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## Viewpoint

### Calling all thinkers!

When we remodelled the front cover and first page of *Energy World* it provided an opportunity for members to write a short section expressing views on any one of the many controversial issues in the energy scene. The scope is enormous. Energy matters, apart from being our professional business, are important enough to engage the attention of the political parties. Hardly a day passes without an energy topic receiving wide coverage (often, unfortunately, not completely accurate) on television, radio or in the national press.

There must be many members of the Institute who hold and can express strong views, factually supported, about energy — such as the balance between conservation and increases in output; the relative merits of nuclear, coal and renewable sources for electricity; the price and taxation policies; and possibilities affecting the balance of use of various fuels for heating.

Examples of controversial issues are the pricing of fuels (like oil and gas at times when the world oil price is low) to ensure that important indigenous sources — too costly at present but viable in the long term — are explored. Should we increase the amount of opencast coal — which is cheap — or import coal, which is also cheap, to keep down the price of electricity. Is it a better investment to build the Severn Barrage rather than one or two PWR stations that are planned?

Engineers must, and certainly do have opinions that can be properly presented on this page. Views on the role of the Institute, its service to its members — and, equally important, ways in which members can promote the affairs and interest of the Institute of Energy. Come on you silent majority we want to hear from you!

While we do not promise to print all viewpoints submitted we shall not act as censors. Viewpoints should be about 100 to 1000 words in length and sent to the Editor of *Energy World*. If you cannot let us have 'viewpoints' we want news about members and the organisations with which they are associated. What members do, and the opinions they hold, are of *real* interest to other members.

News and views please!

**N G Worley** (Member)

*Chairman, Publications and Conferences Committee*

*Why make fuel dear?*

**Institute of Directors, 1986**  
£2.95

As part of its initiative towards reducing and privatising Government expenditure, and getting better value for the spending that remains within the Government sector, the Institute of Directors is studying the budgets and responsibilities of Government departments one by one.

The first topic studied was health and a paper entitled *Better value for money: UK spending on health and social security* was published in October 1985. The second study undertaken was devoted to analysing the UK's energy market. A paper with the title *Why make fuel dear* was published in June of this year.

It discusses the five main energy industries: coal; gas; oil and petroleum; electricity and nuclear power by examining energy policy, Government intervention and privatisation. The Department of Energy (DoE) budget is relatively small (compared to health) but the cost of the UK energy policy since 1945, to the tax payer, has been massive. The paper explains how many millions of pounds could have been saved by the abolition of the many Government restrictions imposed since 1945.

Government intervention has had the effect of fragmenting the market for energy and thus increasing prices to consumers.

The restriction or prohibition of coal imports; restrictions by the British Gas Corporation on the import of coal for coal-based gas; prohibition of the sale of electricity, except to the grid; the purchase restrictions on electricity imports from France, and the veto of the purchase of natural gas from the Sleipner field off Norway are all elements of an intervention process.

In a competitive fuel market, prices would be determined by the prices of internationally traded fuels: coal, oil and gas. The power of OPEC has considerably diminished since the 1970's, and it thus allows a more fiscally free regime if the market were to be released from government interference. Alignment of UK energy prices with international levels would confer competitive advantages on our international industry and commerce.

The whole energy market has, since World War II, been dominated by the influence of Central Government. This centralisation has led to planning and forecasting errors of some magnitude, the most obvious result of which has meant the taxpayer 'standing the losses'. Indeed, the taxpayer has 'lost' even in those nationalised industries in years when profits were made. The IoD report examples the mammoth losses made by the coal industry even in those years when the price of oil increased 10-fold.

It has been said that the centralised operation has diverted allocation from

what is managerial responsibility to forecasting. In practice, the market for oil has been underestimated while the markets for coal and nuclear electricity have been overestimated. Furthermore these forecasts have not been politically neutral, but biased towards over expansion and the interests of the government of the day. This means that price relativities have sometimes been changed for political reasons rather than because of market forces.

In a nationalised monopoly finance for expansion is generated by increasing prices. That is the normal practice of communist countries. However, the taxpayer loses from nationalisation because he is obliged to support the risks of such financing which in non-nationalised industries are borne by private capital. Further, under nationalisation the taxpayer loses also because he or she is usually a consumer also.

The interests of the consumer have not been the most important influence on policy which should be dictated by market principles. Too often policy has been dictated in a producer-oriented way instead of a consumer-oriented direction.

The Government's dear-fuel policy can be exemplified in many ways. Firstly, and perhaps most importantly the restriction of coal imports by the CEGB has 'jacked up' the level of fuel prices generally and led to artificially high generation costs at such power stations as Kingsnorth, Tilbury and West Thurrock, all Thameside stations. This is a paramount example when comparing nuclear and coal fired generation costs, because the dollar-sterling exchange rates would have given a cost advantage of imported coal at the coast equal to about one quarter that of the cost of British coal.

Secondly, the same effect has been felt in the gas industry. It is said that gas generated from imported low grade coal would be half the present price of gas. Different types of gas could be transmitted by competing networks thus giving very economical sales of gas to those customers near the ports where the coal was imported. There is no reason why there should be any restrictions on the production of any kind of gas. If there are reasons why these possibilities are uneconomic then that is a good reason for not capturing the market.

Regional privatisation, for gas as for electricity, has the advantage of removing present restrictions allowing regional schemes to compete near their boundaries. As long as a common carrier system was effectively utilised it would be of no concern whether gas was distributed nationally or regionally.

The monopolistic powers of the electricity system is a third reason for the dear-fuel policy, local markets being forced to accept a highly discriminating tariff structure. In June 1985 the CEGB rejected an offer to purchase electricity from Electricité de France, some 15% to

54% cheaper than that generated by its coal-fired stations. The main reason for the rejection was the 'political' effect on British coal. This example, the IoD claims, shows just what is wrong with the UK's energy policy.

Most European countries are connected into an electricity grid network, including Britain and France now that the first stage of the 2000MW cross-channel link has been commissioned. France is the principal exporter of electricity in Europe and the cross-channel link referred to saw imports in February 1986 at a price 25% below the average price of British generated electrical power.

The fifth example given in the IoD report criticises the Government's veto on the British Gas Corporation's proposal to import £30 000 M worth of gas from Norway's Sleipner field. This effectively removed an alternative and cheaper source of supply.

The cost to the consumer of British energy policy has been increased by the recent fall in the international price of oil. The taxation of oil is a complex question and is not eased by a policy wherein oil is heavily taxed and coal is heavily subsidised.

One must take issue with the report's statement that a national grid network is not necessary, claiming it was costly to build and maintain. No facts are given to substantiate this and it does indeed contradict its statement upon the advantages of a European grid network. For the grid to be contracted out as a common carrier does bear closer examination.

The section of the IoD report on nuclear power is of especial interest. One paragraph quotes an authority in the OECD who described the recent UK nuclear power programme as one of the 'three worst civil investments in the history of mankind'.

To support this claim the report advances the idea that to give a monopoly of research and development for an advanced technology to a strongly centralised authority owned, financed, appointed and supervised by Government, is clearly not the way of promoting rapid growth.

The monopolistic organisation of the National Nuclear Corporation needs to be shed, involving changes which would make it self supporting. It is further recommended that the Government should undertake to sell the whole of its equity in British Nuclear Fuels. The Atomic Energy Act of 1971 empowers the Government to sell 49% of the equity. Government involvement in the nuclear industry should be confined to such supervisory functions as the granting of planning permission, enforcement of safety standards and the regulation of waste disposal.

In the light of the recent disaster in the USSR and the public concern about

nuclear safety the Government's supervisory role should be, and be seen to be, that of independently maintaining the highest standards of procedures and practice in the operation of such plants.

The IoD's report calls for the abolition of the Department of Energy, all its functions divided between the Treasury, the Department of Trade and Industry and the free commercial market.

The UK market in energy should be liberalised, with a freedom to import or export any fuel with tax consequences and political expediency erased. The combination of privatisation and market liberalisation will confer major benefits on the economy in Britain without inflicting any significant losses on the Exchequer.

Whether the public and mainly the taxpayer will be supportive of these ideas is for the future to decide. The Institute however does not make any disclaimers in this most readable and interesting document. The arguments advanced are logical and need much closer examination than I fear the document will get.\*

F John L Bindon

## *Industrial heat recovery: the availability of waste heat in eight UK high temperature process industries*

**Energy Technology Support Unit.  
Energy Publications, Cambridge, 1986  
145pp.**

The corporate author (an arm of the Department of Energy at AERE Harwell) describes the book as a market study for 'the high temperature process industries and their respective equipment supply sector'. These particular process industries generate significant quantities of waste heat at over 300°C or so. This they do while producing metals, glass, pottery, building bricks and bulk refractories. The chemical industry is not included: it is to be the subject of a later study.

With 1982 as the base year, information is given in the book on the sources, amounts, temperatures and cleanliness of the waste heat carriers, on the recovery of waste heat and its subsequent use, and on the problem areas needing further work. The corporate author's aims are to heighten 'awareness of the potential for high temperature heat recovery' and to help the Department of Energy's strategic development in this field. These aims are pursued without loss of perspective. Waste heat recovery is properly ranked as a last step in efficiency-raising, to be taken after heat waste has been minimised by good control, maintenance and so forth.

The volume contains a few titbits for general readers and browsers. Thus the introduction tells us that the basic energy unit employed in the text, the gigawatt,

is worth approximately £3. UK industry used 1740 M of these units in 1982. The octet of the study accounted for 446 M. These eight industries lost altogether 115 M of the units in waste gases generally and 90 M in hot gas emissions. Most of the waste heat (70 M units) came from iron and steel making. Only about eight million of the units produced by the other seven industries were carried by clean media and were readily recoverable. Of the 115 M total about 75 M travelled in contaminated media that would foul ordinary heat exchanger surfaces. Hence 'a major need for equipment which can accommodate contaminated flows, and which will not constitute a heavy maintenance burden'. More generally, there is 'a need both for long term generic research into interaction of materials with waste gases and for the development of equipment for low cost retrofit applications'.

However, despite the titbits, the book is not recommended for general readers or browsers. Nor for beginners, although the text does concede a few reminders on fundamentals: 'All fossil fuels contain hydrogen..., on combustion the oxidation of hydrogen produces water vapour. If this is allowed to condense to water' (what else?) 'a further amount of heat becomes available from the latent heat energy in the vapour'. On the other hand the reader is plunged into a discussion headed *Recuperation versus regeneration* pages before anything much is said about recuperators or regenerators and about the principles that distinguish them.

The study is in two parts. The first of these shows the scope for heat recovery in the eight industries. Available equipment and its main applications are surveyed. Research and development have a chapter to themselves. The second part of the study contains 'profiles' of each of the industries. These chapters begin generally with production processes and energy use, continue with more detailed and analytical accounts, survey current practice in heat recovery and conclude with trenchant and useful summaries.

There is no glossary or index but there are three appendices. One is a bibliography. Another is a list of directories and journals that does not mention *Energy World Reference Book and Buyers Guide* or *Energy World*. The third is a table of costs and quantities of coal, gas, oil and electricity per gigawatt. Arthur Conway

## *Renewable energy resources*

**John W Twidell and Anthony D Weir  
E & F N Spon, 1986**

**£30.00 (hardback), £14.95 (paperback)**  
This is a valuable and timely book which deserves to have a wide circulation. While the authors have written primarily for undergraduates they have also borne in mind practising engineers whose training may not have included all the wide range of sub-sciences involved in harnessing

biofuels, hydropower, solar radiation, wind, wave and tidal power, the heat of the ocean and the heat of the earth. The authors have attempted to provide a halfway stage between books which merely describe methods of utilising renewable energy resources and specialised engineering treatises which cover a limited aspect in very great detail.

Depending upon a reader's earlier education and experience some chapters may appear to lack rigour while other chapters may be difficult. The authors have faced this dilemma and by giving a comprehensive annotated bibliography at the close of each chapter have opened the way to further study at a level selected by the reader.

The authors are enthusiasts, eager to get back to first principles and apply these to the harnessing of renewable energy. They are equally ready to put on rubber boots and tramp the moors of remote Scottish islands, or dressed differently explore the energy resources of the South Pacific. They make the point that those who would harness renewable energy must be prepared to go out of doors in search of it.

The case for renewable energy can be made most strongly in isolated areas. For example a doctor in a remote area in Africa may find that it is as economic to power his refrigerator with solar cells as with a diesel generator. The authors both have experience of working in remote areas. John Twidell, who is head of the Energy Studies Unit at the University of Strathclyde, and has taught in the University of Khartoum and in the University of the South Pacific, would emphasise that while Scotland would not be classified as a third world country many areas in its islands and glens are certainly remote. Tony Weir is senior energy officer at the South Pacific Bureau for Economic Co-operation.

This is a book to dip into. Chapter 1 gives an interesting overview of the fundamentals of renewable energy. Whereas fossil fuels are readily concentrated and have played their part in the creation of the city and the megapolis, renewable energy sources can be, by their very nature more easily distributed. Their eventual use may halt the worldwide trend to move from the countryside into the cities and should help to improve the quality of life in remote areas.

Chapters 2 and 3 review the first principles of fluid mechanics and heat transfer. Inevitably these may prove to be too simple or too difficult depending on the reader's background. These chapters are there for reference as required and the reader is encouraged to skip them initially and go straight to his own topic of interest.

Solar energy is covered in Chapters 4 to 7, hydropower in chapter 8, power from the wind in chapter 9, biofuels in chapters 10 and 11, wave energy in

\*Copies are obtainable from the Publications Department, The Institute of Directors, 116 Pall Mall, London, SW1Y 5ED. Please enclose 35p to cover post and packing

chapter 12 and tidal power in chapter 13. Ocean thermal energy conversion, discussed in chapter 14, may be less familiar to UK readers. This is the warm oceans counterpart of geothermal energy which is treated in chapter 15.

It is of the essence of many renewable sources of energy that they are highly variable. To match the load to a fluctuating energy source requires either feed forward control or energy storage, or a combination of the two. The final chapter is therefore devoted to energy storage and distribution.

Each section begins with an examination of the availability of a particular renewable energy source followed by an analysis of methods of harnessing this energy. For example Chapter 4 looks at solar radiation with the aim of calculating the solar radiation available as input to a solar device, with a given orientation, at a particular place and time. Chapter 5 then compares methods of using solar heat to warm water starting with a simple black bag and moving on to more sophisticated devices using selective surfaces which have a high 'absorbance' to solar radiation combined with a low emittance in the lower temperature infra red region.

Chapter 6 reviews other uses of solar heat, for example for space heating and crop drying. Chapter 7 introduces the theory of photovoltaic power generation associated with semiconductors. It is noted that the cost of solar cells in 1984 was less than one twentieth of the cost of similar cells 10 years earlier. If the next decade were to show a comparable fall in price the solar cell would become a cost effective source of energy in many parts of the world.

It must be recognised that this book does not set out to explore the economics of renewable energy sources. Rather it is intended to equip the reader to undertake his own technical analysis of proposed designs to utilise some form of renewable energy. Then, having established a design which is technically efficient the reader can go on to undertake his own economic analysis against a background of current costs of fossil fuels.

This book deserves a wide readership as it stands. There is intense interest among engineers in developing countries in cost effective renewable energy sources. In the 1950s hydroelectric power was economically viable especially where interest rates on borrowed capital were low. Through the 1970s the rising cost of fossil fuels raised hopes that other forms of renewable energy would become cost effective before too long. The fall in the cost of crude oil in 1985-86 had postponed the fruition of some of these hopes.

When public demand for this book leads to a second edition the occasion could be used to provide an update of ongoing developments. In particular there would be value in adding a chapter on the economics of practical installations against the background of fluctuating energy prices in the 1980s. It would be helpful to engineers in the developing countries and in remote areas to provide

guidelines, based on practical experience, which would help to establish the conditions under which each form of renewable energy is likely to be economically viable.

However, as it stands this book will be valuable to lecturers in the field of energy usage. It provides a ready made series of lectures on the principles underlying the harnessing of renewable sources of energy. Lecturers can select, abridge and expand portions of this book to suit the requirements of their students. Practical calculations are embodied in the text and most chapters end with a series of problems with solutions.

In the course of this review of relevant physics, physical chemistry, biochemistry and engineering the authors use some 177 different mathematical symbols. Even then one symbol may have to serve several purposes. For example  $G$  is used for: solar irradiance, gravitational constant, temperature gradient and Gibb's energy. It is helpful that on pages *xvi* to *xx* the authors have presented a list of symbols together with a summary of how each is used.

*Dr John Barr*

## *The availability and cost of coal in South Africa*

**Ray Long**  
**IEA Coal Research, London, 1986.**  
**74pp. £75.00 (member countries),**  
**£150.00 (non-members)**

This is one of a series of reports by IEA Coal Research which examine the availability and costs of coal in all the significant coal-exporting regions of the world. It closely follows the methodology established in the two earlier publications on Colombia and the USA.

Ray Long analyses the factors which have influenced and will continue to influence the capacity of South Africa to meet domestic and international coal demand.

The author has produced a series of supply curves for the main coal-producing areas of the country — this provides an argued quantification of volumes of coal available at particular costs. Given the wide-ranging nature of determining factors the supply curves are no more precise in their interpretation than the general analysis of the factors themselves. The usefulness of the report, therefore, is centred on its providing a framework showing the underlying influences affecting the costs of coal production.

Because of the detailed nature of the geology, mining procedures, company structure, and costing concepts involved in building up the supply curves, the four areas are treated in detail in the appendices, while the main text concentrates on the broad issues which emerge. There is a fifth appendix on transport infrastructure.

The main text is divided into six chapters. Chapter 2 looks briefly at the basic geology, the historical build-up of the coal industry and at domestic and

external factors influencing current demand and supply. Chapter 3 examines coal availability in terms of quantities, qualities, mining operations, and company structure, while chapter 4 examines in detail the cost analysis and supply curves.

Chapter 5 looks at future trends which will influence cost and availability of coal with particular emphasis on the effect on exports of domestic coal demand, government policy and external factors undermining the country's need to diversify its foreign exchange earnings. Chapter 6 summarises the conclusions — these assume that a measure of government stability and economic development will continue.

Mr Long has produced a highly valuable independent assessment of the availability and cost of coal in South Africa. This book should prove to be both a valuable addition to the existing literature and of considerable assistance to individuals and organisations involved in the international coal trade.

*Andrew W Cox*

## *Coal sampling and analysis: methods and models*

**Alan Geit et al**  
**Noyes Publications, New York, 1986**  
**pp. 188**

The excellent quality of the binding of this book hides the poor reproduction inside, although the publishers go to some lengths to apologise for the hidden economy. Nor can we see the justification for the Appendix on pages 155-188 containing two columns of figures for *Data sets*.

The objective is to predict sulphur emissions from coal-fired combustion appliances by use of analytical data on the sulphur content of the input coal. The authors go to considerable lengths to explain the various sampling procedures and equipment used by *American standard methods*, not generally applicable worldwide. All this information is, of course, already available in the standard reference works and the value of reproducing them here is questionable.

A model has been developed to predict sulphur emissions from the sulphur contents of the coal. Allowance has been made for 'assumed' sources of error but no tests have been prepared to compare these with random errors.

It is doubtful whether this model is of any practical value and those intending to follow the approach adopted in this book should do so with considerable caution.

*B Atkinson G J Corney W R Ladner*

□

# An energy efficient future: a strategy for the UK

John Chesshire†

We publish here extracts from the Emstar lecture, given by John Chesshire in June this year. During the lecture Mr Chesshire sought to justify the case for a more strategic assessment of the role of energy efficiency on two principal grounds. On the one hand, because of the many uncertainties in the international energy policy outlook and the increased possibility of the UK's return to higher net energy imports over the next 15 years. Given the current crisis of confidence about energy policy options, demand-side responses appear to be more robust than many on the supply side. In addition, enhanced energy efficiency offers perhaps the most cost-effective route to the reduction of environmental impacts. On the other hand, he argued that energy efficiency should be assessed in the same macro-economic context as a large supply-side programme (be it oil, gas, coal or nuclear power), particularly with regard to its industrial, technological and employment potential. Here he examines some of the issues which are essential elements of such a strategy.

## The policy context

I wish to argue that the UK, some 13 years after the first oil shock in 1973, and halfway through *Energy Efficiency Year*, has failed to develop a coherent, comprehensive strategy for enhancing the nation's energy efficiency. The UK's international comparative performance in energy efficiency is — by any measure — third rate. That this is so is borne out by the Secretary of State's own recent speeches and by the limited amount of internationally comparative information (which needs to be interpreted with extreme caution given differences in climate and economic structure). As Table 1 suggests the UK's performance lags considerably behind that of West Germany and other comparable countries.

Briefly, why should this be so? The following factors seem to have been of fundamental importance:

- complacency borne out of relative plenty (the UK as 'an island of coal set in a sea of oil') and effective self-sufficiency in energy, at least over the past decade;
- the traditional and excessive fixation of the energy institutions and policymakers in the UK with the *supply* side of the energy equation and their comparative lack of experience and competence in addressing *demand* side issues, such as energy efficiency;
- as stated earlier, the lack of an appropriate, robust and yet flexible energy policy framework in the UK which has resulted in *ad hoc* and short-term decisionmaking (by governments and financiers) and the observation that, in the recent past, narrow fiscal and Public Sector Borrowing Requirement (PSBR) pre-occupations have overwhelmed virtually all other sectoral policy justifications;
- to my mind, and perhaps more controversially, the recent undue fixation with Adam Smith's 'invisible hand' — the price mechanism — as not merely a necessary but a sufficient instrument to adjust energy supply and demand over time, at least if suitably reinforced with information packs and *Breakfast specials*.

This is not to dismiss for one moment the importance of the price mechanism. But, with some politically-significant exceptions, we must all be aware of the

profound market imperfections in the energy sector. On the supply side these include the cartel behaviour of OPEC, not unassisted in the recent past by the Treasury's largesse to BNOC to 'stabilise' — or hold up — oil prices; and the natural monopoly elements of gas and electricity, irrespective of whether such utilities are in the public or private sectors. On the demand side, many would immediately be aware of the impediments to the smooth operation of market forces, such as household and commercial building tenure; the ubiquitous company car; the use of short time horizons for investment planning; ignorance and poor information.

The transport sector poses perhaps the greatest dilemma for an energy efficiency strategy given its almost total oil-dependence, the fact that the development of an economic alternative has to await a breakthrough in technology (probably in electric batteries), and that transport oil demand continues to grow despite numerous energy efficiency improvements. However, an important and rapidly expanding area of transport fuel demand remains largely insulated from the full effects of the price mechanism.

Company-assisted motoring is a peculiarly British phenomenon in scale. It has increased dramatically since the first oil shock of 1973-74 to the point where 60% of new car registrations are attributable to companies and the self-employed. Company cars have been defended on the grounds of being necessary for the job but, in recent years, they have become all too often merely a part of the remuneration package. They have larger than average engine capacities and they effectively isolate many motorists from market forces. Available evidence suggests that two-thirds of all trips in such cars are not for *bona fide* business reasons, but for commuting and leisure purposes.<sup>1</sup> Despite earlier concerns that harsher taxation would undermine the British motor manufacturing industry, over half of them are now imported. Finally, the company car 'perk' has been estimated to represent a tax loss of some £1500 M pa, equal to the subsidy to public transport. Clearly reform is overdue, even though perhaps electorally unpopular amongst this privileged minority. The simplest solution is an accelerated increase in the tax charges, especially for larger-engined vehicles, and tighter control on evasion, so that a position of at least fiscal neutrality is reached relatively quickly.

It is also important to qualify the role of the price mechanism (with its implicit assumption of atomistic

\*The Emstar lecture was given on 17 June 1986 at the Institution of Electrical Engineers, London. The text was first published in *Electronics and Power* in October 1986

†Senior Fellow, Energy programme, Science Policy Research Unit; Specialist adviser, House of Commons Select Committee on Energy

competition) for another reason. I would argue that it is not always appropriate to view decisionmaking as being taken by millions of individual households, motorists or managers well equipped and well informed enough to respond to actual or anticipated shifts in relative fuel and factor prices.

For example, very nearly one quarter of the UK's primary energy is consumed by one organisation — the Central Electricity Generating Board. Fifteen or so large manufacturing companies are responsible for one-half of UK industrial energy use. Most of the 21 M vehicles on the road are designed by engineers in no more than 10 large vehicle-producing companies (though these are by no means all UK based). Likewise 10 or so building societies, perhaps a dozen large local authorities and half a dozen major housebuilders influence the framework of domestic sector energy efficiency decisionmaking — or they could do. Thus energy efficiency policies need to be formulated with an awareness of the crucial role of these large energy decisionmakers on the demand side.

Foremost amongst these is the Government itself. In its reply to the Energy Select Committee's *Report on the Energy Efficiency Office*, the Government stated that 'the public sector spends about £2 bn annually on energy.'<sup>2</sup> This needs to be amplified in a number of important respects:

- i) this limited definition of the public sector must exclude the trading public sector, especially the energy nationalised industries, such as electricity, coal and gas, with their vast expenditure on energy;

- ii) the public sector owns very nearly half of the UK building stock and is responsible for the fabric if not always for the fuel bill (eg as in council housing); and
- iii) such an estimate must exclude Government expenditure of £443 M on fuel allowances in 1985 and a notional expenditure *via* other state income support of a further £2000 M which was discussed earlier.

Against such a self-effacing assessment of the role of the public sector, it is scarcely surprising that recent Government policy on energy efficiency has focussed overwhelming emphasis on the need to stimulate cost-effective investment by the private sector. Placing the whole onus on the private sector, important though it is, has unfortunately drawn attention away from the large scope which exists for promoting energy efficiency throughout the public sector. It is to this issue I now wish to turn.

#### *Investment appraisal in the energy sector*

This leads to the important, though seemingly esoteric question of investment appraisal. There is growing evidence of the divergent criteria employed in determining investment in energy supply and demand. Much debate has occurred over the extent to which the demand and supply-side streams of investment should be viewed as alternatives or complements. This seems a futile point of departure given that supply-side assets need to be replaced over time and that supply-side investment can be a major route to improved fuel efficiency (eg in the electricity

Table 1: Energy/GDP ratios for IEA countries<sup>(1)</sup>

	1973	1978	1982	1983	1984 <sup>2</sup>	2000	Average annual growth rates (%)		
							1973-1983	1983-84 <sup>2</sup>	1983-2000
Canada	1.14	1.16	1.09	1.07	1.09	1.02	-0.7	2.3	-0.3
United States	1.14	1.05	0.94	0.91	0.90	0.72	-2.2	-2.0	-1.4
North America	1.14	1.06	0.96	0.93	0.91	0.75	-2.0	-1.6	-1.2
Japan	0.70	0.61	0.50	0.49	0.50	0.38 <sup>2</sup>	-3.4	0.8	-1.5
Australia	0.68	0.73	0.74	0.71	0.70	0.63 <sup>2</sup>	0.4	-1.2	-0.8
New Zealand	0.69	0.80	0.79	0.82	0.85	0.81	1.6	3.8	-0.1
Pacific	0.70	0.63	0.54	0.53	0.53	0.42	-2.7	0.5	-1.4
Austria	0.66	0.62	0.57	0.57	0.57	0.51 <sup>2</sup>	-1.5	0.9	-0.6
Belgium	0.77	0.69	0.57	0.55	0.57	0.46 <sup>2</sup>	-3.2	3.2	-1.1
Denmark	0.51	0.48	0.40	0.37	0.37	0.27	-3.2	-0.8	-1.7
Germany	0.64	0.59	0.51	0.51	0.52	0.34	-2.2	1.2	-2.4
Greece	0.59	0.63	0.62	0.64	0.64	0.77 <sup>2</sup>	0.8	1.3	1.1
Ireland	0.96	0.91	0.82	0.80	0.77	0.75	-1.8	-3.9	-0.4
Italy	0.69	0.64	0.57	0.58	0.57	0.53 <sup>2</sup>	-1.8	-1.0	-0.5
Luxembourg	1.94	1.51	1.20	1.18	1.24	1.31 <sup>2</sup>	-4.9	5.2	0.7
Netherlands	0.74	0.71	0.57	0.59	0.61	0.54 <sup>2</sup>	-2.3	3.4	-0.6
Norway	0.76	0.71	0.66	0.69	0.70	0.62	-0.9	1.7	-0.6
Portugal	0.53	0.63	0.62	0.63	0.64	0.52	1.7	2.1	-1.1
Spain	0.57	0.64	0.61	0.60	0.61	0.53 <sup>2</sup>	0.6	0.6	-0.8
Sweden	0.69	0.67	0.61	0.62	0.64	0.48 <sup>2</sup>	-1.1	3.8	-1.5
Switzerland	0.41	0.43	0.41	0.43	0.42	0.39	0.6	-2.8	-0.6
Turkey	0.84	0.76	0.79	0.78	0.76	0.80	-0.8	-3.0	0.1
United Kingdom	0.93	0.85	0.76	0.74	0.73	0.66 <sup>2</sup>	-2.3	-1.6	-0.7
Europe	0.70	0.66	0.59	0.59	0.59	0.49	-1.7	0.3	-1.0
IEA Total	0.90	0.84	0.75	0.73	0.73	0.59	-2.1	-0.5	-1.2

Notes: 1 Measured in primary energy terms (tonnes of oil equivalent per \$1000 of GDP at 1975 prices and exchange rates)

2 IEA Secretariat estimates

Source: International Energy Agency, *Energy policies and programmes of IEA countries: 1984 review*. IEA/OECD, Paris, 1985, p 116

Table 2 Payback period compared with DCF rate of return

Payback required (Years)	Project life (years)							
	3	4	5	6	7	8	9	10
2	24%	35%	41%	45%	47%	.....	very large	.....
3	—	13%	20%	25%	27%	.....	very large	.....
4	—	—	8%	13%	17%	19%	21%	22%
5	—	—	—	6%	10%	12%	14%	16%

Note: assumes continuing savings (after payback period).

Source: *Energy conservation investment in industry*, Energy Paper No 50, HMSO, 1982, p 45

supply industry). Both in the public and private sector, they should thus be seen as essentially complementary in character: they are not mutually exclusive.

As long ago as 1975, the former House of Commons Select Committee on Science and Technology called for a re-appraisal of public sector investment criteria, arguing that: 'henceforth, the Government should consider the extent to which increases in energy demand should be met by investment in additional supply capacity or avoided in energy conservation measures.'<sup>3</sup>

During cross-examination the then Secretary of State, Eric Varley, committed the Government to carry out work in this area: 'I am advised that no work has been done in the way you suggest but I can ask for work to be done and I will do'.<sup>4</sup>

The newly-constituted Select Committee on Energy returned to this theme six years later, over which time no progress appeared to have been made. (Indeed the change in public sector investment guidelines in 1978, discussed later, had probably served to exacerbate the situation). In its report on nuclear power, the Committee said: 'We were dismayed to find that, seven years after the major oil price increases, the Department of Energy had no clear idea of whether investing around £1300 M in a single nuclear plant (or a smaller but still important amount in a fossil fuel station) is as cost effective as spending a similar sum to promote energy conservation'.<sup>5</sup>

In its response, the Government promised to consider the matter further<sup>6</sup> but, in the absence of visible progress, the Select Committee commented again in its report on *Energy conservation in buildings*.<sup>7</sup>

Given such growing concern, the Government eventually responded, but in a rather confusing way, via a leaked 'unofficial' report (*Investment in energy supply and use*, May 1982) and a very different 'official' document (*Investment in energy use as an alternative to investment in energy supply*, January 1983). Both documents attempted to address two separate, but related questions — the balance of national investment resources devoted to supply and demand, and the extent to which energy efficiency could assist the PSBR by reducing future energy supply investment.

But, particularly in the context of Energy Efficiency Year and the Monergy campaign, neither document sufficiently appraised the extent to which the PSBR could be assisted in perhaps a more profound way — by increased capital expenditure on a range of cost-effective energy efficiency measures as a route to reducing future revenue expenditure on energy throughout the public sector. This was not the only item of unfinished business, however, because the official version stated: 'the Government is examining whether — within the constraints set by decisions on the level of the PSBR — an investment in conservation will offer a better rate of return to the Exchequer than an investment in supply'.<sup>8</sup>

This assessment has yet to appear. Before turning to

the case for re-examination of public sector investment rules, let us review the evidence about investment criteria relating to both the private and public sectors, in both energy demand and supply. Despite professional and public sector preference for discounted cash flow (DCF) appraisal techniques, the available evidence points to the continued popularity of the payback method in much of private industry.<sup>9</sup> Short payback periods are preferred, at least for what is seen as 'discretionary' investment which includes boiler replacement and energy efficiency investment in even the largest companies (eg ICI).<sup>10</sup>

In a survey undertaken for the Department of Energy, of the 80 firms which were approached, 73 used the payback method for appraising energy efficiency investment and 61 sought a payback period shorter than three years.<sup>11</sup> For a project life of 10 years, a three year payback period is roughly equivalent to a 30% internal rate of return (see Tables 2 and 3). Our own evidence at SPRU of energy efficiency investment criteria at the depth of the recent recession suggests that the majority of companies were using payback periods as short as one to two years. The Department of Energy study found that energy efficiency amongst the survey companies had risen by 10% between 1973-81, but that the potential for further savings was considerably greater. Significantly, the study found that, although awareness was growing of the Government's commitment to its energy pricing policy as the basis for promoting energy efficiency, 'it is not yet as powerful a stimulus to investment as its advocates would hope'. Foremost amongst the reasons for this unresponsiveness to price signals was the use of short paybacks. As a result, the study concluded that: 'both in their preceptions and their actions, many firms are demonstrating that they are not equipped to react effectively to energy price messages'.<sup>12</sup>

On the other hand, private sector supply side investment is regarded as business development or 'profit increasing' in character. As such, it is likely to attract less stringent investment criteria than 'discretionary' energy efficiency expenditure. There is a dearth of information on the criteria used by private sector energy supply companies (in the UK, primarily the oil industry). In general they

Table 3 Payback required to meet a 5% real DCF rate of return (RR)

Anticipated life of investment (years)	Payback required to meet a 5% real RR (years)
5	4.3
10	7.7
15	10.4
20	12.5

Source: *Investment in energy supply and energy use*, Dept of Energy, 1982. Annex A.

appear to prefer DCF rather than payback methods for new oil field development. Whether they expect the 10-20% real rates (after tax) that most private companies use for business development investment is not clear (even to their shareholders). Given that oil and gas investment is said to be of a high risk character, the discount rates used in oil and gas development may be towards the upper end of the 10-20% range. Nevertheless, even at this level, more supply- than demand-side investment is likely to be undertaken in the private sector in response to a common set of price signals.

The principal guidelines for public sector investment appraisal were set out in the White Papers of 1967 and 1978,<sup>13</sup> supplemented by a number of Treasury working papers.<sup>14</sup> The approach adopted by successive governments recognised that, given the size of public sector investment requirements, national resources should be allocated efficiently and that the public sector's claim on investment resources should not distort overall resource allocation throughout the economy.

In principle, at least since 1967, public sector projects have been appraised on a DCF basis, with all costs and benefits discounted at the Test Discount Rate (TDR). In 1967 this was set at 8% real (ie after inflation) but was raised to 10% real in 1969. However, the 1978 White Paper replaced the 10% TDR by a required rate of return (RRR) set at 5% real. There is an important distinction between the TDR and RRR approaches. Whilst the TDR was intended as a yardstick for appraising returns from individual projects, the RRR is applied to an investment programme as a whole. Since 1978, the discount rate to be used by the nationalised industries has not been specified centrally by the Treasury. Each industry has been free to determine its own discount rate after consultation with its sponsoring department, subject to the constraint that the TDR chosen for individual project appraisal should be consistent with achieving the 5% RRR after tax on the investment programme as a whole.

The rationale behind the choice of the 5% RRR in 1978 is far less clear than the notional equivalence with adjusted *ex ante* returns in the private sector which formed the basis of the 1967 TDR rate. Rather, the overall 5% RRR was based upon an analysis of *ex post* returns achieved by the private sector.

How has this framework been applied in practice first on the supply and then on the demand side? The CEEGB places the primary emphasis upon the 5% discount rate, arguing that revenue earning investment is such a large part of the total that this should ensure a minimum 5% RRR.<sup>15</sup> On the basis of the CEEGB's central case presented at the public inquiry, the Sizewell B project is anticipated to earn a 7-8% real rate of return. British Gas uses a 10% discount rate for revenue earning projects, given the need to ensure a 5% RRR overall and the fact that some projects (eg for safety) will not earn revenue.<sup>16</sup> The NCB (British Coal) uses a somewhat similar approach — 10% for marginal projects but a minimum 5% real return for overall colliery investment.<sup>17</sup> It is thus interesting to observe that were the CEEGB to follow British Gas Corporation or British Coal practice in the assessment of revenue earning projects, the Sizewell B proposal would not earn a sufficiently high rate of return to be sanctioned.

All of the evidence suggests that much more stringent criteria are used on the demand side of the public sector in assessing energy efficiency projects than are used by the nationalised energy supply industries for capacity expansion. In many instances, the formal TDR/RRR system simply does not apply and cash limits, influenced by the PSBR, appear to have been very significant in influencing public sector energy efficiency investment

(especially since the ending of 'earmarked' funds in 1980-81).

The evidence from local authorities reveals that few of them have yet given energy efficiency any priority and that because of the binding financial constraints and the clash between revenue and capital requirements, only investments with very high returns are being made<sup>18, 19</sup>. In the case of the health authorities, the comptroller and auditor general found that they faced similar financial constraints and hence favoured short payback periods. Indeed, he identified a range of energy efficiency projects with an average payback period of 1.9 years which had not been undertaken.<sup>20</sup> Other failures to seize cost-effective energy efficiency investment in the public sector lie much closer to home (eg in the Ministry of Defence).<sup>21</sup>

What are the implications for an energy efficiency strategy which follow from this? The 1978 White Paper failed to resolve the issue of capital rationing in the event of many more potential projects satisfying specified investment criteria than could be funded from limited investment resources. All governments are revenue-constrained, but, inevitably, the over-arching concern with the PSBR, the loss of earmarked funds and the cutbacks in the Rate Support Grant have served to constrain the volume of cost-effective public sector investment in energy efficiency.

By halving the real discount rate from 10% to 5%, the RRR fails to act as the determining influence over either the appropriate direction or volume of capital investment within the public sector. This has been acknowledged by the Government which, whilst it agreed that 'investments in energy supply and energy use ought both to be determined by similar criteria', added: 'This does not imply that all investments with a realistic prospect of earning 5% return will go ahead. In allocating resources to different activities (health, law and order, education, energy, transport and so on) Government makes judgements on priorities between them and on priorities within the programme. Particular investment must be justifiable in all the circumstances and the balance between different objectives must be held'.<sup>22</sup>

But surely, the balance must also be held between the supply of and the demand for energy to meet the central objectives of energy and economic policy? Failure to do so would mean that significant misallocation of resources in the public sector was being condoned by sponsoring departments and the Treasury. Unless more rigorous value for money audits are undertaken of the options for public sector energy investment, it would lead to continuing significant waste of revenue expenditure, against which this administration has fought more than most.

In the light of the accumulating evidence, public sector investment rules clearly need to be reconsidered and there appears to be a strong case for a return to the higher discount rates prevailing prior to 1978. A rate in the range of 8-10% real would more nearly equate, after tax and investment allowance adjustments, with *ex ante* rates in the private sector. It would also act more efficiently as a rationing mechanism for public sector investment. Given evidence of the scope for much cost-effective investment which is not proceeding at present there is little fear that it would influence the *total* volume of investment but it might well alter the *balance* between competing priorities, especially that between the supply and demand sides.

But this measure would not serve to increase the volume of cost-effective conservation investment in the private sector. Here there would appear to be a strong case for continuing to support energy audit and survey schemes and the Energy Efficiency Demonstration Scheme. These have been remarkably cost-effective policy instruments<sup>23</sup> and have justifiably received widespread support. They

would, at the least, improve information provision of current best-practice technology and could be reinforced by more extensive targeting and monitoring schemes, in both the private and public sectors. Increasingly, attention must be placed on ensuring rapid replication of proven success.

Finally, given that lack of expertise and capital may prevent organisations acting solely in response to enhanced information provision, the role of contract energy management companies that can offer flexible packages of both expertise and capital, is of crucial importance in both the public and private sectors. By recovering all the financial and other costs of the services provided out of the savings achieved, the financial and technical risks of energy efficiency projects are removed. Widespread use of contract energy management, combined with a return to earmarking of funds, would revitalise energy efficiency investment across the public sector.

Having proposed a number of means of ensuring a more appropriate allocation of investment resources between the supply and demand sides of the energy sector, I would now like to turn to an equally important element of an energy efficiency strategy for the UK, that of institutional structures.

### *Institutional structures*

The demand for energy is a derived one. No one buys fuel or electricity for its own sake (not even for speculative purposes). Instead energy is purchased as a means of undertaking productive processes and of obtaining movement, communication, heating and cooling, lighting and cooking. This inherent characteristic leads to an immediate institutional difficulty. Every household and company, every motorist and office worker is involved in energy purchase and/or use. Likewise the responsibility for the formulation and execution of energy efficiency policies is fragmented because all government departments are directly responsible for a range of activities which consume energy (and indirectly, too, *via* their sponsorship role).

Whilst, with appropriate interdepartmental co-ordination, responsibility for energy supply can be focussed within one Department of State, it is not immediately apparent that this is the best way of tackling energy efficiency policy. Given my earlier comments about the need to adopt a wider macro-economic vision of the role of energy efficiency, the issue of institutional structures assumes even greater importance.

The Energy Efficiency Office (EEO) was created within the Department of Energy in November 1983, having evolved from the earlier Energy Conservation Division. It is thus of relatively recent foundation. Conscious of the need to avoid a pre-occupation with structures rather than content, I am thus hesitant in arguing for a re-appraisal of its role. The development of the EEO owes much to an energetic staff and a committed Secretary of State. However, a successor administration or Secretary of State might not be so enamoured.

Briefly, what are the options and what are their pros and cons? Whilst the possibility of a separate Department of State has been proposed in the past, it is unlikely that this option would command widespread support. A Ministerial Task force has been advocated, too. Whilst this has its attractions, it would complement rather than replace a body with administrative and executive powers. In essence, therefore, the choice would appear to lie between a reinforced Energy Efficiency Office within the Whitehall structure (eg absorbing the relevant resources of the Energy Technology Support Unit and with a broader but agreed remit within the administration) or

an agency at one remove. My preference is for such an agency, as the benefits of independence and freedom to comment in public on relevant issues are to be preferred to the hesitancy and secrecy which inevitably surrounds in-fighting within Whitehall. Nevertheless, the existence of such an agency — if it were to find favour — in no way obviates the need for a sponsoring division, no more than the existence of the UK Atomic Energy Authority or British Coal obviates the need for nuclear and coal divisions.

The activities of the fuel suppliers, especially of the utilities, should also be re-considered. Given their regular, though not always close, links with all categories of consumer, they have an integral role in the implementation of an energy efficiency strategy. At present that role appears confused — for example, should they advocate 'wiser' or 'wider' energy use? As suppliers their institutional *raison d'être* has been understandably interpreted as market expansion of defence. Much of their efficiency advertising and promotion has sought to combine efficient use with fuel substitution: ie use less overall by using more of our fuel, but efficiently.

However, the nature of energy markets is changing and some suppliers have spawned energy efficiency subsidiaries, not always involved in stimulating sales of their parent companies' products. The privatisation of British Gas might lead them into a range of similar activities, especially given their new slogan that 'energy (not gas) is our business'. The suppliers have extended their insulation and advice activities, but too many of the former (eg loft, tank and wall insulation) are charged at rates of interest far in excess of those required of their principal business activities, inevitably distorting the impact of price signals. Finally, the fuel suppliers could more actively sponsor their consumers' equipment suppliers (eg manufacturers of boilers, cookers and electronic meters) thus encouraging the more rapid development, marketing and diffusion of more energy-efficient plant and appliances, and assisting in fending off rising import penetration.

### *Summary and conclusions*

In this lecture, part of a range of activities in Energy Efficiency Year, I have argued that the UK should develop a more coherent energy efficiency strategy. To date, the UK's international comparative performance in this field has been poor: there is no cause to rejoice in the fact that it would have been poorer still but for major and painful structural adjustments in the energy-intensive industrial sectors (eg iron and steel and heavy engineering).

In launching Energy Efficiency Year, the Secretary of State has specified a political objective — a 20% improvement in the UK's energy efficiency worth some £7 bn pa. However, to date — and despite numerous reports on the subject — there has been relatively little debate about the rationale for, and the content of, a strategy which could secure this broad objective. As a contribution to this debate, the lecture has provided an opportunity to outline what I consider to be some of the important energy and economic policy factors which justify a more comprehensive and vigorous approach. These include large market opportunities, industrial and technological competitiveness as well as social policy and employment generation.

As for the content of such a strategy, I have emphasised a number of elements including:

- The sector-specific character of effective energy efficiency policies, including the case for boosting the survey and energy efficiency demonstration schemes for the industrial and commercial sectors, especially to encourage widespread replication of proven success;

and a tighter fiscal approach to company car ownership and use to sharpen energy efficiency responses;

- the need to ensure that investment resources are allocated cost-effectively within the energy field, between energy supply and energy efficiency and between the public and private sectors;
- the important role of the public sector, especially the non-trading elements, in an energy efficiency strategy. In particular, I have outlined ways in which constraints upon cost-effective investment might be overcome including a re-consideration of investment criteria, increased use of contract energy management schemes and a return to earmarking of funds;
- institutional factors, including the case for an independent agency with more freedom to comment in public and able to fuse energy with wider economic considerations (eg industrial, social and employment aspects), and for a re-assessment of the role of fuel suppliers;
- the case for a much more imaginative programme for redressing the imbalance between revenue and capital expenditure to tackle the energy-related difficulties experienced by many of those in receipt of state income support. It is my judgement that a considerable number of jobs could be cost-effectively created through an expanded insulation programme, targeted in particular at public sector housing and at those in receipt of fuel allowances.

To conclude, it is perhaps a testimony to our failure to develop an appropriate strategy that 1986 has been designated Energy Efficiency Year. Our keenest industrial competitors have, for some time, declared every year to be an energy efficiency year. We must seize the opportunity 1986 provides to ensure that the Secretary of State's objective becomes a reality.

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# Moving towards privatisation

The chairman, Sir Denis Rooke presented on 22 July 1986, the Gas Corporation's 14th annual report. In doing so he announced another very successful year in which the operating profit rose to £688 M from £651 M (1984/85) on a turnover of £7687 M.

Despite much debate throughout the year on the question of privatisation the Corporation's main focus was on business performance and efficiency.

In December 1983, the Corporation agreed with the Government a performance objection for British Gas of a 12% reduction in unit net trading costs per therm sold in 1986/87, as compared with 1982/83. The achievement of this objection is progressing well; the reduction over the last 12 months being 12.5%.

The financial target set by the Government for a four year period ending 1986/87 is for an average return of 4% of current cost operating profit on average net assets at current costs. The average return for three years has been 4.4%. The Corporation made an actual repayment of £190 M against its external financing limit (EFL) of £176 M. In determining the EFL for 1985/86, the Government took account of the payment, in cash, of a gas levy of £525 M. Taxation payments were £262 M.

The Corporation again achieved an increase in gas sales and gained customers in all markets. The preference for gas heating and cooking in the domestic market has been maintained and over the last 12 months there was a growth of 264 000 new customers taking the total to well over 16 M. The sale of gas to these domestic customers grew by 8.3% to a total of 10 047 M therms.

In their attempt to gain new markets, the Corporation have maintained the *Gas Warm Homes* promotion which features a certificate of accreditation awarded to developers of sites on which houses are built to a high level of energy efficiency. There are more than 7500 such houses on 1800 Gas Warm sites throughout England, Wales and Scotland.

British Gas serve 87 000 industrial customers who purchased nearly 6000 M therms or 31% of the total therms sold. Commercial customers accounted for 14.6%. Overall a marketing increase was made in the face of stiff competition, particularly from oil as oil prices fell. The amount of gas sold to industrial consumers remained more or less static, but commercial market sales rose by 16%. The industrial and commercial customers who take more than 25 000 therms pa found themselves faced by only relatively small increases in price in 1985/86. The increase amounted to 1.8p/therm in the year representing a 5.6% increase.

In a CBI review of industrial firms and interruptible gas prices, contract gas prices in the UK, when compared to other countries in Europe, were in the middle of the range for firm gas prices, while there was a significant advantage for UK interruptible gas consumers. This latter situation has prevailed for the last five years.

The winter of 1985/86 was colder than average, and indeed February was the second most severe month this century, only 1947 being colder. On no day during the month did the daily temperature reach the seasonal normal. A new record 'send-out' of 9197 M ft<sup>3</sup> was achieved between 0600 hours on 26 February and 0600 hours on 27 February. This beat the previous winter's daily record of 8961 M ft<sup>3</sup> on five occasions. In addition,

a new weekly record of 61 876 M ft<sup>3</sup> was established for the week ending 2 March 1986.

Further progress was made on the Corporation's two largest capital projects; the wholly owned Morecambe and Rough gas fields. The emphasis on Morecambe was on preparing for the next stage of the project, having already been in operation for the winter demand when its production reached 370 M ft<sup>3</sup>/day. The connection, commissioning and drilling have continued on three drilling platforms while the onshore terminal facilities at Barrow are substantially complete.

Progress continued during the year to convert the partially depleted Rough gas field for use as a storage reservoir and gas surplus to requirements was injected into the field at a rate of over 200 M ft<sup>3</sup>/day. During the winter periods when gas demand was high, gas was produced from the field and flows of over 350 M ft<sup>3</sup>/day were recorded following the completion of the new processing streams at the onshore terminal at Easington.

On one drilling platform eight new wells have been completed, and the construction of the final drilling platform is nearing completion. On the question of storage, six liquefied natural gas (LNG) facilities and three of the Hornsea salt cavities were available. In addition to these operational salt cavities, a fourth cavity is being filled with gas, while three others are being leached for filling.

The Corporation had a total of 145 100 miles of mains pipeline in use at the end of the year, an increase over the previous year of some 3500 miles of mains or mains relaid. During the year significant sections of three Scottish pipelines were uprated to enable the system to operate at 75 bar working pressure. Much work has been done in a programme of replacement of parts of the distribution network. This has included new techniques to improve efficiency particularly with mains laying. These techniques have included the use of pneumatic moles to insert polyethylene pipe inside cast iron pipe, thus minimising excavation and reinstatement. This has been featured in national press advertisements to show the high class technology in the gas industry in the late 1980's.

The Corporation's wholly owned exploration subsidiary companies continued their vigorous drilling programme in partnerships with others. Two partnership wells off the coast of Ireland in association with Gulf and BP were made public. The acquisition of new licences provides the basis for exploration activity and the annual report speaks highly of such activity, especially in areas of St George's Channel off the coast of Eire and in sea areas near Denmark and the Netherlands.

As further support for much of British Gas business, revenue expenditure for research, development and testing comprised some £59.4 M with another £4.7 M for operational services. In SNG (substitute national gas) engineering studies, the Corporation spent nearly £12 M. For the latter a methanation catalyst had been used successfully in a commercial coal-gas plant in Great Plains, USA. Other new catalysts are being developed for upgrading purified slagging gasifier gas at higher pressures. Other developments of apparatus for measuring the physical parameters of reservoir fluids are fluid flow through porous media at reservoir conditions of high

(continued on p 15)

# Energy monitoring and targeting by microcomputer

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The Energy Efficiency Office are currently promoting monitoring and targeting (M and T) as a method of achieving, typically, 5 to 10% energy savings in buildings. The recent report by the Audit Commission<sup>1</sup> also recommends that local authorities install central energy monitoring and targeting systems. This article describes the theory of the TEAM\*\* (Targeting, Energy Auditing and Monitoring) microcomputer software used to achieve these savings and improve management information

Keeping check of the fuel consumption of more than one building can prove to be a nightmare for an energy manager. Companies or authorities with multiple sites often suffer under a deluge of paperwork and site information. This all makes the task of simple monitoring for overspend or saving rather difficult. Targeting by accurately adjusting to variables such as external temperature and hours of occupancy may prove too difficult even to consider.

The advent of the microcomputer, however, has changed all this. The office microcomputer with suitable software can be used as the energy manager's 'eyes and ears'. Overspending buildings can quickly be highlighted, or savings accrued accurately logged.

The computer allows a wide range of information and data to be stored on disc. The results from an analysis provide the manager with performance reports for closely monitoring fuel usage in each property.

## Database

One of the most important aspects of a computer-based monitoring system is the database. Care and thought before entering information can save wasted effort later. Subsequent analysis is only as good as the data supplied, so it is important to establish satisfactory procedures for obtaining and entering data.

The database should include the following basic information:

*Property details* — building name, address, site contact, telephone number, account number, utility board.

*Further information* — floor area, heated volume, exposure, hours of occupancy, holidays, shiftwork.

*Fuel data* — delivery or meter reading data, energy usage, cost.

Having created a basic file of information on energy use and related details (Fig 1), it makes sense to utilise the computer to log other information, such as boiler and hot water plant, controls, building fabric, maintenance records and schematic diagrams of plant layout (Fig 2).

The computer program then becomes a useful tool for the maintenance engineer. When an exception report is presented showing a building overspending to target, and in need of attention, the engineer can be presented with a computer printout of the plant details. He may then arrive on site armed with suitable spares, thus saving time by making a further visit less likely.

## Data entry

Data may be entered in the following ways:

- Manual input through a keyboard
- Downloading from magnetic tapes supplied by the utility boards
- Directly from energy management systems

Where a number of properties are supplied from the

same accounting source, eg the same Electricity Board, arrangements can sometimes be made to send data on magnetic tape. This information can then be downloaded from a mainframe computer to the microcomputer holding the database.

Energy management system outstations may be used as an information source when automatic meter reading devices are installed: the microcomputer can be used to collect readings via a telephone line (modem).

The easiest way of monitoring the fuel consumption of each property is from fuel invoices. These contain valuable information of cost and units used within the billed period.

The regular input of data from invoices, meter readings and stock checks, (eg monthly), provides the basic data for the close monitoring and usage analysis.

It is essential to establish acceptable procedures for collecting this information if the monitoring exercise is to be a success. Invoices invariably go directly to the accounts department and regular meter readings and stock checks can often prove difficult to organise.

Some latitude can be allowed on the timing of data received. For instance, if it can be arranged for meters to be read on the last day of the month, all well and good. Failing this, the data may need to be averaged.

Regardless of the method adopted, the input of information should be quick and simple.

## Output presentation

Data analysis and presentation is all important for quick and easy interpretation of results.

Calculation of monthly figures allows a month on month comparison of movements and trends. There are many methods of displaying the analysis and a few are listed here:

- 1 Histogram
- 2 Line plots
- 3 S-curves (Fig 3)
- 4 Regression analysis ('Line of best-fit') (Fig 4)
- 5 Monthly performance ('League') tables
- 6 12 month moving average
- 7 Exception reports

A comparison of one month's data with the same month in the previous year provides a useful indication of movement and allows problems to be quickly identified.

Movements over a number of years may be monitored by a comparison with a base year. Any 12 month period can be selected for a base year. It is usually best to use

\*Consulting engineer with Energy Designs and Surveys

†Systems analyst with the Energy Auditing Agency

\*\*Software (referred to as TEAM) is available from Energy Auditing Agency, 41 Adelaide Street, Luton, LU1 5BD

DEGREE DAY AREA - Thames Valley

PROPERTY NAME ENERGY DESIGNS AND SURVEYS  
 ADDRESS 41 ADELAIDE STREET  
 LUTON  
 BEDFORDSHIRE  
 LU1 5BD

SITE  
 CONTACT MR J.T.SWEETING  
 TITLE SYSTEMS ANALYST  
 TELEPHONE NUMBER 0582 458080  
 BOARD SHELL U.K.  
 DISTRICT  
 ACCOUNT NUMBER 105/52283/05  
 ADDITIONAL DATA Space heating and hot water.

FLOOR AREA (M\*\*2) 3421  
 OCCUPATION (HRS/MONTH) 180  
 OCCUPATION NUMBER 543

DATE	Litres	COST (£)	p/Litres	DAYS FROM LAST DATE	EST
30/JUN/83	26642.00	3421.00	12.84	0	
31/JUL/83	16457.00	2113.00	12.84	31	
31/AUG/83	16338.00	2098.00	12.84	31	
30/SEP/83	41143.00	5283.00	12.84	30	
31/OCT/83	65563.00	8419.00	12.84	31	
30/NOV/83	69097.00	9374.00	13.57	30	
31/DEC/83	98523.00	13367.00	13.57	31	
31/JAN/84	94514.00	13335.00	14.11	31	
29/FEB/84	96219.00	14134.00	14.69	29	
31/MAR/84	117938.00	17324.00	14.69	31	
30/APR/84	63941.00	9371.00	14.66	30	
31/MAY/84	49371.00	7236.00	14.66	31	
30/JUN/84	27524.00	4034.00	14.66	30	
31/JUL/84	6400.00	938.00	14.66	31	
30/AUG/84	5029.00	781.00	15.53	30	EST
30/SEP/84	13042.00	2068.00	15.86	31	
31/OCT/84	37833.00	6389.00	16.89	31	
30/NOV/84	40791.00	7165.00	17.57	30	
31/DEC/84	81366.00	15307.00	18.81	31	
31/JAN/85	103012.00	19943.00	19.36	31	
28/FEB/85	105417.00	22138.00	21.00	28	EST
31/MAR/85	107904.00	22289.00	20.66	31	
30/APR/85	53120.00	9657.00	18.18	30	

Fig 1 Example of database file

the financial year before an energy manager was employed, or energy conservation measures were implemented.

Where several properties are to be compared league tables are useful for displaying highest through to lowest consumers. For properties of a similar type (eg hospitals and schools) it may be more informative to make comparisons in relation to floor area, volume, number of occupants or occupancy levels.

The computer can make selective searches identifying these buildings.

### Adjustment factors

Comparing a building's energy use and costs of, say, this year to last does not provide a true picture. Adjustments are necessary to make provision for variables such as:

- External temperature (degree days)
- Occupancy (hours/month)
- Production units

Each of these variables may affect energy usage. It is therefore necessary to establish the significance of each. For example, oil used for heating would normally require adjustment to external temperatures, whereas oil used for process heating may require adjustment to production levels. Alternatively, electricity used for office lighting might be adjusted to occupancy and a daylight factor.

The usual method of establishing dependency on a particular factor is by common sense and to plot fuel

usage against the factor over a 12-month period to obtain the 'line of best-fit' through the points. A significant slope on the line indicates a relationship. If no factor is found to be significant, or there is a large amount of scatter about the line, then adjustment should not be attempted. In the latter case more accurate data may be required.

Fig 4 shows a typical plot of energy usage against degree days\* for a heating fuel. This is an established method recommended by the Energy Efficiency Office of the Department of Energy (see p 15).

This example shows that the boilers are also used for the generation of domestic hot water throughout the year. Note the 'base load' offset at the intercept with the Y axis. This 'base load' is not degree day dependent and has to be subtracted during adjustment. Only the heating load (signified by the gradient) need be adjusted to the weather factor. It is important to separate the variable portion of the fuel's usage away from the non-variable portion or 'base load'. This is frequently neglected.

Fig 5 further shows a regression analysis of points relating to two years energy consumption (approximately £100 000 per annum). This shows that the 'base load' has reduced, although the heating load remains the same. In this instance the 'base load' had been reduced owing to the insulation of steam heated, heat treatment vats. No measures to reduce the heating load had been considered, therefore the gradient or slope was unaffected.

(continued on p 15)

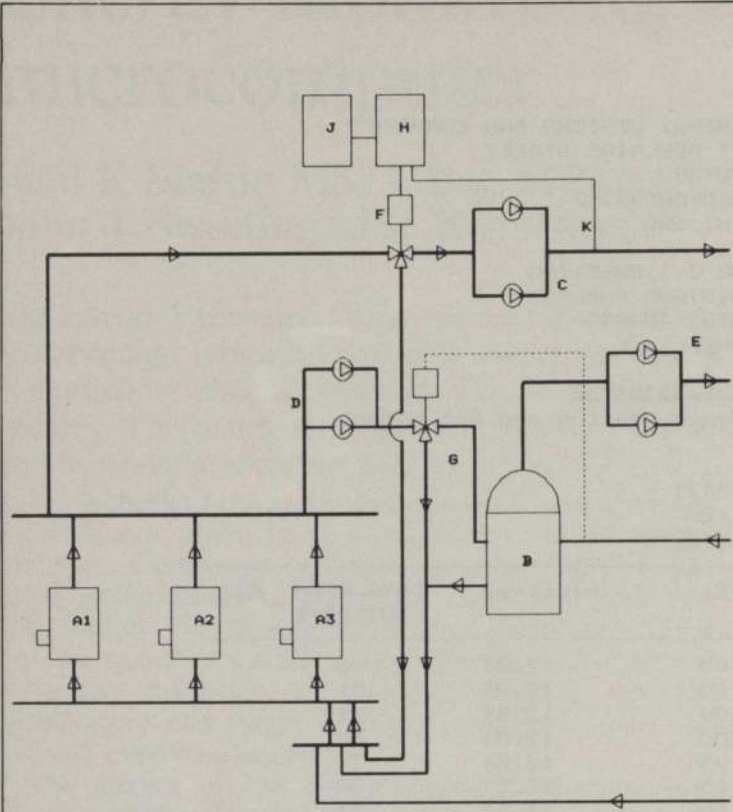


Fig 2 Schematic diagram of boiler plant layout

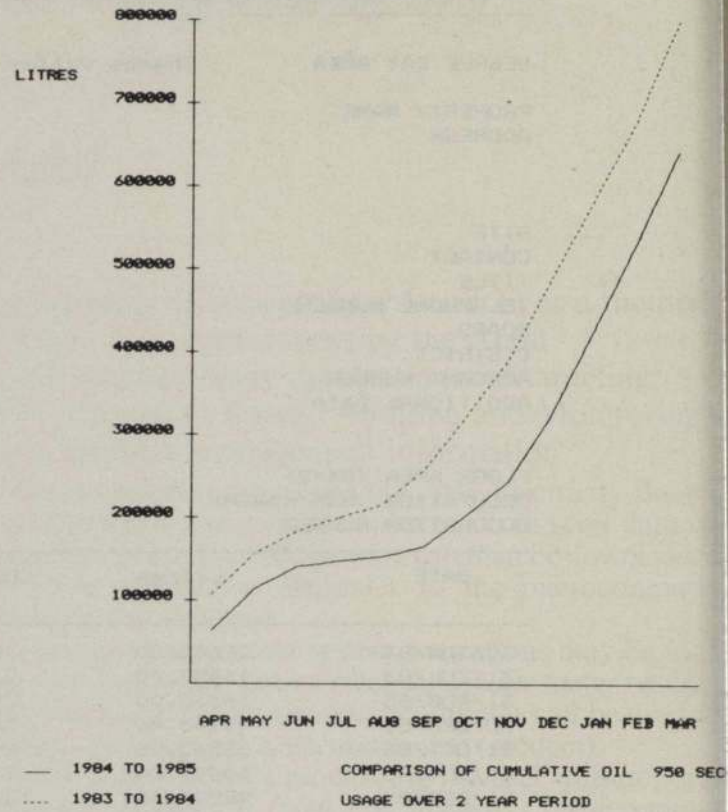


Fig 3 S—curve plot of fuel usage

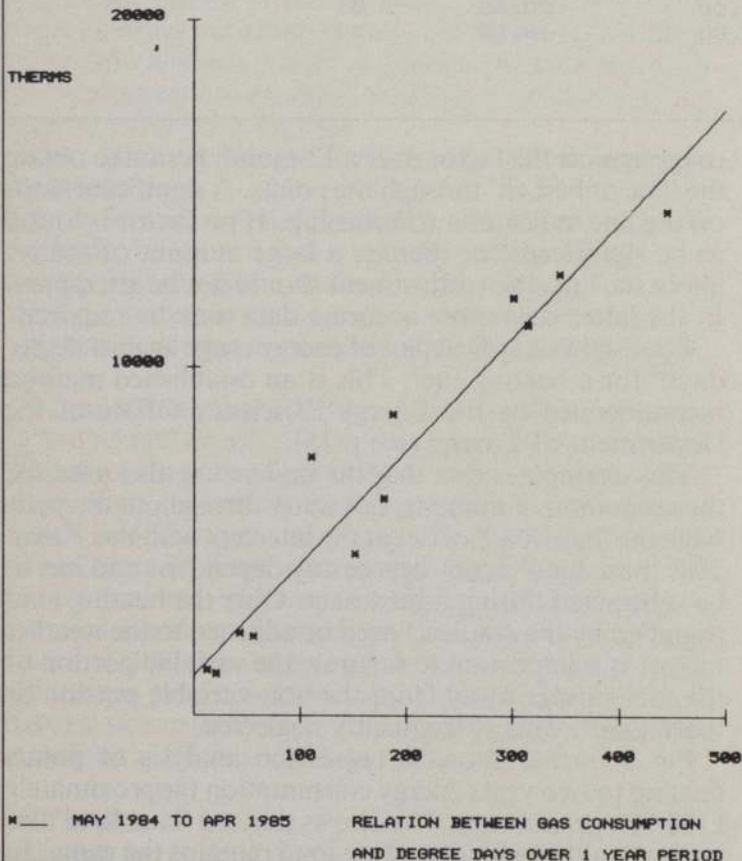


Fig 4 Regression analysis over one year

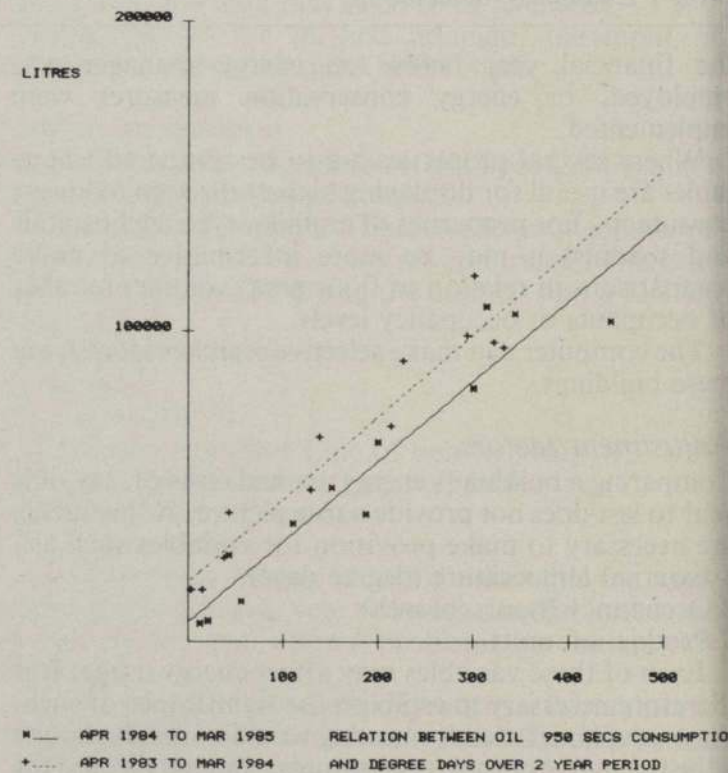


Fig 5 Regression analysis over two years

An example of the importance of adjusting heating fuel consumption to outside temperature was explained by an energy manager. He invested a considerable amount of money in an energy conservation project aimed at reducing space heating costs. A few months into the first heating season the financial director called upon him to explain, not only why the predicted savings were not being achieved, but why the fuel bills had increased slightly. Having analysed the fuel usage with the computer program he was able to explain that the outside temperature was much lower and prove that when one considers the cost which would have been incurred for that month, he had actually saved £1600.

If an outside temperature of 5.5 deg C prevails for one day, the total degree days for that day would be 10 (15.5 deg C — 5.5 deg C = 10 deg C). The accumulated daily degree days are published monthly.

#### Forward forecasting and targeting

Forecast statistics may be derived by using the regression analysis and estimates of the adjustment factor during the forecast period. For example, using a heating fuel adjusted to 20-year average degree day figures, estimates of future usage can be predicted over a financial year. Obviously,

#### British Gas annual report continued)

temperature and pressure has put British Gas in a strong position to understand the mechanics and operation of gas condensate reservoirs.

The report contains a number of other sections of the gas business dealing with the important aspects of safety, staff training and development. Over £24 M was spent on training and management development activities. With a manpower of slightly under 90 000, (3371 less than previous year) the above figure represents 2% of gross salaries, wages and associated costs, and represents an investment of £265/employee.

Since the plans for privatisation were announced, debate on the 'sell-off' of Gas Showrooms has disappeared. This is against a background of a more buoyant retail sales position overall, the volume of appliance sales increasing by some 10%. This resulted in a profit of £11.9 M compared to £9.3 M in 1984/85. The most significant improvements were made in the space heating market, when sales of gas-fires increased by 11.3%. A successful relaunch of wall heaters in the autumn of 1985 led to a sharp rise of 27% in sales for the year as a whole. Gas cooking remains in a leading position, sales of freestanding cookers rising by 3.4%. To encourage higher efficiencies, a marketing trial has been launched of one thousand condensing domestic central heating boilers.

British Gas is actively supporting the *Monergy* campaign for Energy Efficiency Year. A guide to energy

weather predictions of this nature are normally unreliable on a month-to-month basis, but over a year the estimates can provide a good indication. This method can also be useful for budgeting and cash flow predictions.

A target consumption can be set for a property by using normal performance indicators, calculated design consumption, predicted energy savings from, say, insulation, or a simple percentage reduction. The performance to the set target can then be monitored on the computer.

In summary, the microcomputer can make an energy manager's job easier by taking the hard work out of fuel monitoring, alerting him to building/accounts that need attention and accurately calculating savings that he has achieved.

#### Bibliography

- 1 Saving energy in local government buildings, Nov 1985, HMSO.
- 2 Degree days. Fuel Efficiency Booklet No 7, Energy Efficiency Office.

\*The generally accepted definition of the degree days is 'the daily difference in temperature between a base temperature of 15.5 deg C (60 deg F) and the 24-hour mean outside temperature (when it falls below the base temperature)'

efficiency in the world of gas was issued in collaboration with the Government programme. In the Energy Efficiency Office's *Energy projects pack* for schools, the Corporation developed a digital thermometer and light meter to support the project. In its Wales region, British Gas, Wales/Cymru in 1986 was one of a number of major supporters in the organisation of an international conference in North Wales to celebrate the centenary of the aluminium process, the Hall-Héroult process. This is in conjunction with electricity producers and consumers.

In conclusion, the Corporation's trading activities have continued to be very successful and once again British Gas has been wholly self-financing.

The report contains an appendix which clearly shows the financial summary over the past five years. A separate appendix gives some interesting and excellent statistics for the industry over the 10 years from 1976/77 to the present and clearly illustrates the progress and efficiency made.

In his foreword to the 14th annual report Sir Denis Rooke states that the success of British Gas has been founded on sound commercial principles and commends the commitment of all who work in the business giving high standards of service, safety in operating practices and the prudent financial planning.

These strengths will remain with the industry as it enters a new era in its long history. In an important sense privatisation will not mean change at all.

**F John L Bindon (Member)**

Institute of Energy future conference:

24/25 September 1987 at Imperial College, London

1st European Conference on

**The Influence of inorganic constituents on coal combustion**

in small to medium-sized boilers

see call for papers this issue

## Energy award To the weather men

The Royal Society Esso Energy Award for 1986 was presented in October 1986 to a team from the Meteorological Office for their development of a worldwide forecasting model that provides accurate information on winds and temperatures to the civil aviation industry. Flight paths and patterns can now be selected with the help of this information, to use the minimum amount of fuel.

Dr P W White, Dr M J P Cullen, Dr A J Gadd, C R Flood, Dr T N Palmer, K Pollard and Dr G Shutts received the award which comprised a gold medal and prize of £2000, from Sir George Porter, president of the Royal Society.

The development and operational introduction, by the Meteorological Office, in 1982, of a global, numerical forecasting model has led to a major advance in the accuracy of weather forecasting. There are numerous commercial applications, many involving energy savings in the gas, electricity and offshore industries. Of particular importance is its use, by the world's airlines, in the planning of the most economical flight paths, flight levels and fuel loadings. Winds at flight levels sometimes reach 300-400 km/h, and these 'jet streams' may remain intense for thousands of kilometres. The avoidance or seeking of these strong winds is an important part of flight planning. The Meteorological Office provides numerical forecasts twice daily within 4.5 hours of observation time; forecasts are provided direct to many airlines, and also through the Société Internationale de Télécommunication Aéronautiques and through Aeronautical Radio Incorporated. Use of the improved forecasts has been shown to achieve savings of 1.5-2%; the total fuel savings to all airlines involved are in the order £50M pa.

Source: *The Royal Society*

## UK gas price — too high

This year's National Utility Services survey of natural gas prices shows that the United Kingdom is one of only two countries among the nine surveyed to have increased its prices in the 12 months to September 1986. The survey uses data drawn from prices paid by over 750 000 businesses worldwide.

NUS spokesman Andrew Johns says that UK gas prices rose by an average 1.2% over the last 12 months. 'This is significantly out of line with the situation in most other countries, where decreases in the price of oil have generally been reflected in gas price reductions'.

The survey shows that most countries experienced price reductions ranging from a 1.4% drop in Canada to a massive

61.1% cut in Italy. The only other exception, apart from the UK, was Australia.

The average UK price on 1 September 1986 was 34.5 p/therm, the sixth-highest in the NUS survey. The most expensive average of 49.6 p/therm was recorded for France, whilst Italy was cheapest at 16.3 p.

'With cheaper alternative fuels available, British Gas has been, in many cases, dragged reluctantly to the negotiating table, losing in the process a large number of major consumers who switched to burning these cheaper alternative fuels', says Andrew Johns.

'It is evident that the British gas industry, which has argued since 1983 that its prices are not oil-related, has been forced over the last 12 months to take note of the prices charged by competing fuel suppliers in order to remain competitive and retain its market share'.

The survey warns that, with oil prices strengthening and the privatisation of British Gas looming, it is likely that UK consumers will face higher prices and a possible change in pricing policy in the forthcoming months.

Source: *NUS*

## Improve insulation Improve health

Some 5.5 M households are said to be suffering from condensation/dampness, predominantly caused by insufficient heating and/or inadequate insulation. This places some occupants at special risk, ie the very young and very old from excessive and prolonged cold, and those susceptible to a wide range of respiratory illnesses and allergies caused by spores from mould growths.

Improvement by the insulation of these homes is seen by the Building Research Establishment as an important step in alleviating these conditions. Temperature rises of 3 to 4° C are being obtained by insulating walls, generally coupled to proper loft insulation and selected draught proofing, provided heating is maintained. This temperature rise can substantially alleviate this hazard — lessening the risk of mould related illness and of hypothermia.

A plea for action to insulate the affected houses was made by the National Cavity Insulation Association in October. Only some 10% or 2M of the housing stock of 20M, is estimated to have adequate wall insulation. Lack of insulation in other areas of these homes is estimated to waste a further 25% of fuel input.

MPs are being asked to support moves to assist the insulation of the homes of people who are unable to pay. It is claimed the measures would lead to a lessening of demand on the health services — as the home environment has a major effect on health. Some 14 M people

currently live in homes affected by condensation, damp and/or low temperature conditions.

Cavity wall insulation has been seen by the Building Research Establishment as a prime measure to be taken in order to alleviate condensation dampness. Already some 2M homes have been insulated privately and by public authorities. A further 9M cavity walled homes remain untreated, a large number in local authority ownership, or owned by private landlords lacking the incentive to modernise. The 2M treated homes are estimated to be saving their occupiers on average £100 pa on fuel bills or providing greater comfort. This has helped pull the national average energy requirement for homes down by 12% since 1979 says the Building Research Establishment.

Source: *NCA*

## Wax in cold diesel The cure

In October a new diesel fuel was launched. The product, Mobil diesel plus, is formulated for use in all diesel engine vehicles including trucks, buses, light vans, taxis and passenger cars. It will be sold at the same price as regular diesel.

The benefits of the new fuel are: better winter starting and cold weather operating performance; strong detergency to keep the engine and fuel injectors clean.

The diesel is being marketed as a *cure for the common cold*. This refers to its ability to prevent wax particles blocking a vehicle's fuel filter — even in severe weather conditions. By modifying the structure of the wax particles (which improve combustion performance), the fuel keeps flowing at temperatures down to at least -15 C. So, it is claimed that expensive vehicle breakdowns due to fuel blockage should be eliminated, filters should stay clear and engines run more smoothly.

Source: *Mobil*

## Harwell Combustion initiative

The Combustion Centre of the UKAEA's Harwell Laboratory is participating in a £9.5 M international collaborative research programme on combustion launched by the Commission of the European Communities (CEC).

The new initiative is part of the CEC's non-nuclear energy R and D programme. It is designed to ensure a co-ordinated research effort to support the Communities' industrial requirements and maintain European competitiveness.

Over 30 organisations (universities and industries) in the UK, France, Germany, Italy, Denmark and Belgium are participating in the three year

programme. The centre is co-ordinating two major technical areas — turbulence and diagnostic methods, and combustion kinetics. The kinetics programme will be concerned with the chemistry of soot and nitrogen oxide formation, oxidation and the combustion of aromatic fuels. The development of improved models of turbulent combustion is essential to further advances in all areas of commercial combustion technology.

A third topic on internal combustion engine research will be co-ordinated by major European motor vehicle manufacturers. This is a wider study of the behaviour of air fuel mixture in combustion cylinders both before and during the combustion process. The objective is to develop a computer code for the design of more efficient combustion units hence improved fuel economy, reduced exhaust emission and increased competitiveness of European manufacture.

The work on furnaces (a term which covers gas turbines and fluidised beds as well as industrial furnaces) will focus principally on burner aerodynamics.

The CEC initiative follows a survey of European combustion research, carried out for the Commission by the centre. The survey covered the work in all the leading European combustion laboratories, in universities, technical institutes and industrial companies. It identified the key research requirements and the need for a co-ordinated approach if the benefits of Europe's investment were to be maximised.

The CEC is contributing over £5.5 M to the cost of the programme which will begin in 1986. The balance of the funding is being provided by governments, industry, universities and technical institutes in the member states of the European Community.

Source: Harwell

## Underground gasification US tests complete

Large-scale laboratory tests simulating underground coal gasification using high-sulphur, high-swelling bituminous coal were successfully concluded by the Western Research Institute in Laramie, Wyoming, under sponsorship of the US Department of Energy's Morgantown Energy Technology Centre.

Underground coal gasification tests have been successfully completed in sub-bituminous coals which tend to shrink upon heating, allowing easy passage of the reactant gases through the coal seam. The difficulty with eastern bituminous coals is that they swell on heating, tending to close gas paths through the coal seam. Further, recent tests by the Sandia National Laboratory have shown that an unreactive form of carbon, pyrolytic carbon, forms on heating bituminous coal, coats the coal surface and inhibits reactions.

The WRI test results have revealed additional information about the behaviour of swelling coals. Specifically:

- Eastern bituminous coal can be successfully gasified when the operating conditions are properly chosen.
- Combustion and gasification of the coal seam, around the vertical edges of the gasification cavity, controlled the size of the burn area in these plastic-like coals that adhered together when burned. Small pieces did not break off from the cavity roof to expose a fresh coal surface as happens in western coals.
- Operating at ash slagging conditions (where the mineral matter is heated to its melting point) prevented ash from sticking to the walls of the burn area. Thus, a clean char surface was always available for gasification. Unreactive pyrolytic carbon, which inhibits the movement of oxygen into the char and coke, did not interfere with gasification under these conditions.
- The lateral gasification cavity growth was larger than anticipated before the test because of the reaction mechanism.

Source: US Department of Energy

## Australia Coal slurry analysis

A coal slurry analyser that measures aeration has been developed by the Australian Mineral Development laboratories (AMDEL).

The machine, which measures the ash content and density of coal slurry, also measures the degree of aeration in the slurry, resulting in recovery of up to 10% more coal from the slurry.

The South Australian Minister of State Development and Technology, Lynn Arnold, said that the increasing value of coal and the use of mining methods that produced more fine particles had made it economic to recover fine coal that previously was discarded.

To recover the maximum amount of minerals during flotation extraction, almost instantaneous data feedback was needed. The new slurry analysis system gave the percentage of metals and solids of the slurry every five minutes, as well as the percentage of aeration.

Source: Australian Information Service

## Hydrogen recovery New membrane system

A membrane separation system which economically recovers hydrogen for recycling back into refinery and petrochemical processes has been developed.\* The new system reduces costs by about 25% compared with established technology.

Recovered hydrogen is used in such processes as the removal of sulphur from high-sulphur crude oil and the production of ammonia and methanol. Specific applications for the new hydrogen recovery system are being discussed with a number of oil and chemical companies.

The system was demonstrated in a pilot

facility in Oklahoma, United States, since April 1985.

The heart of the system is a newly-developed hollow-fibre membrane, which separates selectively one gas from another. Hollow-fibre membranes offer an advantage over flat-sheet membranes used in some gas separation systems, because they allow the manufacturer to pack much more surface area into the pressure vessel.

For instance, a hollow-fibre permeator 4m long and 30cm in diameter can contain millions of fibres with a total membrane surface of several hundred square metres.

The new system also offers the established advantages of membrane techniques, including low initial investment and operating costs, and reliability and flexibility of design to meet different capacity needs.

Source: Press release

## EMS Growth in market

A recent report by a London based consultancy† shows that the market for electronic energy management systems (EMS) in the EEC has an economic potential for retrofitting existing building stock, at today's installed prices of some \$5.2 bn.

In 1985 the market for EMS was worth \$165 M, some 30% of total world sales of \$560 M. However, the recent dramatic fall in oil prices will reduce growth in demand in 1986 and 1987, the report claims. But despite this, aggregate growth at a compound annual rate of 12% will be achieved by the end of 1990 when total sales will have reached \$280M.

The UK in 1985 was the second largest market with sales of \$51 M but total sales to 1990 at \$430 M will make it virtually the same size as West Germany during the period, thanks to a combination of a less energy efficient building stock and more innovative and cost-effective products developed by UK companies.

The dynamics of the retrofit market will fuel this considerable growth. This is good news for smaller specialist suppliers as the cost effectiveness of their products will be most appreciated in this market. In all countries small entrepreneurial companies are increasing their share of the market at the expense of the major international groups and this trend will continue to 1990.

Source: ProPlan

## Oil in Botswana? Canada helps in search

An agreement was signed between Petro-Canada International Assistance Corporation (PCIAC) and the Government of Botswana in October. The agreement will provide for funding by PCIAC of an integrated geophysical

\*Du Pont

†ProPlan

survey in Botswana to investigate three sedimentary basins. The cost of the survey is Can \$8.5 M. A reconnaissance aeromagnetic survey, made in the mid-1970s with funding by the Canadian International Development Agency (CIDA), yielded results warranting further seismic surveys of these basinal areas.

Despite the fall in oil prices there has been recent interest in exploration in Botswana. However, the Government is of the view that additional geological information will assist in a better assessment of oil potential and strengthen its position to attract investment.

Land-locked Botswana is completely dependent for its petroleum requirements on imports through neighbouring countries. The Government is therefore keen to minimise dependence on imports and to encourage private companies to discover oil and gas in Botswana. The country has considerable resources of coal but, before examining the possibilities of producing oil from coal, it wishes to assess its natural oil and gas potential.

It is hoped that the PCIAC project, by providing additional information on the scope for petroleum development in Botswana, will encourage further exploration and development by foreign oil companies. The provision of data on the area to be investigated will lower the marginal cost of exploration and if the project proves the hydrocarbon potential in the basins it will increase the expected revenue from development work.

Professional and technical personnel from Botswana will be involved in the project and will receive training on the job as well as in PCIAC's offices in Canada. Botswana will provide and pay for local services within the limits of its financial and technical capacity.

Source: Commonwealth Secretariat

## Making the most of... ...sewage

A detailed study of energy use at Thames Water Authority's Deephams sewage treatment works has been completed\* in North London. The works serves a population of about 700 000 in an urban catchment area of 96 square miles.

Deephams, like most large sewage works, generates methane rich gas by anaerobic digestion of sewage sludge. This supplies three quarters of the site's energy requirement, the remainder sourced from imports of gas-oil and electricity.

Cost effective measures were identified, involving moderate capital investment, which could reduce the site's imported fuel bills.

The replacement or de-commissioning of 20 year old dual fuel engine CHP plant was also studied. Although all prime movers were considered, it was found that internal combustion engines offered the lowest overall operating costs.

Retention of CHP capacity was recommended and replacement dual fuel engines identified as offering greatest security of supply and lowest running costs over a wide range of operation.

Source: W S Atkins

## Wind energy project Gets off the ground

The rotor blades of the Department of Energy's vertical axis wind turbine project were lifted on to a 25 m high concrete tower at Carmarthen Bay in September.

The Department of Energy is funding the project as part of the Government's wind energy research and development programme. It is expected that assembly

will be completed to allow the first rotation within a few weeks, with the machine being connected to the grid for trial operation towards the end of November.

The wind energy R and D programme is part of the Department of Energy's renewable energy development programme. The Department currently considers wind energy to be the most promising renewable energy source for electricity generation in the UK. Around £20 M has been spent by the Government on wind energy R and D since 1979, and current funding is running at about £6 M per year.

Source: Department of Energy

## Korea Two more nuclear plants

The Korea Electric Power Corporation has formally dedicated two nuclear power plants on the southern coast of South Korea, each with a generating capacity of 950 MW, the state-run utility company announced.

Kepeco officials said it took about eight years to build the two plants at Kori at a cost of \$1.93 bn. They said the two plants were actually completed some time ago but dedication ceremonies had been delayed.

South Korea now has a total of five nuclear power plants in operation with a combined capacity of 3817MW, accounting for 22% of the nation's power production capacity.

Source: SEASIS Newsletter

\*W S Atkins

## INDUSTRY YEAR 1986

### Women at work

As an Industry Year initiative, business and professional women in the West Midlands have formed WORK — Women's Opportunities, Resources and Knowledge.

A major aim of the group is to encourage girls and women to seek careers in industry and commerce. To achieve this, members have formed a panel of speakers for schools and voluntary organisations. All successful women in their own fields, they will describe their careers, providing examples of the excitement, stimulation and satisfaction to be found in industry and commerce.

Members of the group also plan to arrange for teachers to shadow women in top jobs for short periods.

Source: RSA

### Young engineer title

Sixteen year old, Matthew Barker of Edlington Comprehensive School, Doncaster, received the title of Young Engineer for Britain 1986 and £1250 for his school from Her Royal Highness The Princess of Wales at the national finals of the competition at Wembley, London in September.

He designed a muscle-stretching machine that will help increase the suppleness of athletes and dancers by stretching their muscles.

Before presenting the awards at The Young Engineer for Britain competition, organised by the Engineering Council, The Princess of Wales toured an exhibition of some 50 engineering and technology projects, all designed and produced by the finalists — 70 youngsters, aged 12-19, from all parts of the UK. The finalists came from 12 regional finals in which 500 young people had entered more than 300 projects.

A prize given by the British National Space Centre, which was formed a year ago as a focus for British space policy, was awarded to Andrew Bell, who

invented the Clubmaster, a machine for analysing a golfer's swing. Andrew, aged 18, from Cowes High School, Isle of Wight, will be flown to the United States next summer as a guest of the National Aeronautics and Space Administration (NASA).

The Engineering Council's Women Into Science and Engineering (WISE) award of £200 for the best project by a team of girls was won by Caroline Brooks, 16, Lucy Frederick, 17, and Jacqueline Lane, 17, from Derby College of Further Education, with a project that can be used during knee joint surgery to keep the upper and lower leg in place.

The Institute of Marketing prize awarded to the finalist with a device demonstrating the highest marketing qualities was won by Simon Smith, aged 16, of Westminster School, London. The device overcame existing design problems to enable yachtsmen to reef their sails.

The winning projects also included electronic playkits for the young, a computerised aid for the disabled, a walking aid for blind toddlers and a

(continued on p 19)

(Political and Economic continued)

automatic table tennis training machine.

The Young Engineer for Britain event aims to strengthen links between education and industry and develop the interest of young people in technology and careers in engineering.

Mr Graham Anthony, director industry and regions of the Engineering Council, said the standard of entry was again extremely high; the judges had a very tough time in selecting from some really innovative and creative projects.

He added: 'For the first time this year we highlighted previous finalists who have gone on to achieve commercial success. We are delighted at the interest that many of this year's entrants have shown in promoting their own ideas'.

Source: Engineering Council

## Children visit local employer

School children in Reading, their teachers and career advisers were given the opportunity to discover for themselves how Foster Wheeler, the town's largest employer, operates in the international market-place.

As part of its involvement in Industry Year, the company invited local schools to visit its UK head offices.

The programme of events covered areas as diverse as the company's role in

British industry, the development of projects, the importance of computer assisted design, computerised communications systems and the application of model engineering.

In addition to the invitation offered to pupils and their teachers, careers officers were introduced to representatives of Foster Wheeler's training department and given guidelines on the careers and in-house training offered by the company as well as the qualifications required.

Source: Press release

## Industrial secondments

Esso is increasing the number of its teacher secondments under the *Understanding British Industry* scheme as part of its Industry Year activities. The company is also funding UBI in the form of a five-year covenant totalling £25 000.

*Physics Plus*, a project promoted by the Department of Trade and Industry and the Standing Conference on Schools' Science and Technology, is also being sponsored by Esso.

Other Esso activities have included:

- Involvement in a simulated business exercise at a Reigate school and a visit by its pupils to the company's installation at Gatwick Airport.
- A visit to Expro House by senior girls from a Highgate (London) school and

work shadowing of engineering staff by some of the girls.

- The introduction of a new schools link concept covering syndicate problem solving in business case studies.
- A link between the company's Purfleet Terminal and a sixth form college which began with a visit by 20 students to the terminal and has included work experience attachments.

Source: RSA

## Industrialist in residence

Michael Dobson, who retired recently as training manager of British Aerospace, takes on a new challenge at the beginning of the next school term when he starts work as industrialist in residence to a group of Surrey schools.

Based at Woking College Mr Dobson's work will include consultation over the relevance of courses, project work and industrial visits; giving advice on work experience, shadowing schemes, job applications and interviews; research into the area of transition from school to work; and discussions with staff and students on relevant subjects.

Source: RSA

## Second seminar with Parliamentarians

The Institute of Energy in association with the Parliamentary Group for Energy Studies and the Institution of Mechanical Engineers, the British Institute of Energy Economics; the Watt Committee on Energy

## Energy policies and market forces

on 4 March 1987  
at Institution of Mechanical Engineers  
Birdcage Walk, Westminster

Further information/registration  
enquiries: 'phone 01-580 0008

## Diary dates in June 1987

24/25 June  
(registrations and reception pm 23 June)

## 1st European dry fine coal conference

organised by the Institute of Energy in  
association with the Institution of  
Chemical Engineers

and to be held at

**Crown Hotel  
Harrogate, Yorks**

Watch for programme/brochure &  
registration form in *Energy World* early  
1987

**Immediate enquiries: 'phone 01-580 0008**

## Energy efficiency 1986

### Boiler booster

A new add-on boiler booster system for steam boiler plant, which recovers the heat from condensate to raise feedwater temperature, is now being marketed by **Twin Industries Agencies**. Produced by Fulton, it is claimed that it significantly reduces total energy consumption and speeds the time taken to achieve a full head of steam from start-up.

Instead of collecting condensate in the boiler feedwater tank, the Fulton system uses a heat exchanger between the boiler feedwater pump and the boiler. Pump cavitation is eliminated, feedwater temperatures are increased significantly, and condensate is cooled before return to the storage tanks. It is claimed that fuel consumption is reduced by around 1% for every 5°C rise in feedwater temperature achieved. The increased temperatures resulting from use of the booster prove particularly advantageous at boiler start-up, when steam condenses at two to three times the normal rate. By transferring heat from this large volume of returned condensate, the time taken to produce a full head of steam is very much reduced. Three models are

available, designed and sized for various condensate volumes and relating to boilers with hourly steam outputs in the ranges 200-600 lb, 600-1100 lb and 1100-2500 lb.

**Reader enquiry no 11/1**

### Control system for centrifugal compressors

**Honeywell** has launched the Air Miser packaged control system for centrifugal compressors, which, it is claimed, could reduce energy costs on plant air installations by 30% over conventional control systems. Developed by the **Compressor Controls Corporation**, the system controls discharge pressure for a single compressor or implements load-sharing decisions for one of several parallel-connected multiple compressors for plant air or other centrifugal-compressor applications.

The Air Miser system includes Compressor Control's patented load-sharing algorithm, which automatically maintains stable air pressure and high efficiency over a wide range of air demand by controlling the inlet valve (or guide-vanes) position. Additional control actions prevent destructive compressor surge and damaging motor overload.

**Reader enquiry no 11/2**

### New range of boilers

The European boiler designed by **Stone** for oil, gas or dual-fuel firing is available in 28 sizes ranging from 1 450 to 10 720 kW for steam or hot water. The design for the new European models is generous, with particular attention being paid to the sizing of boiler shell and furnace. This results, it is claimed, in a boiler capable of meeting demanding load fluctuation under severe conditions.

Detailed attention had also been given to reducing flue gas resistance through the boiler so that less power is consumed and there is a consequent reduction in energy costs.

A new design of outer casing by Stone Boiler gives an added thickness of insulation. This reduces both standing and radiation heat loss and releases more heat internally to be transferred into energy.

**Reader enquiry no 11/3**

### Flue gas heater

The Temcana EPF 19E balanced flue gas heater from **Vulcana Gas Appliances** has an output of 50 000 Btu/h. Its heat release per square foot of the wall space it occupies exceeds, it is claimed, that of any other balanced flue heater on the market. The heater can be linked to any control or energy management system.

An advantage is direct spark ignition which obviates the need for a pilot light. There is therefore no consumption of gas when the heater is not in use and considerable savings in running costs are achieved compared with conventional, pilot-lit appliances.

Further savings in running costs and an enhanced performance for the Temcana EPF 19E have been achieved through an integral thermistor to provide electronic thermostat control. This leads to a

much closer control of temperature with less variations. Other advantages claimed are: the powered fan that ensures an immediate and rapid distribution of heat, so minimising the warm-up period; and the balanced flue which eliminates any danger from fumes.

**Reader enquiry no 11/4**

### High-power, high-frequency amplifier

**BBC Brown Boveri** have adapted their radio transmitter technology to produce a high-power, high-frequency amplifier suitable for ion cyclotron resonance heating (ICRH) applications in nuclear fusion research. Two 1-MW amplifiers of this type have been installed at the Lawrence Livermore National Laboratory in California, one of the world's largest fusion research centres.

The two ICRH amplifiers, which operate in the 6 to 20 MHz frequency range, are used to heat a plasma to the required temperature for fusion to take place — about 100 million °C.

**Reader enquiry no 11/5**

### Efficiency monitor for heat recovery systems

Claimed to be the first on the market, a continuously reading heat recovery efficiency monitor has been introduced by **Acoustics & Envirometrics (AEL)**. The monitor is suitable for all types of air to air recovery systems — heating or cooling — with temperatures from -10°C to +50°C.

The unit senses continuously the temperatures of the supply air, exhaust air and the outdoor air, uses the readings to calculate the thermal efficiency of the recovery system and shows the result, expressed as a

percentage on the meter. If the efficiency drops below a pre-selected level, the monitor will initiate an alarm signal so that a potential fault in the recovery plant may be remedied.

**Reader enquiry no 11/6**

### High-temperature combustion flue gas analysis system (Model 450)

Net excess O<sub>2</sub> or net excess combustibles in high-temperature flue gases, up to 1400°C, can be measured and analysed by the **Westinghouse Model 450**. It utilises a proven solid-state sensor, which is mounted directly in the gas flow and eliminates the need for sampling systems. Its high-temperature capabilities allow the Model 450 to perform measurements in or near the combustion chamber.

The single sensor can respond to air-rich or air-deficient combustion conditions so that the analyser's output can be calibrated to be proportional to excesses or deficiencies in a wide range of air/fuel ratios. Two features to the Model 450 — its fast response and its ability to operate in the entire range of air/fuel ratios encountered in combustion applications — make it suitable for use in closed-loop control systems.

Fuel savings from optimising air/fuel ratios can be significant and offer payback times for the Model 450 of less than one year. The system is simple to operate and calibration is performed *in situ* without removing the probe or disconnecting any wires. It is claimed that typical installation costs are 1/10 of normal sampling-type analysers.

Applications for the Westinghouse Model 450 include reheat furnaces, soaking pits, process heaters, boilers, open hearths, blast furnace stoves and coke ovens.

**Reader enquiry no 11/7**

### Licence to market British Gas flowmeter

A worldwide licence to manufacture and market the multipath ultrasonic flowmeter developed by **British Gas** has been let to **Daniel Industries**, a company specialising in flowmetering and affiliated to **Daniel Industries Inc.**

The new meter has been specifically designed for metering high-pressure gas flows where very high accuracy and reliability is required. In addition to having an

accuracy of ± 1% over a wide flow range, the ultrasonic flowmeter offers, it is claimed, a number of significant advantages. It does not interrupt the gas flow and therefore causes negligible pressure drop; it measures the gas flow virtually continuously in either direction, even under pulsating conditions; and it has a smaller site area requirement than conventional meters.

The flowmeter is based on techniques involving the direct measurement of the transit times of ultrasonic pulses travelling in opposite direction along four separate paths across the gas pipe.

High-accuracy metering is necessary for a variety of purposes. At shore terminals, gas is purchased from the suppliers, and the ultrasonic flowmeter was developed primarily for future use in this 'custody transfer'. Other applications are at sites where gas is transferred from the transmission system to a local distribution network; and at compressor stations to ensure efficient control and the prevention of compressor surge.

**Reader enquiry no 11/8**

### De-alkalisation system

A 'Compact' range of de-alkalisation systems designed for minimum maintenance has been introduced by **Dearborn Chemicals**, the Water Treatment Division of **Grace Service Chemicals**. The corrosion-resistant materials of construction used give it is claimed, long life and low maintenance. With service flows from 1.0 to 36 m<sup>3</sup> there is a system available to cover most requirements. Regeneration is initiated by a signal from a pH meter to give an accurate response to changes in the raw water quality.

**Reader enquiry no 11/9**

### Trade publications

**KDG Instruments** have produced a new shortform catalogue detailing instrumentation products for *pressure, level, flow, telemetry and display and readout systems*.

**Reader enquiry no 11/10**

*Filter separators/vane separators/multicyclone separators and scrubbers*. Three new brochures are now available from **Paladon (Engineering)**. They describe in detail these separators developed by the company.

**Reader enquiry no 11/11**

### ENERGY WORLD — COMMERCIAL

(Photocopy acceptable)

Please send me further information against the reader enquiry no(s) listed below (please tick)

11/1 11/2 11/3 11/4 11/5 11/6 11/7 11/8 11/9 11/10 11/11

Name .....

Address .....

Organisation .....

## An open letter from the chairman of the Executive Committee to all members

The Institute of Energy consists of its members, exists for its members and depends on its members. Some of these members — on Council and from the branches — have been having a fresh look recently at ways of improving the attractiveness and value of the Institute to existing and to possible new members. One of our conclusions was that this was an area where all members could help and where it is in the interest of every member to help both by supporting his branch and by letting, as the opportunity arises, his colleagues outside the Institute know what it has to offer. In these connections, we thought we should draw your attention to a few specific areas where we feel the membership at large — much less people outside the Institute — are not fully aware of what the Institute can offer.

For example, do you appreciate that the Institute now

- offers a very attractive deal to *STUDENTS* interested in energy with a single payment covering the duration of their course, an information pack and, it is hoped, special support and activities on their behalf by the local branch.

- offers, particularly in its *PROFESSIONAL ASSOCIATE* and *ASSOCIATE* grades, membership to *all* people interested in energy. This includes, for example, people engaged in the economics of energy, in modelling future demands, in marketing and administration and energy managers.

To be elected to these grades is a valuable demonstration of possessing professional status in one's chosen field of activity in the

general field of energy and entitles the successful applicant to enjoy all the benefits of the Institute as a learned society. These members have an important role to play in the overall development of the Institute: as important, I suggest, as those who, as graduate engineers (or equivalent), form that part of the membership who are also chartered energy engineers and, in most cases, Chartered Engineers.

- offers to qualified *TECHNICIAN ENGINEERS* with an involvement in energy, Associate Membership of the Institute with representation in all activities of the Institute and the approval of the Privy Council to use the designatory initials TEng AMInstE.

- offers companies, firms, public authorities and similar institutions a *COLLECTIVE MEMBERSHIP* by which selected or nominated members of their staff may enjoy the benefits of membership.

The Institute is financially strong, is held in high esteem and is playing a significant role within the professional engineering and scientific institutions of the country. It could — and should — however, do better. More members and a wider membership would help. The Council, led by the president and the honorary officers, and the staff are doing their bit to achieve this growth but, as I remember saying in my year as your president, it is within the branches, in their activities and enthusiasm, and through them with each individual member, that the strength and future of the Institute resides.

G G THURLOW  
(Executive Committee chairman)

## Associate

**Anthony Peter Royston Jennings**, Hamworthy Engineering, Poole, Dorset (transfer)

**Michael Joseph O'Donoghue**, Archway Environmental Consultants, London

**Paul David Marriott**, NW Herts Health Authority, St Albans

## Graduate

**Manuel Orvalho Gracias De Desus**, Oil Ministry, Angola

**Andrew Stephen Holter**, Ewbank Preece, Cirencester, Glos

## Engineering Council Scholarship scheme to be phased out

*The Engineering Council and the Department of Education and Science have agreed that the National Engineering Scholarship Scheme should be phased out. The Council has been administering the Scheme since 1984 on behalf of the Industrial Scholarships Trust, which is principally funded by the Department of Education and Science.*

The decision will not affect scholarships already awarded. The Council has written to schools involved announcing that the 50 scholarships to be awarded this autumn will be the last.

The scheme aimed at encouraging school leavers to pursue engineering studies with a view to a career in industry. For eight years it has been helping to fund some students taking engineering courses, but there is a general feeling that the scheme has served its purpose by helping to raise the level of awareness of the importance of engineering education to the nation's future. Furthermore, industrial companies increasingly prefer to sponsor individual students directly.

The objectives are now actively being pursued in other ways:

- The Government is pressing ahead with its Engineering and Technology Programme.

- The Council is extending its careers activities and expanding its *Opening windows on engineering* scheme — in which young engineers from local firms go into schools to talk about the excitement of their work to groups of children — throughout the country.

- The Council also runs the Young Engineer for Britain competition for youngsters aged 12-19. The Council is encouraging more schools and more schoolchildren to take part in this competition which strengthens the links between education and industry.

The Council also believes that the objectives could be promoted by giving teachers greater experience of the

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## New members

### Fellow

**William Henry Granville**, Polytechnic of Wales, Mid-Glamorgan

**Geoffrey Michael Kimber**, Coal Research Establishment, Stoke Orchard, Glos

### Member

**David Anthony Bailey**, London Borough of Hillingdon, Uxbridge

**Robert Joseph Breen**, British Gas, Solihull, West Midlands

**Rabindra Kumar Chakraborty**, Coal Research Establishment, Stoke Orchard, Glos (transfer)

**Patrick Paul Devereux**, Bolton St College of Technology, Dublin (transfer)

**John William Evison**, Andrews Weatherfoil, Slough

**Kenneth George Nightingale**, NW Regional Health Auth, London

**Edward Thomas Perks**, The Sinnett Partnership, London

**Andrew Frederick Riley**, Mecatherm Engineering, West Midlands (transfer)

**Kevin William Rutledge**, Atkins Research & Development, Epsom

**Malcolm Shute**, Ove Arup & Partners, London

**Kok Man Wong**, Freeman Fox (Far East), Hong Kong

## Technician Engineer

**William Oliver Hewitt**, British Gas, East Midlands, Notts

industrial scene so that they are better able to encourage students to take up engineering careers. It has recommended to the Government that, instead of the Scholarships Scheme, a major Teacher Fellowship Scheme be introduced to enable many more teachers to spend a term working with an industrial company.

## Personal

**J Anderson** is now managing director of British Electricity International (BEI). Mr Anderson was formerly deputy chairman of Southern Electricity. BET is a wholly-owned self-financing, subsidiary company of the Electricity Council. It was established in 1976 to co-ordinate and promote the overseas consultancy services of the British electricity boards.

**Sir Robert Haslam** was appointed deputy chairman and chairman-designate of the National Coal Board in November 1985, and became chairman of British Coal (the trade name of the National Coal Board) when Sir Ian MacGregor's term of appointment expired on 31 August 1986. He was formerly chairman of British Steel Corporation and chairman of Tate and Lyle.

Sir Robert was educated at Bolton School and Birmingham University, where he graduated as a BSc in coal mining, in 1944. Having worked underground during every holiday at university, he joined in 1944 Manchester Collieries, who operated the former Chanters, Gibfield, Bedford and Mosley Common collieries. With experience of a full range of mining work he qualified for his Colliery Manager's Certificate in 1947 and he is one of the longest serving members of the Institution of Mining Engineers. In January 1947 the colliery company became part of the North Western Division of the newly formed National Coal Board.

Later in 1947 he joined the Nobel Division of Imperial Chemical Industries as a mining engineer specialising in explosives in the mining, quarrying and oil prospecting industries. For the next 10 years he travelled the world, visiting and working in mines and quarries in every continent. Subsequently, he had wide general management experience in ICI divisions, becoming chairman of ICI Fibres in 1971, a main board director in 1974, and deputy chairman in 1980.

Sir Robert was appointed non-executive director of Tate and Lyle in 1978, deputy chairman in 1982 and was chairman from 1983 to March 1986. Appointed to the board of British Steel Corporation in July 1983, he was chairman from September 1983 to March 1986.

**M L Hoggarth** (Fellow) has been appointed an assistant director at the Midlands Research Station of British Gas at Solihull. He is to have special responsibility for safety studies.

Mr Hoggarth, a member of Council,

was chairman of the Institute's Midland branch in 1981-82. He is also a member of Publications and Conferences Committee and chairman of their special sub-committee considering the scope for future Institute conferences.

He joined the gas industry in 1959 after he had graduated from the University of Leeds. At MRS he worked at first mainly on combustion and burner design and in 1969 was appointed manager of the Combustion Division.

After he was appointed manager of the Heating Plant Division in 1975, he was particularly concerned with the more efficient use of energy through, for example, introducing new energy saving technology into industrial and commercial markets.

**P H J Johnson** (Member and London and Home Counties branch chairman) has been appointed a member of the Energy Committee of the Institution of Electrical Engineers for the session 1986-87. The Energy Committee reports to the Institution's Public Affairs Board. Five meetings have been arranged for the 1986-87 session.

**Dr G G Thurlow** (Senior Fellow and past president) retired from British Coal on 31 October 1986 after a long association with R & D in coal utilisation, which started when he joined the British Coal Utilisation Research Association in 1947. Dr Thurlow was formerly the assistant director responsible for coal conversion processes, particularly gasification and liquefaction, at British Coal's Coal Research Establishment based at Stoke Orchard, Cheltenham.

His early work at BCURA covered such subjects as boiler corrosion and deposits, heat transfer, and temperature measurements. After becoming head of the Boiler Development Department, his activities included the early stages of the development of fluidised combustion. He became a director of BCURA in 1967 and was responsible for industrial research until 1971, when the then National Coal Board incorporated the facilities and staff of BCURA into the Coal Research Establishment. After a year at the NCB's London Headquarters, he joined the Coal Research Establishment in 1972 to co-ordinate research on fluidised combustion until 1977, when he changed to his recent field of research.

George Thurlow was president of the Institute of Energy in 1984-85 and is, at present, chairman of the Institute's Executive Committee. His association with the Institute also extends over nearly forty years, as he joined the then Institute of Fuel shortly after his first appointment at BCURA and was awarded the Institute's Student Medal in 1948.

He has been consistently active in Institute affairs and was chairman of Publications Committee from 1969-72, a member of Council from 1968-73, and chairman of the Organising Committee of the Institute's 2nd International Fluidised Combustion Conference in 1980. Many of the 60 technical papers he has published have appeared in the

Proceedings of the Institute. He has also encouraged branch activities: he promoted and was the first chairman of the London and Home Counties branch in 1966 and served as chairman of the South Wales and West of England branch in 1982-83.

In addition to his Institute activities, Dr Thurlow has also recently been appointed honorary secretary of the Energy Industries Club, a private luncheon club that meets monthly at the Connaught Rooms, London from October to May. Addresses are given by prominent members in the energy and associated industries. As reported previously, correspondence concerning the Club should be addressed to him at Dell House, Green Lane, Malvern Wells, Worcs (tel 06845 4481).

## Institute of Energy 1986 December meetings

### Scottish

**2 Dec (Tu).** Combined heat and power scheme at Dunlop, by M E Price (Midlands Electricity Board). Royal Scottish Automobile Club, Blythswood Square, Glasgow at 1830 h (tea/coffee and sandwiches at 1800 h). Joint meeting with Inst of Hospital Engineering and CHP Association.

### Midland

**4 Dec (Th).** Science of flames, by P A Cabbage. The Great Hall, University of Aston at 1900 h.

### London and Home Counties

**4 Dec (Th).** CHP rationale in the UK, by Prof J Swithenbank (president). Royal Institution, Bernard Sunley Theatre, Albemarle Street, London W1 at 1800 h (tea at 1730 h). Followed by wine and cheese party at a small charge.

### North-Eastern

**8 Dec (M).** Debate: *The future of nuclear power in the UK*. Chairman: Prof Ian Fells (past president). Speakers: Dr B Edmondson (director, Nuclear Operations Support Group, CEGB) and Walter Patterson (consultant, FoE). Curtis Auditorium, Physics Building, University of Newcastle upon Tyne at 1800 h (exhibition before meeting). Tea and biscuits before meeting. Joint meeting with IEE (and in conjunction with University of Newcastle upon Tyne Public Lectures Committee).

### Yorkshire

**10 Dec (W).** The influence of coal and ash characteristics on the economic operation of coal-fired boilers, by Dr A Sanyal (chief fuel technologist, Babcock Power, London). University of Sheffield, Dept of Chemical Engineering and Fuel Technology, Lecture Room F3, 'G' floor at 1430 h.

□

# CONFERENCES

The following conferences, courses and meetings are organised by bodies other than the Institute of Energy. For Institute conferences please see inside front cover

## December 1986

Problems with the definition of proved reserves

Meeting of IP Energy Economics Group, London (IP), 15 December 1986 at 1700 for 1730 h.

If you wish to attend, please contact Ms G Douglas, secretary, IP Energy Economics Group, Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR (tel: 01-636 1004).

Multi-phase transport and particulate phenomena

International symposium, Miami Beach (FL, USA), 15-17 December 1986.

Details from Dr T Nejat Veziroglu, Clean Energy Research Institute, PO Box 248294, Coral Gables, FL 33124, USA (tel (305) 284-4666).

Development of advanced robots and factory automation

UKAC annual lecture, by Dr Eiichi Ohno. London (Royal Society), 17 December 1986.

Details from Rosamund da Gama, UKAC, 87 Gower Street, London WC1E 6AA (tel: 01-387 4949).

## January 1987

Physio-chemical aspects of direct solar energy conversion

Lecture, by Dr D M Archer. IEE, 15 January 1987 at 1730 h (tea at 1700 h).

Details from Institution of Electrical Engineers, Savoy Place, London WC2R 0BL (tel 01-240 1871; tlx 261176 IEE LDN G).

## February 1987

Bulk handling

London show, Alexandria Pavilion, 9-14 February 1987.

Details from Turret-Wheatland, Penn House, Penn Place, Rickmansworth, Herts WD3 1SN (tel (0923) 777000).

## March 1987

Instabilities, explosions and oscillations in gas reactions

Royal Society review lecture, by Prof P Gray FRS. University of Cambridge, 3 March 1987.

Details from Miss C A Johnson, Royal Society, 6 Carlton House Terrace, London SW1Y 5AG (tel 01-839 5561, ext 277/278; tlx 917876 Ref: CAJ).

Management of hazardous and toxic wastes in process industries

International congress, Vienna (Austria), 8-13 March 1987.

Details from Dr B D Crittenden and Dr S T Kolaczowski, School of Chemical Engineering, University of Bath, Claverton Down, Bath BA2 7AY (tel (0225) 61244; tlx 449097).

## March 1987 (continued)

Pumps

Tenth BPMA international conference, Cambridge, 24-26 March 1987.

Details from BPMA, 3 Pannells Court, Chertsey Street, Guildford, Surrey GU1 4EU (tel (0483) 37997).

## April 1987

Energy options. The role of alternatives in the world energy scene

Conference, University of Reading, 7-9 April 1987.

Details from Institution of Electrical Engineers, Savoy Place, London WC2R 0BL (tel 01-240 1871; tlx 261176 IEE LDN G).

Energy efficiency

UN Economic Commission for Europe congress, Budapest (Hungary), 13-15 April 1987. In conjunction with the *International energy exhibition*, Budapest, 14-17 April 1987.

Details from: (congress) Energy Division, Economic Commission for Europe, United Nations, Palais des Nations, CH-1211 Geneva 10, Switzerland; (exhibition) Aideen Barrett, sales manager, *International energy exhibition 87*, Industrial and Trade Fairs International, Radcliffe House, Blenheim Court, West Midlands B91 2BG (tel 021-705 6707; tlx 337073).

Reliability 87

Conference and exhibition, Birmingham (Metropole Hotel, NEC), 14-16 April 1987.

Details from Mrs A Brown, IQA, 54 Princes Gate, Exhibition Road, London SW7 2PG (tel 01-584 9026).

Coal prep 87

Fourth international coal preparation conference and exhibition, Lexington (KY, USA), 27-29 April 1987.

Details from Industrial Presentations West, 12371 East Cornell Avenue, Aurora, CO 80014, USA (tel (303) 696-6100; TWX 5106013154).

## May 1987

China coal 87

Second international coal technology conference and exhibition, Beijing (China), 7-12 May 1987.

Details from Sloan Associates, 33 Friern Watch Avenue, London N12 9NY (tel (01) 445 3243; tlx 8953555).

Flow induced vibrations

International conference, Bowness-on-Windermere, 12-14 May 1987.

Details from Conference Dept, BHRA, Fluid Engineering Centre, Cranfield, Bedford MK43 0AJ (tel (0234) 750422; tlx 825059 BHRA G).

## June 1987

RETSIE/IPEC 87

Renewable energy technologies symposium and international exposition/International power exhibition and energy conference, Anaheim (CA, USA), 1-4 June 1987.

Details from: (*conferences*) Energy Institute, 1950 Third Street, La Verne, CA 90096, USA (tel (714) 593-9540); (*exhibitions*) Mary Mullen, TMAC, 945 Front Street, Suite 106, San Francisco, CA 94111, USA (tel (415) 398-4800).

Nor-Shipping 87

Eleventh international shipping and maritime offshore exhibition and conference, Oslo (Norway), 2-5 June 1987.

Details from Nor-Shipping 87, Norges Varemesse, PO Box 130 Skoyen, 0212 Oslo 2, Norway.

Coal 87: coal utilisation

Sixth international conference and exhibition, London, 9-11 June 1987.

Details from Industrial Presentations (Europe) BV, 's-Gravelandseweg 284-296, 3125 BK Schiedam, The Netherlands (tel (010) 4158244; tlx 21423 EUREX NL)

Biotechnology

Fourth European congress, Amsterdam (Netherlands), 14-19 June 1987.

Details from Dr R R van der Meer, PO Box 18531, NL-EM The Hague, The Netherlands.

Unit operations in offshore and onshore gas processing

One-day meeting, Aberdeen, 19 June 1987.

Details from Malcolm Southgate, c/o RTZ Oil and Gas, 33 Ashley Place, London SW1P 1LR (tel: 01-630 9211).

## September 1987

Offshore Europe 87

Offshore oil and gas exhibition and conference, Aberdeen, 8-11 September 1987.

Details from Spearhead Exhibitions, Rowe House, 55/59 Fife Road, Kingston upon Thames, Surrey KT1 1TA (tel 01-549 5831; tlx 928042 SPEARS G).

## September 1988

International energy 88

International energy conference, Gold Coast (Queensland, Australia), 11-15 September 1988. *An Australian Institute of Energy project.*

Details from Secretariat, International Energy 88, GPO Box 1334, Brisbane 4001, Queensland, Australia (tel (national) (07) 31 1086, (international) (617) 31 1086; tlx AA 44587 Attn HCE).

## Recognition of Services Award 1986

The members recommended by Membership Committee and approved by Council to receive this award for 1986, for 'special services' to the Institute of Energy, are:

- A Strong — North-Eastern branch
- B Emes — Midland branch
- D M Willis — East Midlands branch

## Responding to the energy challenge: the president speaks

The next London and Home Counties branch meeting will be held on **Thursday 4 December**. Prof Jim Swithenbank (president, Institute of Energy) will speak on *CHP rationale in the UK*.

All will be welcome at the meeting, which will be held in the Bernard Sunley Theatre, Royal Institution, Albemarle Street, London W1 at 1800 h. Tea will be served in the Long Library of the Royal Institution from 1730 h. Cheese and wine will be available after the meeting at a small charge.

## BNF to investigate regenerative burners

The energy-efficient regenerative burner has not yet been successfully applied to the smelting and refining of lead and copper. BNF Metals Technology Centre believe the problems associated with the contaminated waste gases given off by these processes should be investigated and are preparing a research project to find the answers.

They propose to:

- study the deleterious effects of heavily contaminated offtake gases on the ceramic regenerator;
- examine possible alternative regenerator materials less susceptible to chemical attack;
- investigate the possibility of self-cleaning regenerators to reduce or eliminate fouling problems;
- and consider the potential for regenerators on oil fuel burners.

In addition, BNF researchers will determine the most favourable siting of the burners within the furnace and the changes in furnace contour necessary to achieve optimum operation of the burners.

It is anticipated that the initial stages of the study would be undertaken on BNF's own 5-tonne Sklenar furnace, on which various configurations would be tested. Throughout the programme the chemical and physical processes occurring in the furnace and regenerator would be monitored and the results used to define the most cost effective way of utilising regenerative burners with contaminated hot exhaust gases. Upon completion of the proposed study, the equipment would be available for full-scale production trials.

Discussions are under way with major companies in several countries to share the costs and the possible benefits of a multi-client project, estimated to cost £240 000 over 18 months.

Further information from Dr J E Bowers, manager Materials and Processing Group, BNF Metals Technology Centre, Grove Laboratories, Denchworth Road, Wantage Oxon OX12 9BJ (tel 023 57 2992; tlx 837166).

## Fellowship of Engineering: December/January lectures

Admission to lectures is free, but if you wish to attend please notify the Fellowship of Engineering, 2 Little Smith Street Westminster, London SW1P 3DL (tel 01-222 3912/2688 ext 31/32). An advance synopsis of each lecture will be issued six weeks before delivery.

8 Dec 1986 (M). ICE, 1800 h. *Engineering challenges in Selby coalfield*, by C T Massey (British Coal).

12 Jan 1987 (M). RAeS, 1730 h. *Working together for Britain* by Lord Sieff of Brimpton (Marks & Spencer).

27 Jan 1987 (Tu). IMechE, 1730 h. *Research development and decline: Britain's industrial enigma*, by Dr A W Rudge FEng (ERA Technology).

## Mathematical modelling in combustion and related topics

A workshop will be held at the Ecole Centrale de Lyon (France) from 27 to 30 April 1987. Further information from O Ta'eed, Dept of Fuel and Energy, University of Leeds, Leeds LS2 9JT (tel (0532) 431751 ext 435).

## Second World Basque Congress: international energy conference

The second World Basque Congress will be held from August to October 1987. Within the framework of the Congress, four technological conferences will be held in Bilbao from 18 to 23 October 1987. These include a conference on *Energy* and papers are invited to cover the following topics:

- Energy and mining planning.*
- Energy applications, costs and financing.*
- Energy conservation.*
- Energy application advances in furnaces and boilers.*
- New energy sources (renewable energies).*

Further information from II World Basque Congress secretariat, Conferences on Technology, Paseo de la Senda, 15 bajo, 01007 Vitoria—Gasteiz, Basque Country, Spain (tel (45) 230916-230714-230790; tlx 35293 EUJK E).