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THE UNIVERSITY FOR BUSINESS AND THE PROFESSIONS

Journal of the Institute of Energy

September 1999

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> EDITOR Steve Hodgson Tel/Fax: 01298 77601

ADMINISTRATION 0171-580 7124

MEMBERSHIP, AND JOURNAL SUBSCRIPTIONS Tel: 0171-580 0077 Fax: 0171-580 4420

> ART EDITOR Beatriz Cano

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THE INSTITUTE OF ENERGY

PATRON Her Majesty The Queen

PRESIDENT RED Coldwell BA FInstE FRSA

Hon Secretary Dr P J Mullinger, CEng, FInstE

Hon Treasurer J E Ingham, CEng, FInstE

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COVER

The National Standards for Managing Energy logo.

The Standards were launched in May 1997 by MCI, The Management Charter Initiative. They are occupational standards for those responsible for managing energy in organisations and form the basis of the S/NVQ in Managing Energy. The Standards are a useful tool to benchmark energy management activities for both individuals and organisations. See this month's feature on education & training - starting on page 8.



The Renewables Review - options for future support

Gaynor Hartnell, co-ordinator of the Confederation of Renewable Energy Associations

The long-awaited government review, examining "what would be necessary and practical to achieve 10% of UK electricity requirements from renewables by 2010", was finally published at the end of March. The Review, titled New and Renewable Energy, prospects for the 21st Century began two years ago, but publication had to be delayed until a series of wider reviews had been concluded. Results of other reviews meant that significant changes are required if the current means of supporting renewables (the Non Fossil Fuel Obligation - NFFO) process is to be retained. Consequently, the Review, instead of being a statement of policy has turned into yet another consultation document.

Viewpoint

The NFFO has supported renewable energy since the privatisation of the electricity supply industry in 1990. So far it has resulted in over 270 projects, totalling just over 670 megawatts of capacity and dominated by landfill gas, waste-to-energy and wind projects. The competition takes place within technology-specific bands. The NFFO has achieved impressive price reductions, but it has not resulted in the scale of deployment achieved by standard payment policies, such as those in Germany and Denmark.

The Review document has been broadly welcomed by the industry as well balanced and fair. Renewable trade associations have been pleased to note many of their arguments on the value of embedded generation and reinforcement benefits to the distribution network have been accepted. They welcome the concern expressed in the document that the revised electricity trading arrangements are likely to impact badly on smaller generators and particularly intermittent renewables such as wind power. This issue does indeed leave the renewables industry profoundly concerned.

The meat of the consultation document lies in Annex 6, which discusses various possible policy approaches. The document recognises that an obligation of some form is essential if the targets are to be met. The question is on whom should it be placed; electricity suppliers or distributors? And secondly, how should it be paid for; with a levy or without?

During the long gestation of the Review, some players within the renewables industry considered the merits of an obligation based entirely on tradable certificates. This would involve telling suppliers what percentage of their supply should come from renewables and leaving them free to decide how to meet their obligation, using 'green certificates' to prove compliance. However, while having the appearance of simplicity, such an obligation cannot easily be adapted to give it the flexibility of the NFFO, i.e. the ability to support a number of different technologies, spanning a range of generation costs.

Also, many are sceptical that this type of obligation would deliver the long-term contracts required to secure finance for renewables projects.

Supporters of tradable certificates recognise the need for longterm contracts and the need to bring forward the more expensive technologies. The Green Alliance has suggested an approach in which tradable certificates and a NFFO system run in parallel. Suppliers would be obliged to buy certain percentage of their electricity from renewable sources, some of which would have to come from NFFO contracts.

There is a strong consensus for a continuation of a competitive tendering procedure, similar to the NFFO, to be administered by an agency which organises the bidding process and contracts with generators. As with the NFFO, the amount of capacity contracted and the technology mix would remain a political decision. Where thinking differs is on whom the obligation should be placed, distributors or suppliers.

Proponents of an obligation on suppliers argue that, if the burden is shared equally between all suppliers, then a levy is not necessary. The cost could be passed on to customers in prices as part of normal business costs.

The alternative is an obligation on distributors, where an agency would have to sell the electricity to suppliers, who would then sell it on to customers. This could be achieved by auctioning the output, perhaps on a project by project basis similar to the way NFFO1 and 2 projects' output was auctioned just before their NFFO contracts expired. The auction was roughly three times over-subscribed, with many of the suppliers wanting this power to sell on the 'green' market.

Supporters of this proposal believe the approach would work for the vastly increased amount of new capacity needed to reach the 10% target. Others are sceptical that the green market, still in its infancy, could cope with such a large increase in supply. The fundamental difference between the two models is the extent to which they rely on the green market.

An obligation on suppliers could be completely independent of the green market, whereas the distributors' auction arrangement, whilst not entirely dependent on it, would be considerably helped by a buoyant green market.

The end of the review period is only the beginning of the process. The 240 responses received must be analysed, and decisions made. It is expected that whatever new support mechanism emerges will be incorporated into a new Utilities Regulation Bill due to feature in this autumn's Queen's Speech.

Finally, there is more to renewable energy than the generation of electricity. Many renewable technologies can deliver heat too, and some such as solar thermal are solely heat producing. The Review recognises the difficulty of addressing heat markets.

One thing is certain, however, no renewables policy will work in isolation. A range of other factors has to be addressed, most notably the planning regime, which has severely constrained the rate at which projects have come on line. The BWEA recommends that the Government should implement a programme of information dissemination so that the wider public begins to understand the need for sustainable development and renewable energy.

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High-voltage DC power link for China

ABB has won an order to supply two converter stations for a 3,000 MW high-voltage direct current (HVDC) power link to transmit electricity from the Three Gorges hydropower plant in central China to the coastal city of Shanghai and surrounding area. The order, valued at more than \$340 million, was awarded by the state-owned China Power Grid Development Co. The 850 km power link – China's largest – is scheduled to come into commercial operation in 2003. The Three Gorges link will more than triple the amount of power currently delivered from central China to the coast, from 1,200 MW to 4,200 MW. HVDC technology promotes more efficient use of energy resources by transmitting large power loads over long distances with low losses, says ABB. The new link will help meet the growing demand for power in fast developing Shanghai, China's leading industrial and commercial centre.

New extended reach drilling records

The Cuenca Austral

consortium, operated by TOTAL Austral, have set world records for total drilled length and horizontal departure in its Cullen Norte I well in Argentina. The total drilled length of the well, located in the Cuenca Marine Austral offshore permit area near Tierra del Fuego, is 11,184 m (7 miles). The horizontal departure is 10,585 m and true vertical depth of the well is 1,657 m. Baroid, a division of Halliburton Energy Services, was instrumental in helping to set the two new world records by assisting with the engineering, operation and maintenance of drilling fluids on the project. Prior to operation start-up, the Baroid team performed extensive testing of fluids at the request of the operator. The fluid used in the record well made use of Barofibre, a fibrous cellulosic material which successfully reduced the extreme torque encountered during drilling.

BNFL Engineering is celebrating the successful delivery and full acceptance of a glovebox suite for a prototype Plutonium Stabilisation and Packaging System (Pu SPS) at the Rocky Flats facility operated by the US Department of Energy. The glovebox suite was developed by BNFL for the Rocky Flats Environmental Technology Site in Denver and other US DoE sites in Hanford and Savannah River.

The Pu SPS will stabilise and package plutonium metals and oxide powders for long term storage for up to 50 years. Designed to interact with existing plutonium processing facilities, the unit will receive stabilised plutonium material and package it into high integrity multi-layer containment packages for storage.



New sulphur specifications for gasoline

Newiy proposed sulphur specifications for gasoline may provide a significant opportunity to implement Energy BioSystems' proprietary biodesulphurisation technology.

President Clinton has announced newly proposed federal standards for sulphur levels in gasoline that promise to allow automobiles to run 80% cleaner. The tough new specifications call for 30 parts per million sulphur in gasoline, down from the current average of 340 ppm. The US Environmental Protection Agency estimates that this reduction in gasoline sulphur would be equivalent to removing 166 million cars from the road, and would take 3 million tons of pollution out of the air. The plan would be phased in between 2004 and 2006, and about two dozen smaller refiners would be granted an additional two years to meet the standard.

Refiners argue that the cost may be too high to meet the new sulphur standards. The oil industry estimates that meeting the new sulphur targets using existing technology will require more than \$6 billion in new US refinery investment and add as much as 6 to 10 cents to a gallon of gasoline.

However, Energy BioSystems believes it has a feasible solution with potential benefits to both industry and the environment. The company is currently developing its biocatalytic technology to desulphurise gasoline at a

target cost of 1 to 2 cents per gallon of gasoline, with a requirement for capital investment that could be up to 50% less than would be required to implement existing technology. In addition to the cost advantages, biodesulphurisation technology offers the advantage of operating under milder conditions, while consuming less energy and emitting fewer greenhouse gases than existing technologies, says the company.



Iceland - a hydrogen-based economy for the future?

An Icelandic consortium, Vistorka hf (EcoEnergy Ltd) has signed a cooperation agreement with DaimlerChrysler, Norsk Hydro and the Royal Dutch/Shell Group setting up a joint venture to investigate the potential for eventually replacing the use of fossil fuels in Iceland with hydrogen and creating the world's first 'hydrogen economy'.

The joint venture, called the Icelandic Hydrogen and Fuel Cell Company Ltd, with an equity capital of \$1 million, will test various applications utilising hydrogen fuel cells or hydrogen carriers One of the first could be a hydrogen/fuel cell-powered bus service in Reykjavik. Established specifically to take part in the joint venture, EcoEnergy Ltd is owned by a group of Icelandic companies, led by the New Business Venture Fund. Each of the three other partners already has expertise in the field. DaimlerChrysler has been developing the fuel cell technology for automobile applications since 1991. Norsk Hydro has long experience in the production of hydrogen and hydrogen carriers. Shell has recently set up a hydrogen business and has developed technology which can convert liquid fuels into a hydrogen-rich gas. See Energy World September issue for a major feature on hydrogen

US religious coalition promotes green power

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Commonwealth Energy Corporation and the North American Coalition on Religion and Ecology (NACRE) have formed the 'Greensmart Renewable Energy Project' to promote the benefits of green power. NACRE is encouraging the more than 30,000 religious organisations and other non-profit organisations in California to demonstrate their environmental commitment by switching to electricity generated from renewable energy sources.

The involvement of religious organisations in the green power market already has a track record in California. In October 1998, the Episcopal Diocese of California adopted a resolution instructing all 87 Episcopalian churches in California to buy clean, renewable power. On Earth Day, California's Renewable Energy Marketing Board announced that a total of nine churches, all in the San Francisco Bay area, had signed up for green power.

 The New York Power Authority has installed a natural gas-powered fuel cell to provide 200 kW of electricity to New York's Central Park Police Station. The fuel cell technology installed in the park was developed in a government-industry research partnership program between the Department of Energy and United Technologies Corporation..





Levy proposals 'need major rethink'

Criticism of new Government proposals to introduce a new climate change levy from 2001 have continued to flow as organisations responded to the an initial consultation paper from HM Customs and Excise.

Energy users groups were particular critical. The Major Energy Users' Council lambasted plans to refund part of the levy to companies which achieve emissions targets, but via nine trade associations, as "legally dubious and unworkable". The Energy Intensive Users' Group called for a major rethink of the design of the task to ensure that it meets its objectives without damaging business: "the potential damage from a badly designed tax is too significant to be ignored".

Generators' club the Association of Electricity Producers called the proposals an "unconvincing" mechanism for reducing carbon emissions and said that the Government's intention that the levy should balance environmental objectives and simplicity as "hard to take seriously".

Energy consultant ILEX's analysis concluded that the flaws in the proposals are a result of the Government trying to protect producer and user groups regarded as having special interests. The Government should "pause for thought and not rush on to try to ameliorate the worst aspects of a flawed proposal by further fudges" it added, as "reductions in UK emissions since 1990 have given us the time to get a well-designed effective approach in place".

The fundamental problem, says ILEX, is the need to focus measures on actual carbon emissions and not on various proxies: "Basing all measures on a common carbon currency is vital if there is to be coordinated policy-making and a realistic chance of achieving the Government's environmental and other goals".

UK 'on course to meet greenhouse targets'

The UK is well on the way to meeting international commitments to reduce emissions of greenhouse gases, according to Government figures published in May. Emissions of the 'basket' of six greenhouse gases fell by 9% between 1990 and 1997, demonstrating good progress towards reaching the 12.5% UK target in 2008-2012 under the Kyoto Protocol. Commenting on the figures, Energy Minister John Battle said: "Today's analysis of carbon dioxide emissions and provisional estimates for 1998 show the UK is still well on course to meet targets for the year 2000 and beyond, due to improved efficiency in the way in which energy is used. Particularly in power stations and oil refineries where improvements in conversion efficiency have taken place.

Environment Minister Michael Meacher added: "I am delighted to see a further decline in emissions of other air pollutants as shown by the 1997 emissions figures. We will be publishing a revised National Air Quality Strategy at the end of the year. This will set out demanding 5-10 year objectives to further reduce concentration levels of pollutants."

However, the DETR also reported that greenhouse gas emissions rose by around 1% in 1998 due to the increased use of coal in electricity generation, replacing reduced imports from France and due to maintenance and repair of some UK CCGT stations.

OFGEM takes over with 'crystal clear aim'

The successor body to the Offices of Gas Supply (Ofgas) and Electricity Regulation (OFFER) is to be called OFGEM – the Office of Gas and Electricity Markets. The need for a new combined organisation follows convergence of the gas and electricity markets.

Its Director, Callum McCarthy said: "The successful introduction of competition has meant that the new organisation's job has shifted from the regulation of monopoly suppliers to a wider role of ensuring fair play in an increasingly competitive marketplace. Our new name reflects these changing responsibilities."

Energy Minister John Battle said: "The new name will come to represent a crystal clear aim - the Government proposes legislation to reform utility regulation, putting gas and electricity customers first." The British Short-Circuit **Testing Station this year** celebrates 70 years as a leading provider of testing services to the world's electricity supply industry. The Station was established in Hebburn in 1929, the same year that saw completion of the Tyne Bridge and four million people attending the North East Coast Exhibition. It offers manufacturers and electricity utilities a confidential and fully accredited certification and

testing service for a wide range of electrical products, including switchgear, transformers, cables and fuses.





Record oil and gas production in 1998

Record totals of 133 million tonnes of oil and 96 billion cubic metres (bcm) of gas were produced in 1998, according to the latest edition of the 'Brown Book', published in May. These figures were achieved after 1997 data showed very small or negative rises on 1996. A record number of 204 offshore fields were in production in March this year: 109 oil fields, 79 gas and 16 condensate.

Oil and gas production accounted for some 1.7% of the UK's Gross Value Added in 1998, with total income of some £17 billion. Government revenue from the sector was estimated at some £2.6 billion in 1998/99.

Other data reported includes:

- Investment in the sector rose to some £5.1 billion in 1998 (from £4.4 billion in 1997). Including investment in exploration and appraisal, this formed around 17% of total UK industrial investment, and just over 4% of gross fixed capital investment;
- Oil is estimated to have made a positive £3.0 billion contribution to the UK's balance of payments in 1998.

Brown Book estimates of possible remaining reserves of oil fell to 1800 million tonnes (from 2015 in last year's edition) and 1795 bcm of gas (from 1985 bcm).

DTI launches new programme for clean coal R&D support

The Government is to provide £12 million to kick-start a £60 million high-tech drive to develop cleaner coal technologies.

Launching an Energy Paper on cleaner coal, Energy Minister John Battle said: "We are allocating £12 million over the next three years towards a research and development drive on cleaner coal technologies. We expect this 'seedcorn' money to generate some £60 million over the next three years, for joint industry and university projects also supported by the Government's science budget and EU funds. This in turn will contribute to kick-starting the five year R&D programme proposed by the industry-led Foresight Task Force. However, the White Paper added that the DTI would not be supporting a demonstration programme for the moment, though this decision will be reviewed in a few years' time.

The DTI's new programme follows a major review of future requirements of the UK undertaken as part of the Foresight exercise, which identified the ability of cleaner coal technology to make a significant contribution to UK wealth creation and export opportunities if sufficient R&D was undertaken.

Coal use worldwide is expected to grow significantly over the next ten years in countries such as China and India, and is forecast to have doubled by 2020.

New on-the-day-market for gas trading

New gas trading arrangements to be introduced from October will more realistically reflect the costs of balancing supply and demand in the national gas pipeline system, according to Ofgas (now part of OFGEM – see page 5).

A key feature of the opening phase of the new regime will be a screen-based on-the-day commodity market which will replace the present flexibility mechanism – the arrangements used under the Network Code by Transco, the pipeline operator, to balance the system. It will also support shipper-to-shipper within-day trading.

The new proposals also include changes to the way shippers buy entry capacity to the

high-pressure national transmission system. Unlike the existing arrangements where shippers can buy as much capacity as they want, entry capacity sold by Transco will be limited to that which is actually available.

One of the principles underlying the reforms is more accurate cost targeting. Shippers will have stronger incentives to balance their portfolios through reductions in balancing tolerances, and there will be specific incentive schemes for Transco to make more efficient balancing decision. These new incentives should reduce the overall costs of balancing the system, says Ofgas.

ALSTOM has received the 1999 Queen's Award for Technological Achievement, for the development of 3-dimensional steam turbine blades which are amongst the most advanced in the world. Designed using modern test facilities and computational fluid dynamics, supported by model turbine testing in the laboratories, the blades are manufactured at ALSTOM's factory in Rugby using computer numerically-controlled

machines which directly interface with the CAD models produced by the designer.

The blades provides exceptional efficiencies for both new and retrofit high pressure and intermediate pressure steam turbine cylinders. They have already been successfully installed in existing nuclear power plants, increasing output and reducing fuel consumption. In three UK plants they have directly boosted the efficiency of the high pressure units by 9% and increased the output of each turbine by 22 MW.



Straw fuels major new power station, tyres power cement works

Construction work on Britain's first straw-fired power station is underway at Ely in Cambridgeshire. Being developed by Energy Power Resources Limited (EPR), the 36MW biomass fuelled power project will be the world's largest.

The £60 million power station will consume around 200 thousand tonnes of straw per year and generate sufficient electricity to supply around 85,000 homes. The electricity will be sold under a Non-Fossil Fuel Obligation (NFFO) contract from commencement of operations until. Straw is being procured through long-term contracts with local farmers.

EPR built a 10 MW poultry-litter fired station

in Fife, Scotland last year and says it has a further 300 MW of projects under development.

Meanwhile, Castle Cement is in the process of installing the first custom-built tyre feeding machine in the UK at its Ketton works in Rutland, where it will provide fuel for one of the kilns. The company also intends to develop tyre feeding equipment to fuel the new kiln planned for Padeswood works near Mold, north Wales.

Tyres have been burnt for energy since 1997 at Castle and the new system will provide an automatic and reliable means of feeding whole tyres into a kiln with only a minimal need for operator intervention.

'Vital to keep the nuclear option open'

The option to develop new nuclear generating capacity must be left open, according to a new report from the Royal Society and the Royal Academy of Engineering, as "we cannot be confident that the combination of efficiency, conservation and renewables will be enough to meet the needs of environmental protection while providing a secure supply of electricity"

The 27% of UK electricity currently generated by nuclear means will dwindle rapidly over the next 20 years as older nuclear stations are required, says the report. The authors believe that the provision of new nuclear plant should be re-examined as part of a long-term energy policy.

The two organisations add their weight to criticisms of the proposed climate change levy,

which would tax renewable and nucleargenerated power in the same way as it taxes carbon-producing power from fossil fuels. The tax should be based, the report says, on the quantity of carbon emitted.

The report also calls for the formation of an international agency to support nuclear R&D, to be funded by contributions from individual countries.

Friends of the Earth dismissed the report as "absurd", adding that only a massive carbon tax could make new nuclear power stations "anything like cost-effective". It suggests that a programme of renewables, CHP, energy efficiency and traffic reduction could meet the Government's target of a 20% cut in carbon dioxide emissions by 2010.

PowerGen sells two power stations

PowerGen has agreed to the disposal of Fiddler's Ferry and Ferrybridge C power stations to Edison Mission Energy for a total consideration of £1,302 million made up of £637 million for Fiddler's Ferry, £614 million for Ferrybridge C and coal stocks of £51 million. Each station has a capacity of 2000 MVV.

The deal follows undertakings given to the DTI by PowerGen, when it acquired East Midlands Electricity, to help increase competition in generation. Disposal will consist of 199-year leases with the consideration being paid in cash on completion, subject to possible adjustment once the Environment Agency's Integrated Pollution Control authorisations for the plant have been finalised.

PowerGen will supply coal to the stations for a four-year period on terms consistent with the company's overall coal commitments. PowerGen will also provide Mission with a six-month 'contract for differences' in respect of part of the capacity of the plant.



Eastern Groups' first windpower project has started generating green electricity to local homes for the first time. The single 1 MW turbine at Slievenahanaghan in County Antrim, Northern Ireland, is generating enough power to supply 800 customers.

The turbine has been connected to Northern Ireland Electricity's 33,000V network and the electricity is being sold to the local power supplier under the government's Non-Fossil Fuel **Obligation**. Eastern has invested £630,000 in the project which is a first step towards its commitment to renewable energy accounting for 10% of generating capacity by 2010. The British-designed turbine - which stands 45 m high and has a 52 m diameter rotor - has been supplied by Renewable Energy Systems Ltd of St Albans and was built by Peter Brotherhood Ltd of Peterborough. It is being operated on Eastern's behalf by County Antrim-based company, B9 Energy (0&M) Ltd.

Industrial change and the national education



by Dick Coldwell, President, Institute of Energy

n industrial terms it is clear that global competitive forces will continue and sharpen and that the pressure in mature or advanced economies, like the UK, will increasingly be to move into high value added activities. This implies that more and more people will have to be qualified in a wider range of subjects, skills and competences and that the level of qualifications will, on average, have to rise. This has already been reflected in the numbers at universities in the UK, which some 5% of 18 year olds attended in the early 1960s and where over 30% now move into higher education. The Prime Minister is reported to be talking of this figure increasing to 50% early in the next century.

In such a world there should be many opportunities for an Institute like this one. There should be more professionals as a percentage of the population and more who will be looking for support in developing their professionalism. It is worth looking a little more closely at some of the changes which are likely to affect us.

THE ENERGY INDUSTRIES AND THE INSTITUTIONS

One of most significant groupings of companies for the Institute is the energy supply companies. As many readers will be aware, these have changed beyond all recognition over the last dozen years or For the Institute of Energy, or any learned Institution, to flourish it needs to have a very clear idea of the Industrial, economic and political context in which it is working. A considerable amount of time has been spent on analysing these issues in developing the Institute's Business Plan. However it is worth reminding ourselves of the key forces at work - for it is these that will shape the Institute and which will determine both the threats and opportunities it faces.

so. Having been dominated by large, centrally-controlled state monopolies in gas, coal and electricity they have now been transformed into a wide range of private companies operating within competitive markets. Their past, which was dominated by supply side issues and technological imperatives, has now been replaced by a future where a whole series of new features have come to the fore. Private financial regimes, risk assessment, shareholder value, customer service, market analysis and a host of other business concepts loom considerably larger than before and sit alongside the technological strengths of the past.

For the Institute of Energy this presents both opportunities and threats. Perhaps the most significant threat is the reduction of employees that has been the concomitant of these changes. In addition, those employees that are still with the immediate successors of the original companies are under increasing time and cost pressures. These sometimes combine to reduce the support once given to Institute activities.

Alternatively, the changes can provide a range of benefits. There are now new companies entering the market which are often looking to establish liaisons with the Institutions. In addition, all the companies in this new competitive environment are aware that their future is very much influenced by the quality of their people and by the level of their education and training, which they are aware needs constant updating.

This new concept of the learning company is now a familiar part of modern management theory. For example, the company I was with over its first eight years, National Grid, has been very active in reorienting and retraining its workforce since the first days of its operations in 1990. Its HQ is located right next to the Science Park of the University of Warwick and there are rooms reserved at the University for the company's use. It is an active supporter of the National Campaign for Learning and it has large numbers of its workforce engaged in both formal company training and in individually supported education activities. National Grid is also an active Group Affiliate member of the Institute of Energy.

For many modern and blue chip companies such activities are part of the new 'contract' with their staffs. There is no longer a job for life but companies will undertake to assist their employees in upgrading their education and skills so they are continually employable. In fact even with the increasing churn in the employment market and greater numbers switching companies, such training has been shown to help companies retain their staffs.

Other changes within energy companies which the Institute has been alert to for some time - and from which it has benefited - has been the increasing development of the demand side of the market place (with increasing membership from the ranks of the energy managers) and the increasing convergence of single fuel industries into a range of energy service providers. With the Institute's concentration on the whole energy scene, and not just part of it, and with our recent focus on energy and environment linkages, we are now well set to benefit further. But if the Institute is to really take advantage of this radically different environment, it will have to continue to develop and build on recent changes. The future will be for the innovative, the fleet of foot and those determined to be players in a new game.

THE NEW LEARNING AGENDA

As the Prime Minister has indicated on numerous occasions, the three agendas of this Government are education, education

debate - the challenge for the institutions

and education. I am involved in a number of national and local initiatives across further and higher education and can testify that the Government is committed to enhancing learning opportunities, safeguarding standards and promoting a new culture of learning across our communities and the whole economy. It is a vital part of the business and social agendas. Again, there

are many opportunities for the Institutions in this. First, however, it is worth being aware of the scale of the changes that are taking place.

In Higher Education a new 'compact' is sometimes referred to which is seen as including life-long learning, the creation of a learning society, regional economic regeneration and development, pure research and scholarship across and within disciplines, technological innovation, social cohesion and public accountability. The scale and breadth of this is enormous and is a considerable challenge to all those engaged in, or associated with, higher education. To realise life-long learning, the widening of participation (to include larger numbers from social classes D and E, who are considerably under-represented in higher education) and to increase the numbers involved in first degree studies, will require the involvement of a large number of players - universities, colleges, training providers and learned institutions.

In addition to this are the challenges of the new world of information technology. This impacts on further and higher education in many ways. In just one respect however, it offers the ability of leaders in their field to market their courses globally through the information highways. This is already being done, especially in the US. Many now argue that UK universities will have to operate in groupings or alliances in order to be large enough to compete with the rich elite universities of the US.

The institutions are, to an extent, recreating themselves for activity in this fast changing world. Pressures to restructure and simplify the whole gualifications framework in the UK are mounting and the professional institutions are playing an important part in this debate. The institutions are, of course, well set to be lead players in the life-long learning debate, a set of activities they have long been involved in. As a general point, however, this Institute and other learned institutions will need to ensure they can change sufficiently quickly to keep pace with the revolution that is taking place in the learning environment.

The Institute of Energy is already facing this challenge through a number of its activities to support life long learning. From the provision of diverse education opportunities through to the approval of certain company schemes, the Institute provides access to learning for anyone entering or employed in the energy field.

Qualifications for energy managers

Over 500 organisations recently took part in an Energy Efficiency Best Practice Programme study into the changing role of energy management in the UK. Although more than one third of participants said that reducing the environmental impact of their activities was a major driver in their organisations, the survey found that only 2% of industrial, 25% of commercial and 22% of public sector organisations had an individual with full time responsibility for energy management.

The National Standards for Managing Energy were launched in February 1996 to provide energy personnel and their organisations with a national benchmark for their endeavours in energy management. Although energy management is often, as the survey found, not a full-time job, standards for the role substantiate its viability in any organisation.

The Institute of Energy was involved in the piloting of the standards using its members to field-test their suitability. Copies of the standards can be found in a product designed by the Institute to develop the energy professional, the *CPD Manual in Managing Energy* – funded by the DETR.

The Manual contains a profession self-audit for those responsible for managing energy to review their role against. The Manual is useful, therefore, for the individual within an organisation who has responsibility for energy, but it is also a good general reference source for the organisation. The standards contained within it are written for the effective management of energy; there is no technical wizardry to grasp, rather they aim to define the scope of the management of energy and can therefore be used to establish policy and to re-write job descriptions among other uses.

Although the CPD Manual in Managing Energy stands alone for these purposes, it is also the candidate pack for the Scottish and National Vocational Qualification in Managing Energy. The Institute was the first national delivery centre for this award and continues to support its members by delivering this award from the headquarters in Devonshire Street.

The Energy Efficiency Best Practice Programme survey found that the majority of energy managers working in large energy-using companies had an average of five years' experience. The S/NVQ now provides candidates with this level of experience Associate Membership (AMInstE) of The Institute of Energy.

If you feel you would make a good candidate for the S/NVQ or if you would like to obtain a copy of the standards in the CPD Manual in Managing Energy for £49, contact Beatriz Cano at the Institute on tel: 0171 580 7124, fax: 0171 580 4420, e-mail: info@ioe.org.uk

The formation of engineers: education and professional development

by Dr Judith A Secker, Deputy Director - Engineers' Regulation, Engineering Council

A key role of the Engineering Council, as the regulatory body for the engineering profession, is the maintenance and development of high standards. And top of the agenda is the introduction, during 1999, of a radical reform of standards for the education and professional development of engineers'.

Standards have been raised in recognition of changed industrial and commercial circumstances, the most important being the globalisation of markets for goods and services, which underline the need for internationally recognised qualifications.

Employers told the recent Dearing committee of inquiry into higher education that while they needed pure scientists and highly qualified engineers, they particularly, but unsuccessfully, sought engineers with a broader education with 'applied skills and people management abilities' who could apply established technologies to provide business solutions. They were describing Incorporated Engineers, one of the two groups of Professional Engineers registered with the Engineering Council.

The second group is Chartered Engineers who are concerned primarily with innovation, creativity and change. They promote advanced designs and design methods; introduce new and more efficient production techniques and construction concepts; pioneer new engineering services and management methods.

Despite campaigns to alter the balance, Chartered Engineers are still four times as numerous on the National Register as Incorporated Engineers – the professional qualification the Council wishes to encourage in order to satisfy industry's requirements.

The main changes to raise standards and encourage more Incorporated Engineers, are:

- For Chartered Engineers, four years' academic study instead of three as the educational base.
 The requirement can be met by either a four-year accredited
 MEng degree or, equally, by a threeyear accredited BEng(Hons) degree
 plus one year of additional learning
 a "Matching Section".
- For Incorporated Engineers, three years' academic study instead of two as the educational base. The requirement can be met by a three-year accredited 'IEng' degree. Alternatively, the two-year HND and a one year 'Matching Section' will satisfy.
- For Engineering Technician candidates, no significant changes are proposed, other than recognition of the GNVQ(adv) and NVQ3 qualifications, reflecting the earlier 16-19 Qualifications Framework
- The inclusion of entry qualification criteria as part of the accreditation requirements for MEng and BEng(Hons) courses, in order to ensure a cohort of sufficient intellectual capability. For MEng, the exemplifying requirement is 24 UCAS points and for BEng(Hons) 18 points, in each case for 80% of the intake. Similarly, the entry requirement for degrees leading to Incorporated Engineer is 10 points, again, for 80% of the cohort.
 The Matching Section required by BEng (Hons) graduates or those with

an HND must include the learning equivalent to one further academic year of study. The main aim is broadening and deepening to achieve equivalence with the longer courses, both in foundation learning and specialist technical enhancement. There will also be a requirement for a multi-disciplinary Group Project. There are a number of ways of achieving the Matching Section, such as full or part-time post-graduate courses, distance tuition and workbased learning, often in conjunction with the local college or university.

The requirements for higher standards in the educational base are complemented by improvements in the second stage of formation, Initial Professional Development (IPD). IPD comprises the acquisition and development of the skills and specialist knowledge and competence needed to practise in a specific area of engineering.

The competence achieved through IPD is demonstrated and assessed in a more rigorous Professional Review process, the final step before registration. The assessment will be based on evidence of professional competence, set against agreed criteria.

At the Professional Review, the candidate will be expected to demonstrate commitment to Continuing Professional Development (CPD), to the Code and Rules of Conduct for registered engineers and to the relevant Codes of Practice.

SARTOR (Standards and Routes to Registration), Engineering Council 1997.

Two Types of Professional Engineer



Different but Equally Valuable

All Professional Engineers must:

make a personal commitment to live by the appropriate code of professional conduct, recognising obligations to society, the profession and the environment

- utilise effective communication skills oral, written and electronic
- undertake Continuing Professional Development

Chartered Engineer

KNOWLEDGE / UNDERSTANDING LED But needs appropriate know-how

Top class innovative engineering technical and managerial leadership

Mathematical modelling - understanding of theory & IT

System orientation (e.g. synthesis of options for design and continuous improvement)

Pure and Applied Research and Development

Designing beyond limits of current practice

Cultivating medium and long-term perspective

Team and resource management - prospective promotion to middle / top management

Incorporated Engineer

KNOW-HOW LED But needs appropriate knowledge / understanding

> Top class applications engineering -Independent judgement within field

Application of appropriate maths, science , IT

Detailed implementation of today's knowledge (e.g. design, manufacture, marketing of products), Comprehensive quality assurance of products and services

Developing cost-effective systems and safe procedures

Cultivating short and medium-term perspective

Team and resource management - possible promotion to middle / top management

Overlap in Mobility and Employment

The detailed requirements for CEng and IEng are contained in The Engineering Council's policy statement Standards and Routes to Registration (SARTOR)

The Institute of Energy- your membership questions answered

Q What type of person becomes a member of the Institute of Energy?

A. The Institute's membership comprises energy professionals from all walks of life, including: students, academics, accountants, economists, energy managers, engineers, lawyers, parliamentary advisors and technologists.

Q. What grades of membership are available!

A. The Institute offers a range of grades to accommodate anyone working or interested in the diverse field of energy: Student, Graduate, Associate, Associate Member, Member and Fellow. Applicants working within the engineering discipline are, also, able to obtain registration with the Engineering Council at either Incorporated or Chartered Engineer level. Companies involved in aspects of energy production, distribution, use, management or conservation are able to become Group Affiliate members of the Institute.

Q. What are the requirements for each of the grades?

A. The requirements are separated into three categories: educational base, training, responsible experience. Student – for those engaged in a relevant energy-related academic course of study equivalent to HNC/D level or above. Minimum age: 18.

Graduate - for those who have completed the academic qualifications specified above and will, in due course, progress to membership at Associate Member or Member level. Minimum age: 21.

Associate - persons who, whilst their academic attainments do not meet the above criteria, have an active interest in the field of energy and wish to participate in the Institute's activities. Minimum age: 21.

Associate Member - a person who has achieved the Institute of Energy's NVQ Level 4 in Energy Management or an equivalent academic level in an energyrelated subject, who has had not less than five years' relevant training and responsible experience. Minimum age: 23.Applicants seeking registration at Incorporated Engineer level will require an engineering academic qualification to at least HNC/D level.

Member - a person with an Honours Degree qualification or equivalent from an energy-related course acceptable to the Institute of Energy and who has had not less than four years' relevant training and responsible experience. Minimum age: 25. Applicants seeking registration at Chartered Engineer level will require an acceptable BEng(Hons) degree or equivalent.

Fellow a person with an Honours Degree qualification or equivalent from an energy-related course acceptable to the Institute of Energy and who has had not less than five years' professional experience and superior responsibility in a senior capacity. Minimum age: 33.

Q. What if I don't have the right academic qualifications?

A. Persons who have academic qualifications which have not been accredited or approved by the Institute or the Engineering Council can have the syllabus content examined on an individual case basis. Persons who do not possess acceptable academic qualifications for the grades of Associate Member or Member, who are aged 35 years and above, may apply for membership via the Mature Candidate Route.

If further information is required, please contact the Membership and Education Department at The Institute of Energy. tel: 0171 580 0077, fax: 0171 580 4420 or Email: membership@ioe.org.uk.

Earth Centre demonstrates

You're interested in alternative energy and have been to both the Centre for Alternative Technology in mid-Wales and your nearest wind farm. You may have seen the visitor centre at First Hydro's pumped storage scheme, also in Wales. You're also interested in wider sustainable development issues and looking for somewhere new, exciting and informative to take the family in the summer holidays. The new Earth Centre may be just the place, as Steve Hodgson found out.

"In a world with holes in the ozone layer and of persistent poverty, our mission at Earth Centre is to promote understanding of sustainable development and to help people become involved in the process of achieving it in their own lives. Not only does the first phase offer people a lot of fun and an exciting day out, it is a different experience for visitors; they can take away a sound knowledge and practical ideas on how they can live a more sustainable life".

Opened this Easter after nine years of planning, phase 1 of the Earth Centre is the newest and perhaps the most impressive demonstration site yet in Britain for sustainable development. Those who have visited Britain's original and pioneering alternative technology centre in Wales, the Centre for Alternative Technology, will recognise the new Earth Centre as a relative, but much more of the 1990s, and more generously funded.

Phases 2 (to open in April next year) and 3 (in 2002) will add considerably more to the site and begin, under the Bridges project, to export the philosophy of the Centre off-site and into the local community. Phase 3 will also see the opening of perhaps the best-known element of the Centre – the futuristic Ark building.

But Phase I is well worth a visit in itself this summer, before the Centre closes again in November to commission Phase 2 projects. The most striking visual aspect (for me) is the landscaping and planting. You walk around what was until very recently barren spoil tips from the two former collieries, Denaby Main and Cadeby, from which the 400 acre site was developed. One of the collieries was still operating as late as 1986.

LANDSCAPING AND PLANTING

Extensive landscaping has transformed the contours of the site and intensive new planting has created a series of incipient gardens. Rather than import mature trees to plant along the paths (although a few larger specimens have been brought in), bare wigwams of tall forest thinnings poles have been erected to give some height, each planted with a series of climbing plants and a central tree sapling. New trees will emerge as the thinnings decay.

Elsewhere, willow poles have been stuck into the ground and shaped into sculptural forms – these are now beginning sprout and the forms will thicken and fillout as time goes on. Some fencing and screening is literally alive – again sticks of willow now sending out shoots to complete the effect.

I was lucky to spend a sunny morning in May at the site and saw this new landscape to best effect, so far as the plants have grown. Its development over the next few seasons is going to be fascinating to watch.

THE BUILDINGS

The two main indoor exhibitions are Planet Earth Experience – a large, dramatic space with impressive lighting effects tripped by the passage of visitors around the interior - is supposed to demonstrate how we are destroying the planet. This gives way to a second room flooded with natural light, which contains an exhibition of some of the ways forward. The Centre has taken criticism for failing to explain what's going on fully, but the exhibits are dramatic enough without explanation and improved interpretation is apparently be addressed in Phase 2. The main exhibition building is a concrete structure with high thermal mass, partly earth sheltered. A heliostat on the roof tracks the sun and projects this into the interior at suitable times.

The building is heated and cooled by air flowing through a unique labrynth of underground passages. According to consultants Atelier 10, the labrynth is flooded with cool night-time air, which cools the mass of underground material. This stored 'coolth' is then used to cool mechanically-vented intake air to the galleries. Atelier projects total energy use of just half the value for CIBSE-defined 'good' buildings. Three gas condensing boilers are used for preheating in winter.

Across a square which will eventually be covered by photovoltaic canopy is the eat.organic@earthcentre cafe. Again a concrete and glass structure, the building includes an underfloor heating system and huge flat-panel solar water heaters on the roof.

Many more attractions (weird bikes to borrow, a 'reverse pond dipping' facility, several imaginative playgrounds, etc) make the Earth Centre particularly attractive to children and school parties.

WATER AND ENERGY

Another major feature is the Water Works building – a 'living, biological sewage treatment machine'. Waterless urinals and vacuum toilets from the entire site discharge into underground anaerobic digestion tanks. These discharge an odourless product into Water Works, which house a series of deep tanks planted with exotic plant species, the roots of which hold the microbes necessary to finish the job off. Waste water from the tanks flows through a series of beautifully-planted boggy areas to a lagoon.

Together with water saving devices, the system should allow the Centre to use around 20% of the amount of water used by a similar establishment.

The energy content and maintenance requirements of materials used for buildings and landscaping has also been

sustainability in Yorkshire



Aerial Overview of the newly - planted site

carefully considered, says Brian Hodgkinson of the M+E consultant to the project, Farley McGrath. Thus paths are made of gravel instead of tarmac, much use is made of limestone mined just off the site, and buildings and structures use lots of low maintenance concrete, galvanised steel and wood.

Perhaps surprisingly, the Earth Centre has very little in the way of renewable energy generation capacity on-site. However, this is partly explained by the deliberately modest size of the site's energy use. Site energy specialist Rob Clark explained that the approach had been to ask "do we need to use energy here?" first and then install green technology only where the answer is yes.

The Centre does have a series of PV-

powered lamp-posts, incorporating underground batteries and compact fluorescent lamps, but event these are limited in number by the deliberate avoidance of lighting only those areas which don't need to be illuminated. One wind-powered lamp post completes the collection, and the site also incorporates a demonstration PV panel.

More generation is planned for Phase 2; a giant wind turbine and what will be Europe's largest the PV installation. The Centre successfully applied for a NFFO 4 contract for the output from a 250 kW wind turbine, but now plans a much larger device – perhaps 1.5 MW in size – which would power the whole site and export electricity off-site. Planning permission has been applied for.

With average wind speeds in South Yorkshire rather smaller than those in western hills, the turbine willbe an important demonstration of low-speed technology.

The proposed solar canopy, to incorporate BP Solarex cells and Pilkington panels, will have an output of 107 kWp and may be used to charge electricity vehicles used around the site. Like much of the planned technology, the canopy will eventually demonstrate to visitors how solar cells work. PV-powered water fountains is one idea, with visitors able to see the effects of passing clouds on the height of the water jets.

Biomass energy may make an appearance in a later phase. One of the gas condensing boilers may be converted to wood if the small short rotation willow coppice facility is successful. A larger coppice plot has also been planted to supply fuel to the Arbre wood-fired power station currently being built in Yorkshire.

Proposals to export power and wood fuel off the site are part of a move to increase the impact of the Centre on its environment. The Centre lies in one of Europe's worst unemployment areas and winning the support of local people has been a priority. Rob Clark says he is talking to various energy companies about establishing a local energy services company to use renewables and/or a district energy scheme to serve the wider community. Such a project could, says Clark: "export the values and philosophy of the Centre to the local community" and be a major force for regeneration a blighted area.

The Earth Centre is near Conisbrough in South Yorkshire, and very accessible by train. Tel: 01709 513933, e-mail: info@earthcentre.org.uk

The Earth Centre – background to birth

The Earth Centre was founded as a concept in 1990 in response to growth in environmental awareness and, specifically, the call from the World Commission on Environment and Development (1987) for 'vast campaigns of education, debate and public participation'. The 400-acre site, on two disused coal mines in South Yorkshire, was selected in 1991, following an extensive search.

Earth Centre became a national Millennium Landmark project in 1995 when it was offered a grant of \pm 50 million by the Millennium Commission.

Regeneration of the site has meant

more than just the restoration of damaged land. It will also deliver employment opportunities and economic advantage. The local economy, crippled by the collapse of the coal and associated industries, can once again see new jobs – and good work – in a diversifying economic environment. This is the driving force and keystone philosophy of sustainable development.

The first phase Earth Centre is itself a full-scale exhibition of integrated sustainable development – as will be the future phases. It is a community of exhibitions and installations, all carefully designed and operated to create elegant and optimal use of the natural resources within its system. It also strives continually to improve its practice in sustainability and publicise not only the performance of the project and systems, but also the process of refinement that is taking place – often as a result of visitor and user interaction and opinions.

Earth Centre aims to show how the emerging technologies, products and services of sustainable industries and businesses can be the engines of economic renewal. It aims to stimulate a global consciousness amongst its visitors and encourage people to think and act at a local level.

A community-based energy centre for the west country

A rather different scenario has unfalded at Stroud's Energy 21 Project in Gloucestershire. Graham Bond relates how, despite its flagship project failing to win sufficient financial support to be built, the community-based organisation has switched tack.

The organisation has its roots in Stroud, which has a very long history of using renewable energy. Situated at the centre of five valleys with the River Frome powering its mills, Stroud was the centre of the wool trade for the Cotswolds. Of the 100 or so mills still standing, only two are now extracting energy from the river.

The history of Energy 21 began in 1994 when, with the support of the Gloucestershire County Council, The Rendezvous Society - a local educational charity - launched the Vision 21 project, a Local Agenda 21 initiative to enable Gloucestershire to move towards sustainable development. While many Local Agenda 21 processes are entirely local authority run, Vision 21 became renowned for being a community-led county-wide network composed of a broad crosssection of individuals, businesses, local government and other organisations.

Discussions between Vision 21 Working Groups led to the concept of a renewable energy park, a centre which would provide a working example of sustainable development in action. Around that time an old water-powered mill which had remained unsold for several years was discovered and sparked off the basis of an idea for promoting sustainable development. As well as providing education, information and conference facilities the park concept would provide a practical demonstration in real time of the generation of useful amounts of green clean energy. A public meeting, arranged to discuss the renewable energy park idea, led to the foundation of Energy 21 Trust (formerly Ebley Meadows Trust) in 1996 to establish the Renewable Energy Park. The Renewable Energy Park project was

adopted as a Flagship Local Agenda 21 Project for Gloucestershire by Vision 21.

Energy 21 Trust has a board of six directors. Its work is managed and carried out by the Executive Working Group supported by team of eleven advisors. Membership support totals around 200 individuals (127 of whom are local); and 19 corporate.

Energy 21 conducted a pilot design study for a Renewable Energy Park based at Ebley Corn Mill - the old water-powered mill, the site which had sown seeds of the original idea to project founders. The scheme, which won the support of the Stroud District Council, included architectural outline designs for building conversion, extensive landscaping and natural habitat provision, outline specifications for generating plant. The scheme was to have around 3 MW grid-linked capacity provided mainly by biomass plant.

The scheme won the support of around 70 individuals, organisations and politicians. Unfortunately the Millennium Commission, despite two attempts by Energy 21 to gain funding, did not share the same scope for vision and failed to grasp the national significance of the promotion of renewable energy. On both occasions Energy 21's Renewable Energy Park met all the required criteria but was rejected at the second hurdle as "not being as distinctive as others".

The organisation then put into motion a scheme to raise capital by launching a share issue. By the time this was underway and within 12 months of being launched, the owner announced he was not prepared to renew an option to buy. This announcement was shortly followed by the sale of the mill.

Not to be discouraged, Energy 21 has swung into action by opening an office in Stroud aided by the DTI's Environmental Action Fund and grants from the Summerfield Trust and is pursuing its mission in advance of establishing the Park. Beginning with the successful Renewable Energy Fair and Conference in Stroud during August of last year, Energy 21 has

by Graham Bond, Marketing Manager, Energy 21

organised Time and Tide - a conference which addressed sustainable energy and water issues and has just held its 1999 Renewable Energy Fair.

Meanwhile the Renewable Energy Park is not being left to die - far from it! A site selection working group has identified some 23 potential sites for the Park. These are currently being investigated and schemes for raising capital planned. One idea coming from the site selection process is a plan for several separate sites - electricity generation plant, exhibits and conference/education centre - linked by a canal under restoration and possibly featuring integrated solar powered water-based transport in the longer term.

One of these sites holds great promise and may form the first foundation stone of a linear park. The Ebley Meadows Scheme is a project which has aroused great interest from the Stroud District Council and The Renewable Energy Company. The basis of the scheme is a 50 kW small hydropower plant located close to the Stroud District Councils HQ at Ebley Mill, coupled with plans for a 24 acre community recreational and natural habitat area in Ebley Meadows.

Renewable Energy often bears the brunt of opposition and disinterest through misinformation and lack of understanding of technologies and the issues at stake. By operating from the 'grass roots' level Energy 21 believes it is in a prime position to disseminate information and knowledge to all sectors of the community both in the local area and to the whole of Gloucestershire and beyond. Perhaps organisations like Energy 21 hold the key to the acceptance and advancement of

the technologies which will be required to provide the energy we need for the next millennium.

Contact Energy 21 at tel: 01453 752277, fax: 01453 752244, e-mail: info@energy21.org.uk

PFBC - high efficiency clean coal technology

by Lynne Anderson, Market Communications Manager, ABB STAL Utility Power Plants, Sweden

ABB's pressurised fluidised bed combined cycle power station technology is one of the 'clean coal' technologies now demonstrating its commercial viability. Here, ABB STAL's Lynne Anderson describes the technology and its operational experience around the world.

Since the first orders in 1986, ABB has built PFBC plants for both demonstration purposes and commercial application, with wide geographical distribution and varying local environments, both urban and rural. Plants are designed to use a variety of fuels, frequently local, and therefore have detailed design differences depending on the conditions for the individual plant. During 1999, two new plants will come on line, in Cottbus, Germany, designed to use local brown coal; and in Karita, Japan, the world's first utility size PFBC plant. Table 1 shows the location and output of ABB's PFBC plants.

Location	Output (MWe)	
Tidd, USA	70	
Vartan, Sweden	133 plus 224 MW of heat	
Escatron, Spain	75	
Cottbus, Germany	65 plus 90 MW heat	
Karita, Japan	350	
Wakamatsu, Japan	70	

Table I ABB's PFBC plants around the world

ABB'S PFBC CONCEPT

PFBC (pressurised fluidised bed combinedcycle) is a coal-fired combined cycle, where electric power is produced not only in a steam turbine but also in a gas turbine, through which the combustion gases are expanded. This results in a higher thermal efficiency than can be achieved in a conventional steam plant. The gas turbine produces about 20% and the steam turbine 80% of the total electrical output respectively, with the fluidised bed combustor operating at an elevated pressure of 12-18 bar.

Two standard module sizes are available, the 70-100 MWe P200 module and the 350-430 MWe P800. Each module size has its corresponding gas turbine, or 'PFBC-machine' (see Table 2). Larger plants can be built by combining two or more of these modules. The fluidised bed combustor with boiler, the gas turbine with intercooler and economisers, and the fuel preparation and internal ash systems, are collectively referred to as the PFBC Island.

Coal and sorbent (limestone or dolomite) are stored in silos. The sorbent, used to capture the sulphur from the coal, is supplied to the site at the right particle size distribution. The coal is fed from the silos by controlled dischargers to a crusher, where it is crushed to the required particle size. The crushed coal is mixed with sorbent and the coal-sorbent fuel is pneumatically conveyed into the combustor.

The combustion air enters the process via the gas turbine low pressure compressor. It is then cooled in the intercooler in order to keep the temperature, after the high pressure compressor, down to 300°C. The air leaves the high pressure compressor via a concentric pipe ending at the pressure vessel.

Air is forced through the cyclone ash cooler inside the pressure vessel and is fed via ducts into the bed bottom and spread evenly over the bed bottom area via a number of nozzles.

Combustion occurs in a fluidised bed, so called because the action is reminiscent of a boiling liquid. This is characterised by a low gas velocity of around 1 m/s. The bed material consists of coal ash and partially spent sorbent with a mean particle size of 1mm and a maximum of 5 mm. Sulphur oxides produced during the combustion process are captured by the sorbent particles in the bed, obviating the need for secondary deSOx equipment.

After combustion, the exhaust gas with ash dust in suspension leaves the bed vessel via the freeboard and is then cleaned in a multi-stream two-stage cyclone arrangement. The dust is separated out of the gas flow in the cyclones and the cleaned gas passes through the inner concentric pipe to the gas turbine, which drives the generator and air compressor. The gas turbine exhaust gas

Designation	P200	P800
Nominal thermal input	~200	~800
Net power (MWe)	85-100	360-425
Net efficiency (%):LHV	42.5	45
HHV	4.025	43

Table 2 PFBC standard modules

passes to the economiser, and is cooled to a temperature to about 140-150°C. Remaining dust is caught in the baghouse filter before the flue gas is exhausted through the stack.

There are two separate sources of ash: fly ash, which is separated in the cyclones and the baghouse, and bed ash which is withdrawn via a lockhopper system through the bed bottom, to maintain the required bed height.

Feedwater preheated in the economiser enters the combustor and is further heated as it passes through the walls of the boiler enclosure. It then passes through the in-bed tube bundle, including the evaporator and the superheaters, and then to the steam turbine. The steam cycle can be of any conventional type - reheat, non-reheat, pure condensing, combined heat and power, back pressure, process steam extraction etc.

ABB's EXPERIENCE WITH PFBC

Feedback from experience and continued modifications have combined to solve the initial process and hardware difficulties and today PFBC plants are offered with full commercial guarantees as regards output, efficiency, environmental performance and availability. Experience from four plants is outlined below.

Vartan, Stockholm, Sweden

The Vartan PFBC plant represents a prime case of site repowering. The plant, which is owned by Stockholm Energi, and operated by a specially formed company jointly owned by Stockholm Energi and ABB Carbon, is located near the centre of the city of Stockholm and provides the Swedish capital with electricity and district heat.

The two PFBC units have a capacity of 135 MWe and more than 225 MW heat, which is supplied to the district heating grid. Because it is a CHP plant, with no provision for operation in a condensing mode, the PFBC plant typically operates from October till early May, the period when district heating is needed. Its operational profile over the heating season depends on the needs for heat and also on the price of electricity.

The Vartan PFBC plant burns low-sulphur imported coal. It is a new plant with two P200 modules, each with a GT35P machine, and one common, new steam turbine. The plant is equipped with systems for selective non-catalytic and selective catalytic NOx reduction, high efficiency bag filters, fuel and sulphur sorbent storage, handling and preparation facilities, and auxiliary equipment. The fuel fed to the fluidised bed boilers is a coal-sorbent-water paste, with a typical water content below 25%.

By the end of 1998, the total number of operating hours for the two P200 units at Vartan was approximately 50,000. Environmentally, the Vartan PFBC plant shows an outstanding performance, setting standards by which other types of Swedish plants are now judged.

Escatron, Spain

ENDESA's Escatron PFBC plant is a repowered plant using an old steam turbine, and based on one P200 module. It was built by ABB Carbon and Babcock & Wilcox Española, together with ENDESA, to demonstrate the possibility of utilising local Spanish 'black lignite', which typically averages about 6.8% sulphur, 36% ash and 20% moisture, with increased thermal efficiency and greatly reduced emissions of SO₂, NO₂ and particulates. Since Escatron was a demonstration plant, it was built without component redundancies.

Limestone is used as sulphur sorbent. Coal and limestone are mixed and then pneumatically fed into the fluidised bed, with the help of lock-hopper systems, rotary feeders and an air injection system. By the end of 1998, a total of around 33,000 hours of operation on coal had been achieved at Escatron, more than in any other individual unit.

The high amount of ash caused some problems with the preparation and feeding of the fuel-sorbent mixture, sinter formation in the fluidised bed due to locally enhanced temperatures, blockage in the cyclone ash extraction systems, and some gas turbine related problems. The problems were not, however, PFBC-specific, and subsequent modifications have substantially increased plant availability.

The environmental performance of the Escatron PFBC plant has met all expectations. In the summer of 1996, ENDESA installed a hotgas filter of Babcock & Wilcox Española's design at Escatron to replace one of the PFBC plant's nine parallel cyclone stages. This hotgas filter testing project is partly sponsored by the European Commission's Thermie programme.

Karita, Kyushu, Johan

The Karita PFBC plant, which replaces an old, conventional, coal-fired power plant, will be the first 360 MWe size PFBC plant (one P800 module), ever built. The plant will be located at the Kyushu Electric Power Company's Karita site, and will supply electric power to the Kyushu grid on a commercial basis. In accordance with the customer's wishes, the system solutions, with upscaling, have been based as far as possible on the Wakamatsu plant. Entirely new, however, is the 70 MW gas turbine, the GT 140 P-machine, designed, manufactured, tested and delivered by ABB Stal in Sweden.

The PFBC plant is supplied by ABB Carbon through its licensees in Japan, IHI and ABB KK. The delivery consists of the PFBC machine and its auxiliary systems, the fluidised bed in a pressure vessel, fuel and ash systems and the control system. The boiler is designed for supercritical, 241 bar, reheat 593°C steam conditions. A wide range of coal qualities, from lignite to anthracite, will be used, and the fuel and sulphur sorbent will be fed as paste.

The plant was incorporated into the basic plan of the nation's power development through the Electric Power Development Council in July 1994. The plant is now in the commissioning phase, and first coal fire was ceremonially celebrated in May.

Cottbus, Germany

The Cottbus PFBC plant will, when it goes on line later this year, supply the city of Cottbus with most of its needs for electricity, district heating steam and, together with the Janschwalde plant, also district heating water. The PFBC plant will be fired with so-called fluid bed brown coal from the local Lausitz region. It replaces an existing, highly polluting, conventional power plant. The project, which receives some support from the state of Brandenburg and also from the European Commission's Thermie programme, will thus result in a major improvement to the local environment. It also represents the extension of PFBC technology to utilisation of brown coal, with greatly increased plant efficiency and thus reduced coal usage per kWh produced.

The PFBC Island in the Cottbus plant is very close to the new standard P200, but contains some innovations which may become symptomatic of future plants. The plant is based on an ABB P200 PFBC module, combined with oil- or gas-fired peak load boilers. In the Cottbus PFBC plant, a system for freeboard firing, improving part load performance of the plant, will be included in a commercial plant for the first time. In addition to this, the fuel systems have been modified in order to adapt to the characteristics of the fuel. The fuel systems are essentially a simplified version of the systems in the Escatron plant, but with redundancy for maximum reliability.

TOWARDS HIGHER EFFICIENCIES

The motivators which have guided development and led to technical modifications and innovations are changing customer concerns, which are no longer merely increased production, but also the economics of production, leading to demands for higher efficiency and lower emissions, and greater flexibility in use of fuel.

The ability to burn a very wide range of fuels is a key issue in making a project econom-ically viable. In order to utilise the potential of the very wide fuel range of PFBC plants, ABB has invested in a small (IMW thermal input) process test facility, built in Sweden to provide a way to make rapid, cost effective, tests of new combinations of fuels under realistic conditions. The test facility was commissioned in February 1995 and, after a verification programme, has been used to test a variety of coals ranging from anthracites to brown coal, and a number of other fossil fuels, such as petroleum coke and oil shale. Co-firing with biomass and with sewage sludge has also been tested. Results have shown that all fuels can be used.

TECHNICAL INNOVATIONS

The most important recent technical developments, which have an economic impact in that they improve the efficiency and the environmental performance, of the plant, are the introduction of freeboard firing and the development of the 0-stage cyclone.

Freeboard firing

A system for over-bed, or freeboard firing, will be fully applied in Cottbus for the first time in an operating plant. In order to keep the flue gas temperature constant over the load range, a small quantity of light oil is injected into the freeboard at part load. The combustion of this extra fuel increases the temperature of the flue gases and thus the inlet temperature to the expander section of the gas turbine. This leads to an improvement in the plant's part load efficiency. Extremely significant is that it also keeps the conditions for nonselective NOx reduction with ammonia close to those at full load. Additional environmental benefits of freeboard firing have been demonstrated in tests carried out in the PTF, and also in the Vartan plant, and are expected also to be a feature of operation in the Cottbus plant.

Fly ash recirculation

ABB Carbon initiated its first recirculation or '0-stage cyclone' project in 1994, the term 'zero-stage' indicating simply that the cyclone is located before the existing primary and secondary cyclone trains. The aim of the programme was to develop a system to improve the process performance of PFBC as regards improved sorbent utilisation (lower Ca/S ratio) and improved combustion efficiency of low reactivity fuels (petcoke, anthracite, LVB coals).

Since August 1998 a fly ash recirculation system has been operating successfully in the Wakamatsu PFBC plant in Japan. The operating data indicates that the combination of PFBC's deep bubbling bed and fly ash recirculation results in extremely high sorbent utilisation and combustion efficiency as well as lower SOx emissions. In addition fly ash recirculation has resulted in significantly higher in-bed heat transfer.

CONCLUSIONS

Ten years since the start of commercial operation have proved all the initial promise of the PFBC technology. Development continues to enhance technical performance and commercial competitiveness. Standardisation has contributed considerably to reduction in capital costs. Operational costs have also decreased as fuel flexibility has widened and the use of limestone sorbent been reduced. Environmental values have continued to be excellent, even at part load. With this technological solidity and commercial potential, ABB's PFBC products will continue to develop in order to meet the need for clean and efficient power generation from a whole range of solid fuels at a competitive price.

Contact Lynne Anderson at lynne.anderson@se.abb.com

ABB STAL is also involved in a more conventional coal-fired project in Australia, albeit one which is designed to burn coal washery tailings. The company is supplying a steam turbine similar to that shown to the Redbank project under construction some 200 km north of Sidney. The station will use lowemission combustion technology to burn the tailings, the waste product from alocal mine. The 148 MW turbine generator will be used in condensing mode and will drive the 2-pole generator directly.

Due to be commissioned in 2001, the plant will be operated by independent power producer Redbank Project Pty Ltd, set up by ABB, Babcock & Brown and National Power Australia. Power will be sold to local distributor Energy Australia.



Ratifying Kyoto - is the developed world ready

It is not easy to measure the practical progress made towards cutting greenhouse gas emissions since the Kyoto conference was held in December 1997. Much more visible have been the international wrangling over the details of implementation of the Kyoto Protocol. The Institute of Energy's James Harrison reports back from two recent conferences.

he Government has undertaken to reduce the country's emissions of greenhouse gases by 12.5%, in line with the Kyoto commitments, and also has the more ambitious aim of a 20% reduction in carbon dioxide by 2010. As the Institute has commented to the recent consultation paper. the reductions required under the Kyoto agreement are reasonably accessible, although it will become progressively more difficult to reduced emissions further to meet the 20% target. We also pointed out that we agreed with the Government that there is considerable scope for improving the energy component of all sectors of the economy, but much remains to be done to increase enthusiasm in business and at home for these improvements. In this respect we welcomed the conference organised by the Environment Council to consider the Government's challenge to the business community to reduce its emissions of these gases.

As the Chairman of the meeting, Uly Ma, pointed out, the problem is ensuring that emissions are reduced, but at the same time respecting the rights of individuals to carry on their lives in ways which they wish. How do we clean up the atmosphere without interfering with the right to travel, the right to work where we wish and do the things we want to do? What is the effect of environmental legislation on business competitiveness? Does compliance mean job losses or increased activity? The meeting addressed these issues on a personal level and concentrated very much on practical actions which individuals and small businesses have taken and which others could take.

SIZE OF THE PROBLEM

To begin we must know the size of the problem. Emily Hay emphasised the

importance of measurement, with practical guidance on how to use business statistics such as estimates of transport mileages and fuel and energy use, and convert them into their equivalents in terms of greenhouse gases. Wessex Water discussed their experience with such methodology and showed how it had helped to identify their major sources of emissions and hence their first targets for improvement. They emphasised the point that effort should be directed first to the emissions that were largest and most easily dealt with.

Practical advice on improving the environmental impacts of office practice came in the form of audience participation in a competitive game. Various options had to be ranked in terms of their environmental and cost implications. This was a simple but effective way of putting over the message that most in most offices there was much scope for improving energy use and for reducing the wasteful use of materials.

On the shop floor there are similar, proportionally greater, energy savings to be made. Tony Ellingford and Paul O'Hearn demonstrated how their initiative, as Trade Union members, had brought about major improvements in energy efficiency in their own firm, Perkins Engines. They were now helping workers in other industries, in the UK and abroad, to achieve similar results. Although they personally can be credited with this crusading initiative, they freely acknowledged the help which the Institute of Energy had given and was continuing to give them.

The Institute's view that there is plenty of scope for energy savings at all scales of activity was put into perspective by the presentation from John Curren when discussing the problem from the point of view of a major generator of electricity. Eastern's emissions are presently some 23 million tonnes a year of carbon dioxide. Their estimates of the costs associated with different options include energy efficiency at £4-8/tonne of carbon, compared with £11/t for CCGT/CHP and £20/t for renewables.

About 30% of greenhouse emissions can be attributed to transport but it is not surprising that this is recognised as a difficult issue at all levels of private and public activity. One obvious measure is the improvement of public transport. Improvements in the use of public transport are already being brought about by various schemes, including that of Nottingham County Council. Jeremy Prince gave an account of the benefits brought about by an initiative to encourage the reduced use of personal cars and the various possibilities for greener commuting were outlined by Tom Rye.

The overall message of the conference was the importance of individual action. From the Institute's point of view, the current concerns to reduce emissions and the more general concerns about the environment are welcome reinforcements of the continued drive to improve energy efficiency that has long been one of the objectives of the Institute and of our members.

FLEXIBLE GLOBAL SOLUTIONS

Indeed, energy efficiency and the improvement of the environment will continue to be important even if the Kyoto Protocol fails to achieve the ratification by the required number of countries to enter into force. This question was the central concern of the conference organised by the Royal Institute of International Affairs in London on June 14-15.

In order that countries accepted, in principle, to reduce their emissions of Greenhouse Gases, it was necessary to introduce considerable flexibility into the Protocol in the way in which reductions could be assessed. Three mechanisms in the Protocol enable industrialised countries to meet their obligations through bilateral trading among themselves and through investment anywhere in the world through the provision of the 'clean development mechanism'(CDM).

The CDM allows for investment in developing countries to help them to achieve sustainable development whilst allowing investing countries and private companies to be credited with emission reductions against their Kyoto obligations. The flexibilities of the Protocol are unprecedented in an international agreement and represent a considerable movement in opinion in both industrialised and developing countries. The Protocol

to act on climate change?

represents an extension of economic globalisation to environmental policy: to establish a global emissions market to counter the global environmental problems.

However, the flexibility of the Protocol, whilst leading to its acceptance by the negotiating countries, especially the USA, did not resolve problems of interpretation of the provisions or of their implementation. Major issues still need to be resolved. For example the collapse of the Russian economy has resulted in considerable reductions in greenhouse gas emissions in Russia itself and in the Ukraine. How far can countries such as the USA 'buy' these emission reductions to help to achieve their own Kyoto commitments? This is the so-called 'hot air' issue.

If the countries of the EU object to the USA solving its problems this way, how dothey justify the internal trading within the EU which arguably (by the USA) traded the hot air generated by the restructuring of the East German industry and by the dash for gas in the UK against increased emissions in countries such as Spain?

STEPS TO RATIFICATION

It is hoped that the problems of the Kyoto Protocol will be resolved in time for it to be formally accepted by the International Conference of the Parties to the Climate Convention at their sixth meeting. This will take place either towards the end of next year, or in 2001. Progress is being made at a series of meetings of subsidiary committees of the Convention. The latest took place in Bonn, ending on June I th. Michael Zammit Cutajar, of the Convention Secretariat, reported progress to the RIIA Conference.

His assessment was that some progress was being made on some technical issues, such as guidelines in emission inventories and in the development of accounting methods, and there was a recognition that some imperfections would have to accepted. But there were many problems still remaining with the way in which the different mechanisms were linked; with the hot air issue, with the terms of the Clean Development Mechanism and with the overall issue of compliance and enforcement. There were also developmental problems with the relation between the CDM and the already existing General Environment Fund and with mechanisms for dealing with the consequences of adverse effects of climate change. He acknowledged that there were 'torpedoes' that may prevent the ratification of the Protocol.

Some of the problems in ratification, especially those related to the costs of emission reduction, were emphasised by Frank Loy of the USA Government, but he resisted suggestions that the Protocol was already dead. His real concerns, however, were echoed by Canada for which the Kyoto target represents a reduction of 20-25% compared with business as usual projections. In Canada there was a growing appreciation of the problem of climate change, but health care and jobs were still more important. Canada could ratify the Protocol only if the problems of the CDM, emissions trading and equity were satisfactorily resolved.

Concerns about the possibilities of the new mechanisms being used by the industrialised nations to avoid their obligations were expressed by some speakers. The Indian Environment Minister was concerned that the basic objectives of the Climate Convention were being forgotten. Real action needed to be demonstrated by industrialised countries to reduce their emissions before expecting developing countries to take on further commitments under the Convention. Other speakers discussed the circular nature of the present debates where Country A would not act before Country B acted and Country B wants to see action by Country C but Country C is waiting for Country A before acting themselves.

However, in spite of the continuing debate, many countries are already taking action. In Germany there is a commitment to reduce emissions by 25% by 2005. This was being achieved from a combination of policies including the progressive reduction of subsidy, by fiscal reform, by improvement of housing and traffic, by stimulating renewables and new markets for services, and by demand side management. Politically it was seen to be necessary to combine climate benefits with other benefits e.g. jobs, exports, budget reductions, air quality

by James Harrison

improvements. This point of linkage of climate objectives with other objectives was made by other speakers. It is, of course, a 'no regrets' policy as advocated for many years by many observers. Not least by contributors to Energy World.

Michael Meacher, outlined the position of the UK Government. We were now in a crucial stage of the negotiations if implementation was to be possible at the Sixth Conference of the Parties. Developed countries had to take the lead and had to demonstrate action at home. There should therefore be a ceiling on hot air trading. However, he acknowledged the importance of the flexible mechanisms and the role of the CDM in promoting sustainable development. Kyoto was important as a means of paving the way for the much greater reductions that would be needed in future. Meanwhile the UK Government was taking the problem very seriously; Mr Meacher outlined the UK policy actions already in place and the considerations being given to further action.

AN ECONOMIC PROBLEM

It is clear that there are still major problems to be solved before all countries are comfortable with the Kyoto Protocol and the mechanisms for trade, investment and emission offsets which it will provide. These problems may not be solved in time for effective action to be taken to achieve the objectives of the Protocol, nevertheless many countries are taking action to reduce their emissions of greenhouse gases. In many cases these actions are those of 'no regret' in that they are improving energy efficiency and air quality and creating jobs - and are to be welcomed whether or not the Protocol is itself put into force.

Many would argue that, in view of the many uncertainties of the climate debate itself and of the national and international concern for the future of the environment, it is prudent to consider options for further action. However, as someone suggested at the conference, since the issues are predominately economic, there may be merit in re-siting the problem in Ministries of Trade and Industry, rather than in Ministries of the Environment!

etters

Clean fuel vehicles are no solution

Sir

I refer to the article 'Clean fuel vehicles are here to stay' in the April issue, in which the author says that "engines using traditional fuels are now reaching their peak in development". I disagree strongly with this conclusion.

VW have already produced a car (Lupo) which does 100 km on 3 litres of diesel and I am certain that a four-seater car can be developed which will do this distance on 2 litres. This improvement of the efficiency would divide the CO_2 emission compared with current vehicles by a factor of 2 or 3. This would automatically reduce the other pollutants for the same combustion efficiency.

I do not see the electric car as the car of the future because:

- · lead storage batteries are very heavy,
- they have to be replaced every 3-4 years,
- · lead compounds are poisonous,
- if an electric car runs out of charge you have to be towed away,
- recharging is much slower than re-filling a tank, and
- making the electricity also produces CO₂

The use of natural gas requires heavy storage cylinders and, at best, only halves the CO_2 . Fuel cells either run on pure H_2 which is very inconvenient to carry, or on methanol which requires a heavy reformer.

Dr Janota was working in my Department at Queen Mary College (now QMW) about 25 years ago on a parallel hybrid car. I am now convinced that this is not the best way to go as it requires heavy batteries and an electric motor so it probably does not save as much fuel as a vehicle and engine intentionally designed for maximum efficiency.

MW Thring Past President

Climate change - far from proven

Sir

We are all involved financially in the present commitment by the Government, and the previous one, to effect a big reduction in carbon dioxide emissions. I will not burden you with any long dissertation appropriate by a scientist with a life time's experience of pollution in industry, and a qualification in chemistry and geology.

However, if the following undisputed facts do not convince you that I am right in taking an opposing view, please tell me the flaws in the facts.

- I. About the turn of the century there was great concern that industrial and domestic emissions of this poisonous gas would increase in London to the detriment of the health of the population. Over a period of 30 years, Professor Clowes, a well-known chemist even in my youth, showed no average increase in concentration.
- 2. The reason for this is that carbon dioxide is soluble in water forming carbon acid. We have a large rainfall, rivers and oceans to remove this gas.
- 3. That in rain (pH 4.5) acidifies our soil and promotes root growth, it is essential for plant life. That in the sea is taken up by microscopic life and ends up as coral reefs and fossil limestone. That left in the air is converted to green growth of plants liberating oxygen, the source of all animal life.
- 4. The combustion of coal, oil and gas is considered to be, as at the beginning of this century, a reason for an increase in carbon dioxide and now global warming. What are other sources of carbon dioxide? All living creatures from the insect to the elephant breathe out more carbon dioxide than they take in. It is said there are a million insects for every man on earth.
- 5. The mis-named 'greenhouse gas' (carbon dioxide) is known to increase the growth of many plants. The corollary is ignored and if it was all used up life on earth would cease. What then is the concentration in our atmosphere?
- 6. Any engineering text book reports 0.036% or thereabouts. This is much less than the rare gas argon. Over the past ten years, ever since the fiasco at Rio, there have been many claims of an established increase. I have seen no printed figures. I have asked Sir Robert May, the Government Chief Scientist for analyses in remote parts of the earth. None have been produced.
- It is difficult to imagine that an essential gas for life on earth is measured in parts per million should constitute a menace to the globe.
- 8. The vast quantities of fossil limestone formed in our geological past proved the existence of vast amounts of lime in the sea and carbon dioxide in the air. The present production of coral reefs (limestone) is apparently now at a low level.
- 9. There are many claims that past volcanoes have provided vast amounts of carbon dioxide. There is again no proof. Carbonates do not form any part of the volcanic magma below the earth's surface.
- 10.We do need to know more about any changes in our environment. This requires a strictly scientific control system on a world-wide scale. On a more cheerful note: global change needs geological time. Even our recent ice age had little effect south of the Mediterranean. What caused the long period of warm weather at the time of the Norman conquest? Perhaps a few more parts per million of carbon dioxide would produce more growth of plants and therefore, feed more people.
- II.Because the formation of limestone takes carbon out of the air permanently and cannot be used as fuel, should we consider the possibility that the concentration may be in decline? Our original atmosphere, like that of sterile Mars consisted of carbon dioxide, nitrogen and argon. Now, carbon dioxide is a rare constituent.

Neville Potter Past President



August 99

Power supply infrastructure for alternative fuel vehicles Conference, 18-19 August, London, £995 + VAT Details from Access Conferences International, tel: 0171 840 2700, fax: 0171 840 2701

September 99

Wind power comes of age Conference, 1-3 September, Cambridge Details from the British Wind Energy Association, fax: 0171 402 7107, e-mail: bwea@gn.apc.org

Offshore Europe 99

Exhibition and conference, 7-10 September, Aberdeen Details from the Offshore Europe Partnership, tel: 0181 949 9222, fax: 0181 949 8193, e-mail: 0e99@spearhead.co.uk

Compressors and their systems

Conference, 13-15 September, London Details from the IMechE, tel: 0171 973 1316,

fax: 0171 222 9881, e-mail: e_mycock@imeche.org.uk

Fuel poverty review NEA conference, 13-15 September, York Details from Trish Bell at NEA, tel: 0191 261 5677, fax: 0191 261 6496

Metering, billing and data management

Conference, 14-15 Sept, Berlin Details from IIR Ltd, tel: 0171 915 5055, fax: 0171 915 5056, e-mail:registration@ iir-conferences.com

Fuel cells – the competitive option for sustainable energy supply Sixth Grove fuel cell symposium, 13-16 September, London Details from Phillipa Orme at conference secretariat, tel and fax: 01235 868811. e-mail: p.orme@dial.pipex.com

From exploration to generation

Conference on coal and FGD, 16-18 September, Nottingham, £200. Details from the Minerals Engineering Society, tel and fax: 01283 215577

Energy efficiency in motor driven systems Conference, 20-22 September,

London. Details from Sadie Primmer at ETSU, tel: 01235 433525, fax: 01235 433737, e-mail: sadie.primmer@aeat.co.uk

Boilerhouse management

Course, 21-22 September, Nottingham, £350 + VAT Details from NIFES Consulting Group, tel: 0115 984 4944, fax: 0115 984 4933, e-mail: nottingham@nifes.co.uk

Lines, cables and pipes – LCP 99

Conference and exhibition, 21-23 September, Chorley, Lancashire. Details from MEB International, tel: 0121 522 5011, fax: 0121 522 6192

Electricity trading and risk management

Course, 21-24 September, Buckinghamshire, £2175 + VAT Details from Euromoney Energy Events, tel: 0171 779 8330, fax: 0171 779 8946, e-mail: lhussey@euromoneyplc.com

Energies 99

Exhibition of energy efficiency and renewables, 21-24 September, Paris Details from Pollutec, tel: +33 | 47 56 21 | 5, fax: +33 | 47 56 21 | 0

Pollutec 99

Exhibition of environmental technology, 21-24 September, Paris. Details from Pollutec, tel: +33 | 47 56 21 | 5, fax: +33 | 47 56 21 | 0

Distributech Europe

Conference and exhibition, 28-30 September, Madrid Details from Pennewell, fax: 01708 343 541

An introduction to offshore engineering

Course, 29-30 September, London, £750 + VAT Details from Bentham Technical Training, tel: 0171 436 7500, fax:0171 436 2112

October 99

Fundamentals of oil and gas processing

Course, 5-6 October, London, £850 + VAT. Details from Bentham Technical Training, tel: 0171 436 7500, fax:0171 436 2112

Understanding heat treatment

Course, 5-7 October, Birmingham. Details from the Wolfson Heat Treatment Centre, tel: 0121 359 3611, fax: 0121 359 8910, e-mail: whtc@aston.ac.uk

KIOGE 99 – 100 years of oil and gas in Kazakhstan

Conference, 6-7 October, Almaty, Kazakhstan Details from ITE Conferences, tel: 0171 266 1606, fax: 0171 286 0177, e-mail: ingram@iteexhibitions.com

CIDEX 99

Exhibition and conference, 12-15 October, Baku, Azerbaijan Details from Spearhead Exhibitions, tel: 0181 949 9222, fax: 0181 949 9869, e-mail: caspian@spearhead.co.uk

Coatrans 99

Conference and exhibition, 18-20 October, Hamburg Details from Coaltrans Conferences, tel: 0171 779 8945, fax: 0171 779 8946,e-mail: coaltrans@euromoneyplc.com

Coal - powering into the 21st century

Conference, 20-21 October, Wellington, New Zealand Details from the New Zealand Coal Research Ltd, tel: +64 4 570 3700, fax: +64 4 570 3701

European electricity summit Conference, 19-20 October, Brussels. Details from Global Business Conferences, tel: 0171 608 0541, fax: 0171 253 2798

Environmental protection 99 Conference, 25-28 October, Brighton. Details from National Society for Clean Air, tel: 01273 326313, fax: 01273 735802, e-mail: admin@nsca.org.uk

The Institute visits Dalkia Energy Management



Dalkia Energy Management joined the Institute of Energy as a Group Affiliate

Mike Perry Group Affiliate member earlier this year and requested a visit from the Institute to approve their energy management course, with a view to providing their engineers with professional recognition from the Institute of Energy.

On 16 April 1999, a visiting assessment group from the Institute's CPD panel visited Dalkia's training centre in Halesowen to approve the twoday energy management course. The panel comprised Doug Smithson CEng FInstE, Ken Parker CEng FInstE and Deepti Jayawardena Wilkinson, Membership & Education Officer.

The energy management course was designed to not only introduce a basic knowledge and understanding of energy saving principles but also to establish a benchmark for all Dalkia engineers. At the end of the course, all participants are required to complete a project, which is identified by the participant's manager. The project is selected to focus on weaker areas of expertise; to demonstrate team communications and achieve energy reductions based on targets laid down by the participant's manager.

The visiting panel welcomed the enthusiasm of the training team and had the opportunity to observe the delivery of the course, review projects and speak to the course participants. Their comments were very positive and they felt that the



Only an hour away from the hustle and bustle of Waterloo Station lies the serene tranquillity of Whitchurch in deepest Hampshire. Resting quaintly on an island in the River Test is the Whitchurch Silk Mill. Far from being a relic of a by - gone industrial era, the mill remains a fully functional and commercial producer of luxury garments. On the night of 19th May 1999, it played host to the South Coast Branch Annual General Meeting.

The night began with a tour of the mill and a chance to marvel at the wonders of its machinations such as the giant

water wheel that powers the entire mill. After the tour Graham Mills, Chairman of the branch, conducted the business of the day with the most pressing issue being the future of the branch. The debate centred upon the need for healthier turn-outs at branch events. Tim Smith, Branch Secretary, gave a presentation on possible alterations to the branch boundaries. The boundaries could either be increased to have a larger population of members or reduced to cater for a smaller pool of members in a tighter geographical area. The overall message is simple; members need to support their branch events.

For details on the Silk Mill please telephone: 01256 892065.

training manager, Mike Perry and the programme facilitator, Darren Wright provided an open environment in which to participate. The visit proved to be a success and very enjoyable.

The group submitted its report to the Accreditation & Approval Panel, which formally approved the programme subject to certain conditions being met. These have been relayed to Mike Perry.

The Institute welcomes invitations from companies in the energy industry to approve short courses and training programmes for continuing professional development or graduate training programmes for initial professional development. Energy awareness training can also be delivered to employees. Group Affiliate membership is available to all companies working within the energy field and the Institute can provide employees with professional recognition. For further information,



please Darren Wright contact the Membership & Education department on tel: 0171 580 0077; fax: 0171 580 4420 or email: education@ioe.org.uk.



DECEASED MEMBERS

It is with sadness that we report the death of Dr Tony HART CEng FInstE, who died peacefully in hospital on Saturday 12 June 1999.

James Reginald HINTON, Fellow, South Coast

Roger Harvey PLUMBLY, Fellow, South Coast

Robert Allan PEDDIE, Fellow, South Coast

Maurice Pegrine HENZELL, Senior Fellow, East Midlands

William Joseph CROWTHER, OBE, Fellow, Northern Ireland

Desmond G. E. AXFORD, Fellow, London & Home Counties

Frank HAWORTH, Member, Midlands

Paul BODEN, Member, Midlands

William SOMERS, Member, Scotland

The Inauguration of The Institute of Energy Hong Kong branch

DANNY MT LAI, BENG(HONS) CENG MINSTE MIFIREE, ALBERT TS TANG, BENG(HONS) CENG MINSTE FIFIREE MSFPE



The Branch Committee, Honorary advisors and guest speakers.

n May 1998, the Institute of Energy sent an accreditation panel to City University, Hong Kong to assess the BEng(Hons) Fire Engineering programme that has been networked to Hong Kong with the franchise of the University of Central Lancashire in Preston, United Kingdom. The purpose of the visit was to assess the course for Engineering Council registration as well as membership of the Institute.

In anticipation of the influx of applications for membership of the Institute and to satisfy the need for having a focal point for professionals and practitioners working in energy-related fields in Hong Kong, to disseminate scientific and engineering knowledge relating to energy of all kinds, the possibility of establishing a local branch was, also, contemplated.

A meeting was conducted on the day following the degree course accreditation activities, for the Institute's Headquarters' representatives to meet the 70 local members of the Institute and 20 potential members who were graduates of the BEng(Hons) Fire Engineering, to discuss the feasibility of establishing a local branch within Hong Kong. The meeting stimulated enthusiastic discussions and adjourned with fruitful results. Ten people volunteered to form a Preparatory Committee for establishing a Hong Kong Branch of the Institute.

Under the chairmanship of Dr. Dono Tong, the Preparatory Committee worked very hard on the necessary groundwork for founding the local branch. This included the drafting of a branch constitution, society registration, establishing a branch bank account, the preparation of the first AGM and committee members' election, including the organisation of the branch's inauguration ceremony, planning the branch's activities for the coming year, etc. After almost a year's preparation, the first Annual General Meeting of the Hong Kong Branch of the Institute of Energy was held on 6 May 1999, when the Constitution of the Hong Kong Branch was officially adopted, and the Office Bearers and Committee Members were elected. Dr. Dono Tong was elected as the Branch Chairman, Mr. Joseph Chan the Vice Chairman, Mr. Raymond Fong the Hon. Secretary, Dr. Herman Tsui the Hon. Treasurer, and eight Committee Members were also elected.

A ceremony was held on 14 May 1999 at the Regent Hotel in Kowloon, Hong Kong to celebrate the inauguration of the Hong Kong Branch. In the ceremony, Ms. Louise Evans – Secretary and Chief Executive of the Institute presented a Branch Certificate to the Branch Chairman - Dr. Dono Tong, signifying the inauguration of the first overseas branch of the Institute.

Over 60 members and prestigious guests from professional institutions, statutory authorities, utility companies, etc. were present at the ceremony. Guests included Mrs. Tracey Fisher – Membership and Education Manager of the Institute, Mr. Otto Poon - President of the Hong Kong Institution of Engineers, Mr. John Tsang – Director of Fire Services Department, Mr. L.T. Lee – Assistant Director of Electrical & Mechanical Services Department, Mr. SW Pang – Principal Officer of the Environmental Protection Department, Mr. CM Lin – General Manager of the Hong Kong Productivity Council. To mark this very special occasion, Dr. Raymond C.T. Ho – Hong Kong Legislative Councillor (Engineering Functional Constituency) was present as the Guest of Honour.

The establishment of the Hong Kong Branch has provided a new opportunity for bringing together in Hong Kong the professionals and practitioners working in energy-related fields from all walks of life. The Institute of Energy is geared to the advancement of knowledge of energy technology for the benefit of society and its members at large. The Hong Kong branch mirrors this philosophy and not only enhances the Institute's learned society activities but, also, puts its individual members in a stronger position to create solutions to meet the energy needs of society in the future.



Left to right: John KY Tsang, Mrs T Fisher, Ir Dr The Hon Raymond Ho Chung-tai, Ms L Evans and Ir Dr Dono Tong.

NEW MEMBERS

EAST MIDLANDS

Mr KJ Donaldson, Graduate Lincoln Green

LONDON & HOME COUNTIES

Mr CU Ajaelu, Student South Bank University Mr C Caffal, MInstE Dept for International Development (DFID) Mr BR Doran, MinstE Fulcrum Consulting IVO Energy Ltd, Group Affiliate Mr C Keough, Graduate Lawrence Webster Forrest Linden Consulting Partnership, Group Affiliate Mr D Pattrick, MInstE Mackenchnie-Jarvis & Graham Partnership Mr R Speight, MInstE Royal Free Hospital **RD** Williams, Student Nottingham Trent University

Dr CW Wilson FlnstE DERA Pystock Miss VHC Wiltshire, Graduate ACE

MIDLANDS

Mr RW Fullelove, FInstE Agra Birwell Co Ltd Mr N Hodgson, AMInstE Post Office Property Holdings Mr JA Scott, FInstE National Grid Co Plc

NORTHERN IRELAND

Mr JJ Kingsmore, CEng FlnstE (transfer) James Clark & Partners Mr TG Smyth, MInstE IRTU

NORTH WEST

Mr AJ Cowan, MInstE UCB Films Plc Mr MR Choudhury, Graduate Bradford Metropolitan District Council Mr ND Kelly, AMInstE Cerestar UK Ltd GP Morris, AMInstE Preston Borough Council Prof JP Roberts, CEng FInstE (transfer) Univesity of Central Lancashire

SCOTTISH

Mr G Brown, Associate Perth & Kinross Council Mr RI Burns, Student Napier University Mr P Dubouchet, Student Strathclyde University Mr A Menard, Student Napier University

SOUTH COAST

Miss GU Davis, Student University of Portsmouth Mr AJ Nelson, MInstE Mott MacDonald Ltd

SOUTH WALES & WEST OF ENGLAND

PS Norman, FInstE Wardell Armstrong **Mr PG Raftery**, MInstE (transf.) Garrad Hassan Partners Ltd

YORKSHIRE

Mr IR Shipley, MInstE The Burton Group-Debenhams Mr K Singh, MInstE (transfer) Bradford Metropolitan District Council

HONG KONG

Mr DHW Chan, MInstE Hinkley Technical Services Ltd Mr WM Cheung, MInstE The Hong Kong Polytechnic University Mr W Fung, MinstE China Investment Company Mr BKC Lam, MInstE MTR Corporation Mr KH Leung, MinstE Hong Kong Fire Services Department Mr LM Li, MInstE **Fire Services Headquarters** Miss SMA Poon, MInstE China Light & Power Ltd Mr PCK Wong, MInstE Hong Kong Fire Command Headquarters

OVERSEAS

Mr PA Petrou, MInstE Saudi Specialist Construction Ltd

LONDON & HOME COUNTIES BRANCH

The winter programme for 1999 / 2000 is under preparation and will be advised to members when confirmed. Details will also be featured in *Energy World*. The first meeting is being arranged to take place at Imperial College on 19th October when Malcolm Barlow will present a paper on 'Energy Savings by Control and Design Strategy'. On 1st December the meeting will be in the Peterborough area when there will be a presentation by Mathew Bennett of Cranfield University on The Peterborough Energy Audit. A meeting on 15th March 2000 will be a paper on 'High Accuracy Energy and Volume Controls'. The latter meetings are joint meetings with The Institution of Gas Engineers.

BRANCH EVENTS

OCTOBER 1999

MIDLAND BRANCH

Thursday 7 October, 7.00pm 'Energy from the Oceans' -Dr L Ducker, Coventry University. Contact Mr H Freeman, tel: 0121 353 2397

NOVEMBER 1999

MIDLAND BRANCH

Thursday 4 November, 7.00pm Austin Court 'Low Nox Regenerative Burners' - Mr AW Kelly & Mr PG Ramsell. Contact Mr H Freeman, tel: 0121 353 2397

CPD Short Courses

SEPTEMBER 1999

21-23 September Short courses on: Polymers & Textiles in Fires. Dept of Fuel & Energy, University of Leeds Contact Alison Whiteley, School of Process, Environmental & Materials Engineering, University of Leeds tel: 0113 233 2494. E-mail: shortfuel@leeds.ac.uk

Institute Accredited Academic Courses

The following courses have been accredited by The Institute of Energy as meeting the academic requirements for membership of The Institute, and for C.Eng or I.Eng registration with the Engineering Council. Those courses marked * have provisional accreditation under

the new SARTOR 3 regulations, subject to final year assessment.

Heriot-Watt University BEng (Hons) Environmental Services Engineering BEng (Hons) Mechanical Engineering with Energy Resource Engineering

University of Central Lancashire BEng (Hons) Fire Engineering Postgraduate Diploma in Fire Engineering* BEng (Hons) Building Services Engineering Postgraduate Diploma in Building Services Engineering* BEng Fire Engineering for IEng Registration BSc (Hons) Fire Safety for IEng Registration

City University Hong Kong BEng (Hons) Fire Engineering Postgraduate Diploma in Fire Engineering* BEng Fire Engineering for IEng Registration

University of Leeds BEng (Hons)/MEng Fuel & Energy Engineering

Loughborough University BEng (Hons) Building Services Engineering

Middlesex University BEng (Hons) Mechanical Engineering

Napier University BEng (Hons) Energy and Environmental Engineering

Sheffield University BEng (Hons)/MEng Chemical Process Engineering

South Bank University BEng (Hons) Fire Safety Engineering BEng (Hons) Energy Engineering* HND Building Services Engineering* for IEng Registration

University of Ulster BEng (Hons) Environmental Services Engineering*

UMIST BEng (Hons)/MEng Building Services Engineering

University of Wales Cardiff BEng (Hons)/MEng Mechanical Engineering BEng (Hons)/MEng Integrated Engineering BEng (Hons)/MEng Environmental Engineering*

University of the West of England HND Environmental Engineering for IEng Registration BSc Environmental Quality and Resource Management for IEng Registration

Institute Approved Academic Courses

The following courses have been approved for membership of the Institute, but not for registration with The Engineering Council

Glamorgan University BSc (Hons) Energy and Environmental Technology

University of Central Lancashire BSc (Hons) Fire Engineering Management

University of Newcastle upon Tyne BEng Ordinary Chemical & Process Engineering MSc/Postgraduate Diploma in Clean Technology

Sheffield University MA/MSc Energy Studies

University of Ulster Postgraduate Diploma/MSc Energy Technology* Postgraduate Diploma/MSc Renewable Energy*



Programmes currently being reconsidered

Cranfield Institute of Technology MSc Applied Energy - Energy Systems and Thermal Processes or Energy & Buildings for membership

Glamorgan University BSc (Hons) Technology & Business Studies for IEng Registration

Glasgow Caledonian University MSc Energy Systems & Environmental Management for membership

University of Leeds

BEng (Hons) Environmental Energy Engineering BEng (Hons) Fire Engineering MSc Combustion & Energy for membership

Middlesex University MSc/Postgraduate Diploma Energy Conservation & Management For membership

University of Newcastle upon Tyne BEng (Hons)/MEng Chemical & Process Engineering

Portsmouth University BEng (Hons)/MEng Environmental Engineering

Strathclyde University

BEng (Hons)/DiplEng/MEng Environmental Engineering BEng (Hons)/DiplEng/MEng Mechanical Engineering with Energy Studies BEng (Hons)/DiplEng/MEng Mechanical Engineering with Environmental Engineering

New Programmes being considered

Bath University MSc/Postgraduate Diploma Integrated Environmental Management For membership

City University MSc Energy Technology & Economics For membership BEng/MEng Mechanical Engineering & Mechanical Engineering & Energy Management

Imperial College MSc Environmental Technology for membership

Leeds College of Building BSc (Hons) Fire Safety for IEng Registration

University of Leeds BSc (Hons) Environmental Science for membership BSc (Hons) Fire Safety & Management for membership

University of Paisley MSc/Postgraduate Diploma in Waste Management with Environmental Management for membership

Temasek Polytechnic, Singapore

Diploma in Intelligent Building Technology for IEng Registration



ENERGY MANAGEMENT

ONE DAY INTENSIVE COURSE

6 October 1999 & 1 December 1999

Are you responsible for managing energy?

Are you in need of a refresher course?

Are you new to energy management?

Professional expertise

The Institute of Energy has access to a wide range of energy practitioners, who have been leading energy management training development in the UK. With their valuable knowledge and experience The Institute of Energy has developed a comprehensive one day course. It will enable you as energy professionals and newcomers alike to keep up to date with recent developments in Energy Management and participate in valuable discussion topical issues.

Course content:

All aspects of energy management including:

- Energy policy
- Investments for energy efficiency
- The national standards for managing energy
- The principles of monitoring and targeting
- Staff awareness and motivation programme
- Energy management structure & accountability
- Introduction to site services lighting, bms etc

To be held at the Headquarters of The Institute of Energy, London

The cost of the course is £79 for Members and £99 for Non-Members To register please contact Katie Howe on Tel: 0171 580 0008, Fax: 0171 580 4420, E-mail: info@ioe.org.uk