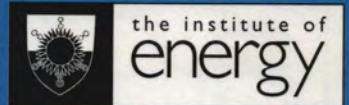


THE MAGAZINE OF THE INSTITUTE OF ENERGY

energy



No.257 March 1998

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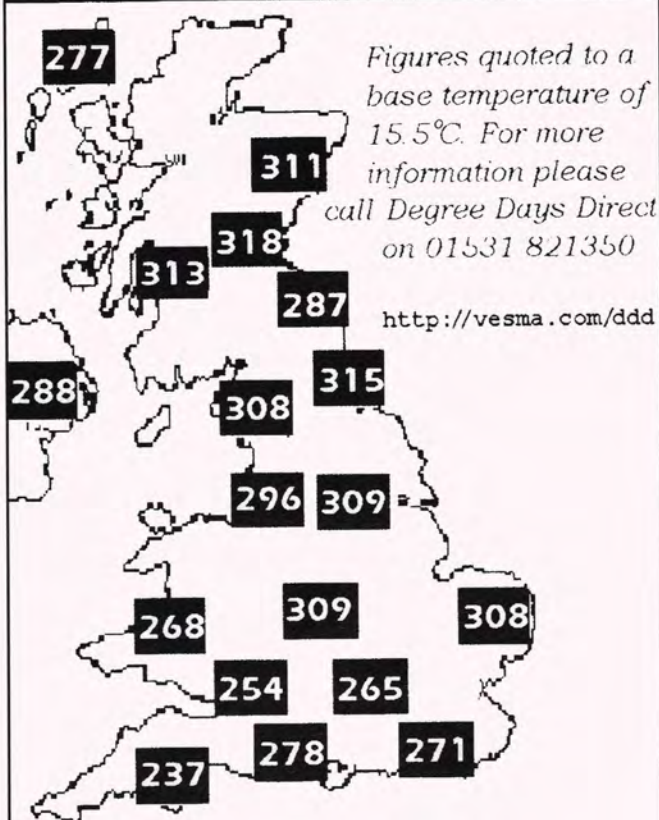


Brent Spar solution

THE FUTURE FOR COAL

Ground source heat pumps

Degree days: December 1997



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South Wales & West of England Branch

CRE Annual Lunchtime Lecture 1998

to be held on 19 June 1998 at Stoke Orchard near Cheltenham.

MR R W Lee of Imperial Smelting Processes will be speaking on the energy issues involved with Zinc and Lead smelting. A field in which ISP are world leaders.

The meeting will start at 10.00am with coffee and a free buffet lunch after the presentation.

Please contact Ken Gaunt on 01222 623879 to book a place.

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

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Numbers for lunch are limited to 120, and spaces are going fast, priority will be given to members of the Institute.

THE MAGAZINE OF THE
INSTITUTE OF ENERGY

Contents



PUBLISHED BY
THE INSTITUTE OF ENERGY
18 Devonshire Street, London W1N 2AU
info@ioe.org.uk
eworld@ioe.org.uk
www.instenergy.org.uk

EDITOR
Steve Hodgson
Tel/Fax: 01298 77601

ADMINISTRATION
0171-580 7124

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

ART EDITOR
Louise Collins

DESIGN
Steven Stoner, X-Design
0181 948 2405

ADVERTISEMENT SALES
RGO Exhibitions & Publications Ltd
Pam Bourne Tel/Fax: 01424 883110

PRINTED BY
Headley Brothers Ltd, The Invicta Press,
Ashford, Kent



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

ISSN 0307-7942

**Energy World is printed on
wood-free, chlorine free pulp**

Viewpoint 2

NEWS

International News 3

Home News 4

Institute News 23

FEATURES

The Government Review - last chance for UK coal? David Parry 8

Global coal market; production shifts from Europe 10

Fossil fuels

UK refinery power station, LNG prospects, North Sea gas deals to Europe 11

Unusual in the extreme - batteries for industry and commerce

John Taylor and David Pattison 12

2020 Vision identifies energy technology for the future 15

Southwark's European energy agency 16

Ground source heat pumps - heating and cooling for buildings

Robin Curtis 18

Refinements in combustion gas analysis Dr Ian Brown 20

Kyoto agreements and UK industry Professor Jim Harrison 23

DIARY

Events 22

COVER

An artist's impression of the quay extension and ferry terminal proposed for Mekjarvik in Norway - due to rest on six 'slices' of Shell UK's redundant Brent Spar structure, thus removing the need to manufacture new steel. Shell has selected this 're-use' option for the giant, disused oil storage and loading buoy after originally planning to sink it in the Atlantic ocean.

See page 6 for the full story.

Complexity, convergence and a little confusion

Pity today's energy buyer. Ten years ago he was promised lower prices, thanks to a burgeoning competitive market. However, whilst he may be enjoying reduced fuel bills, he is now doing business in a market of increasing complexity.

True, there is an abundance of information available from which to make an informed choice. There is also a multiplicity of suppliers all supported by keen salesman, backed by even more information, and, somewhere amongst all this confusion, there is just one solution which is exactly right.

Looking for this perfect solution, the buyer may have been sustained by the hope that by now the market might have settled down. In fact, it is still developing - and this latest stage of development is characterised by convergence.

Advances in information technology are making the traditional structures of gas, electricity and other utilities industries obsolete. Existing databases can be merged so that multi-utility companies can operate a number of markets from the one database. The value here is in the savings of scale and manpower which might be expected to accrue for the company.

As things stand, however, this pattern of convergence is creating certain difficulties. The regulators and politicians are imposing a plethora of reviews, green papers and white papers on the utilities, most of which are aimed at protecting customers' interests. And the postponement of fully liberalising the electricity market in 1998 (see page 4), has led to further confusion with moves to prevent electricity companies supplying gas in areas where the gas companies cannot yet supply electricity.

Convergence should also mean advantages for buyers. For those with large numbers of sites and outlets, modern data management means consumption and charges for all of the sites on any contract can be detailed and totalled on one bill, resulting in administrative savings for the customer. In some cases, both billing and payment are carried out by electronic data interchange (EDI), without the need for the traditional paperwork.

Buyers might also be expected to benefit by buying all their energy requirements from one source with one contract and one bill covering both gas and electricity. However, whilst some suppliers are offering 'dual fuel' contracts, the early experience of a number of purchasers is that trying to use these to cut energy costs is akin to a double-edged sword.

Dealing with one company, buyers have found each part of the contract is negotiated with separate account managers and separate bills are sent for gas and electricity. At least one customer has said there was little difference in dealing with two individual companies.

In one case where the supplier was eventually persuaded to



Peter G Heslop,
Editorial Director,
Major Energy Users' Council

consolidate the arrangements for both gas and electricity, the buyer was satisfied with the electricity price but realised he could have achieved a more favourable gas price elsewhere. In this case the gas consumption was comparatively low and was of less importance than the convenience of single billing.

Many buyers have found that setting up a beneficial contract for the purchase of gas has meant buying electricity at full tariff rates.

Some suppliers, however, have been quick to appreciate the dilemmas and difficulties faced by a buyer who has to negotiate with more than one salesman within a company. At least one organisation has taken steps to allocate a single account manager to handle all aspects of dual fuel arrangements and billing.

At present, buyers seeking the advantages promised by competition in the under 100 kW market are extremely angry at the recently announced delay. The start-up date has been postponed from April to September 1998, when competition will begin in the first of three tranches. Other regions are planned to open in October and December but full competition will not be achieved for a further six months after these dates.

At a recent meeting of the Major Energy Users' Council (MEUC), members were in a particularly censorious mood. There was no excuse for this shambles, they felt. The Electricity Supply Industry had known since 1990 that full competition was due to be delivered on 1st April, 1998 and had stalled until the eleventh hour before officially informing customers of what they had suspected for several months.

Many MEUC members with sites in the under 100 kW market have invested time and money in the installation of half-hourly metering in order to be in the first tranche of the competitive market. This investment would appear to be seriously premature with returns on capital now delayed by several months.

Even the Energy Minister, John Battle, joined in what fast became a cry of general disapproval. "I am not pleased that customers are going to have to wait longer than anticipated for competition," he said, "but I am adamant that we must have thoroughly tested and reliable systems which enable customers to choose their own supplier. It would be irresponsible and irrational to press ahead with incomplete or partially tested systems, with all the risks of disruption to customers that would entail. Why should customers put their trust in these systems unless they have full confidence?"

And why, one might ask, should the user be disadvantaged by the mistakes or misjudgements of others?

Contact the MEUC on tel: 0181 997 3854, fax: 0181 566 7073

EWEA aims for 100,000 MW of wind power



Part of the Juan Grande wind park being developed on the island of Gran Canaria in the Canary Islands. The 67 turbine park uses 300 kW machines which incorporate hydraulic components from the Watford-based Parker Hannifin.

The European Wind Energy Association has adopted an ambitious target of 100,000 MW of wind power in Europe by 2020. The new figure builds on the aim to have 40,000 MW installed in 2010, now incorporated by the European Commission in its White Paper on renewables.

The EWEA also says that:

- Each European country should be obliged by a new EU Directive to supply a committed share of renewable electricity, including a wind energy obligation, towards the overall target of 12% of primary energy by 2010.
- A system of tradable renewable energy credits and an obligation on

electricity suppliers is accepted as an appropriate way forward in a fully liberalised market.

- Local authorities should be obliged by central government to designate specific areas as suitable for wind energy development in line with national targets.
- Offshore wind should be promoted and supported, but to complement and not replace onshore developments.
- A Europe-wide fund should be established to help pay for the major grid development work needed to incorporate a growing proportion of renewable energy.

Photovoltaic market 'will triple in five years'

The European PV (photovoltaic) modules market may be small at present, but it is a highly dynamic and fast growing one, says a new report from Frost & Sullivan. Most companies active in this market are expanding their production and diversifying their product ranges in order to meet the ever growing demand in Europe as well as on a global scale. The total market for PV modules was estimated to be worth \$90 million in 1996 (these revenues were generated from the sales of modules by manufacturers, not distributors or re-sellers), and are forecast to increase to \$350 million in 2003.

According to Frost & Sullivan, the European PV modules market is still fairly

embryonic, consisting of a relatively small number of manufacturers and suppliers. The situation is changing, however, as the market is growing in response to the high demand. Companies trying to enter the market are facing a number of barriers, which has slowed down the rate of penetration. Hurdles include regulation within countries biased towards domestic manufacturers and the complexity of the technologies. However, technological developments in both crystalline and thin film PV modules, the lowering of prices of PV cells, growth in demand in grid-connected applications, and new funding from national governments and the EU will ensure that the market grows.

New coal-fired plant for Zimbabwe

The Government of Zimbabwe has awarded exclusive negotiating rights to develop Southern Africa's first major independent power project National Power, the Zimbabwe Electricity Supply Authority (ZESA) and Rio Tinto Zimbabwe. The project sponsors are to develop a new 1,400 MW coal-fired power station in Gokwe North, situated in north west Zimbabwe, at a project cost of around \$1.5 billion. Output from the plant will be sold through a 25-30 year power purchase agreement with ZESA.

The Gokwe North power station will consist of four 350 MW generating units. Three of these are to be operational by the winter of 2004, with the fourth unit currently planned to come into commercial operation three years later. The plant will be supplied by coal under a fuel supply agreement from a new open cast mine to be developed alongside it by Rio Tinto. The mine has proven reserves of more than 500 million tonnes of low sulphur coal, say the partners, a significant new source of energy for Zimbabwe.

Electricity liberalisation start delayed until September; gas will be completed by May



Professor Littlechild - five month delay will be sufficient

Liberalisation of the sub-100 kW electricity market has been postponed from 1st April to a phased introduction starting in September this year and completed by June 1999. Small business and domestic consumers will thus have to wait at least five extra months before being able to select their electricity supplier.

The delay - which had been expected for some time, despite the electricity industry having a total of eight years to prepare for this last stage of market liberalisation - was announced by electricity industry regulator

Professor Stephen Littlechild after he received a progress report from the PA Consulting Group. PA is acting as overall manager for the '1998' programme, on behalf of Offer

The report, says Offer, pointed to substantial progress in the programme, but also to delays in resolving some industry design issues and in testing IT systems. A number of detailed changes are now required, says Offer, to enable company IT systems to integrate properly with each other.

Professor Littlechild and Energy Minister John Battle both expressed their disappointment. Littlechild said: "It is important to ensure that competition is introduced as soon as practicable. However, it is equally important to ensure that service to customers is maintained and the new arrangements work smoothly. It is clear that the industry will not be ready to implement the necessary changes to ensure that competition can be introduced in April in a

satisfactory manner.

Offer is confident that "a five-month delay will provide sufficient time to complete the remaining work in an orderly manner consistent not just with the early introduction of competition but also with ensuring that the risks of disruption to customers arising from the changes is minimised".

Professor Littlechild stressed that: "Introducing competition for 26 million electricity customers is one of the largest and most complex IT-based change programmes in the world. Notwithstanding delays in some areas, important progress has been made. The new licence conditions are now in place, the commercial agreements underpinning the programme are nearing agreement, major IT systems have been delivered and the overall design completed. National testing has started and this has increased confidence in the integrity of the overall design of the programme".

While some energy users reacted to the delay with anger,

the Electricity Association's chief executive, Philip Daubeney said that: "customers will still benefit from price cuts from 1 April, and they can expect further cuts as full competition in electricity supply is introduced".

Meanwhile, and in marked contrast to the delays to electricity liberalisation, Ofgas has set a firm date - 27 March - for the start of the next step (Tranche 3) of domestic gas competition. From then, 2.9 million gas users in an area stretching from Cheshire to West Yorkshire will be able to choose their gas supplier. This will bring a choice of gas supplier to a total of more than 10 million people - half of those on mains gas throughout Great Britain.

In Tranche 2, domestic gas competition moved to the counties of Cumbria, Greater Manchester, Merseyside, the City of Kingston-upon-Hull, Lancashire, the East Riding of Yorkshire, North Yorkshire and York on 27 February.

Ofgas expects the introduction of competition being completed by 23 May 1998.

Users brand settlement charges 'misleading'

The Major Energy Users' Council has criticised as 'misleading' the announcement by the electricity Pool that the settlement charge levied on 100 kW electricity buyers is to be reduced by 12%. The

Pool says the charge is to be reduced from £565 to £495 a year.

But the new figure of £495 does not include rental charges for communication links, which range between £70 and £140, while this year's

figure of £565 does, says the MEUC. The settlement fee overall has therefore risen by up to 12% it adds.

The figure covers the Pool's operational costs for data collection and analysis, and communications

overheads. The Pool says that, up to now, it has subsidised the cost of telephone line rentals but that these costs will in future be the responsibility of the supplier, who may pass it onto their customer.

Seminars to explain new electricity trading arrangements

Despite postponement of liberalisation until later in the year, small producers and suppliers of electricity face new opportunities in 1998 once consumers are able to choose who they buy their electricity from. Along with the inevitable problems, new trading opportunities will also arise. There will be plenty to learn - about trading arrangements, licenses, meter operations,

charges for use-of-system and many more.

Supported by the DTI, the Association of Electricity Producers (AEP) and the Combined Heat and Power Association (CHPA) have organised a series of seminars to explain the changes and the impact that they will have on small generators, small suppliers and large customers. Speakers include

representatives from Offer, the electricity Pool and the DTI.

The first seminar was held in London in January; further dates are:

- 25 March (Leeds),
- 20 May (Birmingham)
- and 23 September (Bristol).

Details are available from the AEP (tel: 0171 930 9390) and the CHPA (tel: 0171 828 4077).



One of haulage contractor Econofreight's units transporting electrical equipment manufactured by Siemens in Germany to the Seabank power station site at Avonmouth near Bristol. Econofreight is responsible for transporting twelve major structures, up to the 330 tonne gas turbine, from Avonmouth 10 km to the power station site.

Eastern offers boost to British coal

Eastern Group and RJB Mining are joining forces to offer electricity customers nationwide a unique opportunity to directly support the future of Britain's coal mining industry. As the country's electricity markets open fully to competition later this year, Eastern says it will buy extra coal from RJB for every household or small business signing up to a new offer jointly promoted by the two companies.

Eastern and RJB are to launch the offer under RJB's existing Lionheart brand for domestic coal. Every customer choosing the Lionheart brand for electricity will represent an extra 1.5 tonnes of coal per year from RJB mines. If 200,000 customers switch, Eastern will order 300,000 tonnes of extra coal per year to fuel its five coal-fired power stations.

This extra coal will be in addition to the 4 million tonnes per year, from April 1, already

agreed between Eastern and RJB. Richard Budge, RJB Chief Executive, said: "We have in recent months been very much heartened and encouraged by the support we have received for our campaign for a fair deal and level playing field for the British coal industry. We hope that the Lionheart offer opens the door for that support to be turned into a practical demonstration of the desire to maintain a strong and viable coal industry in the UK."

Energy helpline goes national

A pilot telephone helpline set up by the UK Government's Energy Efficiency Best Practice Programme to assist businesses to save money on their gas, electricity and other fuel bills, has proved so successful it has now been launched nationally.

Initially piloted in the Hertfordshire and Birmingham areas, the helpline offers free energy saving advice to all types of industrial and commercial business. Experts are on hand to give advice on issues ranging from tariff switching and staff training through to problems with the building fabric, services (including heating systems) and process improvement.

Recent questions to the Energy Helpline have included:

- We are moving to an older site which needs refurbishing. How do we make sure it is energy efficient?
- We're about the change our boiler system. Which is the best one?
- The expansion of our factory means using more compressors and we're concerned about the impact on our electricity bills. How can we minimise compressed air costs?

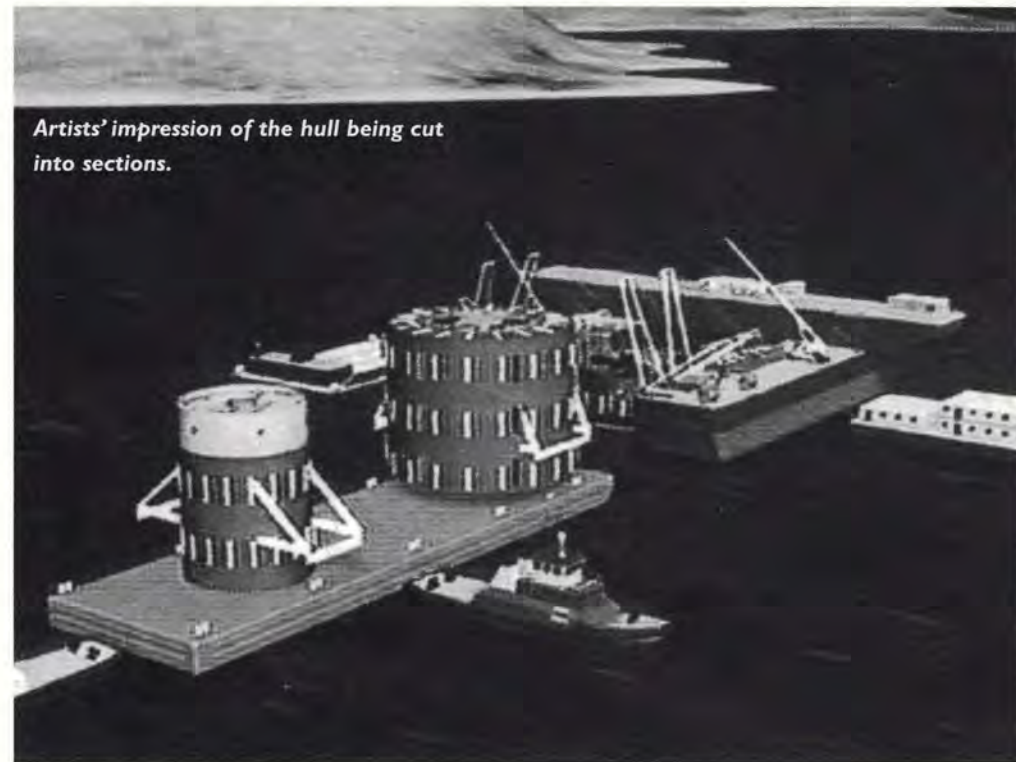
For free, independent advice on any energy-related issue, call the Energy Helpline now on 0541 542541.

Shell picks a re-use option for Brent Spar

Shell UK has selected an innovative re-use proposal as its preferred solution to the problem of what to do with the disused Brent Spar oil storage and loading buoy. The company originally planned to sink the giant structure in deep water in the Atlantic, but was halted in the summer of 1995 by a public campaign led by Greenpeace to find a recycling option.

The new proposal is to use cleaned slices of the cylindrical structure to support a new quay extension at Mekjarvik, near Stavanger in Norway (see cover picture). Shell says that, after detailed analysis of the technical, safety, cost and environmental aspects of several disposal options, and a lengthy public consultation process, the re-use option is the best practical environmental option (BPEO) available.

But it should not be considered a precedent for the disposal of offshore structures,



Artists' impression of the hull being cut into sections.

adds Shell, as the Brent Spar structure is unique and future cases will have to be decided on their own merits. Nor was the chosen option available two years ago, they add.

Both sides of the dispute have claimed victory: Shell that it has found the best solution, Greenpeace that it has demonstrated that dumping at sea is both wrong in principle

and unnecessary in practice.

Deputy prime Minister John Prescott has welcomed the move: "We cannot see the seabed as a vast easy dumping ground".

Agency cuts power station sulphur emissions

The Environment Agency has proposed a revision of the deadline for a 84% cut in sulphur dioxide (SO₂) emissions from power stations in England and Wales from 2005 to 2001. By 2001, changes in the electricity industry, particularly the increasing use of gas, are expected to have reduced SO₂ emissions from over 2 million tonnes a year in 1991 to 500,000 tonnes. The Agency is seeking a further reduction to 365,000 tonnes.

Meanwhile, the levels of sulphur dioxide emissions allowed from two major power stations have been reduced following the installation of flue gas desulphurisation equipment at both sites.

The maximum output at the National Power-operated Drax power station has been cut from 324,000 tonnes a year to 100,000 tonnes. At PowerGen's Ratcliffe-on-Soar station, the authorisation has been reduced from 220,000 tonnes a year to 65,000.

Drivers want clean vehicles to cut emissions

Findings of a new survey released by the Energy Saving Trust's *Energy Efficiency Powershift* show that 82% of ten people in the UK expect to be driving gas or electric cars by 2010.

Conversion to clean fuel vehicles on this scale could result in a reduction of up to 24% in the UK's road transport CO₂ emissions at 1990 traffic levels. This would represent a 5.5% reduction in total UK CO₂ emissions at 1990 levels - more than the

5.2% average reduction obligation agreed at Kyoto, and over a quarter of the UK's own 20% target.

The findings are taken from a survey of over 900 people at the 1997 London Motor Show conducted by Powershift. The survey was co-funded by Transco, PowerGen and Calor Gas.

Powershift is a three year programme which aims to kick-start the market for clean fuel (natural gas, LPG and electricity) vehicles.



Ron Davies, Secretary of State for Wales (left), at the opening of Britain's latest green power station - a 4.2 MW hydro-electric project at the Elan valley, near Rhayader in mid Wales. Built by Hyder Industrial, the £5.2 million project comprises five small hydropower stations at the foot of the valley's four dams.

The five turbines are either located underground or hidden inside existing Victorian buildings and power is transmitted to the local electricity network at Rhayader via 7 km of underground cable. The scheme is backed by a 15 year NFFO contract under which its output is guaranteed an economic market.

Price cuts for gas pre-payment meter customers

Ofgas and British Gas Trading have announced new lower tariffs for gas customers with pre-payment meters. Based on an average consumption of 650 therms a year, the price cut will reduce the average annual bill by around 4% for the majority of customers who have

electronic Quantum meters. In September 1997, the company announced price cuts for customers on its DirectPay, OptionPay and Standard tariffs, but proposed to freeze prices for its pre-payment customers pending the outcome of an industry review headed by Ofgas.

Most waste still goes to landfill

Around 9% of municipal waste created in England and Wales during 1995/96 was incinerated and a further 1% used for manufacturing refuse-derived fuel (RDF), according to the first edition of a new annual statistical bulletin from the DETR on the collection, disposal and recycling of household and municipal waste.

Of the incinerated waste, energy was recovered from just over half of the volume incinerated. Landfill is still by far the most important disposal method, accounting for some 83% of waste by weight. Around 7% was recycled or composted.

Among other facts revealed by the bulletin are:

- Almost 26 million tonnes of municipal waste was generated in England and Wales during 1995/96 but only about 8% came from non-household sources.
- Households produce on

average 21 kg of waste each week. Wales has the highest average weekly arisings at 23 kg per week.

- The single largest source of household waste arisings is the regular refuse collection service, which accounts for 70% of all household waste.
- Higher rates of waste generation by households in wheeled bin areas are found throughout England and Wales.

The bulletin also reveals the importance of local variations in waste disposal patterns. Incineration with energy recovery makes a significant contribution to the recovered fractions in the West Midlands, the South East and Yorkshire, due to the presence of large waste incineration plants there. However, in the South West and Wales the recovered fraction is achieved solely through recycling and composting.

New CCGT for Enfield

London is to get a new, 400 MW combined-cycle gas turbine power plant. ABB Power Generation Ltd of Newcastle-upon-Tyne has been awarded a turnkey contract worth £105 million to build the plant for Enfield Energy Centre Ltd, an independent power producer. Construction is scheduled to begin early this year and to be completed by the end of 1999.

The power plant, to be located in Enfield, has to

meet strict emission and noise requirements. To handle these needs, and the plant's efficiency targets, ABB is supplying a GT26 gas turbine that uses advanced sequential combustion technology to achieve high efficiency while minimising emissions. ABB will also supply a generator for the gas turbine, as well as a steam turbine and heat recovery steam generator, and will install the power plant control system and the balance of plant equipment.

The Government Review

By David Parry, Coalfield Communities Campaign

The Government's current review of energy sources for power generation aims to 'consider the implications of high levels of dependence on any particular fuel'. It is also, potentially, going to decide whether the UK's already depleted coal industry has a future. Balancing the economic, regulatory, environmental and social factors is not going to be easy. Here, the Coalfield Communities Campaign has its say.

Further coal mine closures could result in scenes like this again



Peter Mandelson, Minister without Portfolio, declared recently after visiting a colliery in Yorkshire: "The British national interest is at stake in all this and that's why the Prime Minister has taken such a personal interest." After over a decade in which the national interest and running down the coal industry seemed to go hand-in-hand - could this herald a new departure for UK coal?

DEPENDENCE, DIVERSITY AND SECURITY

The Coalfield Communities Campaign (CCC) has argued for a balanced energy economy and welcomes the review by the Government to take a fresh look at the issue of fuel diversity and security. After all, it, and the previous administration, have regurgitated a policy objective that included the words *sustainable, diverse* and *secure* for many years but have failed to explain how a

free market policy could deliver. During those years, the 'dash for gas' has threatened to sabotage that policy because any energy sector that is dependent on gas is neither sustainable, diverse nor secure.

It is curious that it has taken a letter from David Jones of the National Grid Company (NGC) to highlight this obvious flaw in UK energy policy. The concern of the National Grid Company was that if gas were to be the dominant energy source for power generation it was questionable whether it could provide the flexibility to respond to fluctuations in demand or transmission losses. The ability of gas to fulfil this role is limited by its commitments to domestic use and the small number of terminals where gas is landed. Coal, on the other hand, has proved itself capable of responding more reliably and from many different sources. The NGC was not the only company to complain. Industrial gas buyers on

'interruptible' contracts have been increasingly irritated when their supply is cut off at the slightest excuse during cold snaps. The terms of reference for the Government review of energy sources for power stations specifically addresses the technical problems highlighted by the NGC.

Yet the problem goes much further than just keeping the lights on over peak

winter periods. The shift in the share of power generation from coal to gas has potentially major economic and strategic consequences. From a position in 1996 where coal still had 43% of the power generation market, that share could fall to about 20% in 2001. Gas is set to expand from 22% to 42% over the same period.

THE BEST USE OF UK RESOURCES

In terms of indigenous energy, coal still potentially provides long term security of supply. Estimates of coal reserves range from 300 years to about 20 years. Were the Government to take the view that the UK's indigenous coal resources should be a key part of long term energy security, then estimates of reserves would quickly increase.

Proven, probable and possible reserves of UK gas, will be only 18 years if all the gas-fired capacity planned comes on stream. Dependence on imported gas would mean

- last chance for UK coal?

that the UK would be strategically vulnerable. Much of the world's gas reserves come increasingly from politically unstable areas. Even accepting the inevitability of increasing global energy trading, conserving a proportion of indigenous resources, whether gas, oil or coal, should be the basis of any national or EU energy policy. Dependence on imports of fuels can only have a profoundly negative impact on the UK economy.

AN IMPORTANT PART OF THE ECONOMY

Coal has a difficult task to prove itself. It is generally thought to be outmoded, costly and dirty. The public can be forgiven for thinking the last government was successful in solving the problems of coal by closing down the industry. It survives as one of the most productive and technically advanced coal industries in the world. It has been estimated that the coal sector still supports some 50,000 jobs. The impact of a continued shift to gas-fired generation alone, could result in a net loss of between 20,000 and 27,000 jobs. Although the CCC would not advocate changes in energy policy purely on social grounds, these matters need to be taken account of.

COSTS COMPARED

Since the Coal Review of 1992/1993, it has become accepted that coal-fired power stations, even with flue-gas scrubbers, can produce cheaper electricity than gas stations. This was recognised by the DTI Select Committee in its 1993 review and the Monopolies and Mergers Commission in 1996. The approximate costs of electricity from a nuclear AGR is 2.7 p/kWh, from new CCGTs: 2.45p/kWh, from coal with FGD: 2.1 p/kWh and coal without FGD: 1.8 p/kWh.

The generators contended that avoidable costs were not really the issue and that the valid argument should be a comparison of fuel costs. CoalPro (The Confederation of United Kingdom Coal Producers), in its submissions to the current DTI Select Committee, argues that "the marginal cost of electricity produced

from coal is cheaper than the equivalent average marginal cost of electricity from gas". Thermal efficiency and average fuel prices contained in the 1997 Digest of Energy Statistics are compared. They conclude that CCGTs produce electricity at 1.48p/kWh and coal at 1.356 p/kWh.

THE ENVIRONMENT

If costs were the only relevant factor, coal stations would be used on, or near base-load, and the UK coal market would be assured. However, environmental concerns have become paramount and coal needs to develop its 'green' credentials.

CCGTs have become the power station of choice because they are cheaper to build and produce less emissions than coal-fired stations. The world has much more reserves of coal than gas - 228 years at current production levels for coal and 65 years for gas. Coal demand is expected to double between 1992 and 2010 in China, India and East Asia. The next logical step, therefore is to tackle the problem of burning coal cleanly. By doing so, it is possible to make a much larger contribution to cutting emissions of SO_x, NO_x and CO₂ than it is possible by using gas.

The potential wealth creation for UK business from developing and selling clean coal technologies abroad should in itself be a reason for more investment. Whereas other countries have built operational plants, the UK government is only committed to further research and development. The generators, without a steer from Government, will continue to view gas as the best option.

A number of issues need to be resolved before they are likely to change their minds. First of all, they need time to respond to the latest SO₂ and NO_x emissions targets. Secondly, the more expensive clean coal power stations need to be built as soon as possible with government assistance. This will require a *clean energy levy*, based on the Fossil Fuel Levy. If the Government and the public are serious about cleaning up the planet and running a modern economy, it will cost

money. It has been estimated that 1 GW of clean coal capacity could cost £1 billion. Finally, coal needs to be given a minimum share of the power generation market to justify further investment. It is this last point that needs to be tackled in the 1998 Government review.

MINIMUM MARKET SHARES

Long term planning is essential for the energy sector. Planning for coal has been tainted for many years by the politics of revenge. Development of both coal production and combustion has been neglected. If this decline is to be halted and the position of coal in the energy sector stabilised, it requires Government intervention to make sure the depletion of the UK's fossil fuel resources is managed rationally. That will require a minimum market share for coal.

It is neither possible nor desirable to turn the clock back, but a minimum share of around 30% for coal would ensure that coal producers could effectively plan their development and extraction of coal and coal users could feel confident that investment in clean coal technology was worthwhile. Guaranteed markets may tempt both coal producers and power generators to set high prices. To counter this, the Regulator can be charged with making sure price controls are robustly adhered to and a reformed Pool system can be utilised to achieve the required minimum share for the appropriate fuels.

Government reviews of the coal industry have in recent history merely been a prelude to further contraction. The UK coal industry cannot be reasonably expected to contract much further and remain viable. The Government needs to decide if it really wants to give coal the opportunity to make a long term contribution to UK energy needs. If it cannot or will not make that decision, the industry may soon disappear regardless.

Contact David Parry at the Coalfield Communities Campaign,
tel: 01226 200768, fax: 01226 296532

Global coal market; production shifts from Europe

The international coal industry and market are changing, with major shifts in production and consumption patterns, together with changes forced by environmental pressures. The establishment of an international market for coal has been central to these changes. The International Energy Agency's latest publication on the subject, *International Coal Trade*, analyses the operation of the coal market and the reasons for its success.

The world coal industry and coal trade have changed dramatically over the last 25 years. Today, coal is traded in a mature, stable market, largely free of government intervention. But up to now, this global market has been little understood.

However, the new publication points to two main themes:

- a massive increase in international coal trade over the last 15 years, with exports of steam coal nearly tripling and coking coal exports increasing by 50%. The international coal market is now well-established.
- a major shift in world coal production; away from Europe and towards Australia, Indonesia, Colombia, South Africa and others, where, due to more accessible deposits, coal is produced without subsidy and at lower costs. European production has been in a steady decline since the 1950s.

STABLE SUPPLY AND PRICES

World coal prices have declined in both real and nominal terms over the last 20 years as productivity has improved. Market mechanisms act to keep international coal prices low and stable. Price increases are limited by the capacity of US producers to enter the market when prices rise. Coal reserves are widely distributed and the existence of

several major exporters ensures stable supply. The scope for expansion of exports from countries with low-cost reserves and the existence of potential new exporters tend to restrain prices in the long term. If exporting countries wish to retain market share, they will face continuing pressure to contain costs.

CHANGES IN THE MARKET

The world coal industry and coal trade have undergone dramatic change, but market mechanisms have worked well. For example, demand for low sulphur coal in the United States might have caused supply shortages and higher prices. However, that demand has been matched by Europe's capacity to take large quantities of high sulphur coal following investment in pollution control equipment for power stations.

The growing interest of Japanese utilities in the operation of the spot market could be described as a maturing of the market, following the pattern of other energy markets. It remains to be seen if factors related to this maturing of the coal market, such as the relationship of the level of investment in new mine capacity to price expectations, could affect the market's volatility.

INFLUENCE OF REGIONAL FACTORS

Regional factors may alter the pattern of supply if they influence the relative competitiveness of existing and potential exporters. At present, there is a large pre-production capacity in Australia and Latin America, and considerable flexibility in Indonesia. Expansion in these countries could quickly bring on new production to meet rising demand.

Production in Europe will continue to decline as pressure mounts to reduce subsidies, with some resulting increase in imports. With deregulation and third party access rights in Europe beginning in 1999, growth in coal imports will be limited by competition from low-cost natural gas. The

outlook for the coal industry in Poland, Russian and the Ukraine is not favourable; their exports are likely, at best, to stabilise current levels.

The roles of China and India in the future trade pattern remain major questions. The roles of developing exporters such as Colombia and Venezuela are also uncertain.

SCOPE FOR INNOVATION

Attempts have been made to establish coal futures markets, but these attempts have not gained support from major buyers or sellers. The IEA report suggests an intermediate step to a full futures market might be coal 'swaps'. Producers could reach agreement with coal buyers to allow producers to exchange obligations to supply, so as to minimise transport costs. Such coal swaps would require minimal market infrastructure and could be organised bilaterally between suppliers.

SECURITY OF SUPPLY AND ENVIRONMENT

Greater emphasis on the spot market in the Asia-Pacific region may bring with it growing recognition that a free market contributes to, rather than detracts from, security of supply, provided price signals are accurately and quickly transmitted. Long-term security will also require maintaining diversity through investment in new production capacity.

Measures to mitigate climate change could have a major impact on the future use of coal, and hence on coal production and trade. Such measures may prove to be the severest challenge faced by the coal industry since the start of its rapid expansion in the 1970s.

Copies of *International Coal Trade: The Evolution of a Global Market* are available, for \$43, from the IEA Public Information Office, tel: +33 1 4057 6554, fax: + 33 1 4057 6559, e-mail: info@iea.org

CCGT planned for Coryton refinery

International energy company InterGen and Mobil Power are to develop the Coryton Energy Project on the Thames estuary in Essex, incorporating a 750 MW combined cycle gas turbine (CCGT) power station. The project, originally conceived by Mobil, was granted Section 36 planning consent by the DTI last March. The site is currently being used as a car park by the refinery.

The CCGT plant will export electricity to the national grid, supplying enough power for one and a half percent of the UK's total requirements, says InterGen, which is currently constructing a similar plant in Runcorn, Cheshire.

Situated on a 17-acre site adjacent to the BP/Mobil Coryton refinery, the plant will incorporate the latest technology to make it one of the cleanest and most

efficient in the world. Gas will be supplied via a new underground pipeline, connecting the site to Transco's national gas transmission system at a point 8 km to the west of the site. The electricity connection will be via overhead line.

InterGen and Mobil will work together throughout the project's development phase, with InterGen responsible for the construction and operation of the plant. Mobil will supply gas oil as a back-up fuel to the operational plant.

Construction and commissioning will take about two years to complete with up to 750 people employed at the peak of the construction period, and 40 permanent jobs once the plant becomes operational.

Conoco to sell North Sea gas to Gasunie

Conoco UK has signed an agreement with NV Nederlandse Gasunie to supply approximately one billion cubic metres of gas per year to be delivered between 1999 and 2007. The gas will be delivered from Conoco's gas sources in the UK and transported via the Interconnector and the Belgian grid to Gasunie at the Belgium/Netherlands border. The gas will be sourced from Conoco's extensive portfolio of offshore gas fields.

The contract provides Conoco with the ability to trade between the UK and Netherlands gas markets utilising The Netherlands' existing gas infrastructure, an arrangement which become more common in the future as the UK and Continental Euro-pean gas markets further integrate and liberalise.

Curlew hits the fast track to a record

Shell's central North Sea Curlew gas and oil field has come on stream, having taken just three and a half years from its 1994 discovery to first production, through the floating production, storage and offtake unit (FPSO) Maersk Curlew.

The Curlew field, located about 220 km

east of Aberdeen, is made up of two reservoirs: Curlew B, an undersaturated oil reservoir and Curlew D, a rich, high productivity gas and condensate reservoir.

The life expectancy of the field is short - only four to seven years - and a study team deemed conventional production solutions

uneconomic. The FPSO solution was chosen, but even that took an unusual approach. The Maersk Curlew is a leased facility, with Maersk owning the vessel and contracted to Expro to provide production services. The vessel is leased by Expro for a minimum of four years, with first option for a further 20 years.

Global consumption of LNG 'will double by 2015'

The global LNG market has grown at an average rate of 24% each year since trade first commenced in 1964, according to a new report from MarketLine International, *Global LNG*. And the growth shows no sign of slowing - LNG trade jumped from 2.6 trillion cubic feet (Tcf) to 3.6 Tcf between 1990-1996, and is forecast to accelerate until the year 2015.

The report also says that the volume of LNG consumed in Asia will triple by 2015, with new market entrants accounting for a significant proportion of that trade. MarketLine predicts that long-term demand for LNG within Asia will boom despite recent crises experienced in many of its economies.

The main importer in the region will continue to be Japan, which currently accounts for 75% of world LNG trade, although South Korea and Taiwan will account for an increasing proportion of the region's trade.

MarketLine also predicts strong, although less dramatic, growth in LNG demand in many European markets. For example, LNG consumption in Turkey will increase at around 7% each year to reach 8.1 million tonnes by the year 2015. Possible new importers such as Portugal and Greece also present opportunities for LNG exporters, as might eastern Europe.

One of the aspects that differentiates LNG trade from trade in other fuels is

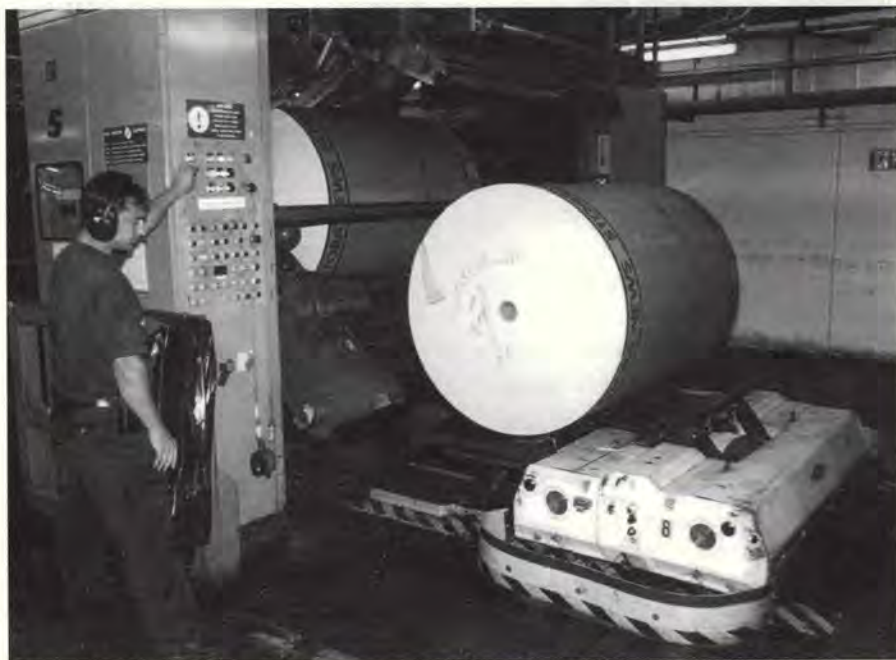
its intensely regional and inflexible nature, even though the recent increase in spot trading may increase flexibility. France, Japan, Spain, the US, Belgium, South Korea, Taiwan and Turkey are the only countries importing LNG, whilst Algeria, the US, Libya, Brunei, Abu Dhabi, Indonesia, Malaysia, Australia and Qatar are the only exporters.

However, MarketLine expects new importers and exporters to enter the market by the turn of the century. An increasingly important area for LNG trade will be Africa and the Middle East, which are the most rapidly growing producers and consumers of natural gas, and whose LNG surplus is set to increase to 2015.

Unusual in the extreme and commerce

by John Taylor and David Pattison, Saft

The average engineer might consider batteries technically mature products. However, commonly an overlooked component of larger, perhaps more interesting products and systems, the battery continues to evolve. The number of batteries in use and the number of applications are both rising - consider the increasing use of computer equipment in critical systems (needing a back-up power supply), and the rise in cordless tools in industry and the home as just two examples. And demanding applications as diverse as electric vehicles, laptop computers and electronic security tags are driving the improvement of existing battery technologies and the development of new ones. This article takes an application-based approach to a survey of advanced rechargeable and primary batteries in industry and commerce, explaining why the appropriate battery was chosen in each case.



An automated guided vehicle used at News International's site in Wapping to move reels of newsprint. Ni-Cd batteries were selected primarily because their cycle life is five times that of conventional traction batteries

Selecting the right battery for any application involves an analysis of the duty required, the likely required lifetime of the installation, the capital cost of the battery, and required level of reliability.

For industrial use, the choice usually comes down to one between traditional lead-acid technology and nickel-cadmium. Lead-acid batteries are capable, in a standard form, of meeting a very wide range of duties, while the nickel-cadmium

battery must be selected to suit a particular application. It is sometimes the case that design and specification engineers have disregarded Ni-Cd batteries because they are more expensive to buy, except for certain critical uses such as operating theatre power back up where the consequences of failure are literally a matter of life or death, and where Ni-Cd's acknowledged superior reliability is important. However, lifetime cost analysis

shows that Ni-Cd and lead-acid batteries compete in many industrial applications.

For smaller industrial applications, including local power for fixed or portable electrical and electronic equipment, the range of battery technologies is wider. Nickel-cadmium, nickel-metal hydride and lithium-ion are the leading rechargeable technologies; alkaline and various lithium electrochemistries for "primary" (non-rechargeable) use. Lithium-based systems are often the only option in extreme conditions.

The range of battery uses - and of their operating environments - is staggering. At one end of the spectrum, a camcorder carried by joint British-Norwegian expedition to the North Pole needed batteries of lithium-sulphur dioxide cells, originally developed for military use, as the temperature reached minus 60°C. The electrical performance of all battery types is reduced as the temperature falls because the rate of chemical reaction slows. The lithium-sulphur dioxide system has a particularly flat power-temperature characteristic that enables the batteries to provide useful power even in these conditions.

At the other extreme, nickel-cadmium railway batteries with advanced electrode designs are capable of high reliability and charging performance at very high temperatures. Batteries of Saft SRM cells back up vital automatic systems on metro cars for the Kuala Lumpur metro. The average daytime temperature in Kuala Lumpur is over 30°C and, in the battery box, the temperatures are even higher - the batteries were sized to give the design loads at a temperature of 50°C.

RELIABILITY

Reliability is as much to do with matching the battery to the application as with the battery's basic design. Often unreliability is the result of a mismatch between application and battery. Two common

- batteries for industry

Nickel-cadmium batteries are essential to their use to start diesel generators to power fire pumps on Shell UK's Auk Platform



factors creating this mismatch are intended lifetime and purchase price. If a battery is expected to last ten or twenty years, then differences in reliability become more noticeable, in terms of potential cost of failure, as the years go by.

For some industries with requirements for ultra-reliable systems, such as oil and gas, fire and security, chemical processing, and telecommunications, the need to reduce costs is a fact of life. Electrical system designers and specifiers must look at ways of balancing overall costs without compromising reliability and safety.

On Shell UK Exploration and Production's Auk A oil production platform, a battery of Alcad XHP 150 cells starts Kolfor diesel generators for fire pumps in the event of a fire. This battery type is designed for high discharge rate duties: the typical current drawn from the battery when the generator is started is of the order of 1600 A for around 10 seconds. The platform operators are taking a long-term view of the systems

they are installing on this platform so lifetime cost is an important factor.

A low-maintenance (valve-regulated) lead-acid battery will last around 10 years under ideal operating conditions - less in a demanding environment such as an offshore platform. A low-maintenance Ni-Cd type will last 20 years, and perform more reliably. The Ni-Cd battery uses an alkaline electrochemistry that does not corrode the cell, and it does not suffer from the risk of "sudden death" failure.

THOUSANDS OF CHARGE/DISCHARGE CYCLES

In some applications the number of charge/discharge cycles that the battery is required to cope with in its life is huge. Special measures need to be taken to cope with this "cycling" use, and batteries able to cope with it must be selected.

An example is the installation of automated guided vehicles (AGVs) at News International's site in Wapping. The AGVs

work 24 hours a day, seven days a week, moving reels of newsprint. Saft Nife STH Ni-Cd batteries were selected primarily because their cycle life is five times that of conventional traction batteries, and to maximise lifetime, the "depth of discharge" (DoD) is kept low with frequent visits to recharging stations. "Opportunity charging" is used, where AGVs take any opportunity in their computer-controlled routine to take a high-current (150-200 A at 1.5V per cell for 45 seconds) charge, typically 15 times during a shift. Longer, slower charges happen typically four times per shift. The DoD is never more than 13%, giving a cycle life of around 30,000 cycles - approximately five years.

In addition, the AGVs at News International are particularly small, with a high power/weight ratio, and the batteries need high energy and power densities. The STH batteries have very high charging efficiency, enabling them to be made smaller: compared with conventional

traction batteries, STH batteries have twice the power density.

SECURE FOR TEN YEARS

The requirements for small, autonomous power supplies in industry and commerce are much the same as for large, stationary applications, with a few added complications. For example, the power and energy densities of portable batteries are often dominant factors, and the safety of the electrochemistry is important for a mass-market battery product. But the concerns of reliable power output over a guaranteed lifetime are still crucial.

In the "home unit" of a card-based water budget payment system, the requirement is a completely independent power source to maintain the system's memory, exchange information with a payment "smart card", and if necessary, actuate a water supply valve. This calls for a power source capable of delivering small quiescent currents over long periods, with regular and irregular higher-current pulses.

The battery should also last for many years.

Lithium-based electrochemistries are unique in being able to meet the demanding requirements of a 3 V minimum voltage, current drains from a quiescent 70 microamps to a 250 mA pulse, and 0.5 Ah minimum residual capacity after ten years of complex discharge patterns. Very low maintenance requirements and high reliability were also factors in the choice of a Saft LS 33600 standard D-size cylindrical lithium-thionyl chloride cell. Reliability, safety and robustness of construction are important because the unit is designed to need minimum maintenance, and is installed in homes.

A second example where a lithium primary cell is the only suitable power

source is for electronic security seals made by Encrypta Electronics, used to ensure the integrity of lorry loads during transit. The demands on the power source are considerable, as the product has a life expectancy without battery replacement of eight years, and operating temperatures can range from minus 40 to 70°C depending on where the lorries are delivering to. In all these conditions, the power supply must deliver a minimum of 2.8 volts to maintain the electronic memory and to power the display and processing electronics when the seal is opened and closed.



Polypropylene-cased Ni-Cd batteries used to power emergency lighting at Cardiff's Butetown road tunnel

Again, a small quiescent current, in the order of a few tens of microamps, is required to maintain the code, with occasional higher currents of between 150 and 200 mA to light an LED display and activate the random number generator and other electronic circuits. Only a lithium electrochemistry can deliver the combination of very long life, high output voltage, temperature range and duty cycle, in a safe, portable package. In addition, all components used need to be physically robust so that the seal functions even when trucks are driven across rough terrain.

THE FUTURE FOR INDUSTRIAL BATTERIES

Two of the key issues affecting all engineering systems in the future are life

cycle costs and environmental impact. Batteries are no exception, and if anything, battery technology is at the forefront of efforts to improve performance in these areas. One reason is that the necessity for energy efficiency requires greater efficiency of energy storage, and the battery is likely to remain the key device.

Although some bemoan the fact that the battery is the largest/heaviest element of some products (electric vehicles, laptop computers) this hides the fact that enormous strides have been made in only a few years in increasing energy and power densities.

Completely new electrochemical systems have been developed to the point of commercial acceptance: for instance rechargeable lithium-ion technology for electronic equipment offers a step increase in these densities of two to three times. This performance increase is not achieved at no cost - Li-ion batteries are still relatively expensive, and are unlikely to appear, say, in mass-production vehicles for some

considerable time.

Battery demand across the world and across the industrial spectrum continues to increase; the battery industry continues to develop with it. Very large sums are invested in research and development by the large manufacturers to increase energy and power, reduced weight and volume, and deliver all this safely and in a sustainable way. It will pay the energy manager and electrical design engineer to keep up to date with batteries in the next few years.

Contact John Taylor and David Pattison at Saft, Castle Works, Station Road, Hampton, Middx TW12 2BY, tel: 0181-979 7755, fax: 0181-783 0494.

2020 Vision identifies energy technology for the future

What will the energy world look like in the year 2020? The Institution of Mechanical Engineers has co-ordinated a major study by a large group of organisations, including The Institute of Energy, into just that. The final report is due to be published in April, but the main findings were released at a conference towards the end of last year.

Fossil fuel supply; energy conversion processes; energy use in buildings; and energy in transport were the key issues highlighted in the 20/20 Vision Energy Report given at the Engineering Council's Engineering the Vision Conference in London.

In her summary of the activities of the Joint Venture Study Group on Energy, Pam Liversidge, President of the Institution of Mechanical Engineers, focused on what she believes will be the key sectors of the energy scene in the year 2020. Conclusions were made in the following areas:

FOSSIL FUEL SUPPLY

- There is a ready availability of gas, oil and coal. The world gas and oil industry currently finds on average twice as much energy each year as it uses.
- Fossil fuels will have to carry the major share of energy demand for the foreseeable future.
- The UK gas, oil and coal industries all use state of the art engineering techniques and have extensive engineering expertise. This provides a significant potential base for export earning.
- All three industries in the UK have the disadvantage that their resource is difficult to win. It is crucial, therefore, to maintain a high level of UK engineering expertise to minimise the cost of developing UK fossil fuel resources.
- There is a need to establish education and training for engineers that is internationally competitive, and is set within a world perspective.

ENERGY CONVERSION PROCESSES

- Energy conversion and use will need to comply with the environmental constraints set by the Government and EU.
- Refinery operation now reflects tighter fuel quality specification and has changed to reflect market forces.
- Since privatisation of the electricity supply industry, UK power generating technology is currently suffering from the lack of R&D investment.
- Demand for new and replacement power generating capacity over the next 15-20 years offers abundant opportunities for UK industries.
- Significant improvements have been achieved in UK nuclear plant operation during the last few years and it is essential that these are maintained alongside the re-establishment of an infrastructure to build nuclear plants on a strictly commercial basis.
- The Government has set what could be ambitious targets for the generation of renewable energy in the first two decades of the next century. The high capital cost and unpredictability of supply will determine whether renewable energy in gigawatt quantity is going to be worthwhile in the UK. This represents a challenge for the engineer.

ENERGY USE IN BUILDINGS

- Two-thirds of electricity and three-quarters of directly delivered gas is used in buildings. Consumption of energy has grown by 15% over the past 25 years.
- There is a potential for up to 30% cost savings in energy usage in buildings.
- Commentators vary in their predictions of the effect of CO₂ emissions on global warming. If the worst scenario is taken there will need to be a reduction of 50% in the world CO₂ levels by the middle of the next century. Energy usage in buildings represents easily the largest area where

substantial energy efficiency improvements can make a dramatic change to CO₂ emissions.

- The technology is available now to make the necessary dramatic reductions in energy consumption.
- The strict measures which have been suggested will be politically difficult to enforce, i.e. more demanding building regulations; buildings fuel tax to force energy efficiency measures; mandatory annual 'MoT' for buildings; mandatory energy efficiency labelling of all equipment used in buildings and, possibly, even the building itself.

ENERGY IN TRANSPORT

- Transport overall is responsible for the most spectacular increase in energy consumption. It accounts today for up to a third of UK energy usage and is still rising. Four-fifths of the transport energy is used on the roads and much of the remainder is used in the air.
- More efficient engines and better traffic management is helping to reduce the energy consumption of road vehicles.
- Worthwhile savings will come if drivers forsake their vehicles for public transport.
- Energy consumption on the railways accounts only for 2% of the transport total. The transfer of passengers and freight to rail will be 70% more fuel efficient.
- Sea transport is a fertile area for the design of both hulls and power units to enable higher speeds without fuel consumption increases. Diesel propulsion will continue to be the basic marine prime mover of the next century. Gas turbines are becoming increasingly attractive for faster vessels.
- Since the first jet aircraft, the fuel burn per seat has been reduced by 60% and further savings may be expected over 20 years.

Southwark's European

Not everything that comes out of Brussels is designed for international application. The European Commission also helps to fund local energy initiatives, such as the new Southwark Energy Agency.

The Southwark initiative

Last year the European Commission agreed to support an application from Southwark Council and the Municipality of Pamplona (Spain) for the setting up of an energy agency in each of the two authorities. The application from Southwark was highly commended by the Commission. The project will be co-ordinated by Southwark.

The total budget for the programme is £360,000 of which 45% will be provided by the EU and the rest by Southwark Council. This will cover all staff costs, administrative costs and other set-up costs as well as project dissemination and collaboration expenses.

The Agency will employ two full time staff and two part time. Its work programme is to be approved by a management board made up of representatives from Southwark Council, local community groups, energy supply companies, research establishments, business and other public bodies. In addition support will also be given by a technical board of experts from the field of energy management.

The Agency is developing a range of projects which will make a significant contribution to the implementation of the Homes Energy Conservation Act (HECA) in Southwark. Indeed the establishment of an energy agency was part of Southwark's 1996 Energy Conservation Report, along with other initiatives including: the production of an aerial thermographic survey, the construction of all 2000 new homes being built in the Peckham Partnership Area to a SAP rating of 80 as

Tony Blair with children who will live in the energy-efficient homes being built in Peckham, Southwark



well as the development of an energy conservation rolling programme of works in the council's own housing stock (54,000 properties). One of the principle purposes of the agency is to therefore deliver a range of projects to assist in meeting the requirements of HECA, these projects are as follows:

- Private sector household energy efficiency*
- development of a grant to the private

hosing sector for the installation of energy efficient heating systems, insulation and condensing boilers.

School curriculum materials - producing teaching materials for use in both primary and secondary schools within the national curriculum.

Business audits - staff will develop a range of energy audits to enable businesses to look at ways of saving energy in the workplace.

Inside the plant room - a 1 MW CHP unit installed at the Wyndham housing estate in Southwark



energy agency

Renewable and alternative energy feasibility study - in conjunction with further education establishments staff will investigate the feasibility for the development of energy from these sources.

Demonstration projects - a comprehensive list of examples of best practice will be developed so that organisations can share ideas for saving energy.

Southwark Energy Study - a comprehensive study of energy use across the Borough will be carried out by staff at the Agency to complement the work already done by the council's Housing Department under HECA.

Appliance project - householders will be invited to trial specific energy-saving devices in their own homes to see what savings can be made.

Transport and energy - this initiative will investigate savings that can be made in

energy use in the transport sector, the project will build on the EU funded ZEUS project being carried out by Southwark for the conversion of the council's vehicles to natural gas.

Health promotion - staff will be developing a training programme for health carers and providers relating to energy efficiency and fuel poverty.

Refrigeration replacement scheme - the Agency will be working with other organisations to replace inefficient refrigerators with more efficient ones for households on income support.

Household education - this programme will promote and develop energy efficiency amongst householders using a wide range of publicity mechanisms.

Communications and dissemination - both agencies will share and exchange with each other findings and recommendations

through the dissemination of information in the form of publications, CD ROMs and conferences.

The establishment of the Agency is a crucial element of Southwark Council's Environmental Strategy, its Environment Statement and its Local Agenda 21 Programme "Sustainable Southwark 2000+". Indeed part of the role of the Agency is not only to raise awareness of environmental issues but also to develop partnerships and involve the community in a range of energy related projects, The Agency is set to become the key organisation in delivering effective partnerships across the Borough between the business, public and voluntary sector.

For further details contact Steve Turner at the Southwark Energy Agency, tel: 0171 525 2193.

SAVE II and European Energy Agencies

In January 1998 the European Commission released funding under the SAVE II programme for the establishment of a series of energy agencies across member states of the European Community. A major element of the SAVE II programme is the addition of value at community level through the establishment of local and regional Energy Management Agencies. To date the Commission has supported the establishment of 141 agencies across all 15 member states. Fourteen are based in the UK. It is the aim of the commission that at least one-fifth of regions, towns and cities across Europe which have more than 100,000 inhabitants will benefit from the services of an Energy Management Agency. Last year the Commission agreed to fund the establishment of 34 new agencies within the union over the next three years, giving a total of nearly £4 million.

Acting locally, agencies should help the Commission to develop a European energy

policy consistent with sustainable development. Agencies will help to:

- contribute to better Community integration in energy matters through a bottom-up approach to energy problems, while encouraging local bodies to co-operate and exchange scientific and technical know-how at European level;
- foster economic and social cohesion by reducing the disparities between regions: because of their proximity to consumers, local energy agencies can

make a worthwhile contribution to this objective and have an impact on the creation of jobs locally;

- boost the efforts of the regional and local authorities in the efforts to combat climate change and thus;
- improve environmental protection and the quality of life.

Agencies fall into three distinct categories: urban/semi-urban, regional, and island agencies. Each category is represented by an association which can assist in the development of the agency. In the case of urban agencies; this is Energie-Cites based in Besancon, France. The associations will also help in training staff as well as disseminating programmes. Other associations include Fedarene (Regions) and ISLEnet (Islands).

For more details on the SAVE II programme contact M S Furfari, European Commission, DG XVII, 226-236 Avenue de Tervuren, B - 1150, Brussels.

Member state	Number of agencies
Austria	8
Belgium	3
Germany	11
Spain	12
Finland	7
France	14
Greece	18
Ireland	9
Italy	19
Netherlands	3
Portugal	11
Sweden	9
United Kingdom	17

Ground source heat pumps and cooling for buildings

by Robin Curtis, GeoScience Limited

Nearly 150 years ago William Thompson, later to become Lord Kelvin, first mentioned his 'heat multiplier engine' that would "permit a room to be heated to a higher temperature than the ambient temperature, by using less fuel in the machine than if such fuel was directly burned in a furnace". This was the earliest recorded mention of the heat pump - and ever since engineers have sought ways of turning this theoretical energy amplifier to widespread practical application.



Pipework being installed in the borehole outside the GeoScience office building in Cornwall - Britain's first non-domestic installation.



The 'plant room' at the GeoScience office building - that's all that is visible

Ground coupled heat pump systems for heating and cooling buildings are today one of the most successful applications of this technology - offering high seasonal coefficients of performance (COP - the measure of 'energy amplification') to buildings anywhere that have access to the surrounding ground. As well as offering high energy efficiency and low CO₂ emissions, earth energy systems, or geothermal heat pumps as the technology is variously referred to, offers a number of other environmental and operational advantages.

Until recently the commonest manifestation of heat pumps has been electrically driven air source heat pumps - used to heat and cool buildings (and fridges!). Unfortunately two characteristics of these particular engines have limited their application. First, an air source heat pump suffers from the fact that on the days that it is called on to supply the greatest amount of

heat, the ambient air is at its coldest - and in fact the unit can ice up - requiring a costly defrost cycle. Similarly, on the days that the heat pump is called on to provide the maximum amount of cooling - the ambient air is at its hottest. This means that the average coefficient of performance of air source units used to heat and cool buildings, has never lived up to engineers' early expectations. In addition, the average efficiency of electrical generation has in the past never risen very much above about 30%. The combination of these two factors have led to a widely held view that the overall energy efficiency of heat pumps has not lived up to the initial promises.

In recent years two factors have coincidentally changed, which has led to a significant improvement in the overall energy efficiency of heat pumps. The first is that electricity generation efficiencies are rising - particularly when viewed as the UK average

generating mix - due to the conversion to gas fired power stations, increased use of CHP, combined cycle generating plant, improved output of the AGR's, an increase in renewable generation, and the removal of older, inefficient generating plant.

Secondly, the adoption of water source heat pumps has led to very significant improvements in COPs. This arises because water source units are inherently more efficient engines than air source units. However, there has been a limitation on the use of water source heat pumps because not everyone has had, until now, a suitable water source. Traditionally, rivers, lakes or ponds have been used - which impose a geographical limitation. Alternatively, process water, where it is available, or combined boiler/chiller units have been used to provide constant temperature water sources.

USING THE GROUND

In the early 1960's John Sumner, an ardent heat pump proponent and well ahead of his time, recognised that the huge thermal storage capacity of the ground could be used

- high efficiency heating

to provide a suitable energy source. He went to the extent of installing what must have been the UK's first horizontal closed loop ground coupled system at his bungalow. There he demonstrated that a sealed water loop buried in the ground could adequately supply a water source heat pump. In addition the enormous thermal mass of the ground meant that water could be delivered at a relatively steady temperature, regardless of what was happening in the widely swinging ambient air temperature.

The combination of the high efficiency water source heat pump with a sealed ground coupled water supply, together with current electrical generating efficiency, results in overall "effective" energy efficiencies that exceed 100% - ie more thermal energy is delivered by the heat pump, than is used to generate the electricity - the additional energy being supplied from the ground. By reversing the process, these systems also provide highly efficient cooling, with the ground absorbing the extracted thermal energy. Moreover, the relatively steady temperature of the ground results in the high instantaneous COPs of water source heat pumps being translated into impressive seasonal, or average, COPs, now approaching or exceeding 4. With the UK generating mix producing electricity at $0.54 \text{ kgCO}_2/\text{kWh}_e$, these systems deliver heating with around 0.15 or less $\text{kgCO}_2/\text{kWh}_{th}$. In cooling mode the systems are typically 20 to 30% more energy efficient than air source units. In overall terms, reductions of up to 40% in total CO_2 emissions compared to competing heating and cooling technologies are anticipated for these systems in the UK context.

Sumner would be staggered to see the extent to which this ground coupled heat pump technology has taken off - but possibly saddened to know that it is in countries other than the UK. It is known under various names - closed loop ground source heat pumps, earth energy systems, ground coupled heat pumps and geothermal heat pumps. In the USA, where the level of activity is currently growing rapidly, the technology has been dubbed GeoExchange. With several hundred thousand units installed, the Americans currently have a five

year programme initiated in 1995 to increase the installation rate by a factor of ten, from 40 000 units per annum to 400 000 per annum. Other countries with active programmes are Sweden, Canada, Germany, Austria and Switzerland

THE TECHNOLOGY

Although simple in concept, it is only in the last ten years the individual components of these systems have been readily available and assembled together. It is a technology whose time has come. The sealed, lightly pressurised ground loops are fabricated from properly specified fusion or butt welded high density polyethylene pipe, and filled with a water/antifreeze mixture. The loops can be installed either vertically in one or more boreholes typically 50 to 100 m deep, or horizontally in trenches to a depth of between 1 and 2 metres. As long as the time dependent building energy loads are known, and the local geology is understood, there are established design guides for sizing the ground loops. Being a totally sealed system, there is no requirement for water abstraction or reinjection licensing. The loops are coupled through water circulating pumps to extended range water-to-water or water-to-air heat pumps. The use of a reversing valve in the heat pumps allows the units to provide heating and cooling - with the ground simply acting as a thermal sponge - absorbing or delivering heat as required.

In addition to the high efficiencies, ground coupled systems offer other advantages. Once installed there are no visible external components; the ground loops are completely sealed and buried. The circulating and heat pumps are installed within the building. Thus there is no visual intrusion and no external noise. There is no boiler, fuel tank, chiller or cooling tower, and no site based emissions of any sort. There is no requirement for water treatment or any associated health risks from legionella. The ground loops have long operational lives, and the only moving parts are the water circulating pumps - hence maintenance costs are minimal. The duty cycles on the water source heat pump compressors are considerably lower than for air source heat

pumps, and in addition as the units are not exposed to the elements they also have long lifetimes. There is no requirement for defrost cycle equipment or control, and hence no requirement for backup heating supplies. Plant room space requirements are minimal.

UK ACTIVITY

Currently the level of activity in the UK is embryonic. Apart from Sumner's house, the author has only managed to unearth vague references to a few early systems.

The only modern, closed loops systems currently operating in the UK are a vertical installation at a new house outside Plymouth, several vertical boreholes at a small commercial office in Falmouth, a horizontal system on a self-build property in the Salisbury area, and a few horizontal DX systems being tested by a utility in the North of Scotland. DX systems are so called because refrigerant rather than water is circulated in the ground loops - leading to even higher efficiencies.

In the very near future the first non-domestic application will be installed in a new health centre currently being constructed on the Isles of Scilly. A number of feasibility studies are underway for a wide range of UK installations and it is fully expected that several of these designs will be commissioned during 1998. As awareness of the effectiveness and simplicity of these robust systems grows it is difficult to see why they should not become more widely adopted through the UK and Europe. As well as offering immediate reductions in CO_2 emissions, continuing improvements in the efficiency of both the electricity generating mix and heat pump technology, will automatically result in ground loop installations yielding further CO_2 reduction benefits over their long lifetimes.

Contact Dr Robin Curtis at GeoScience Limited, tel 01326 211070, fax 01326 212754, e-mail: earthenergy@geoscience.co.uk. Additional information, including a growing number of case studies, can be found on the World Wide Web at www.demon.co.uk/geoscillearthen.html.

Refinements in combustion gas

by Dr Ian Brown, Product Development Manager, Servomex Group



The new xendos 2700 combustion gas analyser from Servomex

New technology just appearing in the gas analysis industry has the potential, if not to change the world, at least to change the way industry views part of its role in protecting it. Until now, emissions from combustion processes have been seen as a problem by environmentalists and as a cost by industrialists. Environmentalists want to eliminate the problem, industry the cost. The two views are essentially incompatible. So what has changed?

Let us first look at the problem of emissions. Every combustion process, whether in the foundry and metals industry, in the pharmaceutical and chemicals industries, in a power station, in a waste disposal plant or in any of countless other process industries, generates emissions. The science of emissions is extremely complex and it is notoriously unwise to over-simplify statements about the subject. However, when sulphur in the fuel burns in the presence of oxygen, SO_x (oxides of sulphur) are produced, and when nitrogen in air is heated to the extreme temperatures found in the combustion flame, NO_x (oxides of nitrogen) are generated. Furthermore, carbon in fuel results in carbon dioxide (CO₂ - the

principal greenhouse gas) being produced. In circumstances where there is insufficient oxygen for all the carbon in the fuel to be completely burned, carbon monoxide is also produced.

The SO_x, notably sulphur dioxide (SO₂), contribute to acid rain, damaging plant life, defoliating forests and corroding metals. The NO_x produce smog, which contributes to bronchial and pulmonary disease, and are believed to help cause ozone depletion which probably has a role in increasing the incidence of skin cancer. Carbon dioxide is, of course contributing to climate change and carbon monoxide is, to put it simply, toxic. To add insult to injury, incomplete combustion of hydrocarbons results in the emission of carbon particulate, better known as soot, which does one's lungs and the neighbours' washing no good at all.

MONITOR OR CONTROL?

The result of the actions of governments and environmental pressure groups so far has been legislation to enforce the monitoring of emissions rather than laws which insist on means of controlling the process whose emissions are monitored. This is understandable, since to draft legislation

capable of enforcing ways of controlling precisely hundreds of different combustion processes would probably be impractical.

However, the effect on companies and public authorities of regulations which set standards of monitoring, rather than standards of control, is to focus their attention on the monitors and the avoidance of prosecution for excess emissions. Shareholder activists and pressure groups also tend to concentrate on improving the monitoring of the emissions rather than on improving the control of the process itself.

The result is the conflict defined neatly as BATNEEC versus CATNAP, not a legal precedent defining animal rights, but acronyms which summarise neatly the two opposing positions. Those who draft the legislation seek BATNEEC solutions (Best Available Technology Not Entailing Excessive Cost) while those hoping to avoid the worst consequences of non-compliance adopt the CATNAP approach (Cheapest Available Technology Narrowly Avoiding Prosecution).

How much better it would be if some of their attention were directed to the combustion process itself and to identifying what can be done to make it both cleaner and (in many cases) more cost-efficient.

If more operators of combustion processes could be persuaded more frequently to take a fresh look at the efficiency of combustion as new technologies and techniques emerge, the opportunities for reduced costs and reduced emissions would be huge. Think of the scale of combustion in power station boilers, steel plants, aluminium smelting and dozens of other energy-intensive processes.

The facts are that the same optimum combustion conditions which minimise emissions and benefit the environment also use the least fuel. From a commercial standpoint, the hard-nosed reasons for installing the most efficient combustion analysis system possible are to be found in the bottom line.

analysis to minimise emissions

THE POINT OF OPTIMUM COMBUSTION.

All combustion control must be, to some extent, a trade-off between combustion efficiency and the control of emissions. Combustion is at its most efficient, and produces the least harmful emissions, at the point when fuel combustion is complete (and therefore carbon monoxide emissions are at their least) and the oxygen content of the flue above the flame is at the lowest level compatible with complete burning of the fuel. For any given boiler and fuel, this point of optimum efficiency will occur at a given oxygen content of the flue gas. Adding more oxygen will ensure that combustion is complete - but will also increase fuel consumption and use the excess heat to raise the temperature in the flue. Reducing the oxygen at the flame will produce incomplete combustion and an excess of CO.

Typical combustion analysis techniques identify the point of 'combustion breakthrough' by analysing the relationship between flue gas components, combustion efficiency and the fuel/air ratio above the flame. In oxygen analysis based systems, an oxygen analyser provides feedback on the oxygen content of the flue to a control system which varies the fuel input to the burner and the air available to the flame until the optimum oxygen content of the flue gas is reached.

In the search for greater precision in the control of the efficiency of combustion, some systems measure the carbon monoxide (CO) in the combustion gases as well as the oxygen. This is usually achieved using 'pellistor' sensors. These were developed to measure the lower explosive limit (LEL) of gases, and while they provide excellent results at the percent level, their capability for low-level measurement, as required in combustion control, is limited by base line instability and cross-sensitivity to other gases commonly found in the combustion process.

NEW TECHNOLOGY, NEW OPPORTUNITIES.

The emergence of a moderately priced, yet fast and accurate combustibles measurement technology, just launched by Servomex, is set to create a completely new cost/benefit scenario in combustion control. Companies can now buy the instrumentation to measure not only the oxygen but also the concentrations of CO above a burner on a continuous basis.

The key is a refined type of transducer based on thick-film calorimetry which makes it possible to measure combustibles in the range 0-500 parts per million (ppm). This new transducer technology is now available in a new combustibles analyser known as the Servomex xendos 2700 which emulates the precision of systems costing many times its

price while providing the reliability of oxygen measurement systems.

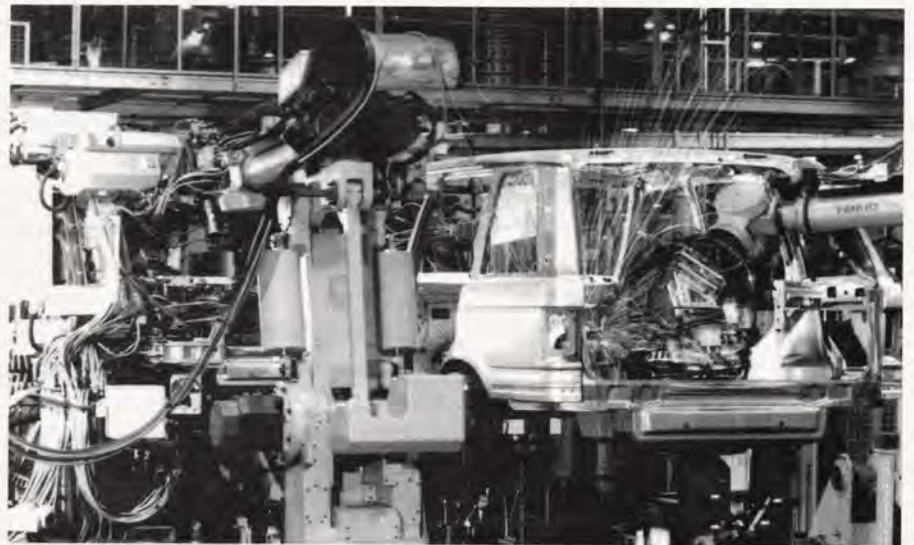
The xendos 2700 makes it possible to refine the approach to combustion analysis, providing a more sensitive measurement of the concentrations of combustibles, in addition to the measurement of oxygen. Moreover, the new instrument meets the key customer requirements of lower initial cost, minimal simple maintenance and more effective combustion control. Extensive trials have shown that the new technology achieves major fuel and money savings by comparison with oxygen-based systems, and greater reliability by comparison with in-situ infra-red systems.

A further benefit of the transducer at the heart of the new analyser is that it is considerably less affected by cross interference from other background gases like water, carbon dioxide etc than are the existing pellistor devices currently available on the world market.

Here then is a technology which has the potential to break the deadlock between accountants and environmentalists; which can provide the bottom line and hope for the future as part of the same equation. It could be the beginning of a different approach to combustion control.

Contact Ian Brown at Servomex International, tel: 01892 652181, fax: 01892 662253.

A refinement of oxygen trim combustion control is the use of variable speed inverter drives to power the oxygen trim systems. Land Rover has recently installed a set of 11 oxygen trim systems, powered by variable speed inverter drives from CEGELEC, at its Solihull vehicle manufacturing plant. The drives provide accurate, variable speed control of boilerhouse fans which, in turn, trim oxygen levels and thus maximise boiler efficiency. Land Rover estimates that the 11 systems will save around £100,000 a year in reduced fuel bills.



March 1998

The UK's commitments to climate change

CIBSE Centenary lecture by David Fisk, 11 March, Manchester

Details from CIBSE, tel: 0181 675 5211, fax: 0181 673 3302

Evaluating multi-residential housing stock

Seminar, 16 March, London, £80
Details from National Energy Services, tel: 01908 672787, fax: 01908 662296

Evaluating multi-residential housing stock

Seminar, 17 March, Leeds, £80
Details from National Energy Services, tel: 01908 672787, fax: 01908 662296

Marketing energy '98

Conference, 17-18 March, London, £899 + VAT
Details from IQPC Ltd, tel: 0171 691 9191, fax: 0171 691 9192, e-mail: energy@iqpcmail.co.uk

Cables for power systems

Course, 17-19 March, Capenhurst, £985 + VAT
Details from EA Technology, tel: 0151 347 2557, fax: 0151 347 2256, e-mail: db@eatl.co.uk

Developing commercially successful CHP Projects

Conference, 19-20 March, London, £995 + VAT
Details from AiC Conferences, tel: 0171 242 2324, fax: 0172 242 2320

Turkish energy

Conference, 23-24 March, London, £899 + VAT
Details from SMi Ltd, tel: 0171

252 2222, fax: 0171 252 2272, email: 100531.3067@compuserve.com

The commercial impact of the Network Code

Conference, 23-24 March, London, £899 + VAT
Details from SMi Ltd, tel: 0171 252 2222, fax: 0171 252 2272, e-mail: 100531.3067@compuserve.com

International private generation workshop

Course, 23-25 March, Brighton, £13950 + VAT
Details from Power Ink, tel: 01730 265095, fax: 01730 260044

Industrial air pollution monitoring

Course, 23-25 March, Leeds
Details from Department of Fuel & Energy, University of Leeds, tel: 0113 233 2494, fax: 0113 233 2511

Winners and losers in the power game

Conference, 24-25 March, London, £445 + VAT
Details from IIR Ltd, tel: 0171 453 5309, fax: 0171 453 5306, e-mail: helenwhalley@compuserve.com

Furnaces 98

Exhibition, 24-25 March, Coventry
Details from FMJ Publications Ltd, tel: 01737 786611, fax: 01737 761685

Central & Eastern Europe power industry forum

Conference, 24-25 March, Warsaw
Details from PennWell Conferences, tel: +31 30 2650 963, fax: +31 30 2650 928,

e-mail: elly@pennwell.com

Electricity - trading in a new market

Seminar, 25 March, Leeds, £150. Details from Pamela Rudolph, tel: 01403 785409, fax: 01403 786189, e-mail: pamelarudolph@chpa.co.uk

Heat treatment for the 21st century

Conference, 25 March, Coventry
Details from the Wolfson Heat Treatment Centre, tel: 0121 359 3611, fax: 0121 359 8910, e-mail: whtc@aston.ac.uk

Nuclear technology

Conference, 25-26 March, Manchester
Details from IChemE, tel: 01788 578214, fax: 01788 577182, e-mail: alandriau@icheme.org.uk

The future of multiphase metering

Conference, 26-27 March, London, £749 + VAT
Details from IBC Ltd, tel: 0171 435 5491, fax: 0171 636 6858, e-mail: cust.serv@ibcuk.co.uk

Power station maintenance

Conference, 30 March - 1 April, Edinburgh
Details from IEE, tel: 0171 344 5476, fax: 0171 240 8830, email: psm@iee.org.uk

Diesel particulates and NOx emissions

Course, 30 March - 3 April, Leeds
Details from Department of Fuel & Energy, University of Leeds, tel: 0113 233 2494, fax: 0113 233 2511

Heat exchangers

Course, 30 March - 3 April, Amsterdam
Details from The Center for Professional Advancement, tel: +31 20 638 2806, fax: +31 20 620 2136

Fundamentals of the power industry

Course, 31 March - 3 April, Berkshire, £2350 + VAT
Details from the Petroleum Economist, tel: 0171 831 5588, fax: 0171 831 4567

April 1998

Photovoltaic systems

Course, 2-3 April, Reading
Details from the University of Reading Energy Group, tel: 0118 931 8765, fax: 0118 931 3327

Investment opportunities in Polish energy

Conference, 2-3 April, Warsaw, £899 + VAT
Details from SMi Ltd, tel: 0171 252 2222, fax: 0171 252 2272, e-mail: 100531.3067@compuserve.com

Gas turbine technology

Course, 6-8 April, Amsterdam
Details from The Center for Professional Advancement, tel: +31 20 638 2806, fax: +31 20 620 2136

Third party access in UK and European gas markets

Conference, 20-21 April, Brussels, £899 + VAT
Details from SMi Ltd, tel: 0171 252 2222, fax: 0171 252 2272, e-mail: 100531.3067@compuserve.com

The Kyoto agreement and UK industry

Professor J S Harrison FEng, FInstE

The Institute of Energy organised a seminar for all Group Affiliate members on January 16 1998. The purpose of which was to discuss the implications of the Kyoto agreement. The organisations present heard from Peter Unwin, Head of Global Atmosphere Division, Department of the Environment, Transport and the Regions, directly about the negotiations at Kyoto, the presentation provoked a lively and interesting debate.

Now that the UK has assumed the Presidency of the EU, the Government will be discussing with other European countries the implications of the recent Kyoto conference on Climate Change. European countries had provisionally agreed before the conference how to share a collective reduction of 10% in their emissions of CO₂, CH₄ and N₂O.

The Kyoto agreement has extended the list of gases to include hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride and commits the European Union to reducing its carbon emissions to 8% below 1990 levels by the period 2008 to 2012. A new agreement between European countries on how to achieve this will now be required.

The meeting, hosted by National Grid Co plc took place on January 16th and was attended by representatives of our Group Affiliate members and special guests who had been present at Kyoto during the negotiations.

Peter Unwin from DETR, who had led the official British delegation, explained some of the background to the negotiations and outlined the plans of the Government to implement the agreed commitments as they relate to the UK and our partners in the European Union. The agreed targets for emission reductions represent a first step in reversing the rising trends in industrialised countries and as

such will require positive action by industry. The pressure on the negotiations had been such that some issues were not fully resolved and the emission targets for some countries were not as stringent as they might have been. In particular, the zero target for Russia, which is forecast to have reduced emissions in 2000, and the increase of 8% allowed for Australia are less ambitious than the European Union had pressed for. Many other issues will require considerable work on them before their full effect can be judged.

The most important of the unresolved issues include the role of developing countries beyond the Kyoto agreement, particularly important to the ratification process in the US, who had argued that those developing countries should also take on commitments at Kyoto to reduce their emissions. The terms on which emissions reductions could be traded between nations remain to be negotiated as does a method for the assessment of the emission credits which could be allowed for projects carried out between countries by the provisions for Joint Implementation in the Convention and in the new Clean Development Mechanism agreed in the Kyoto Protocol. From the point of view of industry it is important that these issues are resolved in such a way that British industry is not disadvantaged.

Group Affiliates particularly stressed the need for a satisfactory consultation process which would allow the concerns of industry to be expressed, before the Government became committed to a particular course of action.

The meeting called for the Government to ensure that opportunities would be created for industries to be able to take part in deciding the targets which could be agreed as the UK contribution to the European Commitments under the Kyoto Protocol. Industry would also need to be consulted about the further reductions in

their emissions which were likely to be required when the Government evolved plans for meeting the larger aim of a national reduction of 20% of CO₂ emissions. It is expected that the consultation process for both the legally binding target and the Government's 20% aim would take place in the Summer of this year, following agreement of the UK's share of the European target in June.

Diane Davy, the Institute's new Secretary and Chief Executive was present at the meeting. She and Tracey Fisher, Membership and Education Manager, took the opportunity to consult Group Affiliates on their views of how the Institute could improve services and to invite them to play a more active role in Institute affairs, including the recruitment of new members to the Institute.

Group Affiliate Services

Group Affiliate membership brings together corporate users and suppliers of energy with consultants, equipment suppliers, research organisations and educational establishments to exchange information and experiences. Every organisation can benefit from Group Affiliate membership of the Institute and some of the benefits include;

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Branch Events

March 1998

NORTH EASTERN

Wednesday, 18 March
Is LNG the Clear Choice for Fuelling HGV's? Speaker to be announced. Contact Dr C R Howarth, tel: 0191 222 7303 for more details.

EAST MIDLANDS

Tuesday, 24 March, 7.00pm
The Branch Technical Lecture by Mrs C Reeby, Energy Efficiency Officer of King's Lynn & West Norfolk Borough Council. refreshments available at 6.30pm. Energy saving measures, energy management projects and waste saving ideas adopted by the council will be covered.

For details contact Mr G Thornton, tel: 01509 212670

LONDON AND HOME COUNTIES

Thursday, 26 March. 6.00pm
AGM at IGASe, Portland Place, London. Contact Mr P M Johnson, tel: 01793 893330 email: philip.johnson@natpower.com

NORTHERN IRELAND

Thursday, 26 March, 7.30pm
The Northern Ireland Branch Annual Dinner at The Culloden Hotel. Contact Dr P Waterfield,

tel: 01232 364090 email: p.waterfield@ulst.ac.uk

SOUTH WALES AND WEST OF ENGLAND

Friday, 27 March, 11.00am
25th Annual Idris Jones Memorial Lecture and Luncheon, Speaker Lord Ezra - Cardiff Castle. Contact Mr D Suthers, tel: 01222 842786

UNIVERSITY OF LEEDS

Monday, 30 March to Wednesday, 1 April
"2nd International Conference on Combined Cycle Power Generation" This conference will provide an opportunity for those working in Combined Cycle Power Generation to meet, present and discuss experiences and the latest information fruitfully. Those wishing to submit an abstract or obtain more details about the conference should contact Dr B M Gibbs, Department of Fuel and Energy, University of Leeds, tel: 0113 233 2496

THE INSTITUTION OF ELECTRICAL ENGINEERS & THE INSTITUTION OF MECHANICAL ENGINEERS

Monday, 30 March to Wednesday, 1 April
"Power Station Maintenance -

Profitability through Reliability" - Heriot-Watt University, Edinburgh. Specialist presentations cover all aspects of power plants, including electrical, mechanical, control and instrumentation of main auxiliary plant. Member rates apply Contact 0171 240 1871 for more details

April 1998

NORTH WESTERN

Thursday, 2 April
AGM - AEA, Birchwood Conference Centre, Risley. Contact Mr M Cropper, tel: 01925 254384, email: matthew.cropper@acat.co.uk

MIDLAND

Thursday, 2 April, 6.30pm
"Energy on the Internet" - Mr R Sayers - West Midlands Fire Service. To be held at the offices of Powerline Energy Services Ltd, Belfont Trading Estate, Mucklow Hill, Halesowen. Contact Mr H Freeman, tel: 0121 353 2397

SOUTH WALES AND WEST OF ENGLAND

Tuesday, 14 April, 5.30pm
"Gas-fired Power Generation" - Peter Southworth of Siemens Ltd. Techniquet Lecture Theatre, Cardiff Bay. Joint meeting with IMechE, buffet

and exhibition prior to event. Contact Mr I Weslake Hill, tel: 01222 757527

YORKSHIRE

Wednesday, 22 April 2.30pm
AGM - AHED House, Ossett. Contact Mr A Mallalieu, tel: 0113 2768888

LONDON AND HOME COUNTIES

Thursday, 23 April, 5.30pm
"Energy and Environment" Natural History Museum, South Kensington. Speaker - Tony Dolding. Contact Mr P Johnson, tel: 01793 893330 email: philip.johnson@natpower.com

EAST MIDLANDS

Thursday, 23 April, 6.30pm
An Evening of Steam - Bring the family to the Industrial Museum, Wollaton Park, Nottingham to see working steam engines. Light refreshments available. For details contact Mr G Thornton, tel: 01509 212670

MIDLAND

Thursday, 30 April, 10.30am.
The Ellis Memorial Lecture to be held at Aston Villa Football Club in the conference suite. Andrea Cook from the NEA will be speaking. Contact Mr H Freeman, tel: 0121 353 2397

Technical Spanish

Do you work in Spain or have Spanish clients, and have trouble communicating with people on a technical level, then we might have the answer.

If you would like to learn technical Spanish then please contact Anna-Marie Jaller on 07970 824244

Sainsbury Management Fellowship Scheme

This scheme supports young engineers of high career potential with the course fees to undertake MBA courses at major international business schools. If you are 26-34 and have the potential to become senior managers and leaders in the UK industry, you may qualify. Contact Ian Bowbrick, tel: 0171 222 2688.

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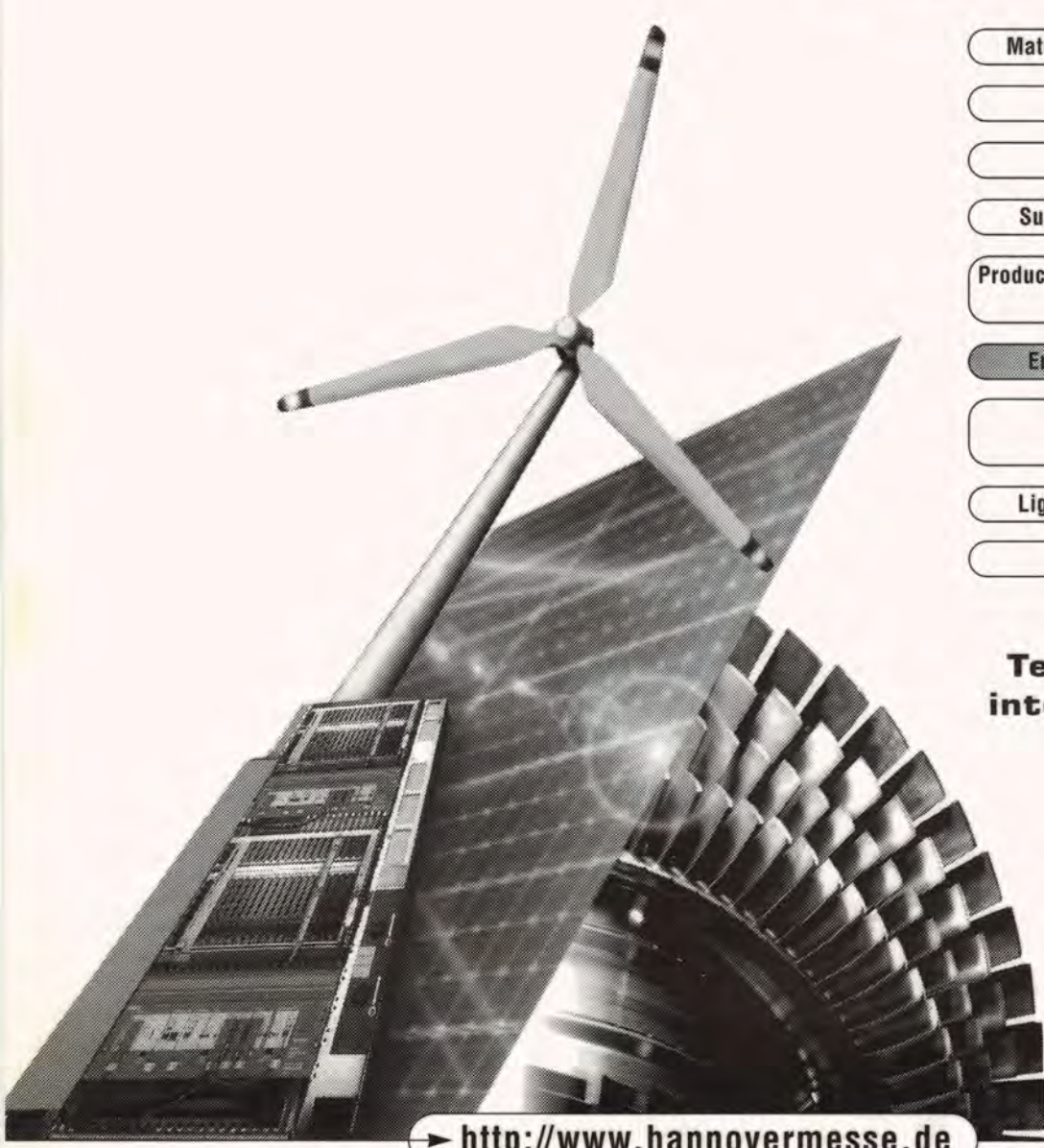
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- Lighting Technology (World Light Show)
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