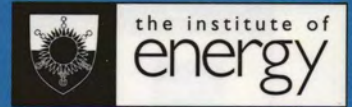


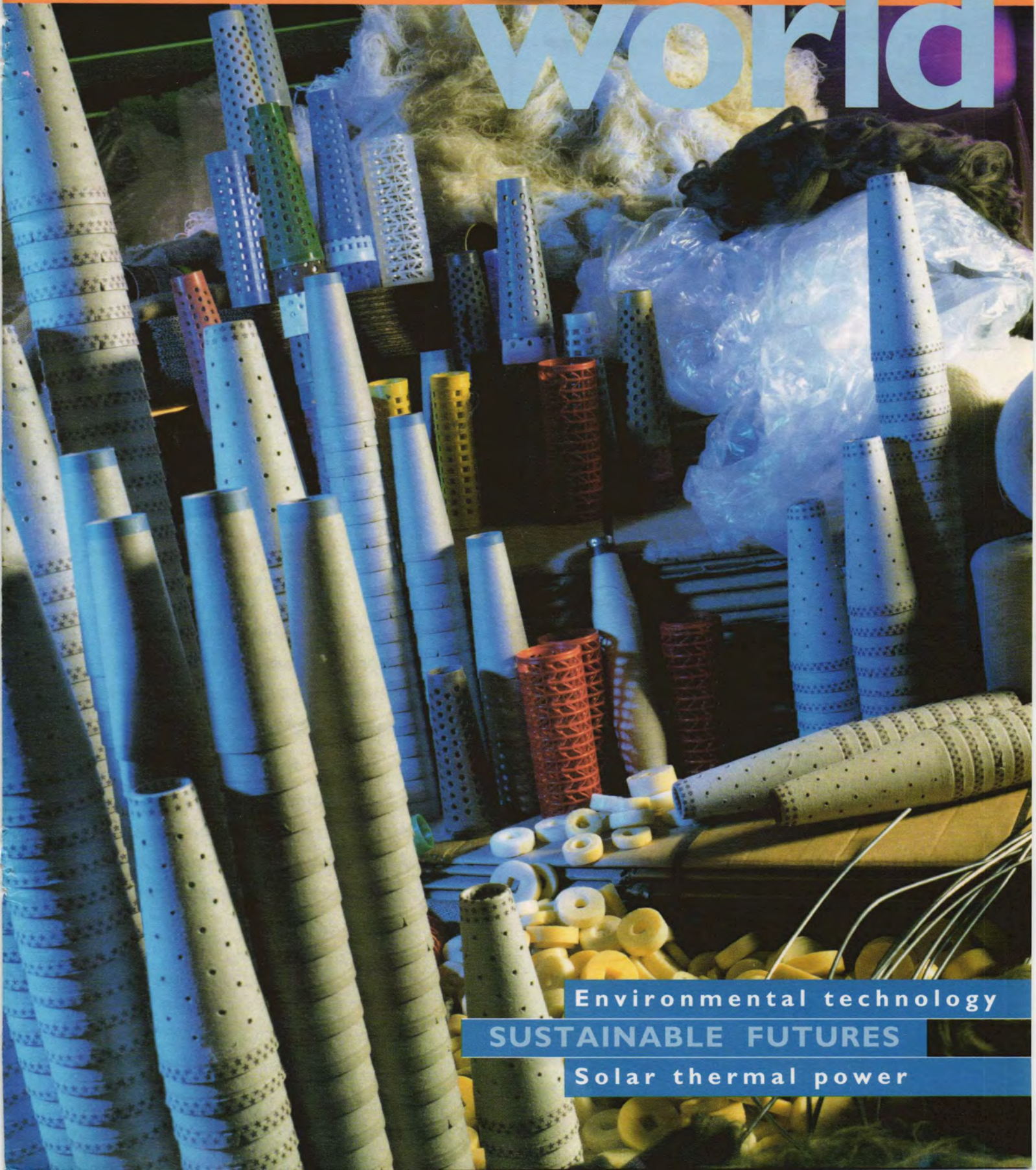
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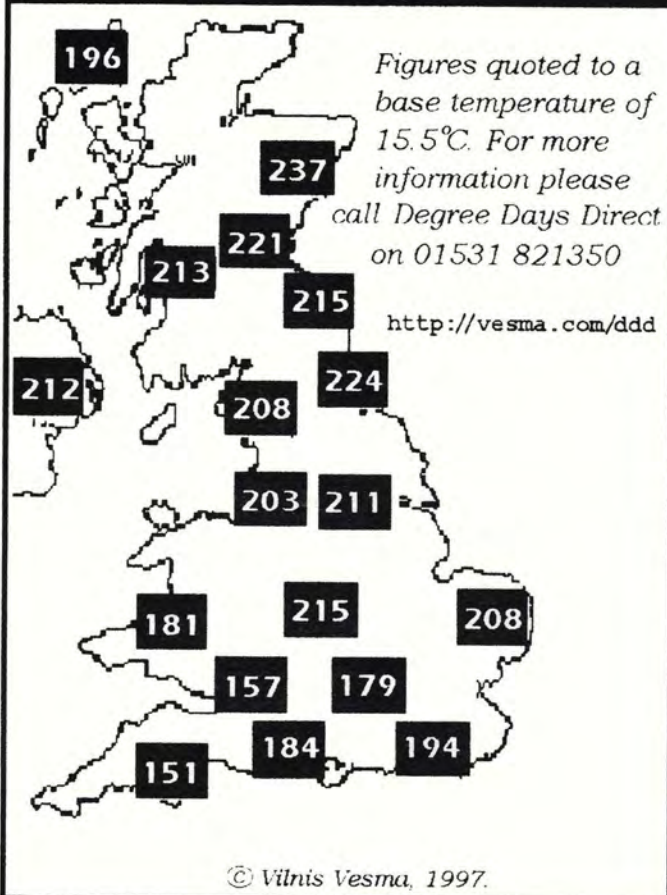


Environmental technology

SUSTAINABLE FUTURES

Solar thermal power

Degree days: November 97



South Wales & West of England Branch

25th Idris Jones Memorial Lecture

Cardiff Castle, Friday 27th March 1998

Energy 1947 to 1997 - A personal review Lord Ezra

Chairman - Energy Technical Services Group plc

The lecture will be held at 10.45am (coffee and reception at 10.00am), and will be followed by the Branch Annual Luncheon at 12.15pm for 1.15pm

Admission to the lecture is free and those wishing to attend should apply for tickets. Tickets to the luncheon are priced at £10 per head

Apply in writing enclosing cheques made payable to The Institute of Energy to Mr David Suthers, 2 Dan-y-Bryn Close, Radyr, Cardiff, CF4 8DJ

Sponsored by:

The British Coal Utilisation Research Association

Numbers for lunch are limited to 120, priority will be given until 15 February 1998 to members of the Institute who give their Membership Grade when booking.

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The Institute of Energy, 18 Devonshire St, London W1N 2AU tel: 0171
580 7124, fax: 0171 580 4420,
email: madams@ioe.org.uk

A day in the life of..

Energy World's editor is looking for members who have an interesting occupation and would like to tell the magazine's readership about it.

The feature has been designed to provide information for those seeking promotion, change of career or their first step on the career ladder.

*If you have an interesting story to tell,
please contact Steve Hodgson on tel/fax:
01298 77601*

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COVER

The disposal of cardboard and plastic yarn cones such as these, and other waste from the worsteds and knitwear textiles industries, can cost some companies dearly. Now, companies in this sector can benefit from a good practice guide on waste management produced under the DETR and DTI's *Environmental Technology Best Practice Programme*. See page 22 for an article introducing the environmental equivalent to the Government's Energy Efficiency Best Practice Programme.

(Photo courtesy of the ETBPP)

Energy: a currency of the future

It is a challenge to work within an environment experiencing rapid change as the energy market is. In the midst of market restructuring and evolution, the imposition of challenging CO₂ reduction targets and global attention on environmental impact and resource availability, energy is surely a currency of the future.

Within this context your professional body, The Institute of Energy is currently assessing how it can best serve you as an individual member, and the energy profession at large. Those of you who play an active role within the Institute will have already seen great changes being made in an effort to refocus and reflect our determination.

I believe that we are on the right track. I hope to work with the Council, committees and staff to develop the Institute, meeting the objectives within our business plan and providing the members and the profession with an Institute which offers a collective voice which is sought after by opinion formers, Government, the media and other agencies.

I have now been in post for a month and if I were to put forward my 'manifesto' there would be a number of issues, not in any particular order of priority, which I believe we can work towards.

Developing membership and broadening our appeal is of prime importance. Energy is climbing the popular agenda once more for a variety of reasons, and we need to capitalise on the opportunities that this presents, and expand our membership base.

On a parallel to this we want to provide more benefits to you as members of our organisation - reasons for participating in our activities and services that you can make good use of. Amongst these, continuing professional development courses and training materials could be improved to offer a greater variety of approved learning sources for members and practitioners throughout the profession. We wish to work with companies to develop in-house training programmes and with other organisations to approve and accredit appropriate third party education and training.

The work undertaken in the Projects Department has



Diane Davy I.Eng., newly appointed Secretary and Chief Executive of The Institute of Energy, offers her first thoughts on the role and direction for the Institute in the future.

produced some new training products and has also raised the Institute's profile through mutually beneficial relationships formed with other organisations such as ETSU and the Energy Efficiency Best Practice Programme. Members are taking an active role in some of the projects, working with staff to provide technical expertise and support. This will continue as a positive route to getting to know you and ensuring an Institute you are proud to belong to.

The Institute also needs to raise its profile. I have learnt that much has improved in this area in the last four years or so, but there is still a great deal to be done. It is not easy to reposition an organisation so that it becomes a focal point or key contact for the agencies I have mentioned. Good media relations requires the Institute to be prepared to offer rapid responses to media enquiries and provide balanced interpretation of current affairs. I

would like our members to help develop a system to do this. As well as raising the national profile, the Institute must expand on a global scale, creating new branches overseas and ensuring provision for international membership services.

These are major tasks which will undoubtedly take time to achieve. In the words of our President, John Chesshire, we will tackle them in 'bite size chunks'. Without you as members there is no Institute. We welcome your participation and we greatly value your support. If you have not been in contact with us for some time, please get in touch and catch up on the positive changes we have been making.

I am an Incorporated Engineer who has successfully led a similar engineering institution and previously worked for the Engineering Council during my career. I understand the pressures and the frustrations involved as both an employee of an Institute and a Fellow of an engineering institution. I believe I can use these experiences to good effect and, as I learn from this Institute, I hope to lead it towards greater success.

Diane Davy can be contacted at the Institute on Tel: 0171 580 7124, Fax: 0171 580 4420 or Email: ddavy@ioe.org.uk

Converting 'refinery bottoms' into clean fuels

Rentech Inc, the Denver-based developer of a process for converting carbon-bearing materials, including natural gas, to liquid hydrocarbons has said that its new gas-to-liquids process can efficiently convert synthesis gas into sulphur-free liquid hydrocarbons such as a clean diesel fuel.

Rentech's Dennis L Yakobson says: "High sulphur, low value residual refinery products are potential feedstocks of growing importance for gasification. Within the next ten years a

large surplus of high sulphur residue is predicted, which cannot be readily absorbed by the market. Conversion of such material to synthesis gas by conventional gasification technologies is an attractive option. Synthesis gas, with its low hydrogen to carbon monoxide ratio, is then an excellent feedstock source for conversion into liquid hydrocarbons by the application of the company's proprietary and patented iron-based catalyst.

The hydrocarbon end

products as well as other by-products such as the excess steam and hydrogen produced by the process can all be utilised at the refinery, says the company. Rentech's patented diesel fuel fraction is an excellent blending stock to upgrade non-specification fuels or to improve the quality of the commercial diesel currently being produced at the refinery by lowering the aromatic and sulphur content and increasing the cetane index, all of which reduce harmful emissions, they add.

The addition of a Rentech conversion facility to an existing or planned gasification system at a refinery could be operational in considerably less time than it takes to build a 'grass-roots' gas-to-liquids facility of equal capacity. With refinery infrastructure, staffing and other required process equipment such as product distillation and storage already in place, retrofitting a Rentech gas conversion plant will be a cost and time effective solution to a growing world problem, says the company.

Consortium studies Russian power network link-up

A consortium formed by the power companies in five countries has begun to study the potential interconnection of the power networks in Russia, Belorussia, Ukraine and Moldavia with the Western European interconnected power system. The study will include the preconditions for the synchronous interconnection of the network, the costs and the benefits.

The consortium, led by EdF from France also includes IVO from Finland, RWE from Germany, TRACTEBEL from Belgium, and CEZ from the Czech Republic. The project, which will take about a year and a half to complete, is financed by the European Union's Tacis programme.



Conoco tanker 'The Guardian' - credited with preventing a major oil spill in south west Louisiana because of its double-hulled design - has resumed operations. The vessel sustained a 30 m by 1 m gash during a collision with a tug-and-barge flotilla on the Calcasieu River near Lake Charles, Louisiana, USA. The 800-foot Guardian, however, did not release any of its cargo of 550,000 barrels of crude oil, because of its protective hull. At the time of the incident, a harbour pilot was aboard the Guardian, which was being assisted by two tug boats.

Coast Guard officials told reporters that the collision would have created a major environmental incident if the Guardian had not been a double-hulled vessel. Instead, the tanker safely discharged its cargo at Conoco's Clifton Ridge terminal and sailed to a Mobile, Alabama, facility for repairs.

Conoco owns and operates five double-hulled and two single-hulled tankers and plans to take the single-hulled ships out of service within the next few years.

BG to develop giant oil and gas field in Kazakhstan

BG Exploration and Production has signed production sharing agreements which pave the way for two major ventures in Kazakhstan. The agreements are for the development of the giant Karachaganak oil and gas field in western Kazakhstan and, in a different partnership, for exploration rights for the Kazakh sector of the Caspian Sea.

The 40-year production

sharing agreement with the Kazakh government gives the go-ahead to the development of the Karachaganak field in western Kazakhstan, which has recoverable reserves of 2.4 billion barrels of oil and 16 trillion cubic feet of gas. The planned production by 2001 amounts to approximately 170,000 barrels of oil and five hundred million cubic feet of gas per day. The field is substantially larger than any

North Sea discovery.

BG's share of the development costs of the field following the agreement is around £400 million. BG Exploration and Production and Agip - the exploration and production company of Italy's ENI - will continue to be the joint operators of the field.

Meanwhile, BG Exploration and Production Ltd - and six other international exploration

and production companies, Agip, British Petroleum/Statoil, Mobil, Shell and TOTAL, together with the Kazakh state entity, KazakhstanCaspishelf - have also signed a major oil and gas agreement with the Republic of Kazakhstan. The agreement grants the participating companies the rights to acreage in the offshore area of the North Caspian on the basis of a production sharing agreement.



A joint venture between Switzerland's Sulzer Hydro and the China North West Electric Power Company is bringing European technology to bear on to the resurfacing of components of hydro power plants in Xian, China. The picture shows a robot applying a ceramic coating to a Pelton water turbine.

The Chinese partner operates ten hydro-electric plants on the Yellow River and its tributaries. The high bed-load of the River - more than half a tonne of sand per cubic metre during the wet season - causes excessive abrasion damage to parts of the turbines.

Sweden's nuclear waste research facility

One of the first research projects at the Aspro Hard Rock Laboratory in south-east Sweden is benefiting from the participation of Bradford University's Dr Stewart Banwart, a lecturer in the Department of Civil and Environmental Engineering.

The Laboratory's international projects aim to

solve the problem of how to dispose safely of spent nuclear fuel.

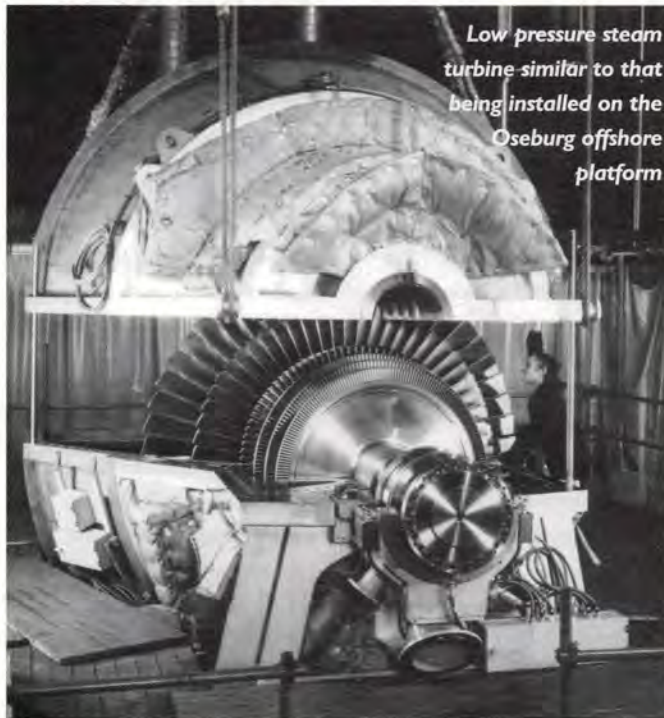
The laboratory - not an actual repository as nuclear waste will never be put in the ground there - consists of a research complex on the surface and an access tunnel that extends to a depth of 450 m underground, with further

research stations at various levels. Testing is based on the disposal of waste in tunnels in the granite bedrock. Spent fuel, simulated at the site by electrical heaters, is buried in copper canisters lined with inner steel containers to isolate the contents from groundwater. Each canister is then surrounded by

compacted clay.

The research programme is designed to establish site investigation methods, provide information on safety-related properties of rock, develop and test the function of engineered barriers at full scale and improve the accuracy of mathematical modelling of site performance.

First offshore CCGT for Norwegian platform



Low pressure steam turbine similar to that being installed on the Oseburg offshore platform

Norway's Aker Maritime is to install what is thought to be the first offshore combined cycle power plant, on the Oseburg platforms in the Norwegian sector of the North Sea.

ABB Miljo of Norway and ABB STAL of Sweden are to supply the steam part of the power plant, which will be located across the platforms. Heat will be recovered from the exhaust gases of two gas turbines used for compressor drives and located on the new Oseburg D platform currently being built by Aker Maritime for the operator, Norsk Hydro. While the steam generation unit will also be

located on Oseburg D, the steam turbine will be installed on the existing Oseburg A platform. Steam and condensate lines of around 400 m long will link the two. Electricity generated by the steam turbine will replace that currently generated by a gas turbine on Oseburg A.

The new power plant will substantially reduce the consumption of gas at Oseburg, and lower carbon dioxide emissions by 80,000 tonnes a year. Norway's high carbon dioxide taxes mean that the reduced emissions from a CCGT plant like this can lead to tax savings of as much as £2.5 million a year.

UK still at bottom end of international gas prices

Large gas consumers in the UK saw average price rises of some 23% in 1997, yet still benefit from the second lowest

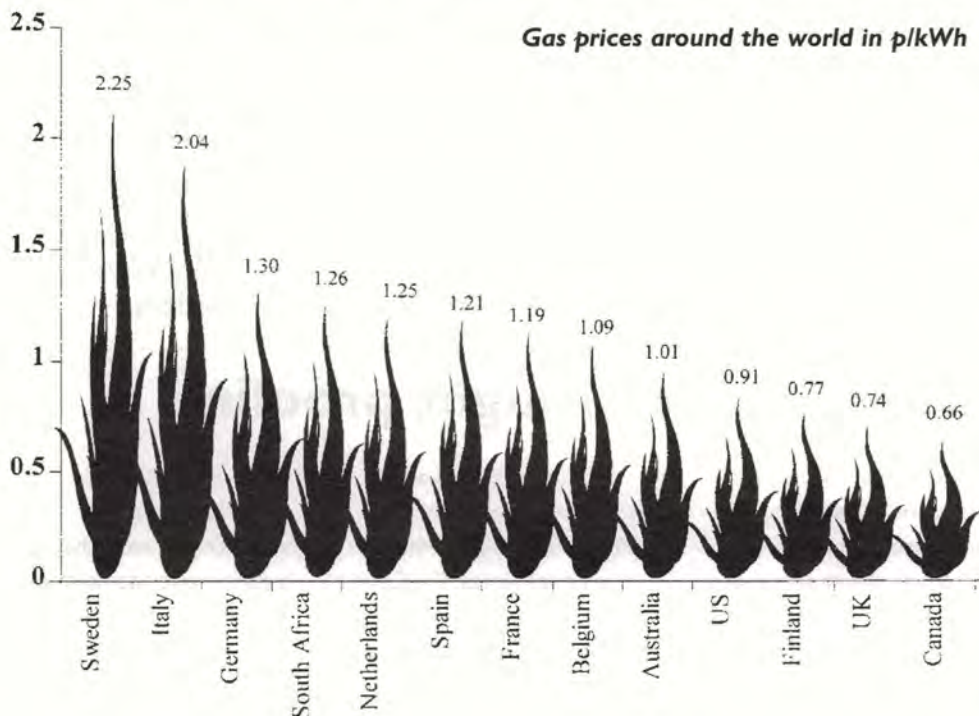
prices among 13 industrialised countries, according to an international survey by National Utility Services. A

previous survey by NUS showed a 40% fall in UK gas prices during 1995, to unsustainable levels.

Sweden also saw a 23% price rise during 1997, giving it highest gas prices among the countries surveyed, at three times the price of gas in the UK. Italy is the second most expensive country, followed some way behind by Germany, which saw a 20% price rise during the year.

Canada's gas prices - the only ones lower than the UK - are expected to begin rising steadily in the coming months as new transportation facilities open up, allowing Canadian producers to export more gas to the more lucrative US market.

The survey is based on unweighted averages of suppliers' prices net of VAT and similar taxes where these are recoverable by business users. Prices were recorded in September 1996 and September 1997.



Government to study 'overdependence on gas'; CHP exempted from moratorium



**President of the Board of Trade
Margaret Beckett**

President of the Board of Trade Margaret Beckett has announced details of the Government's review of energy sources for power generation (see *Energy World* No 255), suggesting that proposed CHP stations would be exempted from the moratorium on new power generating capacity.

In the light of a new round of projected coal pit closures, the Government

decided at the end of last year to approve the building of no new power stations above 50 MW in capacity while it found a way to safeguard the future of at least part of the UK coal industry. More formally, the Government was to "review the

long-term energy requirements of the country and make sure that we have an energy policy consistent with a competitive industry and the long-term energy needs of the country". The announcement halted the further development of several gas-fired power station projects.

Ms Beckett has now confirmed that, in considering requests for exemptions from

the approvals ban, the Government "will be mindful of the environmental and other benefits of CHP". She also lowered the moratorium threshold to power stations above 10 MW.

The terms of reference of the Review are to:

- look at scenarios for the development of generating capacity and sources of fuel supply for generation, and
- to consider the implications of high levels of dependence on any particular fuel.

The Review will take particular account of the role of coal, sustainable development and European and other international obligations. It will also focus closely, says the DTI, on the likely consequences of an overdependence on gas-fired plant, such as the implications of widespread interruptions to gas supplies to power stations and the ability of the National Grid to balance supply and demand where many power stations are connected to regional distribution systems rather than the national grid.

Pool's 1998 trials start well

Despite widespread expectation that the overall timetable for liberalising the domestic energy market will slip, the Electricity Pool says it has successfully passed the first trial of its initial settlement process with two public electricity suppliers, Manweb and Yorkshire Electricity.

The trial tested the end-to-end process from 'meter to bank', demonstrating the accuracy of the first step in the Pool's settlement process for the non-half-hourly electricity market and the ability of the Pool to link up with the separate supplier systems involved in the settlement process. The Electricity Pool's systems will form a key component of the liberalised market, as they enable the settlement of electricity trading between generators and suppliers.

Peter Bostock, the Pool's Programme Manager, said: "There is still a lot of further testing to do, but this successful first stage maintains the good progress to date of the Pool's 1998 Programme. It's encouraging."

First British Standard for draught proofing

The first British Standard Code of Practice for the installation of draught proofing, BS 7880: 1997 *Code of Practice for Draught Control of Existing Doors & Windows in Housing Using Draughtstrips*, has been published. It describes the

correct selection, installation, fitting and maintenance of draughtstrip materials to ensure maximum effectiveness and lifespan. The Draught Proofing Advisory Association was instrumental in the formulation of the Standard.

A supply of fresh air is essential for the safe and efficient operation of fuel burning appliances. The Code of Practice gives clear guidance based on established data as to where draughtstrips may be fitted in housing and contains

important advice on maintaining adequate ventilation to avoid the risk of carbon monoxide poisoning. It also gives guidance on the air supply requirements for domestic gas appliances including water heaters.

Descaling natural radioactivity offshore

Design engineers from AEA Technology have come up with an innovative method of cutting the cost of treating naturally radioactive waste on offshore oil pipelines. Naturally radioactive uranium and thorium occur in the sedimentary rocks that contain oil and gas reserves, and these lead to contaminated residues on pipelines and equipment. This radioactive contamination - known as low specific activity - has conventionally been transported for treatment onshore.

Now, thanks to a new, self-contained closed-loop tubular descaling system suitable for offshore installation, the contaminated scale can be removed and reinjected at source - removing the cost of

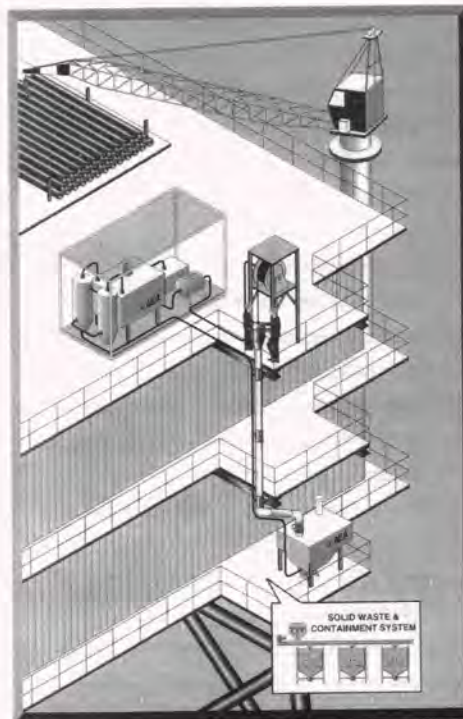
transporting the waste onshore. The new system was devised, developed and brought to market within six months.

"Our breakthrough has been to devise a descaling method suitable for use within the confined spaces of an offshore installation," said Gary Phillips of AEA Technology. "We have achieved this by devising a vertical structure that is as effective at descaling tubulars as our larger, horizontal onshore facilities.

"The benefits of offshore treatment are considerable. The cost of treatment is considerably less than onshore treatment; and it is an environmentally sound solution to reinject the

natural radiation to its source. Our closed-loop system produces no emissions or discharges."

AEA Technology has applied for patent protection on the Offshore Descaling System. It is now being offered as a 'turnkey' service to offshore operators, complete with installation, operation and radiological protection advice.



(above)
AEA Technology's offshore descaling system

Consumers turn to energy clubs to secure best deal

Many gas and electricity companies will soon be turning themselves into 'energy clubs' and their customers into members, according to William Garton-Jones, a utility industry specialist at IT services company Cap Gemini speaking at a utilities conference at the Adam Smith Institute in London in December.

Mr Garton-Jones said that energy clubs, modelled on successful US experience of retail clubs, could provide a better deal for consumers while improving cash flow and customer retention for utilities. The clubs would work by charging a fixed annual fee to members who would then pay for energy consumed at cost. Total annual payments by

consumers would be lower, while utilities would benefit from a substantial inflow of cash at the start of each year and the assurance that customers, having paid their up-front membership fees, would be unlikely to desert to a competitor.

"Research shows that it can cost a utility £40 in marketing and administration costs to sign up a new customer; yet net profit per customer often averages only £4 per year. How much better it would be to sign up new customers as club members at, say, £40 a year, thereby getting the sign-up costs back immediately and earning a profit from the new customer from day one," said Mr Garton-Jones.

Battle inaugurates Armada development

Energy Minister John Battle has paid tribute to the work of partners and contractors in delivering the Armada gas condensate project on schedule and over £100 million below the original budget.

Mr Battle was in Aberdeen to inaugurate the £435 million central North Sea development, which is operated by BG Exploration & Production on behalf of five co-venturers: Amoco, Fina, Phillips UK, Yorkshire Electricity and Agip (UK).

Mr Battle said: "The gas to come from this project will be equivalent to the needs of homes in the whole of Manchester for about 18 years. In addition, 70 million barrels of

valuable gas condensate - the liquid hydrocarbons which come with the gas - will be delivered to Grangemouth where it will be turned into a whole range of chemicals for use in industry.

"And the UK has won already - the project's success was, in no small part, due to designers, fabricators, service companies and manufacturers the length and breadth of the country - from London to Lewis, from Basildon to Bath. Over 85% of the capital cost of the development was spent in the UK.

The three Armada fields - Fleming, Drake and Hawkins - produce gas at rates of up to 450 million cubic feet per day.

Nuclear power and

Sustainable development is on the agenda for stable industrialised democracies such as the UK and other members of the EU. These economies have a number of common characteristics:

- high standards of health, welfare, education and social security,
- great personal liberty, freedom of expression and mobility,
- specialised water, sewage, gas utilities, production, service and economic units,
- highly organised communication and financial systems based on mainframe and personal computers,
- chemical and plastics industries highly dependent upon oil and coal products,
- integrated food processing, importing and distribution systems.

These can be sustained only by a productive economy, based on affordable and reliable energy supplies. To enable an effective transition to the sustainable lifestyle, the society of which these are a part must be stable over the long term but it is not always clear how severely they would be damaged by energy shortages. Consider the last item in the above list.

Agricultural output has been increasing steadily throughout the current century and by about 50% over the last 30 years. Long term interruptions to the supply of electricity would have major impacts at all levels of the food supply chain e.g. fertiliser production, stock rearing, seed production, processing, sampling, hygiene, storage, distribution, retailing and collection. If there is partial failure in this sequence and food supplies are seriously threatened, support for sustainability will decline. Other essential health and utility services depend on electricity and would be affected in a similar way.

There have been times over the last 200 years when employment and the real living standards of the majority of the population have fallen and society has not disintegrated. The slump in the 1920s and 30s and wartime emergencies each introduced step changes into the economic system that had very severe effects on the population, but attitudes today are different. Would

by P H Spare, Prosafe Engineering

Post-Kyoto, but pre-sustainable society, many people are focusing on the prospects for renewables and energy efficiency to replace fossil fuels. But can they, and are we blind to the potential environmental problems around renewables? In this article, Paul Spare argues that energy, and particularly electricity, supplies must be maintained during the transition to a sustainable society, and that only nuclear power can do this. He also explores some likely consequences of much more widespread use of renewables.

draconian controls as imposed during World War 2 be acceptable to support the sustainable economy? Agreeing even small sacrifices at the international level is proving extremely difficult.

More is always required of our health and welfare systems. A higher proportion of people are living beyond retirement age every year, supported by the productive economy. In spite of recent concerns about cancer, leukaemia, salmonella and *E Coli*, the octogenarian population has doubled in the last 40 years. Even the expanding non-manufacturing sectors such as communications and services are highly dependent upon electricity and the productive economy.

If there is no secure alternative to replace of oil and gas and centrally generated electricity, breakdown as seen in Russia could happen. Trees would be cut down to provide fuel. Oil and gas pipelines would be tapped into illegally. Pollution of watercourses and land would follow as maintenance, waste collection and treatment was disrupted. Beyond the transition, energy is also required to enable the best environmental practice to be enforced.

ENVIRONMENTAL CONTROLS

A sustainable economy will have to be protected via enforceable rules and regulations. Integrated Pollution Control (IPC) cannot be operated with primitive technology. It will need a scientific bureaucracy financed by a productive economy.

The implementation of the EC Directive on Integrated Pollution Prevention Control (IPPC) will quadruple the number of regulated plants compared with the UK IPC system. This will necessitate more measurements,

inspections and record-keeping.

Electricity shortages would encourage the fragmentation of industrial processes. Energy shortages would weaken management and make the process of controlling emissions, waste and pollution much more difficult. Good environmental practice requires good management by knowledgeable specialists with well-organised quality systems. The environmental control framework will have to be supported by adequate energy. Possible alternative energy systems are considered below.

THE SOURCES OF ENERGY

It is 25 years since the 1973 oil crisis that shook the major economies. The countries of the EU import about 50% of their energy supplies. With present trends, this could reach 70% in the next ten years. There is some evidence that oil discoveries reached their peak 30 years ago and North Sea gas output is levelling out. Between 1960 and 1990, the share of electricity in final energy consumption rose globally from 17 to 30%. UK consumption was 4% higher in 1996 than 1995 - see Table 1.

Although interest in the environment and sustainability has never been greater, reducing energy consumption is difficult. VAT on fuel proved far less popular than the Ofgas instruction to Transco in June 1997 to reduce its domestic gas charges. If oil and gas supplies are seriously depleted, what are the prospects for fossil fuel substitutes such as renewables?

POWER AND THE LIMITATIONS OF RENEWABLES

Solar

Solar power would appear to offer many advantages as an energy source as the output

sustainability

YEAR	Electricity sales (TWh)
1992	278
1993	283
1994	283
1995	288
1996	299

Table 1 Sales of electricity to consumers in the UK

of the sun will remain unchanged for thousands of millions of years. However, to produce reliable power at the rate of 1 MW (enough for a large village - population 1000) would require an area of panels greater than 20,000 m². That is about four times the area of the Wembley pitch. Even if such areas of land were available throughout the UK, solar output is lowest when demand is highest - midwinter. Other power sources would have to be kept in reserve to provide redundancy. The UK grid system alone has about 700 times more capacity than the 100 MW world solar total - see Table 2.

The environmental implications of scaling up the production processes to such a scale would also be considerable. There are various toxic waste streams that have no ecologically sound disposal path e.g. phosphine or cadmium. Treatment to achieve zero releases on large scale plant will be extremely expensive in capital, labour and land resources. There is also the problem of disposal on decommissioning if solar became a major power source. The solar plant to replace one 1000 MW power station would weigh several hundred thousand tonnes and might have a 25 year life. With stricter landfill policies, it is not clear that there would be a disposal route for such large waste quantities 25 years hence.

Wave energy

A small number of wave power schemes have been tried over the last 20 years. A structure 60 m long would be required to generate 1 MW and 120 km to replace a Drax or Radcliffe (2000 MW). A 120 km unit would require millions of tonnes of construction materials. Installation, maintenance and large-scale power

transmission techniques are completely untried.

There are risks of increased coastal erosion or silting, local micro-climate damage, changes to fish populations and seabed damage. At the end of the working life, all the structures (hundreds of thousands of tonnes of concrete) would have to be brought ashore and dismantled for disposal. The costs of this would almost certainly exceed the original construction costs, and for such enormous structures, the disposal route can be only speculative at this stage.

Wind power

Output in the UK is of the order 82 MW with installed capacity of a few hundred MW contributing up to a percent of the average demand. Unfortunately, the greatest potential lies in the areas of the north and west where the populations are small. The transmission losses to reach the mainland of England, (even if the environmental intrusion of more plant was acceptable) are a problem. No industrialised economy is likely to rely on a contribution of more than about 10% wind power because of the risk of unacceptable

interruptions. As with solar, redundancy would have to be provided to cope with periods of low output but decommissioning wastes more manageable.

Biomass

Biomass potential is very small in the UK with so many demands on land space. If population was declining and land was being released, its prospects would be improved.

A biomass plant to supply 1 MW to a 1000 person village unit would need more than 20 tonnes/day (7300 tonnes pa). This would require a land area of 730,000 m² - over 100 times the area of the Wembley pitch. For comparison, CCGT plant has a power density (MW/m²) 1000-10,000 times greater. In addition to the low output per unit of area, biomass schemes are very prone to common mode failure e.g. vulnerability to disease and pests, reduced or failed output during droughts, increased cloud or volcanic dust cover and severe damage from storms.

Forestry and agriculture are also the only major industrial sector where annual health statistics show deteriorating accidents and fatalities - over 60 in 1996/7.

Waste combustion

UK installed capacity is low (72 MW) compared with other industrialised economies. The prospects for waste combustion may improve as the new EC Landfill Directive will compel some form of waste treatment. This could help the case for some 70 new incinerators in major UK

Table 2 - United Kingdom Plant Capacity (all generating companies)

	UK generating plant capacity (MW)			
	March 1994	March 1995	March 1996	December 1996
Conventional steam	44,239	41,710	41,553	41,686
Combined cycle gas turbine	5,613	8,517	9,185	12,303
Nuclear	11,894	12,037	12,762	12,916
Gas turbines/oil engines	2,248	1,895	1,890	1,637
Natural hyrdo	1,425	1,425	1,428	1,457
Pumped storage	2,787	2,788	2,788	2,788
Renewable	317	369	405	474
Total	68,523	68,741	70,011	73,261

cities. The combined output could rise to 500 MWe. As with all power sources however, there is a pollution problem. Toxic metals in the thousands of tons of slag and fly ash that are tipped onto landfill sites can leach into water courses. This is a difficult issue throughout the EU, and a costly vitrification process may be required (as used for High Level Radioactive waste). Unfortunately, the very large quantities of waste compared with nuclear waste make this prohibitively expensive.

CHP

Industrial CHP can produce useful economies and reduce the quantity of low grade heat that is wasted. It also has good energy density. Some small scale schemes have been developed to supply housing, where gas-fired central heating did not exist. There is little or no incentive for homes that have GFCH to take hot water rather than gas from a central supplier. GFCH is now installed in over 50% of UK homes. GFCH is a very good way to use natural gas, far less wasteful than to use it to generate electricity. Any gas connection will still incur the standing charge and there are the capital costs of the CHP plant and piping network to be recovered. Gradual deterioration is also a problem, as hot water is also a lot more aggressive towards pipes than is methane.

Increased use of CHP will also accelerate North Sea gas use, meaning that an earlier replacement will be needed.

Conservation

Gradual improvements in energy conservation are being made every year, but large dramatic changes in the efficiency of equipment occur extremely infrequently. Improvements rarely match the natural growth in energy demand. Some home conservation measures achieve energy savings, but simultaneously cause damage to health, largely from reduced ventilation.

The average level of radon in UK houses is about 20 Bq/m³ and this is responsible for about 40% of the 2.4 mSv natural background contribution that we all receive. If conservation measures increase levels by 10 (that is to average levels as found in much of Cornwall) then for the most pessimistic

extrapolation for every 100,000 well-insulated homes, the population would be 250,000 and the predicted increase in cancers would be about 110 extra deaths. Obviously if this information becomes more widely known there is a risk that conservation measures will not be adopted.

Summary of renewables

None of the renewable sources can be relied up to provide more than a few percent of the power needed by an advanced society. A total contribution of 1 GW by 2005 is possible (excluding CHP). The annual *growth* in demand will outstrip their contribution, without replacing any existing capacity. A reliable power source is needed to maintain the developed economy and its environmental control systems. The obvious choice is nuclear power, as coal produces CO₂.

THE ATTRACTIONS OF NUCLEAR POWER

Energy source impacts have been integrated over the full economic and technical life cycle, spanning extraction, recovery, transport, waste, production, dismantling and restoration. Such studies have always shown that the system with the least impact on the environment and health is nuclear energy.

Nuclear power fits in very well with four key principles of sustainability:

- to use nothing in nature unless necessary - but some fuel has to be used,
- to use the least useful materials - there is no other use for uranium ore,
- to use the minimum quantity of the material - it is about 20,000 more energy intense than coal and oil, so power stations use only small areas of land per MW, waste quantities are small,
- to use material that can be re-used - the fuel can release a further 60 times more power in 'fast' breeder reactors.

No waste disposal route from any large-scale power industry is acceptable to some environmental groups. CO₂ emissions from gas-fired plant, acid rain from coal plant, slag from waste incineration, carcinogens from wood and redundant oil

rigs are all unacceptable. It will eventually become clear that many renewable sources will also produce vast quantities of waste per MW because of their low energy intensity. Nuclear energy is the only power source where waste quantities are sufficiently small to permit an engineering solution. Which industries can contain almost all their waste products?

In only 200 years of industrial development, fossil fuel combustion has increased the proportion of CO₂ in the air by about 12%. Releases from the nuclear industry contribute about 1 part in 10000 to natural levels of radioactivity (13 x 10⁶ manSv pa).

The factual comparison is clear. Without an increased contribution from nuclear power, the environment and the prospects for a sustainable economy will get worse not better.

SUMMARY

Severe energy depletion will cause enormous damage to public health, widespread abuse of the environment, and forestall the sustainable economy.

A sustainable economy requires the stability that only adequate energy supplies can provide. Renewables cannot produce the assured supply. Thermal reactors can provide the base load in the next 50 years and other reactors after that. With an energy crisis looming, the attitude to nuclear power amongst those who should have the resources and intellect to interpret the published material must be changed.

Paul Spare is a director of Prosafe Engineering, a nuclear safety and decommissioning consultancy. He has worked in the nuclear industry since 1974, progressing through the AGR construction programme (with the Nuclear Power Company), AGR and Magnox support, waste treatment, NIREX repository and project management. Since 1995 he has been engaged largely on work for the UKAEA Dounreay and Harwell decommissioning programmes.

Green and businesslike -

time to resolve to get fit?

By Dave Hampton, Head of Environment Group, ABS consulting

Some organisations still believe that going green costs money and may damage their 'street cred'. Not so, says Dave Hampton - more and more businesses are recognising that being green improves profit.

Last year, my firm, ABS consulting took stock of its own "green" credentials to prove that you can save money while reducing environmental impact. We not only proved it - we also did it. Our work in our own office clearly illustrates what we have found elsewhere, that there are real business advantages from being 'respectably' green, i.e. green and businesslike, including:

- direct cost savings, typically £250 per person per year,
- office efficiency is improved,
- corporate image is justifiably and visibly improved,
- an innovation culture is created or enhanced,
- people actually enjoy adopting greener habits.

The first step for our own London office was a broad-brush audit of the environmental impacts (and the associated operational costs) of things like energy, transport, water, paper and office waste. We made use of the BRE/PA *Office Toolkit*¹ for this - see Figure 1.

Environmental impact was dominated by business travel. Measures were implemented that will reduce this by 33% and save 9% in costs annually. The second (but less significant) environmental impact was from office equipment. This has now been reduced by 47%, saving 47% in costs. By implementing all the measures recommended in the report we will make annual savings of £186 per employee.

Some of the recommended measures were applicable to all staff. A quick training session identified the slight changes in normal routines that were sensible. Other measures required some slight changes in management and company policy.

Even if you are well down the road to greening your business, it is possible to re-energise the process. We have recently completed Environmental Management Overviews for a leading international bank and a global communications company with

impressive results. Benefits accrue in what is now commonly referred to as the triple bottom line²: economics, environment and ethics.

ECONOMICS

In spite of ever-lower prices there is still a robust business case for energy efficiency. This shows just how strong the case actually is - and it's strengthening all the time. Readers of *Energy World* are familiar with the many benefits. But the reality is that the silent majority of organisations continue to overlook the opportunity, preferring to ignore the steady trickle of waste, leaking from their profits, year on year, safe in the knowledge that one day they will find the time to stop it.

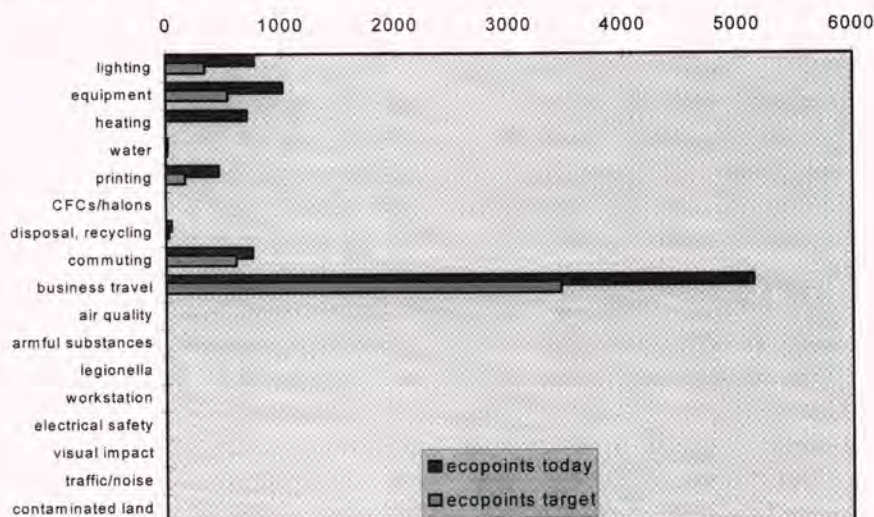
Others however are rapidly catching on, and are discovering they have been missing a trick. Some realise that it's cheaper in the long run to save energy

than it is to use it. They are recognising energy saving and other eco-efficiency options for the investment opportunities that they are. Shrewd would-be investors in 'in-house' eco-efficiency have long been asking where the best returns are. The direct cash savings remain the all-important bottom-line, but if sensible consideration is also given to the scale of the accompanying eco-impact savings, this will sustain financial value in the long term. There is a wide choice of such investment opportunities, all with different rates of return, but all fundamentally good for business.

ENVIRONMENT AND RESOURCES

Of the many resources that flow into a business, the largest usually gets the most attention. Smaller overhead costs such as utilities, paper, printing, and many other expenses are often left largely unmanaged. But most can be sensibly

Figure 1 Environment impact - Axe & Bottle Court



reduced or improved, and less waste often means more profit. This much is simple, but there are also disproportionately large spin-off benefits to be had, as those who have done it will testify. Upgrading isolated components with efficient eco-technology will bring incremental cost savings, but a holistic approach to improving systems often results in large step improvements. Sensible and respectable thrift sends signals - to staff and to customers - that the organisation cares and is well-managed. And coincidentally, you will also have made your organisation greener.

New units - ecopoints and ecocalories

A few years ago most of us would have said that we already have all the scientific units that we need. But the closing few years of this millennium have witnessed the bold invention of two important new 'units' that will probably go down in history as significant innovations of the 90s. Admittedly they are not entirely scientific, but they will be enormously helpful in guiding our decisions. Now we've got them it's hard to believe we didn't realise we needed them ages ago.

These new units measure holistic eco-impact, and hence how green various courses of action are. The first, popularised by BRE in their *Office Toolkit* and then *School Toolkit*³, was the *ecopoint*. The second, was the *ecocalorie* by Going for Green⁴. In essence, both set out to help users measure and improve their green credentials. (As I understand it, the *ecopoint* is mainly for businesses, the *ecocalorie* mainly for individuals.)

It's great to be living in the decade that saw the birth of these important new and user friendly units. Regardless of their scientific merit they are badly needed. Controversial? - yes. Flawed? - maybe. Definitive? - unlikely. But immensely helpful in letting us start taking small positive steps forward with confidence. Back in September 1997 The Independent concluded - in its leader page - that "It is the inability to distinguish between the important and the trivial that

bedevils the green movement." Not for much longer.

Just before Christmas I ordered myself a copy of Going for Green's 'EcoCal - Your environmental health check'⁵. (Thoroughly recommended - it's a simple piece of software that helps you measure your total effect on the environment, in ecocalories. The score is a measure of how green your household is. To my relief, I wouldn't have mentioned it otherwise, our overall score as a household fell just inside the 'green' band, but there were some nasty moments of embarrassment in several areas where we failed to perform well.)

ETHICS - WITH ATTITUDE

A drop in the ocean ?

The name, the *ecocalorie*, sparks off thinking of calories and weight-watching. In our hearts we all know it's time to get in shape environmentally. But just like New Year resolutions we often find it tough to get started, and even tougher to stay the course.

Staying with the dieting analogy a moment longer, many will recall the nasty shock of being told how many hours you needed to spend on a particular exercise machine to expurgate just a few hundred calories. The perception gulf is wide. Huge amounts of personal energy sweat and agony and you've only done enough to earn a slice of toast! Is this the dilemma behind the paralysis facing most governments? How do we take the first steps of a seemingly endless journey? Who's going to pour the first drop into the ocean?

Younger readers will not recall the erg. Like the calorie, it was another unit of energy and has now been popularised by rowing machines or ergometers (affectionately 'ergs') in all health clubs. The reason for mentioning these machines is that they are very effective at measuring continuous human work rates. And it is humbling that most of us would be hard pushed to maintain 100 watts for much more than an hour. In the event of a power cut the average home would need a team of several fit healthy individuals to work flat out to meet just

their most basic power needs. And to be competitive against the national grid, we could only reimburse each one of them roughly 1 penny per hour of hard exertion. (Or a wage of 40p/week.)

New ways of thinking

The point of this is not to say how hard it all is, but rather how innovative we need to be in thinking about energy. With imaginative thinking we can enjoy using less, and we can know that we will be carrying less 'weight' when the going gets tougher and we need to get going - green 'imagineering'. We can make ourselves respectably green - no more, no less. In this process we will rediscover the delight of travelling light, tap into the latent enthusiasm that exists in work colleagues and find a helpful new guiding principal to apply when rival courses of action otherwise appear equally attractive.

There is a growing body of individuals and organisations committed to new ways of thinking positively and imaginatively about the environment. Forum for the Future says in its brochure: "More and more people now believe that the best way forward is to lay much greater emphasis on the solutions to the crisis. Most of these solutions already exist, be they technological, political or economic. Examples of best practice and pioneering innovation are all around us, but few mechanisms or organisations exist specifically to multiply their beneficial impact. Forum for the Future will help to fill that gap."

Do we 'walk the talk'?

Crucial aspects of all this are common sense and consistency, vital prerequisites to credibility. The extent to which we can all 'walk the talk' (i.e. are visible in doing the things that we say we should do) - at home and as a business - is normally quite a good starting point. And it's startling just how many organisations still have a blind spot for what they actually do themselves. We all do.

The biggest gains result from the clarity that comes from expressing things in *ecopoints*, or *ecocalories*. Issue by issue you can be guided as to whether you are

generally doing well, fairly well or badly relative to others like you. Hence you avoid wasting time in areas where you are already above average. You then save lots of money from focusing on those areas where you are most profligate. In many ways it's arguably healthier to be consistently the same shade of green across the board than it is to be any particular shade. It's more important that you understand what's green and what isn't, than how green you actually are.

Ethical investment

"I want my investment to benefit companies which are helping rather than harming the world". 95% of British adults agree - Friends Provident/NOP Ethical Investment Survey 1996.

Generally unforeseen, there will be a rapid acceleration of pressures to improve environmentally over the next few years. We are about to witness a step change in the way we all think about it. Organisations that are greener by nature will survive and thrive. Much has been written about the power of the purchasing chain. Suddenly we will all be asked how green we are - accountable for our own environmental impact on those around us. In turn, we'll have to ask our suppliers to take responsibility for their impact as well. Suddenly our products and our internal operations will be just as important as our image.

Essex man to ethics people

Now imagine what the business environment might be like in 2020? It's really not so far away. For some readers, 2020 is well beyond retirement; for others it's the mid-point of their career; and for all those children that will be born before the millennium, 2020 will be the beginning of their adult life.

Success - for some companies - will have been earned by their ability to thrive, efficiently, optimally, making the best of all their resources. Sweating their resources as well as their assets. Again, 'more from less'.

Consciousness and conscience (environmental, ethical and social) will be

the new benchmarks of excellence. After all, today's 'customer focus' ultimately extends very neatly - taken to its logical conclusion - into future customer conscious. (As in the recent billboard ad, 'couldn't care less' is replaced with 'couldn't care more'.) Some of the most successful companies have been adopting enlightened attitudes - partnering - openness - seeking win-win solutions and they've been getting great results.

This adds up to a situation where we will all have to be immensely innovative to stay ahead. There will be a chain reaction. The triple bottom line of economics, environment and ethics (mind body and soul) will positively reinforce - a *virtuous circle*. The whole will exceed the sum of the parts and suddenly there will be millions of drops in the ocean, each inspiring more around them. Green begins at home. A stitch in time saves nine. Waste not want not. Walk before you can run.

Just do it !

The first step, if you are inclined to give it a go, is to just try something different. For the right reasons, a tiny shift in habit, subtle new purchasing angle. Just do it. A subtle evolutionary effect occurs as the sum of many small beneficial changes. Just as every individual is no more than their actions, so can an organisation or community be characterised by the sum total of the actions of the individuals. Those who empower environmental innovation will thrive, earn respect, and have fun too.

When you go back to work after reading this, sure, there'll be more urgent problems to deal with, but none more important. In 20 years time, what do you think it will be that you will wish you'd tackled 20 years ago?

References

1. Available from CRC, tel: 0171 505 6622
2. after John Elkington
3. Details from BRE on 01923 664462
4. The EcoCal program is available from Going for Green
5. Available for £2, call 0345 002100



THE AUTHOR

Dave Hampton heads the Environment Group at ABS consulting in London. Until early 1997 he was at BRE (leading BREEAM and a team in BRECSU), spearheading many innovative energy and environmental initiatives there. He is a Cambridge Engineering Graduate, a Eur Ing, and a member of The Institute of Energy, CIBSE and the Chartered Institute of Building. Readers interested in the ideas in this article are invited to contact the author at: ABS consulting, Axe & Bottle Court, 70 Newcomen Street, London SE1 1YT, tel: 0171 378 0006, fax: 0171 378 0016, e-mail: admin@absconsulting.uk.com

ABS CONSULTING

ABS consulting has been described as a team of enlightened building experts, combining a flair for getting things done with a capacity for envisioning. There is a shared passion amongst the staff and directors to continue to green our own organisation, so that we can better advise others.

The company specialises in the provision of strategic services to the owners, managers and occupiers of premises and those who serve them. Its main disciplines are facilities management, environment & sustainability, project management, training, information technology infrastructure and roll out, and building services. ABS clients are blue chip manufacturing, financial, banking and commercial corporations, national and local government, privatised industry; NHS Trusts and similar estate-based enterprises.

Diesel/CNG dual fuel solution to urban pollution



CEEL's dual fuel system can be retrofitted to existing engines. The gas manifold block and high speed solenoid-actuated gas injectors sit between the side of the engine and the conventional air intake manifold.

Dramatic reductions in noxious exhaust emissions (including CO, CO₂, NO_x), exhaust borne particulates and noise have been claimed for a diesel dual fuel (DDF) system developed in Canada and now being introduced to the UK.

The DDF system, which uses a mixture of diesel and compressed natural gas (CNG), is being marketed initially to public utility fleets, particularly city and urban bus operators, local councils, and municipal contractors. An increasing focus on the problems and health risks due to urban pollution and tough new guidelines for reducing pollution has set many local authorities looking at alternative fuels for their own and public transport fleets.

The decision to introduce a diesel/CHG system in Britain follows a positive response from transport

operators, according to Clean Exhaust Emissions Ltd (CEEL), which has been set up to bring the technology to the UK, with backing from the makers of the system, the Canadian Alternative Fuel System Group.

CEEL's Wes Rabey says that DDF is far better than a compromise, offering important operating advantages both in power and cost over converted dedicated gas engines. "In our system, most of the energy comes from natural gas, which is the cleanest fuel for emissions. It is also important that we retain the integrity of the diesel engine".

The DDF system uses the computer and high speed solenoid valve technology, together with multipoint injection, to vary continuously the proportion of diesel and CNG entering the engine depending on operating conditions (engine load/speed),

economics and emissions. Typically, the replacement of diesel by CNG is of the order of 70 to 80%. As diesel is retained as the pilot fuel, the engine does not require conversion to spark ignition, and this allows the full power performance, torque characteristics, efficiency and reliability of the base diesel engine to be retained.

This contrasts with dedicated gas engines, according to CEEL, where the need for spark ignition and necessarily lowered compression results in lower power and reduced fuel efficiency.

In tests, most engines have been found to perform comfortably within the latest 'Euro 2' emissions requirements and the company says it is now working on the basis that even tougher measures will soon be with us. Given its suitability for retrofit conversion of existing engines, the DDF system provides transport operators with a practical solution to the problem of meeting tough new environmental targets with their existing vehicles.

Other advantages over dedicated gas engines are, according to CEEL:

- the capability to change, automatically or manually, from dual fuel back to diesel only whilst in motion,
- the need to carry only half the on-board CNG storage tank volume for a similar range.

Contact Clean Exhaust Emissions Ltd on tel: 01582 734353, fax: 01582 413032.

Captured carbon dioxide to power enhanced oil recovery

Pan Canadian Petroleum Ltd of Calgary has agreed to buy carbon dioxide from the Great plains coal gasification plant in North Dakota, USA, to use to increase oil recovery from the Weyburn oil field in Saskatchewan. High pressure injection of carbon dioxide into an oil field can be a particularly effective method of forcing oil from the pores in rocks and towards the production well, enhancing recovery.

Carbon dioxide is already used for

enhanced oil recovery (EOR) in more than 70 projects around the world, mainly using naturally occurring CO₂. But the Weyburn project, according to a report by the IEA Greenhouse Gas Programme, opens up a possible way of using captured CO₂ as part of a CO₂ emission mitigation programme. The IEA has rated EOR as a high capacity and low cost utilisation technique for captured CO₂.

At the Weyburn project, carbon

dioxide will come from the Great Plains Synfuel plant by pipeline. The plant currently produces 124 million cubic feet per day of pipeline-quality synthetic natural gas, together with several other chemical by-products, including 13,000 tonnes per day of CO₂, from lignite from local mines.

For further details, contact the IEA Greenhouse Gas Programme, tel: 01242 680753, fax: 01242 680758.

Reclaimed roadbuilding materials save energy too

The use of alternative, 'greener' materials such as reclaimed bitumen, demolition waste and industrial by-products for road construction and maintenance could yield both energy and cost savings, according to new guidance from the DETR's Energy Efficiency Best Practice Programme. The use of reclaimed or recycled materials would also lead to further environmental benefits from the reduced haulage and reduced use of primary aggregates.

While many of these materials and techniques are already used in parts of

Europe, the UK has been slow to adopt them and most roads are built using virgin aggregates.

Viable alternatives for all the layers below a road surface are available, says *Energy minimisation in road construction and maintenance*, including industrial by-products such as pulverised fly ash, slags, quarrying wastes and incinerator ash. Alternative binders are also available. Energy use can be cut by the use of subgrade stabilisation for new roads and in-situ recycling of existing roads for maintenance.

Savings can be achieved through:

- the use of less energy intensive materials and processes
- the use of cheaper materials
- lower disposal costs, including reduced landfill tax
- reduced transport costs
- reduced need for primary aggregates.

Energy minimisation in road construction and maintenance is available, free, from the ETSU Enquiries Bureau, tel: 01235 436747, fax: 01235 433066, e-mail: etsuenq@aeat.co.uk

Verifying carbon fixing by growing forests

Some of the mists of Kyoto are beginning to clear with the launch, by the UK-based SGS Forestry, of what is claimed to be the world's first Carbon Offset Verification standard.

One of the problems left by the Kyoto agreement, which allows the trading of emissions of carbon dioxide between countries, is how to first quantify and then certify the amount of carbon taken up by newly planted forests to offset against emissions from power stations and industry. The new verification standard, which was actually launched ahead of Kyoto in expectation of the growth of emissions trading, aims to do just that.

Carbon Offset Verification is, says SGS, a proprietary method of measuring the uptake of carbon dioxide by 'carbon sinks' (ie growing trees in temperate forests and rain forests, and pasture lands). Sinks can exist thousands of miles from the location of CO₂ generation, thus allowing carbon absorbed in one country to be offset against that produced by another.



Growing forests 'fix' carbon; now there is a way to verify and certify the process

The amount of offset carbon will be verified by SGS Forestry, giving rise to Certified Tradable Offsets (CTOs) which

are issued to organisations concerned, have market value and thus can then be traded as futures alongside other commodities such as sugar and coffee.

The verification process takes three stages:

- SGS assesses the suitability of a proposed project - crucially, it must give rise to *additional* carbon fixing, ie a forest planned for other reasons will not qualify,
 - the company then assesses the quality of measurement technology to be used at the site - counting and measuring the dimensions of trees - and uses default conversion factors to turn tree weight into dry carbon weight. At this stage it also assesses risks associated with the project.
 - SGS then certifies the actual carbon fixed, resulting in the delivery of a Certified Carbon Offset.
- SGS is already working on a new forest project in Costa Rica.

Contact SGS Forestry on tel: 01865 202345.

From willow plant to heat and



Year two willow

John Gilliland is primarily a farmer - of 850 acres of cereals - but also an enthusiast for renewable energy. He has operated large straw and wood-fired boilers, which provided all the heat for the Brook Hall Estate near Londonderry, since 1990. But he has long wanted to go further, and in 1995 applied under the Northern Ireland Non Fossil Fuel Obligation to sell electricity generated from energy crops at the Estate to the Grid.

In the spring of 1995, with funding from the EU, John Gilliland planted a trial of five acres of willow coppice. The following spring he planted 35 more acres, this time on a commercial basis, on European 'setaside' land. This was to be the first of three plantings, staggered over three years, to fuel the proposed CHP unit.

Later in 1996, he was awarded a 15 year contract under the NI NFFO and erected facilities for storing and drying woodchips. He also installed the grid connection and placed contracts for the woodchipper, gasifier and CHP unit.

1997 saw another 35 acres of coppice

A farmer in Northern Ireland is pioneering the complete biomass-to-energy cycle. He is growing and harvesting willow coppice; chipping, drying and then gasifying the harvested wood; and using it to fuel a CHP unit, selling electricity to Northern Ireland's power grid and providing heat both to dry the willow and for space heating of farm buildings.

planted; the third and final area will be planted this year. John also had the plant erected and commissioned in 1997, culminating in an opening in October. Until the first of the willow coppice is ready for harvesting (in 1999) the plant is fuelled by imported wood, chipped and dried on the Estate, and the heat used mainly for drying grain. From next year, the harvesting cycle will be complete and another 35 acres of willow should be ready for chipping each year from then onwards.

Once harvested, the coppice is cut, chipped and bulk dried on a ventilated grain floor. Over a period of three weeks, the moisture content is reduced from around 50% at harvest to 8-10%.

Dried wood chips are then fed to a pressurised gasifier, where they are gasified at 1200°C in an environment in which the amount of air is strictly controlled. Under these conditions, the chips give off their volatile gases without burning. These gases are then cleaned and scrubbed to remove dust and tars and cooled in a condenser before being piped to the CHP unit.

The gasifier and CHP plant were both supplied by Rural Generation Ltd, which John Gilliland chairs and which exists to bring commercial gasifiers to the market. "Willow chips are difficult to gasify as they are full of twigs and thus flow poorly" says John Gilliland: "so a gasifier which copes with this should cope with any type of wood chip".

Rural Generation Ltd has won the contract to commercialise a prototype plant originally developed by the Department of Agriculture at Enniskillen College of Agriculture.

The CHP unit supplies 100 kW of electricity and 150 kW of heat, recovered from the engine's cooling and exhaust systems. Electricity is sold to Northern Ireland Electricity at an index-linked price, currently 6.95 p/kWh. Heat is used both to dry the willow chips and to provide space heating and hot water for the Estate's buildings.

The project cost some £138,000 of which the European Regional Fund contributed £69,000. With a net annual revenue of £23,000, the project should repay its capital costs in around six years. The Northern Ireland Department of Economic Development says that around 70,000 hectares of agricultural land in the province could successfully be dedicated to arable coppice. If all of this was developed, it would equate to 54 MW of power production.

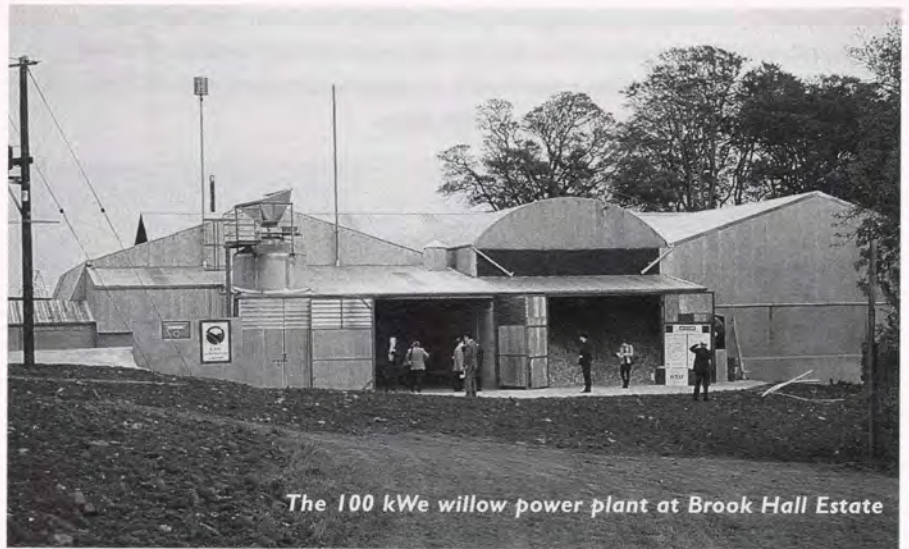
Willow coppice has several advantages over fossil fuels: it is carbon dioxide neutral (the growing crop fixes as much as is released by burning the wood chips) and emits almost negligible amounts of sulphur dioxide and oxides of nitrogen. The growing crop also provides an attractive habitat for local flora and fauna.

The Brook Hall project received substantial support from the EU and is

power plant

believed to be the first to be completed in Europe. The experience has convinced John Gilliland of the potential to make biomass-to-energy plants a success on a larger scale in Northern Ireland. He is now looking at ways to bring farmers and local energy consumers together in order to develop further and larger plants.

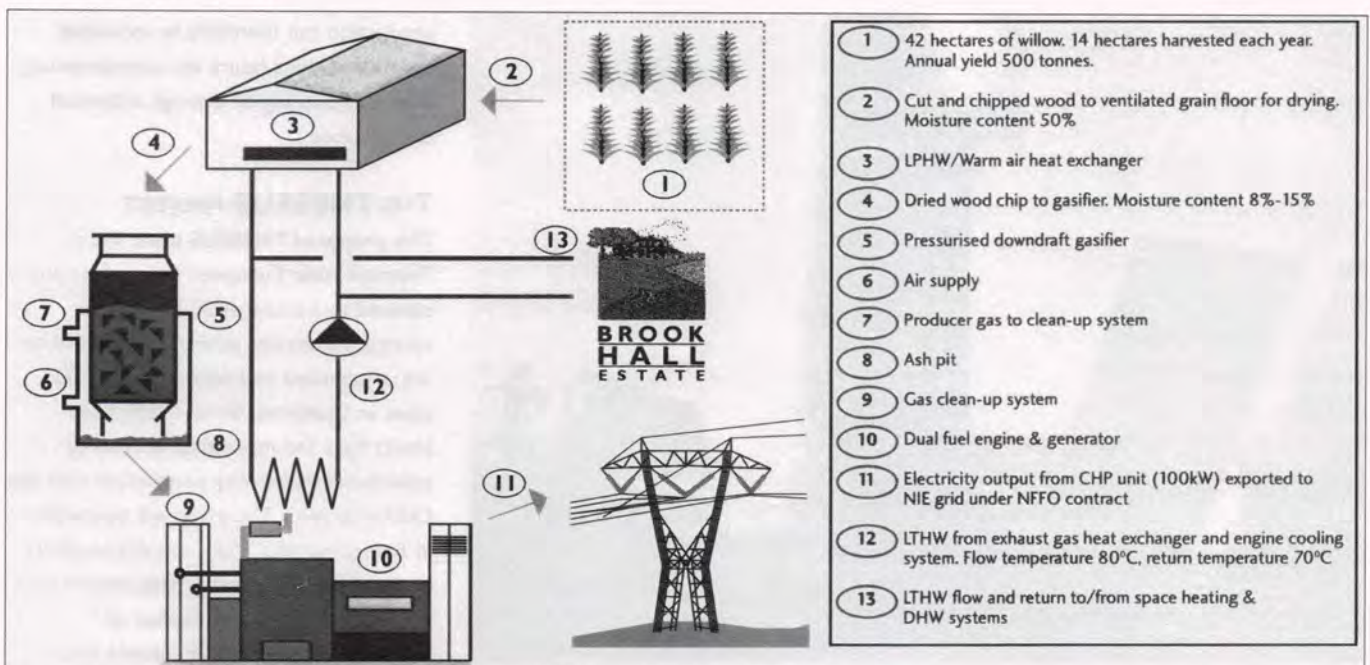
Another local company, B9 Energy Biomass Ltd, is already building a second biomass-based CHP plant (see *Energy World* No 253). The 200 kWe B9 plant will be fuelled by both willow coppice and forest residues gathered from three counties.



The 100 kWe willow power plant at Brook Hall Estate

This article is based partly on an Initial Profile on the Brook Hall Estate project, published by the NI Department of Economic Development. Copies are available from the Energy Division of the DED, tel: 01232 529900, fax: 01232 529549.

Schematic of the plant



Large scale solar for Europe

Europe is yet to build its first solar thermal power station, where solar energy is concentrated by mirrors to give high temperature heat for steam generation. Yet southern Europe, on the edge of the sunbelt, represents an ideal location for solar thermal generated power. Now, supported by a new industry association ESTIA, projects for Greece and Spain have entered the design stage.



The solar Power Tower at the Plataforma Solar de Almería, Spain. A circular array of mirrors (known as heliostats) surround the tower, concentrating sunlight onto a central receiver where the energy is transferred to a heat transfer fluid, and then via a thermal store to a power-conversion system. The PSA receiver can reach temperatures in excess of 700°C and has a maximum power output of 3 MW.

The **THESEUS** project, a proposed 50 MWe solar thermal power plant for Frangokastello, southern Crete was submitted for support under the European Union's THERMIE Programme in 1996. Funding was approved for the design phase for this innovative power plant, the first large-scale plant on European soil, at the end of 1996. The THERMIE Programme also provided support for another southern European plant, proposed by Colon solar for Huelva in southern Spain. Whilst hurdles remain to be overcome before both plants are built and commissioned, there is an excellent chance that by the start of the new millennium, the solar collectors from these two plants could be generating over half a million MWh of energy a year.

Solar thermal power plants are, in principle, conventional thermal power stations that can either fully or partially replace fossil fuel traditionally used as thermal energy input. Solar collectors are used to concentrate solar radiation to produce high temperature solar heat for steam generation in a Rankin cycle power block. However, solar energy alone is not able to meet demand when, for instance, solar radiation is low, such as after sunset and in poor weather conditions. Solar production can therefore be extended beyond sunshine hours via complementary fossil fuel burning or through a thermal energy store.

THE THESEUS PROJECT

The proposed **THESEUS** plant (from Thermal Solar European Power Station) is planned as a nominal 50 MWe solar electric generating power plant based on the established and well-proven SEGS plant in California. Since 1985, these plants have fed more than 6 TWh of solar-based electricity production into the California grid. The plant will be located in Frangokastello, Sfakia, on the southern coast of western Crete. The selection of the site is based on a number of characteristics, including suitable land

thermal power

availability, high levels of year-round sunshine and proximity to water and electrical infrastructure. Crete's development in recent years requires increased electrical generating capacity, and the solar thermal field will be integrated with a fuel oil power supply to adequately meet local demand. As in many areas of the Mediterranean, there is a marked late-evening peak for electricity demand on the island.

The solar field will consist of parabolic trough concentrators similar to that used in the SEGS plants, but with a number of innovations and design improvements which have been incorporated from close monitoring of the SEGS plants.

The Consortium behind the bid includes world-renowned engineering and manufacturing companies including Pilkington Solar International, the project co-ordinator; EUCOMSA, an Andalusian-based metal structure supplier with experience in manufacturing support structures for heliostats; and Fichtner, one of Europe's independent consulting engineers. The consortium further comprises of major European research facilities such as DLR (the German Aerospace Research Establishment) and the Greek national centre for Renewable Energy Sources (CRES).

Locally, the Development Organisation of Western Crete (OADYK) is responsible for local infrastructure projects, and was a collaborator in the THESEUS pre-feasibility project. Its sophisticated solar measurement station was used in a 3-year measurement programme which verified that the site location has, at 2,300 kWh/m², one of the highest European annual direct normal solar radiation levels - comparable to areas of the Sahara Desert, and almost 90% of that experienced by the California SEGS plants in the Mojave Desert.

COLON SOLAR

The Colon Solar plant aims to use a different solar collection technology to extend the life of an existing fossil fuel

power plant, the Cristobal Colon plant located in Huelva, southern Spain. The proposal is to modify the existing plant so that solar-derived steam can be used to supplement the fossil fuel used as thermal energy input, thus reducing carbon dioxide emissions by over a quarter. The planned conversion will also allow the use of fuel oil or natural gas in the boiler, as opposed to just natural gas (in the SEGS plant) and fuel oil (in THESEUS).

Unlike the THESEUS plant, the technology used will be based on a central receiver technology (so-called 'power tower' technology) which uses mirrors to focus sunlight onto a central receiver, mounted on a tower, and through which the heat transfer fluid flows (see photograph).

The Colon plant will not seek to maximise the available solar radiation, so that the temperatures experienced at the receiver are significantly lower than would otherwise be the case. By sacrificing some of the solar energy, it is hoped that a lower-level of technology can be used in the receiver, which would reduce overall costs and increase the reliability of the system (the temperature at the receiver will be within the evaporation zone of the Rankine-cycle). The Colon Solar plant effectively uses the solar contribution to generate saturated steam - the remaining energy processes of water heating and reheating steam is performed in the existing boiler using fossil fuel. There are therefore only two modes of operation: solar/fossil-fuel hybrid and fossil fuel. This compares to THESEUS which has an extra mode of operation, that of purely solar energy input.

The Colon Solar Consortium includes three utility companies, who are looking to evaluate and (if successful) replicate the concept in other parts of southern Europe. They are Sevillana (the local utility, and owner of the power plant), ENDESA (Madrid) and the Electricidade do Portugal. The Consortium also includes Babcock &

Wilcox (manufacturer of the boiler) and ABB Stal of Sweden.

THE FUTURE

Both plants have now entered their respective design phases. Although some problems remain before either enter commission and begin generating power, the future seems bright for large utility-scale solar thermal power generation in southern Europe. Increasingly, there is an awareness amongst policy-makers of the key role that solar energy must take in reducing greenhouse gas emissions, and averting global warming. This is increasingly being translated into innovative financial mechanisms to overcome the economic barriers that solar still faces. This process can only increase, and both consortiums hope that, with proven success, both these projects will form the blueprint for replication in sunbelt countries across the world.

This article is based on an article originally published in 'Sun at Work in Europe'

ESTIA AIMS TO HASTEN THE INEVITABLE

Last year saw the establishment of the European Solar Thermal Power Generation Industry Association (ESTIA) with a mission to hasten the inevitable building of the first stations in Europe. German, Spanish, British and Israeli companies met in Germany for the first annual general meeting.

Secretary General Leslie Jesch says that "with a production record of 6.5 billion kWh the proven maturity of solar thermal power technology is widely recognised. In areas of high solar radiation, solar thermal power produces the cheapest solution to producing electricity from the sun. In terms of installed capacity, it is also the most successful solar technology, with more than 350 MW of capacity already providing electricity to about 200,000 homes in California."

The ESTIA Secretariat is based in Birmingham, tel: 0121 459 4826, fax: 0121 459 8206.

A global pinch



It is almost 20 years since Bodo Linnhoff and John Flowers published their paper on the 'Synthesis of heat exchanger networks', which introduces a thermodynamically orientated method to solve the synthesis problem and provide maximum heat recovery in an optimal network which is economically acceptable. It is now well established under the label 'Pinch Analysis' and sits in a toolbox called Process Integration. But Pinch Analysis has been changing.

There is no better person than 'Mr Pinch' himself to provide a clear picture of the evolution of the technology, which Bodo Linnhoff successively does in his State-of-the-Art Overview written in 1993.

"In the late 1970s Pinch Technology emerged as a tool for the design of heat exchanger networks against the background of the then-current energy crisis. Its key contribution was to give the engineer simple concepts which were used interactively. The approach differed from most of the black box computer-based methods proposed at the time. Using the concepts of Pinch Technology the engineer could stay in control. He or she could use simple targets, take account of operability, plant layout, safety, etc and drive the design towards solutions which were not only thermally efficient (the input of Pinch Technology) but also industrially acceptable (the engineer's input).

In the mid 1980s Gundersen and Naess published a seminal review of heat exchanger

by Barry Firth, Department of Process Integration, University of Manchester Institute of Science and Technology

network design methodology. They gave prime attention to Pinch Technology emphasising its contribution to the definition of heat exchange structures. This fairly reflected at the time the accepted view of Pinch Technology.

Since then, the methodology has become more broadly based. Its principles are still based on those of heat and power thermodynamics and its key strategy is still to set targets prior to design. However, the methodology has been extended to address systems including distillation, heat pumps, cogenerating turbines, furnaces, etc and to address non-energy objectives such as capital costs, operability, and emissions. A general approach has emerged for the integrated design of energy and process systems.

The feel of the methodology has also changed. Its scope has widened and its emphasis has become targeting rather than design. In practice, it is now primarily used for process analysis rather than technology. Today's experienced practitioner will use Pinch Analysis to scope and screen alternative options early during the conceptual design of integrated systems. In other words, the analysis is used as a general methodology for conceptual process design up-stream from flowsheeting and simulation."

INCREASING TAKE-UP

Notwithstanding the promotion and dissemination activities that heralded its birth, childhood, adolescence and, now maturity, awareness, take-up and popularity of the technology appear to be well established only in the UK. However, other industrialised nations are beginning to utilise the technology more widely.

The International Energy Agency established an Implementing Agreement on Process Integration in September 1995 in the belief that such an Agreement would enhance awareness amongst the senior echelons of

governments and major industry and, consequently, create 'top down' pressure for take-up and implementation.

However, in a highly competitive business world, improvements to operational efficiency have to be measured against the cost of implementing change. Where the potential for achieving promising results from investing in new technology and methods is speculative there is suddenly a shortage of risk takers in the business.

PROCESS INTEGRATION

Where does Process Integration technology fit into this scenario? Its advocates make strong claims, backed by sometimes dramatic results, that the conceptual design tools that are available, at relatively low cost, can lead the way to singular success for the company in its efforts to improve efficiency.

But why are the companies not knocking on the developers' doors? Whilst some sceptics continue to consign the power of Pinch to the waste incinerator, the research, its applications and results have now been so extended by the team at the Department of Process Integration at UMIST that the global potential can now be more readily digested. International interest is growing.

It was here at UMIST that Bodo Linnhoff and Robin Smith came in the early 1980s to pioneer and develop the work. A research consortium was established in 1984 and by 1986 a Centre for Process Integration was set up within the Chemical Engineering Department. In 1993 the University Council accepted that the methodology was an academic discipline in its own right and a Department of Process Integration was formally established in that year.

Robin Smith became Professor and Head of Department in 1995 and at that point began to broaden the research programme and extend the boundaries of the work to such an extent that both the academic and

commercial world have sat up and noticed.

The UMIST research programme is now well established around three major themes, efficient use of raw materials, emissions reduction, and of course, energy efficiency, which was where it all began back in 1982. It has now been extended to include the efficient use of capital assets, process operations, and process development. There are 25 specific research projects in operation within these themes.

The researchers at UMIST make good use of the Process Integration toolbox to help them achieve the best and speediest results possible. Whilst Pinch Technology (or Pinch Analysis) is the prominent tool for targeting the best design options, other tools such as mathematical programming, simulated annealing and exergy analysis are also utilised. These techniques provide tools for scoping and screening many design options quickly and efficiently and to provide systematic methods for designs that can be achieved in practice by industry.

The success of the research depends heavily upon industry's utilisation of the technology. There are many impressive published testimonials about the effectiveness of the department's research. Major operators from around the world have achieved improved efficiencies of up to 30%, along with reduced capital costs, within very short payback periods following investment in a new or modified design process that has utilised the technology. These successes have also been mirrored in water and wastewater minimisation, where improvements have been as dramatic as a 95% reduction in the final volume of effluent to be treated, along with an annual saving of \$1 million per annum in operating costs. In another case, a design solution has been provided that will reduce the on-site fresh water demand by 50%, along with a 65% drop in wastewater production.

A major technique for hydrogen management in oil refineries has also been developed and proven, whilst a new method for scheduling has achieved substantial savings in delivery costs for another major operator.

The potential for many other successes is emerging through research on reactor design, distillation design, and automated

design of heat exchanger networks, cogeneration and total site utility systems, and power station design.

RESEARCH CONSORTIUM

Industry's response to all of this is increased growth in the membership of the UMIST Department's Research Consortium, which began life in 1984 with six founder members and has now reached 30.

The growth of the Consortium reflects some interesting trends. In the early 1980s, its composition was entirely of production companies. By the late 80s this sector was further consolidated but was also joined by a significant group of engineering contractors. The latest trend, however, is the recent involvement of software and engineering consulting groups. The current make-up is 16 production companies, seven engineering contracting companies and seven software and engineering consultants.

This now provides much more balance to the Consortium. At the same time it is an extremely vibrant body of people with a common interest in developing and applying Process Integration technology to the intensifying challenges of a progressive and diverse process industry.

There are also interesting geographical trends in the disposition of the membership, with six in North America, nine in the UK, three in Japan, one in Indonesia, three in The Netherlands, three in Romania, and one in each of Belgium, France, Norway, Finland.

Head of Department Robin Smith believes the successful growth of the Consortium acknowledges the position of his young department as a world leader in the field of process engineering design technology. "Thirty major companies from around the world don't spend their money on research activities if they don't believe they will gain a quick return on their investment." Smith also points out that this also keeps his researchers on their toes. "If we don't focus on the needs of industry, we won't be able to deliver results of any value."

Much of the department's recent success has been achieved by its ability to

transfer its technology through an impressive array of Windows-based software design packages that are exclusive to the Consortium members.

The identification of the research programme is undertaken in consultation with the sponsors who collectively see the themes as their key business drivers. Application of the results will improve operational efficiency in an economically acceptable way. Viability in this context also has levels of acceptability in the political and global environments.

WIDER SCOPE

The challenge of winning global support is slow and frustrating but the technology has the flexibility to address not only engineering, civic, and all environmental resource issues, but also has the potential to provide an optimisation tool for the world of finance. Whilst political leaders are vociferous, money really talks!

The extension of Process Integration to large-scale total factory sites was an enormous step change that brought equally rewarding benefits. Similarly, applications can be applied to district community services in power and water supply, and improving their efficiency.

The larger the scale, the greater the complexity of the challenge which is embedded in the data required for analysis and optimisation. Implementation of conceptual design options then requires investment related to payback time in monetary terms, but increasingly also in environmental terms. It also requires widespread technical awareness and "champions" who will ensure successful implementation.

When top down support for take-up of the technology is achieved in a global arena, society will ultimately benefit from a relatively low cost investment and the innovators deserve wider support and recognition on the international stage.

Contact Barry Firth at the Department of Process Integration, UMIST, tel: 0161 200 4393, fax: 0161 236 7439, e-mail: b.firth@umist.ac.uk

Don't waste an opportunity

Most readers of Energy World are familiar with the DETR's Energy Efficiency Best Programme. Less well known is the joint DETR/DTI equivalent for environmental technology.

Where can companies find help when faced with fierce competition and pressures for improved environmental performance? A good place to start is the Environmental Technology Best Practice Programme, a DTI and DETR initiative designed to help companies increase profits and reduce waste. The Programme runs the Environmental Helpline, which is free for all UK businesses, and promotes measures for companies to reduce waste at source.

ENVIRONMENTAL HELPLINE

The Environmental Helpline (on 0800 585794) is the gateway to the Programme. As well as giving you information about the Programme's activities, the Helpline provides free up-to-date information on any environmental issue. Helpline staff will try to answer any environmental query immediately, or they will arrange for a specialist to contact you. The specialist can work on your problem for up to two hours free of charge.

If your company has fewer than 250 employees, you may be eligible for an Environmental Counselling visit, another free service offered by the Helpline. This confidential service provides for an environmental specialist to visit your site and prepare a report showing priorities for action.

WASTE MINIMISATION

It is fair to say that few companies know how much waste really costs them. The cost of waste is often seen as simply the cost of waste disposal, which can be calculated from waste contractors' and water companies' invoices. However, a number of case studies have shown that disposal costs are just the tip of the iceberg - the true cost of waste is often ten times higher than the disposal cost. The true cost includes the cost of wasted materials, wasted energy and wasted time.

A good example of how waste costs are underestimated comes from the

Leicestershire Waste Minimisation Initiative, which helped ten companies to reduce the amount of waste they produced. At the start of the initiative, the companies estimated the total cost of waste at about £500,000 but many admitted that they didn't really know. Experts reviewed the true cost of waste to each company and found that it was actually about £13 million per year - 26 times what the companies had estimated.

The results from the Leicestershire initiative are in line with other projects which have found that, on average, waste costs companies about 4% of turnover. The good news for companies is that they can usually reduce the cost of waste by about 25% by undertaking a waste minimisation exercise. This effectively means that they can turn 1% of turnover into profit.

Many ways of reducing waste will involve little or no capital investment and will bring cost savings almost immediately. However, in many industries, even larger benefits will accrue from investment in cost-effective cleaner technology.

HOW THE PROGRAMME CAN HELP

In addition to the services of the Environmental Helpline, the Programme provides guidance on reducing waste at source. The Programme produces a range of publications, which are all free of charge to UK businesses:

- Good Practice Guides - designed to give practical advice on waste minimisation and cleaner technology options. The range includes guides for all companies and guides for particular industry sectors.
- Case Studies - these leaflets give details of what individual companies have done to reduce waste at source. They cover a range of sectors and technologies and the results are independently audited by the Programme.
- Environmental Performance Guides - produced on sector-specific issues, these guides show the ranges of environmental and cost performance for particular operations. They allow companies to see what scope for improvement they have in comparison

with their competitors.

The Programme also organises free seminars and workshops or helps other organisations to do so.

ENVIRONMENTAL MANAGEMENT SYSTEMS

The take up of accredited environmental management systems (EMS) by UK industry has been slow. One reason for this has certainly been the confusion over which standard to adopt. With the international standard now operative and the British Standard due to be superseded, this barrier has effectively been removed. However, many companies are yet to be convinced of the benefits of an environmental management system. For these companies, the Programme recommends that waste minimisation is looked at first. By undertaking a waste minimisation exercise and incorporating it into everyday working practices, they will be using a type of environmental management system and will learn the benefits. This will put them in a good position to progress to a full, accredited system in the future.

A Good Practice Guide on EMS is available through the Environmental Helpline. Although it is aimed at foundries, the Guide describes a practical step-by-step method of implementing an EMS which should be of use to a wide range of companies. The workbook approach of the Good Practice Guide is designed to help a company with no previous experience of environmental management to carry out an environmental effects review, write a policy, plan the programme and then implement an EMS. Similar guides are being considered for other sectors.

CONCLUSION

By using a systematic approach to waste reduction, companies can save money and reduce their environmental impact. The Environmental Technology Best Practice Programme can provide guidance on how to do this and its Environmental Helpline (freephone 0800 585794 please quote ref 96/40/EVV) can give information and advice to all businesses on any environmental issue.

February 1998

International coal supply contracts and transport logistics

Course, 9-13 February, Surrey, £2485 + VAT
Details from CoalTrans Training, tel: 01779 8945, fax: 0171 779 8946

European Energy 98

Conference, 10-11 February, Brussels, £1199 + VAT
Details from RISK Publications, tel: 0171 487 0707, fax: 0171 487 0715, e-mail: conf@risk.co.uk

UK gas market

Conference, 10-11 February, London, £999 + VAT
Details from IIR, tel: 0171 915 5055, fax: 0171 915 5056

Commissioning buildings - an opportunity to reduce energy costs

Workshop, 11 February, Manchester, free
Details from BRECSU, tel: 01923 664723, fax: 01923 664602, e-mail: brecsuenq@bre.co.uk

Application of CIBSE Energy Codes

Workshop, 11 February, Manchester
Details from CIBSE, tel: 0181 675 5211, fax: 0181 673 3302

Switchgear technology for power systems

Course, 11-12 February, Chester, £675 + VAT
Details from Del Bennett, EA Technology, tel: 0151 347 2557, fax: 0151 347 2256, e-mail: db@eatl.co.uk

Commissioning buildings -

an opportunity to reduce energy costs

Workshop, 12 February, Coventry, free
Details from BRECSU, tel: 01923 664723, fax: 01923 664602, e-mail: brecsuenq@bre.co.uk

Oil and gas after 2000

Conference, 16 February, London
Details from the Institute of Petroleum, tel: 0171 467 7100, fax: 0171 255 1472

Electricity and gas - stakeholder expectations in a competitive market

Conference, 16-17 February, London
Details from The Economist Conferences, tel: 0171 830 1000, fax: 0171 931 0228

The Yamal pipeline and the European gas market

Conference, 16-17 February, London, £899 + VAT
Details from SMi Ltd, tel: 0171 252 2222, fax: 0171 252 2272, e-mail: 100531.3067@compuserve.com

UK generation workshop

Course, 16-18 February, Brighton, £1395 + VAT
Details from Power Ink, tel: 01730 265095, fax: 01730 260044

How to do an energy survey

Course, 17 February, Manchester, £194
Details from Mid Career College, tel: 01223 880016, fax: 01223 881604

World deepwater technologies

Conference, 17-18 February, London, £749 + VAT

Details from IBC, tel: 0171 453 5491, fax: 0171 636 6858, e-mail: cust.serv@ibcuk.co.uk

Oil price

Seminar, 18 February, London
Details from the Institute of Petroleum, tel: 0171 467 7100, fax: 0171 255 1472

CHP 2000

IMechE conference, 18-19 February, London, £424 + VAT
Details from IMechE, tel: 0171 973 1304, fax: 0171 222 9881

How to conduct an energy survey

Course, 19 February, Bristol, £75 + VAT
Details from TORPY Energy, tel: 0117 938 9300, fax: 0117 938 9315

Innovations in offshore field developments

Conference, 19 February, London
Details from the Institute of Petroleum, tel: 0171 467 7100, fax: 0171 255 1472

Boilerhouse management

Course, 23 February, London, £194
Details from Mid Career College, tel: 01223 880016, fax: 01223 881604

Offshore pipeline technology

Conference, 23-24 February, Oslo, £799 + VAT
Details from IBC, tel: 0171 453 5491, fax: 0171 636 6858, e-mail: cust.serv@ibcuk.co.uk

Efficient use of electricity in buildings

Course, 24 February, London, £194
Details from Mid Career

College, tel: 01223 880016, fax: 01223 881604

Electricity Pool 1998-2000

Conference, 25-26 February, London, £999 + VAT
Details from IIR, tel: 0171 915 5055, fax: 0171 915 5056

March 1998

Emissions from combustion plant

Conference, 3 March, Birmingham
Details from the Combustion Engineering Association, tel: 01685 879119, fax: 01685 874400

Power system protection

Course, 3-5 March, Chester, £895 + VAT
Details from Del Bennett, EA Technology, tel: 0151 347 2557, fax: 0151 347 2256, e-mail: db@eatl.co.uk

Gas, power and regulation in Latin America

Conference, 4-6 March, Miami. Details from the Centre for Global Energy Studies, tel: 0171 704 6161, fax: 0171 704 8440

Renewable energy on roofs and facades

Conference, 8-9 March, The Netherlands
Details from European Media Marketing, tel: 0181 289 8989, fax: 0181 289 8484

Where is the gas market growing?

Conference, 9-10 March, Stratford-upon-Avon, £595 + VAT
Details from the Gas Association of Great Britain, tel: 01670 514617

He's a winner!



Past President Peter Johnson, awarding the President's golfers cup to John Ingham, Honorary Treasurer. (it's not a fix honestly!)

On the 15th of October Institute representatives from all over the country prepared to tee off at the crack of dawn in Middlesex. The golfers day, hosted by Peter Johnson was

deemed very enjoyable and successful, but we are told there were no holes in one. John Ingham hopes to host the event in the Midlands this year, so get your putters ready!

New Members

LONDON & HOME COUNTIES

MR A M MACQUEEN, MInstE, Hertfordshire
MR B K MCROBIE, Associate, Battersea
MR J WAKEHAM, Associate, BP Energy Ltd
MISS D GILLESPIE, Student, Middlesex University
MR J O WANDJE, Student, Southbank University

NORTH WEST

MR D F BLUNDELL, Associate, NW Trains

NORTH EAST

MR A D SCOTT, Associate, NEA, Newcastle
MR M C ADAMSON, Student,

Newcastle University
MR J S TATTERSALL, Student, Newcastle University

MIDLANDS

MR I AHMED, Student, Aston University

SCOTTISH

MR S J GADSDEN

SOUTH WALES AND WEST OF ENGLAND

MR J B LACY, Associate, Lucas Diesel Systems
MR JP NETTLETON, Graduate, Cardiff

OVERSEAS

MR A TSALAMANDRIS, Student, Greece

Branch Events

February 1998

IMECHE

Wed -Thurs, 18-19 February
CHP 2000 - Cogeneration for the 21st Century. To be held at the IMechE Headquarters, 1 Birdcage Walk, London. Cosponsored by The Institute of Energy, so member rates are available. For details contact Uloma Otuonye, tel: 0171 973 1304

NORTH EASTERN

Monday, 9 February
"Gas Transportation for Power Generation" by Mr J Carmicheal & Dr R Treece, Advance Engineering Solutions Ltd at University of Newcastle, Merz Court, Lecture Room L101. Joint meeting with IEE, IChemE and IGasEng. Contact Mr C R Howarth, tel: 0191 222 7303

SOUTH WALES AND WEST OF ENGLAND

Tuesday, 17 February, 5.30pm
"Energy Efficiency in the Human Machine" - Speaker to be announced. Cardiff University, Newport Road. Contact Mr I Weslake Hill 01222 757527

YORKSHIRE

Wednesday, 18 February, 2.30pm
"Human Factors in Process Safety" Dr Martin Pitt of Sheffield University at The Department of Fuel and Energy, University of Leeds. Contact Mr A Mallalieu, tel: 0113 2768888

NORTH WESTERN

Thursday, 19 February, 7.30pm
CDM/Risk Assessment CPD - Mr T England, Health and Safety Officer. Contact Mr M Cropper,

tel: 01925 254384, email: matthew.cropper@acat.co.uk

NORTH WESTERN

Wednesday, 25 February, 5.45pm
"Aspects of Atmospheric Pollution" - Dr R Clucas at AEA, Birchwood Conference Centre, Risley. Contact Mr M Cropper, tel: 01925 254384, email: matthew.cropper@acat.co.uk

March 1998

THE COMBUSTION ENGINEERING ASSOCIATION

Tuesday, 3rd March
Emissions from Combustion Plant IV - A review of the Kyoto Earth Summit and the practical implications for Combustion Plant Operation. Cosponsored by The Institute of Energy, so member rates are available. For details tel: 01685 879119

MIDLAND

Thursday, 5th March, 6.30pm
"Photovoltaics" - Prof. R Hill of the University of Northumbria. A joint meeting with the IEE at Austin Court, Birmingham. Contact Mr H Freeman, tel: 0121 353 2397

NORTH WESTERN

Tuesday, 10 March
Visit to Manchester Airport. Contact Mr E Curd, tel: 0151 625 6744

SOUTH WALES AND WEST OF ENGLAND

Wednesday, 11 March, 4.30pm
Committee meeting followed by "Young persons paper evening" sponsored by SWEB. Contact Mr I Westlake-Hill, tel: 01222 757527

TEMOL Tributes in Northern Ireland



(left to right) Keith Bradley, TEMOL candidate, Ulster Carpet Mills Ltd, Andy McCrea, TEMOL tutor, Herbie Wright, Vice Chairman of Northern Ireland Branch, Robin Davey, TEMOL tutor, John Hill, TEMOL candidate, Green Park Healthcare Trust

At the end of last year the Northern Ireland branch arranged an awards ceremony for the Training in Energy Management through Open Learning (TEMOL) candidates that had completed the course. The two candidates began TEMOL when it was first developed and were part of the pilot group that tested the materials.

Satisfied with the content, they have now completed the course, and so are competent in the fundamentals of energy management. John Hill is now climbing the energy management ladder to the very top, by collecting evidence for his VQ in Managing Energy, using knowledge gained from TEMOL. So hopefully you will see more of John in future

editions, when he collects his VQ unit certificates at the awards ceremony due to be held at the end of March.

If you would like more information about TEMOL, the VQ in Managing Energy, or other energy management initiatives, please contact Louise Collins on 0171 580 7124, email: lcollins@ioe.org.uk

NI Branch Yearbook and Directory

The Institute's Northern Ireland Branch has published its 1997/98 Yearbook and Directory. The 150-page publication includes news and reviews of Branch events, a series of articles on the energy scene in Northern Ireland and directories of both members of the Institute and local suppliers of products and services.

Under its new Chairman, Charles Hamilton, the Branch has gone from strength to strength, holding eight meetings over the 1996/97 period including a lecture by Dr Mary Archer on the role and future of renewable energy in the Province.

A major event coming up this month is 'The Flames Roadshow' - a lively presentation by scientists and engineers from the Gas Research and Technology Centre in Loughborough and aimed at schoolchildren. The event will be held in Belfast on 25 February.

See the events calendar for more events in Northern Ireland.

For copies of the Yearbook and Directory, contact the Branch's Honorary Secretary, Dr Patrick Waterfield, School of the Built Environment, University of Ulster, Jordanstown BT37 0QB, tel: 01232 364090.

Energy Management

The Standard has been set,

now reach and uphold the national standard with these four practical workshops

Aston Science Park, Birmingham, February 24

The Industry Centre, Sunderland, March 3

Anniesland College, Glasgow, March 4

Regent Posthouse Forte, London, March 5

Call Maria Adams for a brochure on 0171 580 7124, email madams@ioe.org.uk

