car engine, inevitably leads to gaseous emissions to the atmosphere. By mass, the principal emissions are carbon dioxide (CO_2) and water. Other substances will also be emitted and for large power generation plant, the most important are oxides of nitrogen, SO_2 and, for coal-fired systems, dust.

SO_2 is formed from reaction of sulphur impurities in the fuel with oxygen in the air introduced for combustion of the fuel itself. The sulphur content of the fuel, rather than the design of the combustion system, therefore determines the amount of SO_2 produced.

By the mid 1990s PowerGen will have invested over £1 billion in highly efficient combined cycle gas turbine power stations which produce no SO_2 and reduced levels of CO_2 and nitrogen oxides (NO_x). The company is working hard to increase the efficiency of its existing plant, is making use of cleaner fuels and is closing older, inefficient plants.

In 1988 European environment ministers agreed what is commonly known as the Large Combustion Plant Directive with the aim of limiting the emissions of certain pollutants into the air from industrial plants, including power stations. For the UK, total emissions of SO_2 from existing large combustion plants must be reduced by 20%, 40% and 60% by 1993, 1998 and 2003 respectively.

A national plan has been drawn up which allocates responsibility for achieving the directive's requirements. PowerGen's response has been to implement a comprehensive strategy to reduce emissions, not only of SO_2, but also of NO_x and CO_2.

It is against this background that the company took the decision to install FGD equipment at Ratcliffe on Soar power station in Nottinghamshire, one of the company's largest and most efficient coal-fired plants. The station, which is capable of meeting the electricity demand of some two million people, burns around five million tonnes of coal a year. This coal comes from numerous mines located principally in the West Nottinghamshire area, and contains a range of sulphur and chloride levels according to source. Fitting FGD at Ratcliffe has enabled PowerGen to focus its investment where a major environmental benefit will be achieved.

Ratcliffe power station lies adjacent to the confluence of the Rivers Soar and Trent, less

than 10 miles south west of Nottingham. The plant, with its four 500 MW generating units was fully commissioned in 1970. Over the next two decades it established itself as one of the country's most successful power stations in terms of electricity output.

How FGD works

So how will the Ratcliffe FGD plant work? It will use limestone — calcium carbonate — as its raw material in what is essentially a simple process. Gases from the power station boilers are directed into absorber towers where they pass upwards through a series of fine sprays of powdered limestone mixed with water. To give some impression of the scale, each of the power station's four boilers will have a dedicated absorber tower measuring 16.2 meters in diameter and 43 meters high.

Inside the absorbers the SO_2 reacts with the limestone to produce calcium sulphite. The chemical reaction is then completed by blowing air into the absorber base tank to form calcium sulphate or gypsum. The cleaned gas is reheated and discharged via the power station chimney.

The gypsum produced in the process is dewatered in centrifuges to leave the high grade product which can be used in the plaster product and wallboard industry. At present the gypsum used in the UK is either mined or imported. The process water purge from the FGD process is treated to a high standard set by the National Rivers Authority before being released into the local river.

When completed, the Ratcliffe FGD plant will require about 300 000 tonnes of limestone a year, and will produce over 400 000 tonnes of gypsum. Exact sources and methods of transport for the supply of limestone have yet to be finalised.

It will come as little surprise to learn that when considering a potential investment of some £250 million, the choice of installation is no simple matter. Before placing an order for such a system, PowerGen first had to make a careful selection of the process to be utilised.

A number of processes were evaluated at an early stage. To reduce SO_2 emissions at a power station you have three main options. First, you can tackle the problem pre-combustion through some form of coal cleaning technique. The second option is tackle the emissions during combustion through in-boiler injection of a reagent such as limestone. Finally you can opt for a post combustion process.

Here the options really do open up. PowerGen considered at least eight different systems. They included the lime/limestone gypsum process, lime/limestone sludge process, the magnesium oxide process, the Wellman Lord process, the combined DeNOx/DeSOx process, the seawater washing process, the lime spray dry process and the Dual Alkali process.

A range of factors were taken into consideration before a favoured system was arrived at. Factors such as the overall lifetime costs of the FGD process selected, the fact that UK coals range from medium to high sulphur levels, and the need to operate power station-boilers continuously for 38 months between overhauls. Clearly, it was also necessary to take into account the likely remaining operational life of the power station to be retrofitted to ensure that the investment could be justified.

It would be wrong to suggest that the fitting of an FGD system is all good news. In the increasingly competitive post privatisation UK power market, power stations must strive to increase thermal efficiency and reduce costs. Fitting an FGD system will lower plant efficiency and annual operating costs of £15 million are hefty, putting pressure on the station's competitive performance.

Another important factor was the availability, and access to, the required feedstock for the FGD system adopted. Equally significant was the question of the by-product of the process. Was it 'socially acceptable'? Would it be marketable? Did suitable sites exist for disposing of any surplus by-product? What transport links would be required to handle feedstock, by-product and any waste product? How successful had any given process proved when installed elsewhere? With only one other power station FGD retrofit in the UK, international experience had to be taken into account.

When all these factors — and numerous others — were weighed up, PowerGen finally selected the limestone gypsum process as the most suitable for retrofitting at Ratcliffe. This process — or its variants — is the most widely used FGD type worldwide and accounts for over 75% of European installations.

Following a tough international tender, the company awarded the major turnkey contract for the project to the British company John Brown Engineers and Constructors Ltd in March 1991. PowerGen Chief Executive Ed Wallis commented at the time: "Our investment at Ratcliffe represents a major step in the implementation of our plant strategy. It gives us the flexibility to use higher sulphur British coals, including those from Midlands pits, whilst meeting our environmental obligations. When fully operational in 1996, we expect the plant to reduce PowerGen's total emissions of SO_2 by around 15%.

Plant design

Having selected the FGD process to run with, the next question was one of design. Five main design parameters were set for the plant, focused on stack (or chimney) emissions, effluent discharges, plant availability, quality of by-products and planning consent requirements.

Emissions are monitored and regulated in the UK by HM Inspectorate of Pollution (HMIP). However, with no current regulations concerning the design of retrofit FGD plant, PowerGen proposed its own design parameters which were discussed with HMIP and other relevant bodies. Subsequent to this, the 1990 Environmental Pollution Act has added the requirement of an HMIP authorisation to operate FGD plant.

The three principal design parameters for station emissions were a 90% SO2 removal, the ability to maintain a temperature not less than 80°C for emitted gas entering the stack, and dust emissions which did not exceed 85 milligrams per cubic metre.

Due to the relatively high chloride content of UK coal, it was necessary to fit a liquid purge stream to control the level of soluble chloride in the process. Purge treatment prior to discharge reduces the level of heavy metal contaminants.

The next key consideration was plant availability. In Germany, legislation allows for a maximum of 10 days of plant operation without FGD each year. This is equivalent to plant availability of 97.5% and was the tough standard adopted by PowerGen. It is a potentially high target value in relation to the onerous power station operating regime of 38 months before outage, with 90% boiler availability levels currently being achieved.

Production of a high quality by-product was an essential requirement if the company was to market the gypsum successfully. Last among the key requirements were the planning consents which set down criteria to be met in terms of visual impact, noise levels both in construction and operation, and standards to be met in road and rail transport to and from the site.

It is interesting to note that though FGD is clearly designed to protect the environment, any proposal to fit such equipment comes under close environmental scrutiny. In fact it is a legal requirement that any application for the extension of a power station is accompanied by a comprehensive statement which assesses the likely impact of the extension on the environment. This 'environmental statement' and an associated non-technical summary were made widely available when PowerGen's application for planning consent was made.

PowerGen is committed to maintaining a high standard of environmental care throughout its business. The company complied fully with its emission limits for 1992 and a programme of investment in new and existing plant will ensure that it is well placed to meet these limits in future. Ratcliffe FGD is on course to make an important contribution. ❑

Going Dutch

Nedalo (UK) Ltd is the latest in a succession of joint ventures involving the regional electricity companies of England and Wales. Eastern Electricity plc has joined forces with Dutch company Nedalo BV (Holland) to provide a complete service to small to medium-scale customers wishing to take the CHP route. Energy World visited their head office in Horsham, West Sussex.

Nedalo (UK) Ltd was formed in December 1991 as a joint venture company between Eastern Electricity plc and Nedalo BV of Uithorn, near Amsterdam in Holland. The company supplies, services and supports packaged combined heat and power (CHP) units from 45kWe (81kWth) to 770kWe (1162kWth).

Nedalo (UK) began trading in January 1992 and has already amassed an impressive list of customers. Managing Director, Steve Guttridge, feels the joint venture company is particularly well placed to be successful in this fast-growing market. Eastern Electricity, who has a 75% interest in the venture, as a regional electricity company already has access to facilities, and is in a good position in terms of financial resourcing. Nedalo BV is the leading packaged CHP company in Europe, with fifteen years experience in the market, and over 1000 units installed. It is this combination of expertise that has made Nedalo (UK) so successful so soon. March 1993 saw the end of their first financial year, and they confidently expect to be in profit by the end of their second year of trading.

Nedalo's packaged CHP units are based on gas engines of UK and overseas origin, assembled with other components to form a CHP package by Nedalo in Holland. The UK company provides a full service to its customers: from feasibility studies, site surveys, to supply, installation and commissioning of units and comprehensive maintenance agreements. They offer three types of contract. The first offers routine maintenance only (Nedalo will train customers' staff to carry out maintenance themselves, if required). The two remaining contracts are a three-year and a five-year all-in agreement. Once installed and commissioned, customers' systems are remotely monitored from Nedalo (UK)'s headquarters in Horsham, West Sussex.

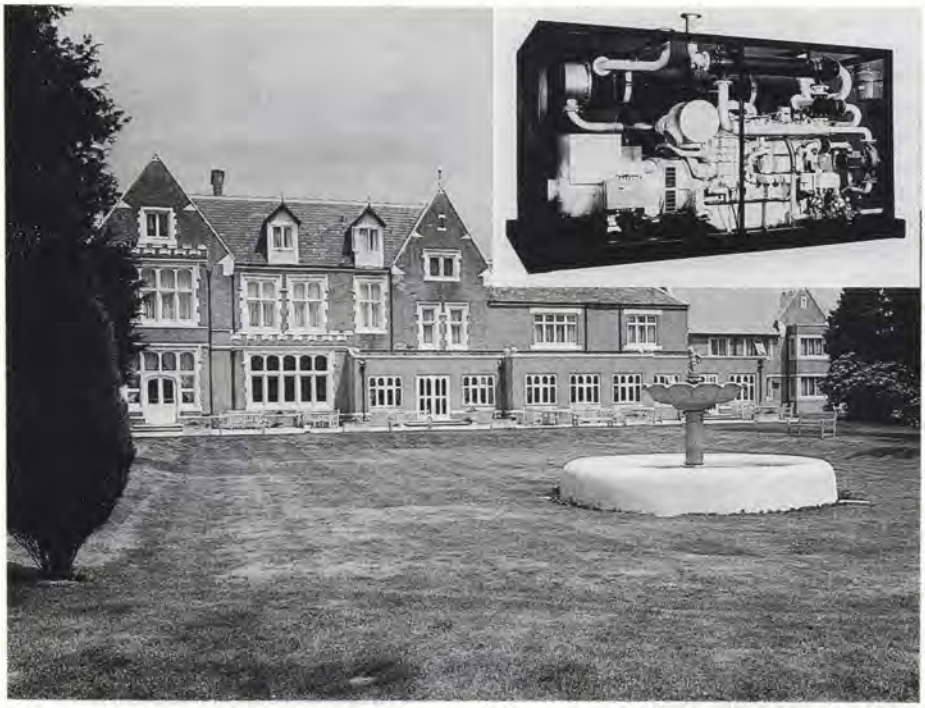
For a company intending to follow the CHP route, Nedalo offers two financing options. The first is a straight forward capital purchase. The customer buys the system outright, which is installed, commissioned and serviced by Nedalo, if the customer so chooses. The usual payback period is only three-and-a-half to four years. Alternatively there is the 'Optima Heat and Power' scheme, involving no risk and no capital cost to the customer. Nedalo take care of the gas pipework to the unit and telephone line, and the client pays for their power on a pence per kW basis and for the gas used. The result is that their gas bill will rise, while their electricity bill falls dramatically, with a net saving in the region of 35%. Unlike many similar schemes, Optima is not a lease purchase, and if the guaranteed savings are not achieved, Nedalo will recompense the customer accordingly. In addition, the client retains the right to purchase the system at any time during its 10-year design life, the depreciation is reflected in the purchase cost to the customer.

Most CHP companies offer three-year maintenance contracts, but Nedalo recommend five years, to cover complete lifecycle maintenance. Longer contracts are available, up to nine years in duration, at the customer's request.

Nedalo (UK)'s largest contract to date, worth £1.3 million, is to supply and install CHP units at four RAF bases. The company will supply two 280kW units: one each to RAF Markham in Norfolk and RAF Waddington in Lincolnshire; and two 500kW units, one each to RAF Conningsby, also in Lincolnshire and RAF Wroughton in Wiltshire.

The RAF commitment to CHP follows a decision to reduce energy costs, become environmentally friendly and to improve their operational effectiveness. This began in 1990 when they embarked on a five-year gasification programme. British Gas are in the process of converting and supplying 52 RAF stations with natural gas. The CHP project is running hand-in-glove with the gasification scheme.

Nedalo (UK)'s customer list includes leisure centres, hospitals, hotels and schools — for all of whom the CHP option is ideal.❑



The Stakis St Anne's Manor Hotel in Wokingham has been reaping the benefits of a Nedalo 45 kWe CHP unit for over three years. Inset is a 280kWe unit, similar to those used for the recent RAF contract.

New members

Fellow

Norman McAuley, Northern Health & Social Services Board, Northern Ireland *(transfer)*
Roy Wilkinson, *(transfer)*

Member

Mark Cameron Anderson, Gloucestershire County Council *(transfer)*
Daniel Francis Brennan, British Gas West Midlands
Richard Edward Davidson Coldwell, National Grid Company, London
Terry Heppenstall, International Research & Development Ltd, Newcastle upon Tyne
Graham Kitching, British Gas South Western, Bristol
John Francis Lockett, British Gas South Western, Bristol
Maurice Noble Millar, Scottish Hydro Electric plc, Perth
David Oakley, Energy UK plc, Stockport
Peter Louis Roberts, MacKechnie — Jarvis & Graham, Essex
David John Ryan, Hamilton Oil Company, London *(transfer)*
John David Stott, PowerGen, Solihull

Associate Member

Raymond George Bovey, WBB Devon Clays
Robert George Caldwell, Du Pont UK Ltd, Londonderry
Keith Lawrence Chilton, British Gas North Western, Manchester
Michael Holmes, Scottish Hydro Electric plc, Aberdeenshire
Marco Giuseppe Lowers, London Borough of Havering, Romford

Associate

Sananda Canden, Nottingham City Council
Roger Charles Crane
David Lancaster, Hamworthy Combustion Systems Ltd, Dorset
Ulysses Ma, ETSU, Oxon
Ian Wilton Powe, Gas Consumers Council, London
Ian Webster, IEA Greenhouse Gas R & D Programme, Glos

Graduate

Robert William Cargill, Oscar Faber Consulting Engineers, Herts
Matthew Golding, British Gas South Western, Bristol
Antony Peter Odell, University of Leeds *(transfer)*
Ostap Stefan Melnick, Strathclyde University, Glasgow
Paul Edward Orchard, London Underground Ltd
Bryan Mark Shaughnessy, Cranfield Institute of Technology, Bedford
Anthony Mark Ward, Cranfield Institute of Technology, Bedford

Major Group Affiliate

British Telecommunications plc, Sheffield

Group Affiliate

Oracle Corporation UK Ltd, Berkshire

Student

Athier Alani, University of Leeds
Henry James Alder, Middlesex University, London
Steven David Allen, University of Leeds
Kathryn Voirrey Bridson, Middlesex University, London
Catherine Cater, Nene College, Northampton
Soon Ping Chang, Loughborough University of Technology, Leicester
Paul John Michael Cooper, Imperial College, London
Ryan Donovan, Nene College, Northampton
Susan Ndudi Eziashi, Middlesex University, London
David Lawrence Ferguson, Middlesex University, London
Elizabeth Jane Foster, Middlesex University, London
Claire Elaine Fryer, Nene College, Northampton
Andrew Maxwell Goodwin, Middlesex University, London
Roy Hancock, Middlesex University, London
Katrina Ann Henderson, University of Glamorgan
Robert Alastair Jackson, Strathclyde University
Rory Carrick Terence Jones, De Montford University
Anita Jamieson, Nene College, Northampton
Amanda Jane Jarvis, Middlesex University, London
Nicholas Antony Jones, Middlesex University, London
Sami Mostafa Kamel, American University in Cairo
Nicholas James Kelly, Strathclyde University, Glasgow
Spyridon Koutroufinis, Middlesex University, London
Mark Andrew Lander, Nene College, Northampton
Herpreat Mehat, Nene College, Northampton
Helen Clare Mills, Nene College, Northampton
Paul Stephen Mills, Middlesex University, London
Stephen Anthony Noyce, Middlesex University, London
Alexandros Papageorgiou, Middlesex University, London
Rebecca Jacqueline Palmer, Nene College, Northampton
Adrian James Peacock, Nene College, Northampton
Gordon James Peacock, Nene College, Northampton
Stephen Perfect, Middlesex University, London
Kasim Rahman, Middlesex University, London
Genella Rushton, Nene College, Northampton
Amar Saad, University Tech of Malaysia
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Mehdi Siami, Middlesex University, London
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Dawn of a new era?

The 17th report of the Royal Commission on Environmental Pollution: Incineration of waste

THE 17th report of the Royal Commission on Environmental Pollution is both forward-looking and comprehensive. Prepared under the chairmanship of Sir John Houghton, it recommends a complete revision of the method of disposal of waste, particularly municipal solid waste (msw), in the UK. It recommends that the Department of the Environment (DoE) should give high priority to completing a national strategy for waste management based on a four-stage decision procedure:

- wherever possible avoid creating waste;
- where unavoidable, recycle waste if possible;
- where wastes cannot be recycled in the form of materials, recover energy from them;
- when the foregoing options have been exhausted, utilise the best practical environmental disposal option.

The report recommends that this task should not wait until the Environment Agency is in operation, but should proceed as expeditiously as possible, particularly by the introduction on a national scale of municipal waste incinerators incorporating equipment which enables the plant to meet the stringent EC and HMIP standards now required with regard to atmospheric pollution.

The incinerators would be designed to utilise the heat produced to generate electricity for transmission to the National Grid, preferably as part of CHP schemes. In coming to this important conclusion and recommendation, the report considers comprehensively a number of factors involved.

Incineration of sewage sludge and clinical waste is mentioned, but the main subject of the report is the present and planned use of incineration of msw, and a comparison is made with other developed countries. It is clear that when most of the existing aging incinerators in Britain are shut down, by the end of 1996 because they do not meet the new pollution standards, less than 5% of msw will be incinerated. This contrasts with France, where the figure is 42%, Sweden (55%) and Japan (72%). The US National Strategy, published in February 1991, called for a seven-fold increase in electricity generation from msw by 2010. Incinerators in the US, planned or under construction, are likely to increase capacity to about a quarter of the arisings of msw forecast for the year 2000.

The emissions to air from the old municipal waste incinerators installed in the past in the UK included excessively high emissions of particulate matter, hydrogen chloride, cadmium, mercury, lead and dioxins. Modern plant is designed to reduce the emissions to levels acceptable to HMIP by suitable gas cleaning equipment. The report emphasises that qualified personnel must be employed with adequate monitoring of all plant as part of a national scheme, which must be enforced both for comparison purposes and to improve techniques.

Energy recovery from waste is considered in detail, and it is concluded that bulk incineration of msw in incinerators with a capacity in the range of 200 000 tonnes per annum to 1 500 000 tonnes per annum is the most practicable solution with our existing knowledge. At the same time, research and investigations of other techniques should be continued. Where incineration of untreated msw is adopted instead of landfill, the emission of landfill gas containing methane is eliminated. This is regarded as a significant and worthwhile benefit in terms of reducing emissions of greenhouse gases.

Health issues associated with emissions of dioxins, other organic compounds, heavy metals, acidic gases and particulates from old types of incinerator are considered. It is concluded that emissions from the proposed well-operated incineration plants complying with the new HMIP standards are most unlikely to cause any health effects.

Other forms of possible environmental impacts such as visual intrusion, smells, vehicle movements and socio-economic effects are also considered.

Attention is drawn to future technologies. Whilst these may be suitable for the destruction of chemical and clinical waste, it is considered that there is no alternative technology suitable at present for msw.

In considering the place of incineration in a waste management strategy, it is stressed that DoE should give high priority to completing a national strategy for waste management, based on the four-stage decision procedure; and that this task should not wait until the Environment Agency is in operation.

A programme, already in operation in Holland, is described and the report considers that their ten-year programme on waste management could serve as a useful model.

Detailed comparisons are made of the cost of landfill and municipal waste incineration. Because of the high capital cost of the incineration plant, the cost of sending municipal waste to landfill is generally considerably lower than utilising incineration with power generation. To counter this it is recommended that:

- an electricity subsidy should be continued for electricity generated by means of municipal waste incinerators similar to the NFFO, although not necessarily in its present form;
- based on the 'polluter pays principle' a levy should be applied to all untreated msw deposited on landfill sites. A levy of £10-£20 per tonne is envisaged.

In reviewing this report, I suggest that the Government might consider whether the proposed levy on the disposal of untreated waste on landfill sites should be paid to the 'control agency', and be used as a proportion of the capital cost of the new incineration plant. A corresponding proportion of the income from the sale of power should then return to the 'control agency', which may subsequently become part of the proposed environment agency. A levy should not be applied to residual waste from an incineration plant sent to a special landfill site where HMIP are satisfied that measures are taken to ensure that any leachate from the site is purified to a satisfactory standard. There would be no landfill gas from these special sites.

The Commission is to be congratulated on the preparation of this report. Relating to municipal waste incineration, the UK is far behind other developed countries. This may not be such a disadvantage if the report's recommendations are introduced expeditiously. Advantage can be taken of the results of research and experience available from other developed countries.

The UK is particularly suitable for the centralised approach recommended in the report, as we are a compact community, and we have many vacant industrial sites within close proximity of urban areas. Many have the necessary road, rail and/or water transport facilties.

Byrom Lees

Selection of references

'Exergy' compiled by John Devine. Published by the Information and Library Service, Institution of Mechanical Engineers, London, 1993, 105 pp, £19.50.

'EXERGY' is the fourth in a series of bibliographies published by the Institution of Mechanical Engineers' Information and Library Service.

Compiler John Devine covers a 20-year period, from 1973-1992, with the listings organised under a total of 49 different headings: from compressed air to costs; standards to systems engineering.

At 105 pages 'Exergy' does not intend to represent a comprehensive collection of literature published on the subject. However it does provide a good overview of recent literature, with over 350 abstracts, covering computers, cooling towers, desalination, energy storage, fluid mechanics, fuel technology, gas turbines, heat pumps, heating, refrigeration and air conditioning, power plants, solar energy and much more besides.

The publication is 'user-friendly', with an explanatory page on 'How to use this bibliography', an author index, an extensive keyword index and an author affiliation index. Four pages are left blank at the back for readers' notes. In addition it is possible to obtain copies of the articles referred to from an Information Officer at the Institution's headquarters in London.

Informative handbook

'Applications for coal-use residues' by Lee B Clarke. Published by IEA Coal Research, 1992, 406 pp

THIS most informative handbook provides basic details on over two hundred different applications and processes which utilise coal-use residues. These derive from more than twenty countries.

The applications vary from high-volume, low-technology uses to highly specialised low-volume. Commercial processes and applications are efficiently catalogued. The listed also include those which are at an experimental or developmental stage, emanating from both private and governmental research organisations. This work would provide a most useful reference guide.

Process and manufacturing descriptions are given for each application. Much data is provided on three aspects: the types of coal-use residues utilised, other materials incorporated as well as properties of manufactured products. The applications are clearly described, giving supplier and product information, as well as product details. In many cases, to aid understanding, process flow charts or diagrams are incorporated.

With the advent of greater environmental concern and responsibility, the applications of coal-use residues are becoming an important and relevant issue. This is because, although in many countries landfill provides a basic method of disposal, higher costs and stricter regulations are making dumping a far less acceptable option. Utilisation of waste materials, rather then their disposal, appears to be the welcomed industrial culture of the future.

A wide range of utilisation options are markedly demonstrated in this publication. These include applications relating to agriculture, industrial materials, as well as building and structure materials. Not only are established commercial applications described, but also those innovations which are currently being researched.

The publication is a most comprehensive guide in the area of coal-use residues. It is excellently indexed, and its depth can be clearly seen in the fact that it contributes 16 pages of references. All those engineers and technologists involved in coal-use residues, whether on an operational, strategic or academic level, will find this handbook most professional.

Dr Alan Stainer

A range of measures

'Efficiency without tears: 'no-regrets' energy policy to combat climate change' by Dr Tim Jackson. Published by Friends of the Earth, London, 1992, 82 pp, £10.00. From Friends of the Earth, Publications Dispatch, 26-28 Underwood Street, London N1 7JQ.

A NEW policy programme to remove distortions in the energy market could stimulate cost-saving investments in energy efficiency improvements, put money back into the economy AND cut UK carbon dioxide emissions, according to this study from Friends of the Earth (FoE).

Author Dr Tim Jackson, who undertook the study on behalf of FoE, proposes new measures linking mortgage tax relief to energy efficiency; tighter energy efficiency standards on buildings and appliances; innovative price regulations for electricity and gas companies to encourage energy saving; a small carbon tax to provide a National Energy Bank with some £400 million each year to support energy efficiency improvements.

According to the study, a series of fiscal and institutional distortions in the energy services' market at present mean that householders and businessmen alike do not perceive energy efficiency and cutting CO_2 as being in their economic interests. The author examines a range of policy measures and mechanisms available to alter this perspective, highlighting the value of each measure in reducing each market distortion. In addition he models the impact of these policies on the investor's perspective.

The study criticises incoherence amongst policy makers and their tendency to focus on one-track policies to stimulate energy efficiency improvements, particularly in the case of carbon tax. FoE has identified a role for a 'very modest' carbon tax (around 4-7%), but the study suggests a more comprehensive approach to policy development than has been typical to date.

Recently published

'Illustrated Encyclopedia of Building Services' by David Kut. Published by E & FN SPON, London, 1992, 355 pp, £49.95. Available from E & FN SPON, 2-6 Boundary Row, London SE1 8HN. Tel: 071 865 0066.

'Building environmental and energy design survey'. Published by the Building Research Establishment, Watford, 1993, £25.00 (+ £2.50 p&p). Available from the BRE Bookshop, Building Research Establishment, Garston, Watford WD2 7JR. Tel: 0923 664444.

'Survey of Equipment for Small-scale Motive Power and Electricity Generation from Wood and Agricultural Residues' by E A Williams and A P Robinson. Published by Natural Resources Institute, 1993, iv+18 pp, £7.50. Available from NRI, Central Avenue, Chatham Maritime, Kent ME4 4TB

'Russian Oil: Status and Outlook'. Published by Smith Rea Energy Analysts Ltd, Canterbury, 1993, 118 pp, £1200.00 (twin volumes). Available from Smith Rea Analysts Ltd, Hunstead House, Nickle, Chartham, Canterbury, Kent CT4 7PL. Tel: 0227 738844.

'Tensioned Buoyant Platforms: analysis design and field experience'. Conference proceedings, published by Bentham Press, London, 1993, 220 pp, £90.00 (UK) £95.00 (overseas) inc p&p. Available from BPP Technical Services Ltd, 2 Tavistock Place, London WC1H 9RA.

Unity over unification

TWENTY-TWO engineering institutions have made a joint response to the interim report of the Steering Group on the Unification of the Engineering Profession, *Engineering Into the Millennium*.

In a letter to Sir John Fairclough, signed by 22 Secretaries, Executive Secretaries, Honorary Secretaries, General Secretaries and Secretary Generals, the interim report was welcomed, with full support for the recommendation to establish a new relationship between the institutions and a reformed Engineering Council. This new relationship must bring about a radical change in culture, strengthening the existing register and the three registerable grades.

The institutions have questioned the role of the colleges, and consider more detailed thought should have been given to their composition and function. Whilst the need for 'groupings' is accepted, these should not perpetuate rigid barriers between disciplines or sectors of industry, says the letter, fearing greater bureaucracy.

Nor does the letter accept that a case has been made for a single institution for the whole of the engineering profession. Unification should be achieved by means of the new relationship, it argues, allowing institutions to harness all that is best to meet the challenges facing the profession in the future.

Record numbers for young peoples' award

THE Engineering Council has announced a record number of entrants for the 1993 Young Engineers for Britain competition.

Almost 1000 youngsters have entered 750 projects from 260 schools. This amounts to double the entries for the 1992 competition. Devices entered range from the simplest of ideas to highly sophisticated inventions, involving advanced electronics and computers. Judges will be looking for originality, enterprise, engineering and design skill, application of relevant scientific principles and presentation of each project. Marketability, usefulness and whether the project meets an economic or social need will also be considered.

The winners will be announced in London on 15 September.

Boost for students

A £10 million scheme to attract students into engineering was announced by the Education Secretary in June.

The scheme, which will be administered by the Engineering Council, will provide incentives of £500 per year to students with very high A level grades, or their equivalent, who choose to study for an accredited engineering degree. The scheme will start next year and covers students entering higher education in 1994, 1995 and 1996.

A recent survey has shown professional engineers reporting increased job satisfaction, not just with salaries and conditions, but also with training and technical opportunities. The average pay of a typical 21-year-old engineering graduate, with a second class honours degree, last year was £12 800, making engineering an attractive discipline to potential students.

The government hopes the scheme will attract up 2000 extra students a year.

Key role for engineers

A FORTHCOMING code of practice proposed by the Engineering Council recognises a key role for engineers in safeguarding and enhancing the environment.

The nine-point Code of Professional Practice on Engineers and the Environment, currently at the discussion stage, aims to encourage greater awareness, understanding and effective management of environmental issues.

By following actions highlighted in the code it is hoped engineers will be able to give a lead in proposing and implementing sound engineering solutions to safeguard the future. This should process the wider debate over how sustainable activity can be achieved.

Chairman of the working party on the code, Prof Michael Burdekin of UMIST, has stated: "Professional engineers are already giving a high priority to environmental issues. They show skill and ingenuity in designing products and processes which lessen future environmental damage. Our aim in producing this code is to heighten awareness and to make the environment a key consideration in *every* project."

The code is one of a series of initiatives on environmental matters by the Engineering Council. A brochure, *Engineers and the Environment*, has been produced to increase awareness among engineers. The Environment Award for Engineers, sponsored by British Gas, highlights the positive contribution engineers can make to the environment. The Council's Young Engineers for Britain competition also contains an environmental category, sponsored by National Westminster Bank.

Copies of the discussion document *Code of Professional Practice — Engineers and the Environment* are available from The Engineering Council, 10 Maltravers Street, London WC2R 3ER upon receipt of an A4 sae.

Young engineers' conference in 12th year

'COMMERCIAL awareness and business skills for young engineers' is the theme of a weekend conference organised by the London Younger Members section of the Institution of Electrical Engineers (IEE). This annual conference is open to young engineers (less than 30 years of age) in all engineering disciplines. It will be held from 29-31 October at the Britannia International Hotel, Canary Wharf in London.

Now in its twelfth year, the conference is divided into two parts. One is a series of lectures by respected members of the business community. The second is a demanding management game, giving delegates hands on experience of a wide range of business issues, including marketing, finance and teamwork.

Delegates are thus given the opportunity to broaden their awareness of non-engineering factors which combine to make successful products and services. There is scope to develop these themes through formal and informal discussion with colleagues and guest speakers.

For more information contact: Joanne Jones, Conference Services, IEE, Savoy Place, London WC2R 0BL. Tel 071 344 5473.

Careers agreement

THE Civil Engineering Careers Service (CECS) have signed an agreement with the Engineering Council to enhance promotion of civil and structural engineering careers information to schools.

A key part of the agreement is for civil engineering careers information to be distributed and promoted through the Neighbourhood Engineers scheme. The scheme helps teachers to deliver the national curriculum, promoting industrial awareness among students.

CECS produces a factfile on careers in engineering to highlight opportunities for young people.

Chairman of CECS, Stuart Higham, said that establishing a formal relationship with the Neighbourhood Engineers network is a logical step in improving the careers service to schools. "Many of our members are Neighbourhood Engineers already, and this will ensure that schools receive up-to-date information in an organised manner."

Denis Filer, for the Engineering Council, said: "We welcome the opportunity for closer cooperation between Neighbourhood Engineers and the CECS. Greater coordination between careers providers can only help in attracting bright young people into the profession.

August 1993

Natural resources, energy and environment — law, policy, economics and finance
1993 summer programme of training and executive seminars, 30 August-1 October, Dundee, UK. Details from Mrs Moira McKinlay, Centre for Petroleum & Mineral Law & Policy, The University of Dundee, Park Place, Dundee DD1 4HN. Tel: 0382 307300; fax: 0382 22578.

September 1993

Industrial air pollution monitoring
Course, 13-15 September, Leeds, UK. Details from Miss Julie Charlton, Dept of Fuel & Energy, University of Leeds, Leeds LS2 9JT. Tel: 0532; fax: 0532 440572.

26th ISATA
Conference, 13-17 September, Aachen, Germany. Details from ISATA, 42 Lloyd Park Avenue, Croydon CR0 5SB. Tel: 081 681 3069; fax: 081 686 1490.

Major hazards — practical risk management
8th European summer school, 13-17 September, Cambridge. Details from Liz Kinniment, IBC Technical Services Ltd, tel: 071 637 4383; fax: 071 631 3214.

Strategic planning in the minerals industry
Conference, 14-16 September, Leeds, UK. Details from The Conference Office, IMM, 44 Portland Place, London W1N 4BR. Tel: 071 580 3802; fax: 071 436 5388.

Solid-liquid separation
Continuing education course, 14-17 September, Bradford, UK. Details from Dr Ing J Svarovska, Course Director, 8 Carlton Drive, Bradford, West Yorkshire BD9 4DL. Tel/fax: 0274 546276.

12th international corrosion congress — advances in corrosion control for increased reliability, conservation and productivity
19-24 September, Houston, Texas, USA. Details from 12th ICC/NACE, PO Box 218340, Houston, Texas 77218, USA.

The future of European energy
Conference, 20-21 September, Vienna Marriott Hotel. Details from The Economist Conferences, 40 Duke Street, London W1A 1DW. Tel: 071 493 6711; fax: 071 409 3296.

Incineration and energy from waste
Course, 20-22 September, Leeds, UK. Details from Miss Julie Charlton, Dept of Fuel & Energy, University of Leeds, Leeds LS2 9JT. Tel: 0532 332494; fax: 0532 440572.

Energy and society
International symposium, 20-24 September, Paris, France. Details from International Symposium Energy & Society, UNESCO, Engineering & Technology Division, 1 rue Miollis, 75732 Paris Cedex 15, France. Tel: (33-1) 45 68 39 01; fax: (33-1) 40 65 95 35.

Non-traditional energetics '93
1st international exhibition, 20-27 September, Moscow, Russia. Details from Negus Expo, Russia 111578, Moscow, Molostovykh str 2-1-4. Tel: (095) 280 39 57; fax: (095) 280 05 77.

Environmental engineering
Ist international conference, 21-23 September, Leicester, UK. Details from the Marketing Centre, De Montfort University, The Gateway, Leicester LE1 9BH. Tel: 0533 577577; fax: 0533 577533.

Hydrocyclones
Continuing education course, 21-23 September, Bradford, UK. Details from Dr Ing J Svarovska, Course Director, 8 Carlton Drive, Bradford, West Yorkshire BD9 4DL. Tel/fax: 0274 546276.

Small engines and their fuels
4th international conference, 21-24 September, Chiang Mai, Thailand. Details from The Energy Group, Dept of Engineering, University of Reading, UK. Tel: 0734 318561.

Plant layout
Course, 21-24 September, Nottingham, UK. Details from Dr J K Walters, Dept of Chemical Engineering, University of Nottingham, Nottingham NG7 2RD. Tel: 0602 514178; fax: 0602 514181.

Site investigation for contaminated sites
Two-day conference, 23-24 September, London. Details from Liz Kinniment, IBC Technical Services Ltd, tel: 071 637 4383; fax: 071 631 3214.

Gas cleaning at high temperatures
2nd international symposium, 27-29 September, Guildford, UK. Details from Mrs Jean Libaert (ref: GE93), Centre for Environmental Strategy, University of Surrey, Guildford, Surrey GU2 5XH. Tel: 0483 506330; fax: 0483 509394.

Combustion fundamentals
Course of 20 post-experience lectures, 27 September-1 October, London. Details from Prof Weinberg FRS, Dept of Chemical Engineering & Chemical Technology, Tel: 071 589 5111 ext 4360/4498

October 1993

Clean coal technologies: future in the European Community energy scene
Robens Coal Science Lecture, 25 October, London. Details from BCURA, Coal Research Establishment, Stoke Orchard, Cheltenham GL52 4RZ. Tel: 0242 673361.

DEGREE DAYS: MAY 1993

Source: **Degree days direct**

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

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

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

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

INSTITUTE OF ENERGY CONFERENCES

Please note that the conference programmes are subject to modification. For the latest information please telephone Judith Higgins on 071 580 0008.
The Institute of Energy, 18 Devonshire Street, London W1N 2AU, UK.

First International Conference on

Combustion & Emissions Control

21-22 September 1993, Cardiff

Keynote speeches from international figures will precede contributions on the following subject areas: Boilers and Furnaces, Emissions Reduction — Gas & Oil Systems, Emissions Reduction — Solid Fuels, Waste Utilisation and Combined Cycle Power Generation.

Making Energy Privatisation Work

The Future of Regulation

17 November 1993, London

Speakers include: Tim Eggar MP, Minister for Energy; Professor James Harrison, Institute of Energy; Professor Nigel Lucas, Imperial College; John Baker, National Power plc; Malcolm Chatwin, Yorkshire Electricity Group, plc; David Jefferies, National Grid Company plc; Cedric Brown, British Gas plc; Alan Marshall, AGAS; Lady Wilcox, National Consumers' Council; Ian Blakey, British Iron and Steel Producers Association; OFGAS speaker to be advised; Richard Caborn MP, Trade & Industry Select Committee. Conference Chairmen: Mr Ian Powe, Gas Consumers' Council and Professor Nigel Lucas, Imperial College.

Modernising Central Europe's Energy

Organised in association with the Parliamentary Group for Energy Studies

9 March 1994, London

The Church House Conference Centre, London SW1

The morning session will comprise keynote presentations covering financial and political aspects. The afternoon session will give in depth analyses of investment opportunities including the discussion of technology transfer, case studies on district heating, housing stock renovation, transmissions systems, restructuring and development of state industries and power generation.

2nd International Conference on

Ceramics in Energy Applications

20-21 April 1994, London

The conference will consider material solutions to new and existing applications of interest to energy suppliers and users. Important aspects of materials innovation in energy saving will be explored. New Developments & Applications; Energy Saving & Heat Transfer; Evaluation & Performance; Power Generation; Sensors & Catalysts; Energy Efficiency.

Events Co-Sponsored by The Institute of Energy

8 December 1993

Process Controls For Boilers & Furnaces

26 October 1993

The Monitoring & Management of Combustion Processes following the EPA 1990

General Enquiries should be directed to:
David Suthers, Combustion Engineering Association, PO Box 15, Farm Road, Aberaman, Aberdare, Mid Glamorgan CF44 6YZ. Tel: 0685 879119

Combined Cycle Power Generation

January 1994, Calcutta, India
First International Conference on
General Enquiries should be directed to:
Professor Prabir Basu, Technical University of Nova Scotia, PO Box 1000, Halifax, Nova Scotia, Canada B3J 2X4, Tel: 1-902-420 7531
Paper Co-ordinator for the submission of abstracts from European Countries:
Dr J R Howard, Tel: 44-21-705 1946

Hungary's energy situation

— potential for renewable technologies

by Jenniy Gregory MCIM ACIM

IT Power recently undertook a study on the energy situation in Hungary, and identified a number of potential applications for renewable energy technologies. Jenniy Gregory explains their findings in detail ...

AS THE countries of Eastern and Central Europe move towards western-style market-based economies, restructuring their energy sectors and controlling the intensity and efficiency with which industry uses energy have become paramount.

Energy consumption is higher in these countries than the majority of OECD countries. However, cheap fuel available through the COMECON trade agreement is no longer available. Importing expensive fossil fuels to power inefficient industries has imposed a spiral of increased debt burden on these emerging economies.

One measure being implemented to try and curb the high and inefficient use of energy is to decrease the intensity of industry, either through closure or by improving their energy efficiency. Another action being undertaken and supported by the World Bank is to reduce subsidies both to the industrial and domestic sectors. However, increased energy prices have sent shock waves through the economies, decreasing energy demand in the short term and resulting in the closure of many energy-intensive industries. At the same time, there have also been reductions in foreign trade (higher price of exports), and an overall short-term decrease in social wealth.

To minimise the medium to long-term implications of higher energy prices, all forms of generation need to be considered. This assessment should include all external costs, environmental concerns (such as air, ground and water pollution), and the sustainability of proposed power generating sources. In doing this, national governments of the region necessarily need to consider renewable energy technologies, such are now beginning to be utilised in Western Europe.

The countries of Eastern and Central Europe have the potential to utilise renewable energy technologies, the economics and viability of which are influenced by regional climatic and infrastructure variations. In Hungary a first-step study has been undertaken to ascertain the potential of renewable energy resources, and further analysis is planned.

A study for the European Commission, undertaken by IT Power of the UK, looked at the potential for solar energy technologies in Hungary. Research showed that Hungary has the potential to use solar energy to generate electricity, and to provide hot water for both domestic and industrial applications. Regionally, it has a wind resource which could be harnessed for electricity generation; there is a large potential for biomass technologies to provide energy from both agricultural and domestic (landfill) waste; and the existing geothermal resource couldbe more fully exploited.

This report also analysed the possibility of manufacturing renewable energy technologies locally, and concluded that there existed a wide range of local technical expertise, which would be complimented by technical exchange from Western European to Hungarian firms.

Energy consumption

Hungary is energy intensive by western standards, with consumption per capita in 1991 being comparable to the level of Japan — despite much lower GDP per head. However, the economic outputs of Hungary and Japan are widely divergent.

This energy inefficiency is a result of the development of heavy, energy-intensive industry, inefficient thermal building techniques and heating systems, inefficient power generation, and lack of price incentives to curb energy wastage. One of the contributory factors to this high energy requirement was brought about primarily by the supply of cheap and plentiful oil and gas from the former Soviet Union.

The government of Hungary has commenced a programme to increase energy efficiency. Measures include the removal of energy subsidies; implementing electricity charge rates which discourage consumption at peak times; closing energy-inefficient factories (notably those in the iron and steel industries); reducing the reliance of foreign imports; liberalising energy prices to reflect international values; and passing on increased energy costs to the consumer (previously these were absorbed by the state-owned electricity utility and not reflected in consumer energy costs).

In 1990 total electricity consumption was 39.5 TWh, up 4% from 38 TWh in 1985. Over the decade to 1990, consumption increased on average by 2.6% per annum, although consumption in 1990 was down 2.7% on 1989. It decreased further in 1991 to 37 TWh, and is expected to have fallen another 2 TWh in 1992. The trend towards decreasing consumption of electricity is expected to continue until 1993, when it is predicted to bottom out, then increase by 1-3% per annum.

In April 1993, MVM, the Hungarian Power Company, released details of its future power generating strategy to the year 2000. This predicts three possible rises in demand: the lowest scenario is a demand increase to 37 TWh/yr (roughly corresponding to 1991 levels); the middle scenario is for 40 TWh/yr (equivalent to 1990 demand); and the high scenario would see an increase in

The author

Jenniy Gregory works with IT Power (Eversley, UK) in marketing and project management. She has been involved with renewable energy technologies for many years, in Australia, France and Switzerland. She is currently undertaking a PhD at the University of Southampton, assessing the role of marketing on the installation of solar energy technologies.

high-performance electric motors. This programme enables companies to: reduce the power used and the amount of electricity consumed by electric motors; increase the total efficiency of motors; reduce the electricity bill for the whole life of a motor.

Lighting efficiency programme. This enables companies to reduce their electricity bill; maintain or improve the quality of their lighting; benefit from financial assistance from Hydro-Quebec to cover as much as 50% of the investment (not including labour costs).

SPVC: Programme providing electrical analysis of pumping, ventilation and compression systems and related initiatives. This enables industrial firms to benefit free of charge from studies evaluating the energy efficiency of pumping, ventilation and compression systems to a maximum of Can$20 000; benefit from financial assistance when they implement the energy-saving measures for which the investment recovery period is too long; and substantially reduce their consumption of electricity.

Assistance programme for the implementation of electrotechnologies — phase III. This programme, which focuses particularly on economic development as well as promoting energy efficiency, allows industrial firms to benefit from many specialised services. Hydro-Quebec expertise and technical and financial assistance can make them more competitive and improve the quality of their products. Financial assistance from Hydro-Quebec is also available for the implementation of the chosen electrotechnology, and loan guarantee with the lending institution.

Public lighting conversion programme. This enables municipalities to benefit from financial assistance to cover up to 75% of a technical and financial study conducted with the aim of converting their whole lighting system by installing sodium vapour lighting. They receive a financial contribution when they carry out the conversion.

Programme to improve the energy efficiency of industrial processes. This programme enables major industrial companies to benefit from various services, such as free evaluation of processes to determine whether they can be improved; financial assistance with draft design studies and financial contributions towards the modernising of processes.

Programme to improve energy efficiency in Hydro-Quebec buildings. This programme consists of various energy-saving measures in Hydro-Quebec's own buildings, resulting a reduction in electricity consumed of 88.4 GWh, or 34%. This is in spite of the fact that three quarters of these buildings were built according to high standards of energy efficiency.

Managing consumption

Turning now to the consumption management portion of the energy efficiency project, Hydro-Quebec's residential customers can take part in the new dual energy programme, which combines electricity as the principal heating source with another fuel used at peak times, so as to maximise the efficiency of each source. Customers in the CII market (commercial, institutional and industrial) can also take advantage of a commercial dual energy programme, allowing for the sharing of the electricity consumption of participating companies during peak periods or periods of shortage. In addition the interruptible power programme promotes peak period reduction of the electricity demand from the major industrial customers participating in the programme. In exchange for a special rate, some 40 energy-intensive firms have agreed to suspend certain activities for a given number of hours in order to reduce electricity demand, if necessary. Hydro-Quebec has acquired particular expertise in load management and, in this field, stands out even among the most forward looking North American electric utilities.

New time-of-use rates will soon be offered to residential and industrial customers.

Starting in 1993, Hydro-Quebec will offer its customers the possibility of participating in increasingly integrated approaches to energy efficiency. A total quality approach will characterise planning, operational rationalisation, and the setting up of programmes to achieve objectives at the lowest cost, while maximising customer satisfaction.

Each new programme will be of the generic type. This will allow for the programme application procedures to change according to market and energy conditions as revealed by the annual impact study.

Quebec enjoys a rather special energy situation. The province produces nearly all the energy its needs from its hydro-electric resources. The reliability, low cost, safety and environmental friendliness of hydro electricity make it one of the most appealing forms of renewable energy available today.

The advantages of hydro electricity and the quest for the greatest possible degree of energy self-reliance have led Quebecers to replace fossil fuels with electricity for many purposes. Today, electricity accounts for 40% of Quebec's energy use, a figure that has doubled in just twenty years, while the role of fossil fuels has diminished from 40% to 20% during the same period. This energy choice has resulted in dramatic reductions of greenhouse gas and acid-rain causing emissions. The export of Quebec power to neighbouring provinces and US states has helped reduce these emissions elsewhere too.

Hydro-Quebec has chosen energy efficiency as a resource that enables it to balance supply and demand in the long term. It relies on consumption management to deal with peak periods on its power system. In doing so, it is acting in accordance with sustainable development as recommended by the World Environment Commission.

The resulting economic spin offs for Quebec are substantial. The scale of the project, the importance of its objectives and the large number of interested parties mean that the energy efficiency project is a major one for the whole of Quebec society. In addition to generating and transmitting the electricity required by Quebecers at the lowest possible price, Hydro-Quebec's mandate is to contribute to the economic development of Quebec.

While Hydro-Quebec's energy conservation programme was originally conceived in line with its mandate from the Quebec Government, the expertise acquired has applications throughout the world. Hydro-Quebec is now actively engaged in marketing its skills and forming joint ventures worldwide through its subsidiaries, Nouveler Inc and Hydro-Quebec International. ❑

Table 4: Hydro-Quebec and customer energy conservation expenditures

Energy conservation initiatives	Expenditures 1991—2000 (1992 $ billion)
Hydro-Quebec expenditures	
support activities	0.45 (£0.23)
programmes	1.52 (£0.79)
Total, Hydro-Quebec	**1.97 (£1.02)**
Participating customer expenditures	1.01 (£0.53)
TOTAL	**2.98 (£1.55)**

Energy technology centre

EFFICIENT energy utilisation is only achieved when the way energy is used is carefully and precisely matched to the needs of the customer.

This is the prime aim of Midlands Electricity's energy technology centre. The centre, which has been recently refurbished and extended, now supports MEB customers in the domestic, commercial, environmental and industrial market sectors.

Midlands Electricity (MEB) has provided technical support for industrial customers for many years. This support extends from information services to demonstration and application development work.

The development facility, originally set up in the 1960s, is still unique among the regional electricity companies. Its current development stems from the decline of the Midlands steel industry in the 1970s, when the fall in electricity demand spurred MEB to actively promote electroheat throughout the engineering, ceramics and glass sectors.

In 1988 the energy technology centre extended its facilities to cover a wider spectrum of electroheat, investing in new equipment and facilities for drying, metal melting, finishing and coating and heat treatment.

The latest development, highlighted by the new name 'energy technology centre', now extends MEB's customer technical support facilities into space heating, air conditioning and building energy management. This has been achieved by the addition of new air conditioning plant, a variety of metering and domestic heating appliances, sophisticated computer-aided design facilities, building energy management systems (BEMS) and remote monitoring facilities. The remote monitoring is applied to the MEB's own building and selected development projects working in cooperation with a wide range of customers, including public services customers, such as the City of Birmingham.

At the same time the electroheat facilities have also been updated to include an extensive range of infrared heating systems, induction heating equipment, and new heat treating methods, including demonstration units for plasma technologies and fluidised bed heat treatment.

The energy technology centre's philosophy is essentially a practical one to help MEB customers apply electrical technology in an effective and efficient way.

Over the years, the staff at the centre have developed electroheat processes and associated plant to enhance existing technology and apply new technologies to MEB customer production processes. Since 1970 over 6000 customers have used the centre to help them apply proven techniques in innovative ways, to improve quality, cut costs, speed the production process and enhance working conditions. As a result, the centre has acquired an international reputation, especially in infrared and air knife technology.

Since their privatisation, the regional electricity companies (RECs), have diversified their business operations. Midland's Electricity have further developed their range of electroheat services to commercial and industrial customers with the extension and refurbishment of their energy technology centre.

The centre has also been heavily involved in collaborative development work with many academic institutions, including the Universities of Strathclyde, Birmingham, Aston, Staffordshire and Imperial College, London. There are ongoing programmes in association with Ceram Research, EA Technology and other industry-orientated research and development organisations.

Special air knife rig, designed for food drying, seen here drying carrots. The rig allows potential users to prove the technique before commissioning designs for full scale equipment.

The range of practical work carried out by the energy technology centre (ETC) extends from assessing paint covering systems to finishing textiles, metal melting methods or food processing.

One ETC project, carried out with Tomkinsons Carpets of Kidderminster, helped the customer achieve annual process savings of £41 500 for an investment of £70 000. In this instance the ETC identified dehumidification drying as a cost effective solution to Tomkinson's drying problems, and put them in contact with JCN Ltd. JCN then helped Tomkinsons design and build a 1.5 tonne capacity low temperature (50°C) double insulated drying chamber. The chamber design included four 16.5 kW dehumidifiers with forced ventilation at 7 m/second provided by twelve 450 mm fans with a combined rating of 3 kW and a total load for the installation of 69 kW.

The system allowed Tomkinsons to dry large batches of wool after dyeing using low cost electricity at night. Quality was radically improved, 're-dyes' and rejects were virtually eliminated, labour costs were reduced, and the working environment was much improved. The combined efficiency benefits produced annual process savings valued at £41 000. The system was so effective that Tomkinsons built an additional, identical chamber. The new system cut total annual direct energy costs by £8000 to give an annual energy saving on the drying process of 61%.

One of the centre's special areas of interest is the air knife. The ETC helped D'Or Produce of Dorstone, Herefordshire, to revolutionise potato preparation by introducing air knife technology. A 44 kW air knife system is used by D'Or to help prepare 15 000 tons of potatoes each year to meet the highest standards of Britain's supermarkets.

Another typical project was the introduction of an infrared tunnel oven, which cut KMF Precision Sheet Metal's cycle time for powder curing by 66%, improved quality and working conditions in their paint shop at Stoke on Trent.

Energy efficiency is a high priority in all application areas, and the ETC includes metering, control systems, engineering and computer-aided design facilities to help achieve energy efficient solutions. Comprehensive advice is also on offer, as well as assistance with customers' R&D and new product development programmes.

Environmental engineering

The energy technology centre has its own air conditioning and mechanical ventilation, incorporating the latest zone control and energy management. BEMS at the centre can carry out remote monitoring of MEB's own buildings.

The centre has the latest methods of home and office heating, humidity control, ventilation, hot water and hygiene services and other cost-effective ideas for comfort.

The environmental engineering section of the ETC is able to demonstrate many new, energy efficient concepts of electric heating, and heat pump and heat recovery technology. These include the MEB's new divisional offices at Stoke on Trent, which received an Office of the Year Award in 1992; the MEB headquarters building at Halesowen, and an innovative heat pump development project for the City of Birmingham.

Equipment at the centre allows customers to see how applications of insulation, controlled ventilation, interactive control and heat recovery systems can play an effective role in new building design.

Computer-aided design facilities can asses system performance to produce accurate predictions of capital and running costs for buildings and manufacturing processes. This enables customers to select the best design and applications so that they can achieve total energy efficiency.

The ETC's production engineering section covers pollution control and management, surface cleaning, preparation and coating, drying and induction heating. It can demonstrate a variety of clean-up technologies. These include venturi aeration, which treats effluent to reduce organic contamination and its biological oxygen demand; the Chemelec Cell which extracts heavy metals from process liquids; and the U/V ozone techniques which purify water without using chemicals.

The centre also demonstrates technologies designed to eliminate pollution at source, by using intrinsically clean material and technologies. Processes available include the application of ultrasonics technology, and the cleaning processes which enable water-based liquids instead of organic chemicals to be used for degreasing components, infrared systems for curing water-based paints, and U/V curing techniques, which avoid the use of solvents.

Surface preparation

A complete facility has been designed at the centre to prepare metal and plastic products for painting or coating. Complete finishing systems, including warm air, abrasive cleaning, spray painting, infrared curing and U/V curing, can be demonstrated and applied to a variety of products, extending from foods to ceramics and metal components.

Part of the high temperature process hall at MEB's energy technology centre, showing a fluidised bed furnace and a high temperature process furnace.

Equipment includes flatbed and tunnel ovens specially manufactured in a modular style so that they can be effectively applied to a variety of customers' samples in a production environment.

Demonstrations of the air knife, a technique pioneered by MEB, take place at the centre. There are also demonstrations of dehumidification drying, microwave and radio frequency drying and curing. Some of these cover drying techniques which have cut costs by a factor of ten, 20 or even more.

Many electrical techniques can be used for a variety of different applications, at different stages in the production process. The centre can use induction heating to cure coatings, heat treat or melt metals and heat liquids. A full range of working equipment can be used to demonstrate this inherently clean and precise method of process heating, ranging from small scale precision techniques to practical systems for large metal components.

MEB's centre can also advise customers on the choice of induction and resistance furnaces designed for production scale metal melting for iron, aluminium and specialised alloys. Full scale resistance melting furnaces are used to demonstrate the advantages of non-ferrous electric melting. Heat treatment facilities include advanced techniques such as a fluidised bed system and plasma nitriding, together with a variety of other furnaces to heat metal and ceramics to temperatures up to 1800°C.

Equipment at ETC uses state-of-the-art control technology in a wide range of different applications, to demonstrate the advantages of electroheat in maintaining product quality, reducing operational costs and achieving energy efficiency.

Accuracy of information is vital, and the ETC features all the latest methods of metering, from the basic domestic meter to sophisticated computer-based systems. The metering system can provide local or remote readout and data storage to meet large customers' needs for cost information throughout their businesses, so that they can achieve effective energy management.

A databank is maintained, covering all aspects of energy management. MEB technical staff can search national and international databases on behalf of customers for products, systems and technologies which may solve operational problems, improve energy efficiency or reduce costs. They can also provide information on the availability of grants and allied financial advice.

MEB's energy technology centre breaks new ground with its emphasis on commercial and domestic technical support, and the weight it gives to computer-aided design and building management. Over the years the company has concentrated on high levels of technical support to achieve both increased electricity sales and higher energy efficiency. This policy has produced real benefits for both the customer and the energy supplier, and will continue to do so into the next century. ❑