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Energy for the Future

The world energy scene is in ferment with wildly fluctuating oil prices, the nuclear disaster in Russia, and alarm over environmental pollution from acid rain and nuclear waste. The Institute of Energy joined the debate last month with a policy statement that goes directly to fundamentals. The Institute's new document on United Kingdom Energy Policy, entitled *Energy for the Future,* is a second and substantially revised issue of the document it published in the summer of 1973, when it was still called the Institute of Fuel. This had appeared just two months before the Yom Kippur war and the sharp rise in oil prices that followed, and it contained an analysis of future trends in energy supply and demand, together with guidelines for an energy policy for the United Kingdom.

This second issue of the report has been compiled by three past presidents of the Institute (now the Institute of Energy) who have re-addressed the subject over the last year. They found, not to their surprise, that many of the recommendations of 1973 were still valid, but that little action had been taken, as is indicated in the following pages wherein are reproduced both the conclusions and recommendations of both 1973 and 1986 editions. Overall, the message of today's second issue of *Energy for the Future* is that the passage of 13 years since the first issue has not invalidated the earlier recommendations, rather has it emphasised that they were sound: giving preference to energy systems that are less vulnerable to changes in fuel price, getting on with tidal schemes, combined heat and power, research into fusion, the education of industry in energy efficiency techniques, all from the original report.

The key recommendation, then as now, is to set up an Energy Commission to advise on the facts and the underlying realities, and to get away from the illusion that market forces on their own will produce a valid answer.

Speaking at the press conference held at the Institute on 24 September to mark the launch of the publication, the president Prof Swithenbank, commented: *'Our work shows that the essentials of sound energy policy can endure over decades. An earlier Secretary of State for Energy said that looking for an autonomous energy policy was like 'Hunting the Snark'. He was wrong. Our document provides the necessary guidelines and we must get away from the short term pragmatism of party politics. Energy projects are inevitably long-term affairs, they need to be matched by long-term policies and regularity of practice'.*

CONCLUSIONS AND RECOMMENDATIONS

The 1973 text is printed first in italics and the 1986 comments are given below it. It will be realised that some of the 1973 recommendations have been acted upon by UK Governments since that time, many others have not; neither outcome affects their validity.

1 *The availability of reasonably priced oil to meet the projected increased demand over the next 20 years is in doubt. Part of this demand should be reallocated to indigenous fossil fuels (particularly coal), and nuclear fuel; leaving oil to supply those markets where no alternative fuel is possible.*

Still a valid conclusion; 12 years have passed, and the estimate of Proven and Probable reserves in the UK Continental Shelf from the 1986 Brown Book is equivalent to around 10 years of UK consumption at the present rate. Gas reserves have held up better, but their life is still limited, on current estimates, to a few decades. Fluctuations in oil prices in the short term do not substantially alter the long term trend.

2 *Clear scientific and practical standards on air, water and thermal pollution should be drawn up as soon as possible so as to indicate the limitations of operation to be placed on future fossil fuel and nuclear plant.*

This is still valid. Little real progress appears to have been made.

3 (a) *Oil should be bought on the world market for as long as is economic, with some indigenous supplies preserved for the future.*
(b) *Oil reserves under the North Sea should not be exploited at a maximum rate but should be carefully controlled, so as to realise the maximum potential.*
(c) *Further exploration of the continental shelf for oil and natural gas must be encouraged. This policy implies Governmental control of North Sea strategy for deploying oil supplies, and the obtaining of adequate financial returns from exploitation of North Sea oil and gas.*

This is still valid.

4 *Natural gas should only be used in applications where a clean fuel is essential. Depletion of North Sea fields should be manifestly controlled to maintain supplies for as long as possible, and further exploration of the continental shelf encouraged. Techniques for the production of gas from either oil or coal should be further developed.*

The first part is still valid. As to the second part, there is little incentive for producing gas from oil, but synthetic natural gas (SNG) from coal is still the correct longer term option when reserves of natural gas for the domestic market become depleted. Much progress in the technique of SNG production has been made since 1973, and this needs to be maintained at a pace appropriate to the depletion of the larger reserves of natural gas now believed to be available off-shore UK.

5 *Coal will have an increased importance in the fossil fuel market during the next two decades, provided that prices are kept within reasonable bounds. Continued development of automated mining methods should be encouraged. Exploration to find coal more economic in the winning, followed by sinking of some new mines will be necessary.*

This is still valid.

6 *Nuclear power generation must take over a large part of the increase in energy demand by 1990.*

Still valid in general terms, although the impact of the Chernobyl accident on public opinion has now made this unrealistic. There has not in fact been a net increase in UK primary energy demand from the 1973 level, and the increment to 1990 is not expected to be high. Even so, the nuclear contribution to primary energy had risen to 6.8% in 1985.

(a) *A full scale breeder reactor-based station must be built as soon as is practicable for engineering and economic evaluation.*
(b) *No new thermal reactor technology should be introduced into the immediate nuclear programme.*
(c) *A foolproof nuclear waste disposal system must be developed as a matter of extreme urgency.*

(a) Not now as urgent as it seemed in 1973 as uranium resources are more extensive than had seemed, and uranium demand is lower because fewer thermal reactors have been built. The objective of engineering and economic evaluation will be met by the European collaboration that has now been negotiated.
(b) Still valid. In 1973 this conclusion was aimed at those enthusiastic for change from Gas-cooled to Steam Generating Heavy Water Reactors. It is just as valid now when change to Light Water Reactors is proposed.
(c) Still valid.

7 *Research into fusion power should be substantially increased as "back-up" for the breeder reactor programme.*

Still valid in principle, on an appropriate time scale. Solid progress is being made, broadly in line with the conclusion.

8 *Possible hydroelectric and tidal schemes should be appraised taking into account likely rises in fuel costs over the next 30 years. Viable schemes should be initiated as soon as possible.*

Still valid. The building of the Severn Barrage and other barrages could provide valuable additional diversity in primary energy supply and proof against future fuel price increases.

9 *Measures to use energy in its various forms more efficiently should be instigated at once. In particular, methods for the more efficient conversion of heat energy into electricity should be developed and the waste heat generated put to use wherever possible.*

Still valid, especially through combined heat and power (CHP) with industrial and domestic heating, and through combined cycles; also a defence against fuel price increases.

10 *Well-established technology for the efficient use of fuel should be promulgated in industry, and techniques for insulation applied and encouraged wherever fuel is burned.*

This is still valid. The importance of this and the previous conclusion have been underlined in 'Energy Efficiency Year'. (1986).

11 *Fuel saving in the areas of public and private transport can, and should, be effected by legislation governing the use of private cars in urban areas, and engine size and power-to-weight ratio of petroleum-fuelled vehicles. Encouragement of electric traction for private and public transport has the triple advantage of reducing oil fuel requirements, providing a smoothed night load for electricity generation where electric storage batteries are used, and reducing noise air-borne pollution.*

Still valid, in general; there has been some progress in improving the fuel consumption of models; research into a battery suitable for transport applications has shown the problem to be more intractable than expected.

12 *Methods for transmitting energy within the UK, particularly pipelines as opposed to the high voltage electricity grid should be examined on a cost and efficiency basis.*

Still valid.

13 *Decentralisation of future electricity generation with smaller units should be examined: gas turbines in the case of oil or gas, and perhaps SGHWR reactors for nuclear fuels, sited in closer proximity to areas capable of using waste heat.*

This conclusion is somewhat dated. The SGHWR option was abandoned on technical grounds in 1978, and would not have been suitable for these purposes. Moreover, it is not now believed that, except where there is a potential for CHP, cost-effective electricity generation can come from small units: they have inherently less favourable steam conditions, it is more expensive per unit of output both to manufacture them, and to control their emissions to a given standard.

14 *An Energy Commission should be set up to oversee the co-ordinated use of energy in the UK. The main function should be to advise the Government on a coherent, flexible and continually updated fuel and energy policy, to anticipate likely future trends of an engineering as well as an economic nature, to integrate the development of the nationalised fuel industries, the nuclear industry and the oil industry and to avoid duplication and unnecessary competition between industries aimed at increasing levels of energy usage.*

Still valid. As many Departments of State are involved, not just the Department of Energy, perhaps a Cabinet Office type of structure would be appropriate.

15 *Research and Development of the kind outlined in this document should be initiated and guided by the Energy Commission, co-ordinating and, where necessary, commissioning research over the whole field of energy usage. The Energy Commission should foster collaborative R & D programmes within the European Community, and with countries such as the USA where large, joint research programmes into fields such as nuclear fusion, nuclear waste disposal or solar energy are necessary.*

Still valid. Useful progress in international collaboration is being made, for instance through the International Energy Agency, (IEA) the Organisation for European Economic Development, now the Organisation for Economic Cooperation and Development (OECD) and the European Commission; but there is scope for more.

16 *A concern for education in all aspects of energy supply and particularly the efficient use of energy would be a continuing function of an Energy Commission, as would a concern for the protection of the environment. Here the Institute of Fuel has a clear and independent role to play.*

This conclusion is still valid, perhaps with the explanation that the word "education" is used in its broadest sense of the awareness of the public and of the media in the matters mentioned. The Institute of Fuel is of course now the Institute of Energy; its role would be "independent" in the sense of being non-political, but collaboration with other engineering institutions is, of course, envisaged.

17 *A series of studies should be initiated by the Government in association with professional bodies such as the Institute of Fuel and other engineering institutions. The following topics are particularly timely:*

(a) *The efficient use of energy industrially and domestically.*
(b) *General education for engineers in fuel technology.*
(c) *Thermal insulation.*
(d) *Urban transport rationalised in terms of fuel economy and pollution control.*
(e) *Energy transmission and an examination of decentralised systems.*
(f) *Combined cycles for improved efficiency of electricity generation.*
(g) *Energy storage with particular reference to electricity.*
(h) *Materials problems and corrosion in power generation.*
(i) *Environmental problems and design of very large flares.*
(j) *Solvation and gasification of coal.*
(k) *Equilibrium sources of energy.*
(l) *The large-scale use of hydrogen and methanol as fuel.*
(m) *Social costs in changing patterns of fuel usage.*

These are still valid with the exception of (i) where the problems are largely solved.

Additional topics are:

(n) New, more effective planning procedures for energy project proposals.

(o) Public understanding of the risks and benefits of energy supply and waste disposal systems.

(p) Problems of measuring, monitoring and controlling pollution across national boundaries, in particular acid emissions from fossil fuel combustion and radioactive fallout.

(q) International control and monitoring of nuclear reactor operation and safety (in consultation with the IAEA).

The Institute of Energy with its broad base of membership covering many disciplines is well placed, in partnership with other Engineering institutions, to coordinate factual assessment of the economics and viability of proposed energy projects where protagonists and antagonists fail to agree.

Energy for the Future: press launch

Over 40 of the media attended the press conference held at 18 Devonshire Street on the publication of 'Energy for the Future', (Prof Fells had been interviewed by Brian Redhead of the 'Today' team, earlier that morning). The president, Prof J Swithenbank, (centre) introduced two of the report's authors: Prof Ian Fells (left) and P C Warner (right): Prof Alan Williams was at the last moment unable to attend through indisposition. Following the president's introduction Prof Fells and Mr Warner talked to the essentials of the report, and interest was amply apparent from the very full discussion in the question and answer period — the extent of which was a pointer to both the topicality and validity of the report's recommendations

The worst accident in the world. Chernobyl — the end of the nuclear dream

William Heinemann
Pan Books, 1986
246pp. £2.95 paperback.

It was a considerable achievement to write and publish a book on the Chernobyl incident in a matter of a few weeks. In a situation where real facts have been scanty there is a remarkably large amount of material in this book.

Prepared by a team who are presumably not nuclear engineers there are inevitably some inaccuracies which will be apparent to most engineers who know the industry well.

The book is easy to read and either directly or indirectly raises issues which need discussion and debate in the technical community in Britain. One of the problems resulting from the polarisation of opinion in the United Kingdom is that rational and sensible discussion of important aspects of nuclear power does not occur.

The reporting of the Chernobyl accident in the so-called 'quality' papers and television has been markedly better than on most nuclear issues. However the adversarial approach which means that opposing views have to be balanced regardless of the technical qualifications of the participants, and the general suspicion of official representatives often leaves the reader or viewer with a feeling of unease.

This approach, where lay views based on a journalist's idea of public opinion, suspicious of high technology, pervades the book. It has a theme and thread, although there are several authors. It is a familiar one. It is that there has been a policy in the nuclear industry to disregard safety, misinform the public, and that nuclear plants are basically unsafe and that an accident like Chernobyl was inevitable. The statistical probability analysis used by engineers where numbers have been associated with possible incidents provides easy targets for critics of the industry.

The book's conclusion is that 'nuclear power is too demanding a technology for fallible men — the dangers are of a nature and magnitude which exceed any other human activity'.

Chapter 1 sets the scene, an excellent description of the area, a not too happy description of the reactor complex at Chernobyl.

The fuel was uranium dioxide not uranium; *'huge'* amounts of energy are not released from each fission; the rods are not encased in a maze pipework, they are in straight pressure tubes and, are nuclear reactors really cauldrons of dangerous forces?

Chapter 2: *Radioactivity* — on the whole a reasonable chapter. Of course abridged statements of conclusions and the assumptions of lengthy studies and reports can lead to over simplifications. Radiation is not detectable by human senses, but it can be precisely detected and measured.

Chapter 3: *Building a nuclear world.* A map shows a gas-reactor at Winfrith which no longer operates, the PWR at Sizewell which has not even been approved or started. The different designs of AGR started in the mid-1970's did not spread the nuclear expertise too thinly — the nuclear physics, fuel element and nuclear graphite core design have not been problems and these have been associated with organisation, material technology and insulation. It is notable that the more recent AGR's have been built to time and budget.

The comments on the Sellafield — Windscale plant seem unbalanced. The Windscale reactor fire was surely not a 'disaster' and the lessons were quickly learned. The early radiation experience of nuclear weapons explosions really have no relevance to any activities in civil nuclear power. Nuclear defence engineering is by its nature often experimental.

The chapter really requires a balancing section which describes the careful and deep research, and mathematical modelling which lie behind the designs of reactors and their safety systems. Analysis of results from these have been used to make nuclear plant designs progressiveley safer. Plant simulators ensure that reactor operators are trained to interpret and deal with all conceivable operating and accident situations. Engineers report and analyse incidents and plant operational problems. These analyses are the basis of plant improvements and modifications. This is the method of all engineering from motor vehicles, to aeroplanes and nuclear plant. The chapter gives no hint of this. The engineers involved in the industry do not accept that they have been guilty of 'wilful indifference to danger'. All of those I have known in Britain, USA, France and Germany would strongly resent such a misrepresentation.

Chapter 4: *The red specialists.* It is more difficult to comment on this chapter. Some engineers would doubt whether the inquiries and American planning systems really lead to substantially safer plants. The concept of engineers needing outside bodies to make them do their jobs in a responsible way does not correspond with experience. Soviet engineers, like their Western counterparts read published information on safety in the West and doubtless incorporate much of the conclusions into their engineering. The influence of engineers on safety decisions in Soviet plant is doubtless considerable — the Soviet system whatever its other defects does pay considerable attention to engineers and scientists.

The concept of a pressure tube reactor is familiar in Britain (the steam generati heavy water reactor) and Canad (CANDU). Pressure tubes have bee checked and replaced. I do not belie that uranium metal fuel was used in water cooled reactor and it is unlikely th this is relevant to the Chernobyl inciden The rest of this chapter is a most usef review of the politics and organisation the Soviet nuclear industry.

Chapter 5: *The accident.* This and th previous chapter are the ones that mo engineers will find interesting. The mai sequence is stated clearly althoug material released since the publication ha provided much more detail of how th explosion was initiated. The wate pumped to the base or the reactor is no 'cold', it will be close to saturatio — the optimisation of the degree o subcooling as a function of channe characteristic is one of the basic reacto design calculations. The aspect of th design that I find puzzling is the hig temperature of the graphite and th cooling of this by direct contact with th pressure tubes. However, the graphit was in an atmosphere of inert gases. I d not think that one should glibly accep that the core emergency cooling syste was solely aimed at a below core break The whole question of emergency coolin of fuel element clusters in a pressure tub is most complex and technically difficult

Chapter 6: *How the world found out* This chapter has some fascinatin information, it illustrates the advantage the press have of a world network o sources of information. Of course thi disparity between the Western estimate of casualties and the Russian informatio was basically due to the interpretation o the nuclear disaster analysis referred to i Chapter 2. The small number o immediate casualties appears to hav been due to the few staff on site at th time of the explosion and the effect of th fire carrying most of the radioactive material high into the atmosphere where it dispersed.

Chapter 7: *The cloud spreads.* Again a interesting chapter based on the news network. There are pertinent comments on the British preparedness for such a incident.

Chapter 8: *Struggling with a monster* Again good reporting, some of th activities are almost incredible Considerable heroism was shown by many people whose activities helped to contain the accident.

Chapter 9: *A poisoned inheritance.* A lot of this material is conjecture and we shall not know for many years the aftermath effects of the accident. From some countries little is likely to emerge There must surely be some public pressure in countries like Finland, Eas Germany and Poland for more information.

Chapter 10: *The end of the nuclea dream.* The Chernobyl accident certainly was a serious blow to the nuclear industry

nd engineers involved in it. Its relevance nd effects will take many years to assess. n a world where fossil power generation lso has its problems in the release of npleasant materials into the atmosphere uclear power cannot really be dismissed s too dangerous. No human progress has een achieved without risks, engineering rogress by the assimilation of xperience, and most of all by mistakes nd failures.

The book, then, is to be welcomed for ts reporting of facts, some of the views nd opinions may not be so welcome. At he price however a good investment.
N G Worley

Nuclear power in the western world, post-Chernobyl

Nigel Evans and William Bullen
Cambridge Energy Research, 1986
23pp. £20.00 (UK), £25.00 (Overseas)

The contents of this report were published early in July 1986 in, it would seem, an attempt to be quickly recognised as a forerunner in making an early forecast of future nuclear programmes following the accident at Chernobyl.

The report is an extremely thin one containing only 23 pages and its introduction is therefore somewhat sparse. The authors suggest that Chernobyl has had a profound short-term effect; a rather premature statement to make coming as it did only some few weeks after the event.

The purpose in producing the report is said to be to look at the longer term implications of the Chernobyl scene as it affects other nuclear states. To look at the long term possibilities for the world is a much more realistic approach if viewed purely as a forecast activity.

Much of the information is gleaned from IAEA material and other nuclear press material. Following the introduction is a table projecting high and low nuclear capacity in the WOCA, (world outside communist areas) for the years 1990, 2000, and 2020.

Some attempt is made to build up a picture of the nuclear outlook in a number of countries or areas, post-Chernobyl, but again the details are regrettably sparse. Dr Nigel Evans' previous publication called; *Nuclear power in the Western world to 2020* published in 1983 was a useful exposition and discussion forming document. One feels that this publication would have been more useful if a great deal more time had been allowed for the facts of the accident to become fully available, so that a more logical and scientific judgement could have been made.
F John L Bindon

Sulphates in the atmosphere

P Harter
IEA Coal Research, 1985
155pp. £15 (member countries), £30 (non-members)

This is a comprehensive review of papers on the transfer of sulphur compounds, not just sulphates, in the atmosphere. It covers atmospheric processes which may involve the formation of sulphates, from emission of sulphur dioxide to deposition of sulphates, and the direct effect of atmospheric sulphates. Possible ecological pathways and the mechanism of acidification of the environment by pollutants from coal combustion will be treated in a forthcoming review so that this review is not directly concerned with solution to problems associated with 'acid rain'.

Part 1 of the book deals with the formation, transport and deposition of sulphur bearing compounds and Part 2 with the effects on health, materials and the atmosphere.

There are more than 600 references, mainly from journals and papers dealing with the atmospheric environment. A high proportion are concerned with conditions in USA and Canada.

Unselected data from papers which are open to contention by scientists working in the field are included and naturally this raises suspicions about conclusions in the review. Thus it is quoted that 1-3% of total sulphur is released as directly emitted primary sulphates by coal fired boilers as opposed to 5-9% from oil fired boilers burning fuels of a similar sulphur content. Extensive work carried out over the years by scientists engaged in problems associated with SO_3 and low temperature corrosion indicates that this data is far too high by a factor of five to 10 times.

Clearly the transfer and chemistry of SO_2 and SO_3 in the atmosphere is extremely complex considering the effects of day and night conditions, temperature, humidity, air flow, the presence of catalysts, particle size of aerosols and inversion layers. It is very desirable to gather together this data but the subject is so complex that one may be left more confused after reading through the numerous summaries than when the book is first picked up.

It is concluded that the review forms a useful basis when considering a particular problem, such as the transport in the atmosphere of sulphur compounds from the UK to Scandinavia, in order to take into account all the different factors which may be pertinent. Local conditions and factors then require to be studied to assess which factors are of major importance in order to formulate how the pollutants may be transferred and precipitated and how they will affect the polluted area. Methods used to reduce pollution in one region may not be suitable for application in other regions.

A comprehensive review of present day data on the extremely complex subject of transfer of sulphur bearing pollutants in the atmosphere which still leaves the subject open to wide speculation and interpretation. Benefits from steps taken to reduce this type of pollution are likely to take many years to be measured with adequate accuracy because of the many factors involved.
Byrom Lees

Leaching of low and medium level waste packages under disposal conditions

Edited by M Dozel, W Krischer, P Pottier and R Simon
Graham and Trotman, 1986
£30.00

The authors of this important book are all members of Commissariat à l'Energie Atomique (CEA) and the basis of the book is a presentation of a report of a meeting of experts organised by CEA and CEC (Commission of European Communities).

The meeting was in the form of a workshop and its scope limited to low and medium activity waste. Thus spent fuel and all heat generating wastes were excluded.

The transfer of radioactive nuclides and other substances from a solid waste form into a water environment is referred to as 'leaching'. The work of the authors is an attempt to explore waste management and safety analysis of such wastes when stored in sites likely to lead to leaching problems.

The overall philosophy governing all disposal concepts is that long term isolation by a multi-barrier system is safe. Genuine testing of performance over long periods of time is obviously not possible and thus tests have to be devised with models to give at least a reasonable assurance that such systems are effective.

The workshop's five sessions are described in the book. Session 1 looks at the evaluation of the data that is needed for risk assessment, identifying safety related properties. Session 2 examines waste package characteristics and engineered barrier interactions. This is followed by the discussion of a number of performance tests under the influences of changing temperature and pressure. National regulations and acceptance of national criteria are summarised in chapter 4 while the ultimate chapter views future developments.

The book is well produced with clear diagrams and appears to fulfil its objective of providing a better understanding of the risk assessment of low level/medium level disposal sites.
F John L Bindon

Ocean disposal of radioactive waste by penetrator emplacement

Ove Arup and Partners
Graham and Trotman, 1986
£30.00

The authors of this book are all (presumably) members of a company of consulting engineers called Ove Arup and

Partners, London. The book is published under a corporate name having been prepared for the EEC's Cost-Sharing Research Programme on *Radioactive waste management and disposal* covering disposal in sea-bed geological formations.

Waste management of radioactive waste is one of the most important topics in all countries' nuclear energy programmes and which, through media coverage, gets the most attention next to safety aspects. It is true to say that there are numerous solutions being sought world-wide to the problem particularly the one covering high-level radioactive waste.

High level radioactive waste is generated when spent nuclear fuel is reprocessed in order to recover uranium and plutonium for future use. Such waste products resulting from reprocessing are highly radioactive and generate a considerable amount of heat.

Work is being undertaken in both the UK and France, as well as elsewhere abroad, including Australia, to find means of not only reducing the volume of high level waste (HLW), but encapsulating it in a material to ensure safer storage. The method is known as vitrification and the French system as well as the UK one would, if finally accepted world-wide, lead to its emplacement in stable geological formations.

It is important from a public acceptance point of view to safeguard the health of mankind from any radioactivity which might give rise to concern. Pollution of the environment must be minimised by ensuring that in isolating such wastes there is no possibility that leaching can occur.

The book considers the *penetrator option*. In this concept waste would be loaded into carefully designed containers and transported by sea to suitable deep ocean sites. On release under free fall the containers would embed themselves completely in the ocean floor. Protection of the waste would be by a multi-barrier system including vitrification.

The book describes aspects of the feasibility study undertaken by the company and shows how the penetrators could easily achieve a depth of embedment in excess of 30 m. The theoretical studies conclude this to be a most effective barrier depth for radionuclear isolation. That of course is not the end of the story because the integrity of the sediment barrier can change with temperature, which is effected by the heat generating waste.

For those in the waste management field this book is an important study on one particular option. It is well laid out but has a disadvantage in not having an index, although its 10 chapters are carefully broken down into sub-sections. The diagrams are well designed and clear.

The first half of the book examines penetrator designs and disposal options, each chapter bearing well defined conclusions. This represents about one third of the book.

Part 2 takes the penetrator design and operations to a greater degree of development study and describes the various problems that would be involved in penetrator manufacture; an interesting aspect. The same interest applies to the design of the disposal ships and methods of penetrator release.

F John L Bindon

International tokamak reactor — phase two A, part I

International Atomic Energy Agency, Vienna, 1983
775pp.

The *International tokamak reactor (INTOR) workshop* is a collaborative project among Euratom, Japan, the USA and the USSR. It is conducted under the auspices of the International Atomic Energy Agency (IAEA).

INTOR is viewed as the major experiment in the tokamak programme between the present generation of large demonstration fusion reactors (DEMOs). The project will identify the physics and technology prerequisites for the design and construction of the DEMOs. Then, those prerequisites which can best be satisfied by INTOR and those for which complementary physics experiments and test facilities are needed can be distinguished.

The text contains 16 chapters plus appendices showing details of the various parameters for the design and construction of the DEMOs.

For the benefit of the reader, preference appears to have been given to providing a complete description of the INTOR concept and not just the recent research. For this purpose, some of the sections have been taken from the phase one report.

In the executive summary the technical issues were identified where an intensive, multi-disciplinary effort was required.

After a close examination of the design and construction schedule it appears that following engineering tests the actual demonstration experience of the reactor will be possible from the mid-1990s.

This is a highly specialist report which should be of interest to individuals who are involved in nuclear fusion research. It is well-produced and acts as a valuable record of the research work carried out by the INTOR workshop.

Andrew W Cox

The oil supplies industry

A comparative study of legislative restrictions and their impact.
Dr Peter Cameron
Financial Times Business Information, 1986
242pp. £158 (UK), £168 (overseas)

The recent collapse in oil prices, and swift retrenchment by the majors, is having severe repercussions on upstream supplies companies. At the same time many such UK companies have been seeking or exploring export opportunities based on their North Sea experience. Diversifying overseas carries a number of risks as w as opportunities. This business rep which is copiously referenced, examin the impact of legislative controls impos by 'host' governments on 'foreig companies. Failure to understand or ta these into account could be disastrou

Seven selected countries are examin in some detail — UK, Norway, US Canada, China, India and Indonesia. further chapter discusses other importa producing countries briefly on a regior basis.

The UK government has operated fairly laissez faire approach to offsho supplies up to 1983 but since then t intervention of the OSO to promote U content has received the attention of t EEC Commission. In contrast t Norwegians have operated a heavi defended market from the beginning (ar are also immune from EEC regulations

In North America, the USA is a class instance of export opportunities beir stifled by a range of trade barriers and strong domestic capability. Last year t Investment Canada Act introduced a entirely new framework to encourag foreign participation but a track recor has to be established.

Opportunities in the three Asia countries examined are even mor complex and diverse due to cultura political as well as legislative factors These are presented in a very we structured manner with many interestin examples.

The key message from this informativ report is that offering a high qualit product or service at a competitive pric is not an automatic entrée into oversea markets. The growth prospects of worl offshore expenditure quoted in the repor forecast an increase from $54 bn in 198 to $74 bn in 1988. This trend has alread been seriously eroded.

Essential reading for all upstrean services and supplies companies wh should, in general, seek joint ventur opportunities to obtain a foothold in a increasingly difficult overseas market.

D F Rosborough

Fundamentals of bulk solids flow

Peter A Wood
IEA Coal Research, London, 1986
64 pp. £15 (member countries)
£30 (non-members)

In coal mining, one of the majo problems in recent years has not been s much extraction but transportation. Thi publication gives an excellent review o recent literature to allow the reader a understanding of the problems of th bulk solids flow process. The very soli nature of coal means that it must b handled in a granular or powdered form Thus, the successful handling of solids i an important factor governing th development of fossil energy component and systems.

The report starts with a basi introduction into the behaviour of bul solids and illustrates the variou

fundamental types of flow, flow patterns, and problems that can be expected. This is followed by a most interesting and comprehensive review of the fundamental research being presently carried out that could contribute to a better understanding of the mechanics of bulk solids flow, as well as the parameters affecting that flow.

The main conclusion is that a fundamental understanding of bulk solids flow is urgently needed and that the present level of understanding is inadequate. The author strongly argues that an active interchange between experimental, theoretical and computational research should increase understanding and help to determine a more reliable prediction mechanism.

One of the major contributions of the report is its excellent and extensive list of references, which will prove most useful to all interested in the subject. It is written in a clear style which is well illustrated, and provokes many new ideas for consideration, not only for coal but for other solid fossil fuels, such as oil shale and peat, and their waste products, such as ashes and slags.

Dr Alan Stainer

Physical coal beneficiation and electricity costs

Hugh Mellanby-Lee
IEA Coal Research London, 1986
70pp. £30 (member countries)
£60 (non-members)

In the last few years, much attention has been paid to coal beneficiation for power stations, and a considerable amount of research is being carried out on new beneficiation technologies. This interest has been generated because changes in mining are now producing dirtier, smaller or wetter run-of-the-mine coals that affect the performance both of coal preparation plants and of power stations. This is underlined by the increasingly stringent environmental regulations particularly on sulphur emissions. Also, the production of a coal-water mixture, or some other very clean product that can more readily replace oil, has been the dream of coal marketing managers for years.

This well written report deals with the combined economics of coal beneficiation and electricity generation. It tackles the questions of how burning cleaner coals affects the overall costs at power stations and whether the costs of coal preparation are justified by these savings. The main conclusion is that these combined economics depend on the particular circumstances and that each situation must be studied separately. The report thus reviews the considerable research that has been carried out around the world on these issues, and it presents the relevant information, where it is available, on the costs and performances of existing and proposed coal beneficiation processes and coal-fired power stations.

It is a most interesting and well written document which gives considerable information that is well illustrated, particularly on the cost and efficiency of physical coal beneficiation. This is supported by an excellent bibliography. The report will appeal to all those concerned with coal beneficiation especially in the field of technological economics.

Dr Alan Stainer

Integrated energy planning: a manual

Executive Summary, 39pp.
Volume I — Energy data and energy demand, 230pp.
Volume II — Energy supply, 275pp.
Volume III — Energy policy, 227pp.
Edited by Réné Codoni, Hi-chun Park and K V Ramani
Asian and Pacific Development Centre, Malaysia, 1985

This three volume manual (plus *Executive summary)* is based on a major research project which was initiated by the Asian and Pacific Development Centre (APDC) in 1982. It is intended to provide a conceptual framework plus the analytical methods and tools which could be useful in developing national energy plans.

The manual contains an introductory chapter and 18 others grouped under four divisions namely, *Energy data, Energy demand, Energy supply* and *Energy policy*. The *Executive summary* presents abstracts of these.

Governments usually have a collection of energy policy options which are mostly complementary and occasionally conflicting among themselves, with the goal being an acceptable rate of sustained economic growth where the supply and use of energy are controllable variables.

The manual outlines the main policy options that shape national energy planning efforts. The extent to which any of the options are reflected in national energy policies depends upon the individual energy and economic situations of countries, as well as related socio-political considerations. Eventually each country had to decide (often by trial and error) as to which policy measures will most benefit them in the long run.

The concept of integrated energy planning is set against this background.

Unlike many publications of this type I was impressed by the considerable discussion concerning the possible obstacles which are encountered in the development of a national energy policy. In volume 3 these were summarised as including: data limitations; confusing, conflicting or inadequate legisaltion; a lack of an 'interface' between energy and other policies plus an unsystematic allocation of responsibility and authority; late inputs into planning and implementation; personnel and equipment — related constraints; inadequate communication; and political interference.

Integrated energy planning will, hopefully, be received as an important addition to the energy information base in the Asian and Pacific region. It attempts to emphasise as far as possible issues and problems of relevance to the region.

The manual should act as a set of operating instructions for constructing and managing an ideal energy plan. It is a compendium of knowledge on the range of available methodologies out of which many possible choices can be made by those directly concerned.

The authors claim that it was developed with four groups of audience in mind: energy and economic planners and policy makers; senior and middle level government officials who manage approved economic and energy plans; managers of public utilities, government agencies and private sector corporations engaged in energy supply; researchers and lecturers in the energy and economic policy areas. The real value of the manual will be as a tool for training those individuals listed above, with the documentation being a primary component for seminars and training courses.

Andrew W Cox

Publications received and noted

Managing design for competitive advantage
The Engineering Council
Guidance Statement on the Engineering Council registrants and trade union membership

Available from the Engineering Council, 10 Maltravers Street, London WC2R 3ER. Please enclose an A4 size SAE bearing a 22p stamp.

Also by the Engineering Council, a pamphlet entitled **On being a school governor** which is aiming to encourage engineers to become school governors.

Increased profits from energy
Energy Efficiency Office.

Energy Technology Series
1. Energy Management Systems
2. Infra-red thermography
3. Energy efficiency technologies for swimming pools
4. Small-scale combined heat and power*
5. Heat pumps for heating in buildings

The series has been prepared for the Energy Efficiency Office by ETSU. Copies are available free of charge from the Enquiries Bureau, ETSU, Building 156, AERE Harwell, Oxon, OX11 0RA. Tel 0235 834621.

*Number 4 in the series will be reviewed in a later edition of *Energy World.*

The keeping of LPG in cylinders and similar containers
Guidance note CS 4 from the Health and Safety Executive

This guidance note replaces the advice first published in 1973 as a Home Office Code of Practice, later reprinted with minor amendments as Health and Safety Executive (HSE) Guidance Note, Chemical Safety Series 4 (GN CS4) in February 1981.

Energy efficiency in industry — the electri answer

Peter D Hopkins MSc CEng FIEE FBIM DMS*

Of the many revolutions in the 19th century it was the revolution of a wire in a magnetic field which set off a chain of events, culminating in a revolution of another sort one century later — the electric revolution. It is ironic that a nation like ours, that pioneered the generation and distribution of electricity, should be so backward in exploiting this efficient and productive energy form. Fortunately it is not too late to redress the balance but it is important to understand, first and foremost, what we can do as a nation. Secondly what the electricity supply industry is doing with regard to electricity utilisation, marketing, and product development. Thirdly what this demands from the electrical engineering profession and industrial management.

As a nation we should do well to cast our eyes on the success of our international competitors who have trodden the electrical route to growth. This route is open to UK industry, I believe that many industries could ensure a better future by adopting electro-technology for specific and cost effective applications. In other words following the electrical route to productivity and increased profitability. It is the aim of the electricity supply industry to encourage such beneficial and effective energy transfer to electricity.

At present electricity provides only a 13.8% share of the UK delivered energy market. This of course includes transportation. Exclude energy consumed by transport and electricity's market share rises to around 20%, still low in relation to other countries. Even the most optimistic scenario predicts only a further 4% increase in market share by the turn of the century.

However, we live in a changing world where all aspects of the energy business are being conducted in a complex, rapidly changing and unpredictable environment.

There are three things we can reliably predict about the future. Firstly it will not be like the past; secondly the future will certainly not be like we think it will be and; thirdly the rate of change will probably be more rapid than ever before.

Stunning progress

This latter point, the rate of change of progress, is illustrated by the size of computer that would equate to the power of the human brain using the technology available at particular points in time.

The progress is stunning. In not much more than half a generation mankind will have advanced in technological capability from an impossibly complex device equal to the size of a major conurbation, to an equivalent practical device in density and capability of the order of the human brain.

Those of us expecting to be working at the turn of the century can take comfort from the fact that, although the artificial brain may be no more than human sized it will cost topside of £5 M, that still makes us pretty good value to employers.

The days of cheap energy are over and energy efficiency is of the essence, not only to save money but because the more easily used fossil fuels are being depleted at a rate that cannot be sustained indefinitely.

The world's reserves of oil and gas are a little over one third of the reserves of coal, yet they are being consum at twice the rate. The key elements in our energy poli are the efficient use of coal and nuclear power, ensuri that as gas and oil become more scarce and expensive adequate and economic supply of electricity will available. Remember in many situations electricity is t most environmentally acceptable way for coal to be us by industry for its energy requirements.

It is essential to encourage the cost effective a efficient transfer of energy used by industry from t rapidly depleting resources of gas and oil to electrici produced predominantly from coal and nuclear powe

Electricity growth abroad

Look how other countries are managing their ener resources. At first sight, Sweden, with its national asse looks well placed to face the future. However, rece legislation aimed at curbing the exploitation of t Swedish river system was predicted to lead to unacceptab importation of expensive fossil fuel at the turn of t century.

Faced with this prospect the Swedes have be concentrating on electric solutions which minimise ener consumption. Between 1960 and 1973 electricity usa rose in line with total energy demand. After 1973 consumption reduced, initially as in many countri because of conservation. But then substitution measur began to take effect and electricity assumed an increasi proportion of Sweden's energy demand.

Amongst the electric solutions in Sweden that ha brought about this change in direction are electrohe applications in industry.

Bivalent or dual energy systems for use in industry ar also the home. With two fuels, say oil and electricit customers can often save money by using cheap night ra electricity for most of the year switching to oil or perha gas to cope with peak demands.

In addition they have adopted flexible tari arrangements linked to time of day costings, much in th same way as some UK industrialists have done.

Last but by no means least is their attitude to educatio Sweden was once known for its permissive society, b in terms of energy, permissiveness is not tolerated. Th Swedes have changed their outlook and are now ve energy conscious — perhaps a lesson to be learned f Energy Efficiency Year here in the UK.

Sweden however is not alone in its adoption of electr technology. There could scarcely be a greater contra between Sweden, with abundant energy supply an conservation minded people, and France, which has litt in the way of fossil fuel resources, but has a policy encouraging industrial growth by offering extensive chea electric power. As you might expect, the French ener demand is bound to to be a bit different from that of th Swedes, but their anticipated increase in energy is almo wholly put down to electricity.

The list of electric solutions which I have outlined f Sweden also apply to France but with even greate emphasis placed on electro-heating.

In fact it is calculated that electricity's share of tot

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nergy consumption in France will rise from 31% at resent to as much as 50% by the year 2000. Compared ith the predicted UK electric growth rate over the same eriod the French can well boast of becoming the *power ouse* of Europe. They are rigorously pursuing the nuclear oute, are now seeking ways of exporting electricity to ther countries.

West Germany, too, is following a similar road, and urther afield, so too is Japan. Japan has perhaps been ne most successful country in terms of its growth and emarkable industrial success, but what part has energy layed in making this success possible.

Japan has virtually no resources of its own and for nany years was heavily dependent on imported oil. During the early 1970's they resolved to move away from il and accepted that electricity in abundance would be ital if their planned high growth rate was to continue.

There is one further energy growth pattern which ontrasts noticeably with the others that I have ighlighted. It belongs to a nation which, because of its arge oil, gas and coal reserves has not yet faced up to the nergy policy decisions taken by other nations. There are o prizes in guessing the name, yes it is the United Kingdom!

The Swedish, French, German and Japanese ircumstances clearly differ from those in the UK. However, the fact remains that nations similar to ours vith industries similar to ours, are increasing their fficiency and productivity by adopting applications of lectrical technology.

From this evidence it would seem that higher levels of ndustrial productivity and efficient use of electricity go and in hand. Compare, for example, the UK's record f growth in GDP and electricity with that of other mportant western nations

Poor UK record

I would suggest that our own poor record on the use of electricity could well be an important contributor to our poor record in economic growth.

It is however not the only cause of our poor economic ecord. Surely our *laissez-faire* attitude, our reluctance to nvest in new technology, our lack of spirited marketing, our inability to transfer our extraordinary national nventiveness and creativity into the market place are all ymptomatic of the national malaise.

In the UK we are now reaching the peak of our roduction of oil and gas, although their decline from here n may be slow. You will be aware that the Government ave vetoed BGC's intention to import gas from the Norwegian Sleipner Field. What you might not be aware f is that currently BGC is importing some 25% of gas onsumed in the UK, and this is predicted to rise to round 50% by the turn of the century. With diminishing ndigenous sources we can no longer afford to be omplacent in our attitudes to future energy policy. I would suggest that if we do not learn quickly from the xperiences of our competitors, our already weak nanufacturing base may well decline further.

Expand manufacturing base

I believe it is the responsibility of the electrical engineering raternity and industrial managers to meet the challenge, by finding solutions which improve and expand our ation's manufacturing base. One solution I would prefer s the better utilisation of electricity through substitution.

I would add that by substitution I do not mean onservation which is often wrongly taken to mean the ame thing. In practice there is a world of difference etween them. Conservation is generally associated with educing costs by reduction of output, for example, reducing the annual mileage of your car would be conservation. But, trading your vehicle in for a model which returned a higher MPG would be substitution, which would be of direct benefit to your pocket and to the nation at large by reducing its oil importation. The same applies to electro-technology when it replaces fossil fuels.

But what is so special about electricity, that does not apply to other forms of energy? It is very flexible, for a start. As a multi-functional form of energy electricity is used by industry for a multitude of purposes varying from motive power through to electrolytic applications for aluminium and chemical manufacturing processes.

Help from electricity

In a control mode electricity facilitates speed variation, temperature variations, through to the actuation of robotics and transfer lines. The versatility of electricity can also make a unique contribution to industrial processes by enabling elements of production to be used more efficiently, and by reducing demand for scarce resources.

It has to be recognised that it is necessary to optimise the use of all resources, not just energy. Typically this includes the use of effective capital, land, space, raw materials and people as well as energy.

To examine the conditions where electricity can be beneficially substituted for fossil fuels we calculate a substitution coefficient. This factor referred to as *gamma,* measures the number of fossil fuel units for which 1 kWh, also quantified in the same unit, can be substituted across a wide range of industrial processes. In practice, it means that if around three units of primary energy can be replaced by one unit of electricity then the electric solution is beneficial, not only for the industrialists but also for the nation.

For many new industrial processes using computers, robotics, plasma or laser technology, the *gamma factor* is often measured in tens and indeed sometimes in hundreds.

Equally important are the benefits which each organisation sees when it installs electro-technology since that decision frequently results in increased productivity and profitability - not to mention a healthier working environment.

For example, copper billets, previously heated in a fossil fuel combustion furnace in hours now take only several minutes to heat using an electric induction furnace. Timber, previously kiln dried by gas in 25 days now takes one day using a heat pump technique, and containers with ink labels can now be cured under UV light in one second compared with eight minutes or so in an oven.

Equally as spectacular is the continuous annealing of copper tube at a rate of 3 m/s using induction techniques compared with several hours in a conventional batch furnace.

As a further example radio frequency drying techniques can be used to dry materials 10 times faster than conventional means.

These new electro-technologies are dependent on electricity to operate successfully. In combination they are undoubtedly the key to improving efficiency and productivity.

Why then, is not every industry looking at the electric route, and why is the UK energy growth pattern so dismal. Both the technology and experience are there, so what is going wrong?

The answer, in my view, is the failure of British businessmen, particularly the decision takers, and their advisers, to develop and introduce new ideas. We need to create more entrepreneurs, establish organisations that

encourage innovation, reward initiative and tolerate failure. It is said that if you asked an Italian or Japanese businessman to join you on a new idea his first response will be 'Am I the first to have it?'. In Britain the first question we often ask is 'Where can I see it working?'.

Power for efficiency and productivity

Fortunately, there is a growing band of notable exceptions where some of the more enlightened UK businessmen and women have shown that the electric route can work successfully. These are the people who have entered and gained from the electricity supply industry's power for efficiency and productivity award scheme, PEP for short.

The award, which has *eta* the mathematical sign for efficiency as its symbol has two main aims.

Firstly to encourage manufacturing industries to make more efficient use of energy by taking full advantage of the benefits of electrical technology, and secondly to encourage the cost effective transfer of energy use to electricity in order to improve the UK boomerang curve.

All the 14 area electricity boards in the UK have presented regional awards to winners in each of two categories: manufacturing units with up to 200 employees, and those with more than 200 employees.

Companies were asked to describe a project where the use of an electrical process or service had helped them to be more successful. Ideally the project had to show several distinct improvements.

First of all, a decrease in the amount of energy used per unit of production. Secondly, an improvement in product quality, and then thirdly an improvement in the working environment, that is improved overall cost effectiveness or better working conditions.

In the first two years of the competition the 56 regional winners have collectively invested a total of £5.4 M and achieved annual savings of around £4.0 M which gives an average payback of just 16 months.

I should emphasise that these savings were achieved through just 56 projects. Our industrial sales engineers nationally are involved with thousands of projects each year and I estimate that the total energy saved by our activities amounts to over 300 000 toe.

It is also very encouraging to hear that as a result of improved competitiveness, many of the companies have increased production and employment opportunities. The winners can cite examples of significant increases in output and growth in exports, especially important at this time of high unemployment, and the creation of new jobs.

Let me outline a selection of the companies who have benefited by entering the PEP competition and have secured winning honours in the MANWEB area.

Reaping the electric benefits

Last year we saw United Glass Containers of St Helens secure the winning place in the larger company category. They went on to be placed third overall in the national competition.

The company manufactures bottles of every shape and description. Glassmaking is a highly energy intensive industry and to make the best use of energy large capacity furnaces are used to melt the glass, which is then distributed to a number of glass forming machines.

Each machine requires its glass at a different temperature and condition from the central furnace so an individual forehearth is needed for each station. This conditioning process is a critical stage and any variation in forehearth temperature has a direct effect on the glass weight of the container and hence its capacity.

Traditionally conditioning consisted of a controlled cooling of the glass, followed by reheating aimed at achieving uniform temperature immediately prior to the forming process. This was done by gas burners which practice proved inefficient.

Electricity provided the solution in the form of dire resistance heating. Electrodes spaced down the enti length of the forehearth pass electricity through the gla resulting in a faster and more uniform heat transfer.

United Glass have,by substituting electricity in place gas for forehearth heating, reduced their energy bill b over £100 000/y, and have been able to improve bo operating efficiency and quality of product.

The 1985 PEP winner in the first category (ie less tha 200 employees) was Buckley Foundry, Chester.

In 1979 the writing was on the wall for the basic iro foundry. Manufacturers were demanding a new breed casting with a standard, strength, quality and perfectio that had not been previously considered. At the same tim plastics manufacturers began making massive inroads int the traditional small iron casting market.

The situation was particularly critical for famil businesses like the Buckley Foundry, but the compan adopted a positive approach and invested in the futur by changing from coke and oil fired melting to electri melting using induction furnaces.

Today the product range has expanded from a handfu to hundreds, with increasing market penetration improved product quality and reduced metal wastage. No only this, as a proportion of their production cost Buckley have seen their fuel costs fall by almost 20%.

The same is true of American Can (UK), based a Runcorn. This firm manufactures 2 M cans each day fo the beer and beverage industry. During the manufacturin process eight ovens, which are sited some 20 feet abov ground level, are used. Problems arose in providing hea for the staff at ground level.

Heat was originally supplied by two roof mounte indirect gas fired units each rated at 2 M Btu. Owing t the plant's location and the heat barrier produced by th high level ovens the gas system was proving to b inefficient. Quartzray infrared heaters were installed t warm up the areas used by the machine operators. Th heaters were placed in line of sight of the operators. A a higher level a heat recovery system was installed t recover the heat emitted by the ovens, making the spac heating even more effective.

As a result the firm saved 81% on production area heating costs, and at the same time improved industria relations.

As a final example Midland Rollmakers of Crewe in their quest for new business were quick to spot the potential in the cast steel roll market. However thei existing metal melting plant did not have the necessary capacity.

A new plant would have called for massive investment so an alternative , where the steel could be produced in two batches, using existing plant was used.

An existing pouring ladle of 22t capacity was converte to enable an induction loop to be built into the side. Using the metal as the secondary turn of a short circuited transformer, heat was generated within the metal. Whilst the second batch of metal is in preparation the first batch is removed to a holding station.

Midland Rollmakers are able to cast steel rolls of up to 50t capacity and have so far increased their annual turnover way in excess of £⅓ M. They have secured new markets, which has led to increasing the utilisation of thei existing plant, reducing their unit cost for each steel roll produced, and a return on their investment in a matter of weeks.

The electricity industry is also encouraging the introduction of more flexible seasonal and time of day tariffs, which provide attractive prices at off-peak periods

d encourage improved utilisation and energy angement.

Although the price of electricity is now very competitive th other fuels, particularly on *Economy 7* night tariffs, stomers can, by taking advice on energy management, ake even greater savings by simple adjustments to the ne when electricity is consumed.

Research into more flexible metering and control stems helps promote more tariff flexibility. The supply dustry has taken the lead on metering technology, driven the need to pass the savings onto the customer and in e long run the nation.

Helping the area electricity boards to develop new lvances in electro-technology is the task of the Electricity ouncil Research Centre at Capenhurst on the Wirral.

Crucial to their success is the matching of precise energy quirement of a process with the energy input. Typical their approach is the development of the air radio equency assisted dryer known as ARFA, which operates sing the simultaneous combination of convective and dio frequency heating. This development which offers dustrialists increases in production of up to 500% has ade electrical drying an economical alternative across wide range of industries previously dominated by gas nd oil fired dryers.

Textiles, paper and board, plastics, rubber and sulation materials can all be dried efficiently, at much wer energy costs and in only one tenth of the time taken y conventional dryers. The addition of just 3.5 kW of F heating to 45 kW of conventional warm air reduces. ne drying times of over 40 minutes to around six minutes us resulting in considerable energy savings.

Another development is the Chemelec Cell. When a etal is in very dilute solution it cannot be recovered and lot of precious metals like copper, silver and cadmium et washed into our rivers in very high dilutions. Capenhurst developed the Chemelec Cell to recover these etals.

It works by agitation, using tiny glass beads to bring he solution to electrodes where the metal is plated out.

A vacuum flask manufacturer who found himself with ountains of broken glass coated with silver which no lassmaker would touch. A Chelmec Cell was used to ecover the silver and the clean glass was then sold. 11 kg f silver was recovered each week. The big design problem vas in fitting padlocks to the cell.

Many engineering components have their wearing urfaces hardened with carbon or nitrates in an oven urrounded by carbon rich gas. This is often an energy ntensive process. Plasma carburising was developed at Capenhurst. The component is one electrode in a high oltage container supplied with methane. The component s bathed in an electrical discharge and carbon atoms are propelled into the surface under the attraction force of he electric field. This gives a rapid and very uniform urface treatment even down very narrow blind channels vhich conventional treatment cannot achieve.

Other process research currently being undertaken at Capenhurst includes mechanical vapour recompression, high temperature heat pumps for heat recovery, the plasma torch for cutting of materials, the Venturi Aerator for effluent treatment, etchant recovery for the electronics trade, along with transverse flux annealing, and rotary kiln heating to name but a few. Apart from the process research Capenhurst has worked on energy in buildings. Methods of energy savings in buildings have been developed which include new techniques for installing and sealing factory type buildings which are notorious heat squanderers. Also research into all aspects of human comfort and performance in the office environment is undertaken at the centre.

Slashing the nation's energy bill

At MANWEB the energy marketing manager has a team of 30 highly qualified engineers operating throughout the Board. They are backed up by specialist staff at head office who liaise directly with Capenhurst. The service is available to all and is completely free of charge. Also available is a wide range of technical literature, video and case history material, along with the backing of the Electricity Council.

Given that 1986 has been designated *Industry Year* this should provide some impetus to apply new ideas involving the utilisation and substitution of electricity for fossil fuels. It is also *Energy Efficiency Year* and the Secretary of State for Energy is forecasting that as a nation we can slash as much as £7 bn a year from our £35 bn annual energy bill simply by implementing energy efficiency techniques.

Taken together these campaigns will set the right climate, but in the end it will be changes in attitudes which will lead to the creation of the wealth we need to survive as a nation in today's competitive world.

A recent study undertaken by the Japanese Ministry of International Trade and Industry showed that of the significant inventions and innovations on which their industries and the industries of other western nations were based; 6% were of Japanese origin, 14% from France, 22% from the USA. and an extraordinary 55% from the UK.

Tragically it would seem that our excellent research and development are being ignored by our own industries and instead are feeding the successful marketing efforts of our competitors.

I have explained that this country has at its disposal a means of improving performances in world markets — the electric route.

Each of us must become involved in the production of wealth and in this respect the electrical engineer or engineering manager has a key role to play since he should be in a key position to influence the way in which organisations think and act and he should understand the vital contribution to be made by electricity. It is time for the electrical entrepreneurs to show the way to success, hopefully others will then follow.

□

*Central Electricity Generating Board**

Annual report and accounts 1985/86

Breaking the records

The CEGB made a trading profit of £645 M on a current cost accounting (CCA) basis in the year ended 31 March 1986. After meeting all costs, including interest charges, a profit of £141 M was achieved.

This sound financial result is the result of a most successful 12 months of operation from its 79 power stations. They supplied a total of 227 TWh of electricity, beating a production record which has stood for over seven years.

Apart from another improvement in thermal efficiency again this year from the Board's coal-fired power stations by 0.35% to 34.65%, a major factor was improved plant availability. The Board's nuclear power stations played an important role by producing a record number of units, nearly 38 TWh.

Before expanding upon some of the details in the *Annual report,* it is worthwhile underlining some of the points made by the chairman of the Board in his statement of introduction to the report on the 31 July 1986.

Lord Marshall began by recalling that on the occasion of the proceedings at last year's annual report (1984/85), the whole of that year had been dominated, by the effects that the NUM's dispute had had on the Board's operations. That dark shadow had disappeared, but regretfully had been replaced by yet another, Chernobyl.

The exceptionally splendid financial and operational results which culminated on the 31 March 1986 had now been unfortunately overshadowed by the accident in April at the Soviet nuclear power plant in the Ukraine.

The absence of the full facts from the Soviet Union on the accident had not helped public confidence, either in the UK or elsewhere. Lord Marshall said it would be totally unrealistic not to accept that Chernobyl has significantly affected the public perception of nuclear power. The public had to be made aware that despite this tragic event, nuclear power was a safe-clean form of energy which had significant environmental advantages. The development of nuclear power made good sense and the task ahead was to communicate with the public more effectively than had been done in the past.

Lord Marshall said that some people were so disturbed by the Chernobyl accident that they were calling for the immediate close-down or rapid phase out of nuclear power plants. If a future government so instructed the Board to suspend its nuclear operations, then within a short period of time, secure supplies of electricity to the nation could not be maintained. The dependence on nuclear power was such that it seemed we had passed the point of no return.

On the question of new stations, the chairman reiterated his often spoken view on capacity. The present CEGB excess capacity is not one that is able to remain static as electricity demand continues to grow. Some new power station construction was needed very shortly if load demand problems were to be avoided and that was why the CEGB awaited Sir Frank Layfield's Inquiry Report with some impatience.

A decision by the Government was needed as soon as possible thereafter. The application to build Sizewell had been as long ago as 1981 and now no buffer period remained.

Lord Marshall emphasised that power stations were needed in the South of England whether they be coal nuclear. The growth of electricity demand is primarily that region and thus, under the existing transmissi system, a large power flow occurs from north to sou placing the system under greater strain. The priority potential nuclear or coal-fired stations sites must be a fi priority in southern England.

Finally, returning to the question of nuclear safety, t chairman stated that the CEGB was in no way complac about safety. Engineering equipment, technical procedu and managerial responsibilities were all the subject o rigorous examination throughout the Board. Safety w given top priority and was a continuing process. Lo Marshall added that in Britain the public could have eve confidence in the standards set within the electric industry. In a quarter of a century they had establish an excellent record for the safe operation of nucle stations.

The CEGB's financial performance in making a tradi profit of £645 M represented a return of 2.39% on avera net assets, which are currently placed at £27 012 M.

In December 1985, the mandatory status of th accounting standard on current cost accounting w suspended. However, the Board and the electricity supp industry are continuing to report their results, as they ha done since 1980/81, on a CCA basis because of i relevance to the circumstances of their business. Ca needs to be exercised, therefore, when comparing th Board's financial performance with other organisation most of whom prepare their accounts on a historical co basis.

The 1985/86 trading figures were based on the Board *Bulk supply* tariff and its total income was £8015 M an total costs were £7874 M. Of this latter figure over £471 M was expenditure on fuel. This represented 59.8% o the CEGB's total costs.

The financial target set by the Secretary of State fo Energy was for the Board to earn an average return o 2.7% over the three years, 1985/86 to 1987/88. The retur is expressed as trading profit before interest and moneta working capital adjustment (MWCA), as a percentag of average net assets measured on a CCA basis, includin construction work in progress.

The level of the target is 1.45% higher than the previou one, but it reflects the benefit of the 0.5% brought abou by the increased life of the Magnox stations.

In 1985/86 the Board made a contribution of £146 M based on Government definitions as to the Industry's tota EFL (External Financial Limit) repayment. The paymer was less than anticipated, mainly because of the need t rebuild coal stocks following the end of the miners' strik in 1984/85.

In March 1985 the Secretary of State for Energ approved capital expenditure by the CEGB of £700 M a outturn prices. In fact an expenditure of £745 M occurre the excess being mainly due to the Cross-Channel Lin and continuing difficulties associated with the new AGR's However, this extra expenditure was partly offset by othe savings in the Board's investment programme.

The Secretary of State for Energy had set a further air

*Mr Bindon will be reviewing the annual reports of British Gas an British Coal in a future issue of *Energy World*

for the electricity supply industry for the period to 31 March 1988. The aim is for average controllable costs to be reduced by 6.1% in 1987/88 compared with those in 1983/84. The CEGB's contribution to this objective is to try for a reduction of 5.7% over this period. By 1985/86 a reduction of 3.8% had been achieved, principally from its increased nuclear output.

The second year of working towards this new target looks very bright. The BST has been set broadly in line with inflation and the fall in oil prices and the revised coal price agreement negotiated with British Coal means that a return of 2.9% is expected in 1986/87.

The structure of the bulk supply tariff for 1986/87 is identical to the preceeding year, except for some technical amendments. The average charge per kWh was 3.507p and it is not expected that the average charge in the present year will be greatly different.

The CEGB sales of electricity to area boards, direct consumers and the SSEB were 226.968 TWh. This is 4.8% higher than in 1985/86, continuing an upward trend commenced in 1982/83.

Temperatures in the spring and summer of 1985 were a little below normal and a mild autumn lasted until the beginning of November when the weather changed abruptly. In 1986 we experienced the coldest February since 1947 and the second coldest this century. March was especially windy with storm force winds. All this leads to increased demand.

The peak demand for the year however occurred at 17.00 hours on Tuesday, 7 January 1986 and was for 45 185 MW. On 20 November 1985, a demand of 44 052 MW occurred, the highest for November ever recorded.

These abnormal weather conditions caused a number of major faults on the *supergrid* circuits, damaging towers etc. There were no widespread losses of supply, but a fault did occur on the North Wales system which caused the shut-down of Wylfa power station.

The supplies of electricity to the area boards in the year were supplemented, both from the SSEB (2192 GWh) and Electricité de France (1039 GWh).

The CEGB's 79 power stations had a declared net capability (DNC) of 52 107 MW, an increase of 974 MW compared to a year earlier. There was 1435 MW of new power station plant commissioned at: Drax (No 5 unit), Dungeness 'B', Hinkley Point 'B' (increased rating) and Bull's Bridge gas turbine), while four stations of 461 MW were decommissioned.

The average load as a percentage of average declared net capability was 49%, as against 46.1% the previous year.

The thermal efficiency of the CEGB fossil-fuelled stations was a record 34.65%, exceeding the previous highest by 0.35%. This represents a fuel saving of £40 M. The system efficiency five years ago was 33.77%. If this is expressed in terms of coal saved then 2157 units were generated in 1980/81 for each tonne of coal used. On todays' figures an extra 57 units are being generated per tonne of coal.

Had the thermal efficiency stayed unchanged over the last five years, the CEGB's fuel costs would have been £338 M higher. The major factors supporting these improvements were: higher availability of high merit plant, thermal efficiency, increased nuclear output and the use of pumped storage.

The factor of increased availability of high merit plant, was responsible for £71 M of the £338 M, while thermal efficiency contributed £40 M, £57 M came from the use of pumped storage and £171 M from the increased nuclear output.

The Board's nuclear power stations generated a record 37 935 TWh in 1985/86, some 16.7% of all units supplied. Of this total 24 665 TWh were supplied by the eight Magnox stations, while Dungeness 'B' and Hinkley Point 'B' contributed 9634 TWh. The remainder came from the pre-commissioning operations at Heysham I and Hartlepool. Wylfa, the last of the Magnox stations generated 6586 TWh at a load factor of 89.5%.

The CEGB is undertaking long term reviews of its Magnox stations, subjecting each to an extensive and continuous scrutiny. The review of Bradwell and Berkeley which began operation in 1962 has had its assessments virtually completed with the NII now examining the results. High priority is being given to completing similar assessments of all the remaining Magnox stations.

The generation figures quoted above indicate yet again that the Magnox stations have proved themselves to be the 'work-horses' of the Industry.

In terms of fuel usage the nuclear stations consume the equivalent of 16.41 Mtce in providing the 16.7% component in generation already mentioned. The coal consumption by the CEGB in the year was a total of 78.98 t.

The average price of fossil fuel consumed was 204.92p/GJ compard with 209.4p/GJ which formed the basis for the BST in 1985/86. The average calorific value of the fossil fuel being 24.089 GJ/t. The equivalent cost of the nuclear fuel is omitted from the report.

An interesting point emerges from the statistics presented in the several statements of the accounts as published, although the figures are somewhat hidden. The sales of electricity to the area boards can be calculated to be 3.05p/unit, given the units supplied against the total charge made.

A similar calculation can be made of the sales to British Rail, a direct consumer. This shows that BR paid 3.8p/unit. However, the charge per unit made to 'other direct consumers' is only 0.7p/unit. Undoubtedly, this refers to the 1811 M units supplied throughout the year to the Anglesey Aluminium Smelter at Holyhead in North Wales. It is recalled as a fact of history that the aluminium smelter was located at Holyhead in the late 1960's because of its close proximity to the Wylfa nuclear station. A confidential tariff contract was struck at the time of the Wilson Government to encourage the building of the plant in Britain rather than lose it to overseas competitors.

The annual report contains a review of the position of the AGRs. No attempt is made to hide the fact that the continuing difficulties on the AGR design are encountered because of its complex technology. The reasons for the long delays are restated yet again as in former reports.

Each of the two units at Hinkley Point 'B' now have a commissioned rating of 560 MWso (sent out). Hartlepool and Heysham I have achieved substantial output, although both have not yet been formally commissioned. The first unit at Dungeness was commissioned at an interim rating of 450 MWso as of April 1985 and the second unit is expected to be given a similar rating in 1986.

Up to the 31 March 1986, Hartlepool, Heysham I and Dungeness supplied electricity worth £290 M producing a saving of the £170 M, money that would have been spent had they not been in operation.

Every effort is now being made through 'architect engineering' and improved project management by both CEGB and NNC to bring all the AGR projects to completion.

The report praises the Hinkley Point 'B' station in particular. It has operated at power levels in excess of 1200MW and supplied a total of 53.2TWh to the system up to 31 March 1986. This was done at a cost significantly below that generated by coal-fired plant.

On the question of the future for the AGR design the

report is ambiguous, It states that the CEGB is committed to maintaining the capability of building AGR's but that this is only to the end of the 1980s, a mere three years away.

The CEGB feels it has the need for new capacity as the chairman is already quoted as saying is a proiority. It does appear to the outside observer that so much emphasis is placed upon expecting to begin building a PWR this autumn that should the decision of the Layfield Inquiry not be a straightforward one, then this would leave the Board in a critical position.

Under the thermal strategy of 1977 it may well have been wise to have proceeded towards the building of a new large coal-fired station. That would have been started at least five years ago.

The CEGB has a number of sites 'pinpointed' for future nuclear stations, although from the foregoing it seems likely that after Sizewell, the Hinkley Point location is the favoured one.

Turning to environmental considerations the Board has a statutory duty in this respect, both in its power station siting and its transmission lines.

In November 1985, the Nuclear Industry Radioactive Waste Executive was incorporated under the Companies Act and became NIREX Ltd. The CEGB is a major shareholder with a 42.5% stake, the Government holding a single 'golden' share, allowing it to exercise a veto over all the company's activities.

The Ionising Radiation Regulations 1985 came into existence on the 1 January 1986, replacing earlier regulations. The change also incorporates the use of SI units in radiological protection.

Environmentally, radiation doses to employees and to members of the public, as a result of the Board's operations, were well below the statutory limits throughout the year. All radiological discharges from the Board's nuclear stations were well within the authorised limits in 1985/86.

The report states that there were three occasions when the site emergency plans had to be implemented at 'site incident' level. The nuclear station emergency plans provide a way of rapidly mustering personnel, of minimising toxicity risks associated with CO_2, and of initiating precautionary monitoring both on and off site.

The event at Hinkley Point 'B' on the 29 November 1985 released some 8t of CO_2 to the environment due to a gas circulator inlet guide vane defect. There was no detectable release of radioactivity off-site.

At Sizewell on 26 January 1986, 2t of CO_2 were released in a fuelling machine operation. Again no off-site effects occurred. On 21 February 1986, 15t of CO_2 were inadvertently released into the atmosphere, when at Trawsfynydd power station a gas safety relief valve lifted prematurely.

A number of other minor incidents occurred in the year, but on all occasions the public were well informed. That the CEGB is presenting the facts surrounding these events more widely to the public than hitherto is indeed praiseworthy. It underlines the efforts being made to foster a greater public understanding.

On its fossil fuel operations, concern remains with the effects of the emissions of sulphur dioxide and nitrogen oxides. The report indicates the growth in SO_2 emissions since 1860 which reached a peak around 1970, when for a variety of reasons a sharp decrease occurred. Today, the total emissions are down to a level which existed at the start of this century.

It is expected that by the end of this century, the emissions will have declined rapidly as existing power stations are phased out and new generating capacity will be of very low emission potential.

Obviously a primary aim is to establish whether the reductions in emissions will cure acidification problems, but the report clearly shows the CEGB's concern for this detrimental effect upon the environment.

The CEGB again repeats its desire to have a clear undertaking with the public at large on all aspects of its business. Its public information activities are aimed at helping to bridge existing gaps particularly in the nuclear field.

The Board responded to the Parliamentary Select Committees which undertook the investigation of nuclear matters. One of these investigations on the environment published a comprehensive report on radioactive waste in March 1986.

The Select Committee's report highlighted the gap which was observed between the professional's perception of the problem and the anxieties expressed by representatives of the public. The report confirms the CEGB's concern about this gap.

The case for reprocessing is repeated again and supports the construction of THORP (Thermal Oxide Reprocessing Plant) at the Sellafield site.

The CEGB had also continued its support with the various international bodies on topics of mutual interest and its ties with Electricité de France have strengthened through the cross-channel link.

The first flow through the new 2000MW high voltage direct current link with EdF occurred on 16 January and commercial transfers up to 500MW began on the 24 March 1986 as an import to the CEGB's system. The agreement is for this import of power to continue for two years. It reflects the substantially lower cost of electricity in France.

Previous annual reports have referred to organisational changes and the 1985/86 report is no exception. Although this report gives a background to the changes, aimed it is said to streamline the Board's operations, it is very difficult for the outsider to see any positive advantages. This should be spelt out to the public (consumers) in a more straightforward way than is given in the report. The reduction in the number of power stations and the increased technology of the CEGB's business would have occurred inevitably, and so the new organisational framework adds nothing positive to that.

The fall in the number of its employees since 1958 from 52 774 to 47 798, while sales have doubled is termed in the report as 'Manpower productivity'.

Finally, the chairman in his report pays tribute to the hard work and professionalism of the staff, especially in ensuring continuity of supplies during times of severe weather. The report together with *Statistical year book* which is provided is a very comprehensive 'yardstick' to show the measure of efficiency which is continually sought. Few annual reports are able to match it with its great depth of detail.

F John L Bindon (Member)

Back on course

he Electricity Supply Industry (ESI) for England and 'ales can be more than proud of its achievement in)85/86 of recording a net profit of £414 M, this)llowing the disastrous 1984/85 year when it recorded £1700 M loss.

Sir Philip Jones, chairman of the Council, in presenting ie *Annual report and accounts* said that the ESI had :monstrated many times in recent years its resilience and)ility to meet challenges, however demanding.

During the past 12 months the Industry has been :covering from the effects of the miners' strike and :turning to profitable growth. Immediate priorities were) rebuild coal stocks at power stations and to return the 'stem to normal economic working as quickly as)ssible. These objectives were quickly and successfully :complished and the industry is back on course to meet ie financial targets and performance objectives as agreed ith the Government.

The Industry achieved an operating profit of £944 M. his represented a 2.65% return on net current cost ssests, against the 2.3% originally planned for the first :ar of the three year target for an average return of .75%.

The EFL (external financing limit) originally agreed for repayment of £1128 M took no account of the effects f the miners' strike on the industry. As a result of higher iterest charges levied because of the need for increased orrowing, the Industry actually made a repayment of 467 M.

The performance aim, as agreed by the Secretary of tate for Energy, was for a reduction in controllable costs 'uel, salaries, goods and services) per unit sold of 6.1% ı real terms between 1983/84 and 1987/88. The erformance target in 1984/85 was severely distorted by ie effects of the miners' strike. However, in non-fuel)sts, the reduction was 4.6% in 1985/86, a drive in the ght direction.

In comparison with the previous year, the electricity ıpply turnover increased by 7.9%, reflecting a 5.1% ıcrease in units sold and an average increase in income er unit of 2.8%. After making adjustments due to the ffects of the NUM dispute, fuel costs rose by 5.4% and :presented almost half the revenue expenditure of lectricity supply.

Of the Industry's total expenditure of £10 328 M, fuel)sts accounted for £4734 M. Total income from lectricity sales was £9905 M from a total income of 10 742 M.

The higher level of sales of electricity was an important ıctor in the Industry's improved performance. In 985/86 sales exceeded 213TWh passing the previous :cord of 1978/79 of 205TWh. Sales to industrial ustomers grew by 4.5% to an annual total of 8 685GWh, 36.9% of the total. In the commercial sector, ales were 7.2% higher than in the previous year, and omestic sales grew by 4.6%.

The increased marketing effort and encouragement of nergy efficient applications of electricity as an alternative or other fuels have been reflected in the sales figures for ach sector. The sales of electricity on the *Economy 7* ariff increased for the third year in succession, reflecting ie increasing awareness of the advantages of off-peak electricity at less than half the price of the standard domestic tariff. The Economy 7 tariff had the added benefit of improving the utilisation of the Industry's assets.

The sales of domestic appliances increased by £3.4 M to £32 M, a 9.9% return on net current cost assets. Profits on installation contracting increased by £2.1 M to £7.3 M, an increase of 12.4%.

Electricity prices were increased from 1 April 1985, the year under review, by an average of 4.2% for domestic customers and 3.8%, plus fuel cost adjustment charges for industrial customers.

On 1 April 1986, electricity prices were increased by an average of 4.7% for domestic customers and 3.7%, plus fuel cost adjustment charges, for industrial customers. These increases were made to recover anticipated costs in 1986/87, and thus allow the Industry to make adequate progress towards achievement of the three year financial target. In formulating these tariff prices, full account was taken of the better than expected financial performance over the past 12 months.

The new agreement concluded between the CEGB and British Coal offers immediate and long-term price advantages to all customers. The fall in oil prices early in 1986 enabled the CEGB and British Coal subsequently to agree these significantly lower prices for coal supplied to CEGB power stations. As a result, quarterly billed customers, mostly domestic, received a price reduction of 0.2p/unit after the 1 July 1986. This is equivalent to a reduction of about 3.5% on the domestic standard tariff and 9.5% on the Economy 7 night rate. Industrial customers received the benefit of the fuel price reduction automatically, through the fuel price adjustment clause in their tariffs.

The 1985/86 *Bulk supply* tariff (BST) did not incorporate any major structural change, except for some technical amendments on capacity charges. Load management arrangements continued to prove beneficial to large customers.

The increase in industrial electricity prices of 3.8% was in line with the average throughout the EEC. In fact, tariff prices paid by most industrial customers in England and Wales are generally lower than those for other industrial customers in EEC countries, except for France. Again, it has to be reiterated that the very high proportion of electricity generated by hydro-electric power and nuclear energy is the over-riding reason for this position.

Marketing activities in Energy Efficiency Year 1986 have reflected the Industry's objectives of encouraging customers to use cost-effective methods that make better use of resources, use energy more efficiently and improve productivity and environmental standards. These objectives recognise that electricity produced from coal and nuclear energy should be used increasingly, as oil and natural gas resources decline.

The Industry had sought to meet these objectives by identifying appropriate methods and market opportunities and by informing customers of the benefits of electricity.

The predominant activity in domestic energy marketing is to emphasise to customers the benefits of half-price electricity on the Economy 7 tariff. The report states that there are nearly 2M customers now on this tariff. Off-peak heating schemes associated with *Medallion, Civic*

shield and *Energy wise* award schemes are setting high standards in local authority and housing association homes in placing particular emphasis on energy efficiency.

On the industrial front, the report describes the PEP award scheme *(Power for efficiency and productivity)* which is about to enter its third year. The awards aim to encourage the more efficient use of energy in industry through the use of electrical technology and to stimulate the cost effective transfer of energy use to electricity. Of the 28 regional winners in 1985, a cost saving of about £2.4 M is now being achieved. In 1986/87 a new award for designers of commercial and public buildings is being introduced.

The Industry's corporate objective is to develop and maintain electricity supply to meet customers' needs on a continual basis as cheaply as possible. In this respect where prolonged outages occurred these were generally due to adverse weather conditions which made access for repairs impossible. In a year which saw abnormally low temperature conditions, particularly in February 1986, the performance indication of national average minutes 'lost' per customer per annum, shows only a marginal increase on the previous year. The average minutes lost per customer was 91.2 minutes against 76.9 in 1984/85.

The development of plant incorporating new technology continued in all fields of distribution equipment. Studies to develop more precisely methods of determining the climatic loading of overhead lines based on meteorological records are reported to be nearing completion.

The annual report mentions that damage to equipment is still being caused by vandals who, it appears, are oblivious to the danger even to themselves, other members of the public and to children. In July 1985, two children unfortunately died as a result of an accident in an electricity substation, the first deaths resulting from accidents in substations for 18 years. A working party, established to study such matters has recommended a series of security measures to prevent any re-occurrence.

The area boards continued in 1985/86 to promote policies for customer care designed to meet customers' needs. As a result, the report records that the latest results suggest that high levels of satisfaction with the service provided are continuing for customers.

The ESI is promoting a wide range of payment schemes to enable customers to spread out the cost of their electricity bills. Over one in 10 domestic customers are now taking advantage of such schemes. Every effort is being made (as for gas customers) to ease the burden of payment and to avoid having a disconnection of supply whenever possible, by offering special payment arrangements to those customers who face such difficulties.

Sir Philip Jones indicated the many contributions made to provide good relations with the public. Extensi discussions continued with the Electricity Consumer Council, especially in services for the elderly and disable

The Electricity Council has given its support f Industry Year 1986, and sponsored a travellir exhibition. It has a continual interest in the protection the environment and has provided grants for tw educational projects. Community activities have bee identified as requiring assistance by the area boards. Th *Understanding electricity* educational service is particular relevance to schools and the Council is active supporting a schools *Energy factor* project competitio

In line with its duty to develop and maintain an efficie co-ordinated and economical system of electricity suppl for all its customers the ESI's research and developmer seeks new and improved methods of generating, supplyin and using electricity, having proper regard for the car of the environment.

In 1985/86, the Industry's expenditure on these matter totalled £157 M, capital expenditure amounting to £10 M and revenue to £147 M. The research effort for generatio accounted for the main body of the money, the remainde being related to the transmission, distribution an utilisation of electricity including commercial, economi studies and environmental research.

The chairman, in his statement presenting the Council' annual report, mentioned the support given to Britis Electricity International (BEI) the overseas consultanc company for all UK electricity boards. Its turnover fo the year ended 31 march 1986 exceeded £16 M. Some 21 staff from a wide variety of disciplines undertook assignments in 18 countries. As part of its campaign t familiarise overseas utilities with British electrica engineering practice, procedures and standards, 44 students attended UK courses.

On 31 March 1986, the number of persons employed in the Industry in England and Wales was 131 466, a 1.7% reduction in the year. Although the Industry has contributed greatly to programmes of education and training including the Youth Training Scheme, it nevertheless is sad that the report indicates a 56% reduction in such involvements over the past five years.

In his conclusion, the chairman expressed the view that the year 1985/86 had by any standard been a highly successful one. Sir Philip Jones spoke very highly of the UK nuclear industry's splendid safety record. Chernobyl was a tragic accident and had understandably given rise to considerable public concern, but we should not get it out of perspective.

We must not in the ESI become complacent, adding that by unstinting efforts we must ensure that our 21 M customers are provided with the highest standards of service at the lowest possible cost.

F John L Bindon (Member)

South of Scotland Electricity Board

Annual report and accounts 1985/86

In a review of the SSEB's operations during 1985-86, the chairman, Donald Miller, announced a 54.9% increase in operating profit over the previous 12 months. This turned a deficit of £31 M into a surplus of £22 M on a turnover of £887 M. It gave an 11.7% net return on average net assets employed.

Interest charges ran to over £227 M and nearly £22 M was set aside for supplementary depreciation making some allowances for the effect of inflation cost of the Board's assets. The SSEB's total assets less current liabilities are placed at over £2500 M.

Mr Miller reported that the annual report was evidence that the SSEB had fully recovered from the effects of the year-long miners' strike which ended on 5 March, 1985. Coal stocks had been rebuilt quite rapidly and by September 1985 had regained their planned levels.

During 1985-86, the highest ever sales of electricity from the Board's power stations were achieved. A total of

.8TWh compared with 17.5TWh (1984/85) were the its sold at an average price of 4.537p. There were reases in sales in all sectors of the market; industrial es up by 6%, domestic sales increased by 9.3% and mmercial by 5.9% and the trend is continuing. Thus, eems there is little doubt that the buoyant sales reflect e great awareness of the competitiveness of electricity r a wide range of uses in industry, commercial and mestic sectors. In the latter, sales for home heating by *hite meter* tariff increased by over 50%.

The electricity output from the Board's 17 stations ich represent an installed capacity of 7940MW was 518 M units, although the total effective capacity was duced by placing into storage 1284MW of plant at the verkip oil-fired power station.

The SSEB generating capacity is such that it is able to rn considerably larger quantities of oil but its policy s been one of striking a balance between its customers d its security of coal supplies in the longer term. llowing the reduction in oil prices in early 1986, the EB have been able to effect agreements with British al which readily reflect the competitive edge between e two fuels.

During the year the Board purchased more than 7 Mt coal, including slurry, and nearly 600 000 t from private al mines. This enabled the Board's coal fired stations meet their operational requirements burning more than 25 Mt, the highest for four years.

The coal stocks were restored to normal before the start the 1985/86 winter and the Board gives full praise to e efforts in this direction made by the combined efforts the coal industry, British Rail and the road hauliers.

Although the oil fired station at Inverkip has resumed normal standby role after the miners' strike, it has again en demonstrating its ability since the 31 March 1986 by king advantage of the further fall in the price of oil. The sition at Inverkip and indeed at Peterhead (North of otland Hydro-Electric Board) has meant that further nefits have been secured in lower fuel prices for ectricity consumers.

This has allowed the SSEB to reduce electricity prices an average of about 3% on a current bi-monthly billing riod. If such savings can be maintained for a full year, en Scottish consumers will benefit in 1986-87 by prices sing to less than half the present rate of inflation, amely, less than 2%.

The SSEB is the biggest coal consumer in Scotland nd have been using their undoubted effective method of peration of their power stations to build up a steady xport of 'coal by wire' to the CEGB. Over 2000 M units ere exported to the CEGB system during the year presenting a 'coal' export of over a million tonnes. This, financial terms, gives £50 M for the net units exported.

The SSEB's system saw a maximum demand occurring 17.00 hours on 7 January 1986, the power stations' utput at the time recording 4536MW of which 1059MW ere being exported to the CEGB.

The supply of electricity in Scotland at the lowest ossible cost is heavily dependent on the continued ccessful performance of its nuclear power stations at lunterston. These stations provided 49.8% of the oard's system requirements and sent out well over 10 000 1 units.

Both Hunterston 'A' and the AGR at the 'B' station ntinued to operate without incident. Radiation levels ere 10% of the statutory limits and no person exceeded ne limit. Both the reactors at the 'A' station have mpleted their full depreciation life of 20 years operation. A safety review is being examined by the NII with the bjective of receiving a licence for continued operation Hunterston 'A'. This review is nearing completion. This station continues to maintain its reputation as one of the world's most reliable nuclear generating plants. Its output has been increased by raising the bulk outlet gas temperature 10°C to 370°C giving an additional 15MW. To achieve this the core restraint structure temperature has been restricted by removing 32 peripheral fuel channels.

Hunterston 'A' had a load factor for the year of 87.4% against 82.6% in the previous 12 months, a further illustration of this station's outstanding performance.

At the AGR station at Hunterston further improvements in performance have also been recorded. Its output has been raised to 1150MW from 1100MW. In 1985/86, the station generated over 8101 M units, a 4.5% increase over 1984/85. Its load factor was improved also at 80.7%.

With such high performances from its nuclear plant, the SSEB's premier coal fired stations at Longannet and Cockenzie faced the difficult task of meeting the variations in customer demand. In spite of this onerous operating regime, both had load factors well in excess of 80% and two sets at Longannet had a thermal efficiency of 34.69%, the highest ever achieved.

On the question of nuclear safety, radiological monitoring in the Hunterston area showed no adverse effects upon the environment. Discharges of radioactive liquid and gaseous effluents were within authorised levels.

Another factor which is contributing greatly to SSEB's electricity economics is improved irradiation times of its nuclear fuel. At present, a trial of fuel elements at the AGR at Hunterston is loaded with a target of 24 GWd/te and this fuel is yielding very satisfactory results. These new elements will form the type of fuel for the initial fuel change at Torness. In addition, much greater capacity and flexibility for handling irradiated fuel is being sought.

Scotland's new nuclear station being constructed at Torness near Dunbar is making excellent progress and construction is to the plans laid down six years ago. Commissioning of the first reactor is now well under way and it should be delivering electricity to the grid system by the Spring of 1987. The second reactor will follow 12 months later.

The progress is such that the 400kV and 132kV substations and transmission connections are all made. The main sea water cooling system, fresh water chemical treatment plants, auxiliary boilers, CO_2 plant and the eight diesel generating sets have all been commissioned. The 700MW turbine generator has also been run.

It is anticipated that the operational capacity of the station will be 1450MW, a 10% increase over the original 1320MW design capacity and a substantial enhancement of the economic value of the plant.

SSEB's assessment of the economics of coal fired stations compared with nuclear is: AGR: 1.99p/unit; PWR: 2.07p/unit; coal: 3.8p/unit. SSEB would need to buy coal at about 25% of the current price to break even on the above costs. The Board has no plans to reduce, however, its dependence on coal, its nuclear component already being around 50%.

The report indicates how very high standards of transmission and the distribution network have been maintained with a high level of continuity of supply for customers. This was achieved in the face of severe weather conditions both in the winter and during violent lightning storms in July 1985. The average period of disconnection for all customers was 83.4 minutes compared with 81.1 minutes in 1984/85.

In his report Mr Miller commented upon the degree of vandalism to the Board's equipment which is still causing

(continued on p 21)

Tidal power from the Severn*

The Severn Tidal Power Group

A detailed study which assesses the potential for harnessing the tidal power of the Severn Estuary to generate up to 6% of present electrical demand in England and Wales has been completed.

The schemes proposed have important long term regional implications for the development of industry, tourism, leisure activities and by the provision of a trunk road across the estuary linking into existing and future road networks in the South West and South Wales. The study, entitled *Tidal power from the Severn* was undertaken by the Severn Tidal Power Group (STPG). Its objectives were:

- ☐ to assess the commercial viability of a barrage, built and operated in the private sector
- ☐ to assess, with others, its environmental effects
- ☐ to obtain an assessment of regional planning implications, in liaison with local authorities and others
- ☐ to define what further work would be required prior to a construction decision, and how such work would be funded.

The study analyses two options:

- ☐ the further development of proposals for a barrage on the Cardiff to Weston line favoured by the Severn Barrage Committee, chaired by Sir Hermann Bondi and which reported in Energy Paper 46 in 1981;
- ☐ the development of a scheme based on a barrage adjacent to the English Stones, some eight kilometres downstream from the existing Severn Bridge.

Principal details of the two schemes are given in Table 1 and approximate alignments of the barrages are shown in Fig 1.

It is estimated that an average of 44 000 jobs would be directly created for six years during the construction of the Cardiff-Weston scheme resulting in at least a further 22 000 jobs not in the energy sector. Equivalent figures for English Stones would be 12 000 and 6000 respectively for four and a half years. During operation there would be direct employment of almost 2000 and 400 people on the schemes respectively but many more jobs would directly result from increases in tourism, the leisure sector and general industry within the region.

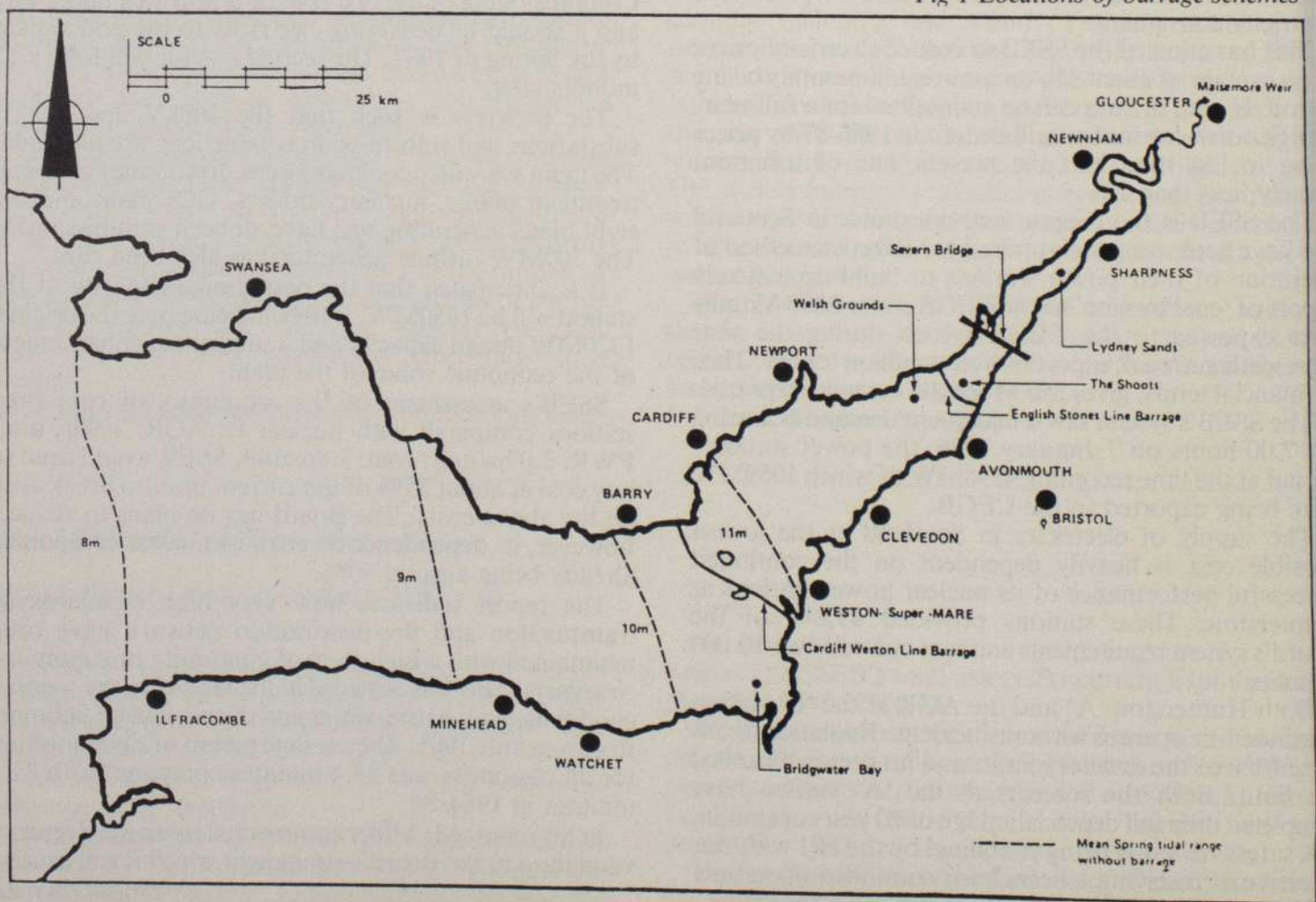
The STPG say that by the nature of the project, the benefits to the region, in terms of industry, housing and tourism would be greater than for any similar capital investment in thermal or nuclear power stations. Each option could accommodate, for example, a trunk road across the estuary which would link into the present and proposed major road network in the South West and South Wales.

During the study, STPG have maintained a dialogue with many interested and representative bodies including the Standing Conference of Severnside Local Authorities (SCOSLA), the relevant Water and Ports Authorities and

*The study has been financed jointly by STPG and the Department of Energy. Whilst much of the work was done in-house by members of STPG various consultants have been employed including W S Atkins and Partners, Binnie and Partners and Salford Civil Engineering.

A review of the study will appear in a forthcoming edition of *Energy World*. The study may be obtained from Thomas Telford Ltd, 1-7 Great George Street, London SW1P 3AA. Telephone 01 222 7722

Fig 1 Locations of barrage schemes



ıe English and Wales Tourist Boards together with the EGB.

There was a lot of consultation on environmental ıatters and in particular studies were done on fine diment transportation and aspects of ecology within the ıtuary. It is clear that generally there would be no long-rm sedimentation problem with a scheme using a arrage on the Cardiff Weston line but there is a potential roblem with the English Stones scheme which would eed a major study to evaluate.

It was recommended that a six year preconstruction rogramme will be necessary for either scheme to cover esign and planning requirements. Construction durations ould be seven years to first generation and nine years) full generation for the Cardiff Weston Scheme while the corresponding times for English Stones would be five and six years respectively.

The economics have been measured two ways. The first is the cost of generation, to compare it with other generation projects in the public sector; the second is internal rate of return (IRR), more important for financing from the private sector. Taking the first, at 5% discount rate, the cost of generation is 3.0p/kWh for the Cardiff-Weston scheme and 2.9p/kWh for the English Stones scheme, which compares well with the cost of generation from Sizewell B, as published most recently by CEGB (Table 2).

Internal rate of return for Cardiff-Weston is 7.4% and for Englsih Stones 7.7%. These are based on the middle of five economic scenarios originally presented by the CEGB for its Sizewell B case. Sensitivity studies were made to assess the variation of IRR over the full range of these scenarios and also using the CEGB's bulk supply tariff to value the output. The STPG believe, given the inherent risks and lead times, that these rates of return are too low for private sector financing without Government support. In comparing the figures for the two schemes it must be noted that there is a potential sedimentation problem with the English Stones scheme which could affect the economics of that scheme.

The IRR does not take into account many other benefits of the scheme to the nation. These include:

- ☐ Strategic diversity of energy sources which has always been public policy;
- ☐ A measure of insurance, with tides producing free energy, against unpredictable increases in primary energy costs;
- ☐ The generation of electricity by tidal power non-polluting to the environment;
- ☐ The hundred or more years of life of the barrage which is not given much credit by conventional economic appraisal;

In order to more fully develop the energy potential of the estuary and having regard to the potential siltation problem with the English Stones alignment, STPG favour the development of the Cardiff Weston alignment. It sees such a tidal barrage as a major national asset and therefore welcomes the Government's decision to proceed with the next phase of the necessary development and planning work.

Table 1 Principal details of the schemes

	Cardiff Weston	*English Stones*
Total length of barrage (km)	*16.3*	*7.1*
Installed capacity (MW)	*7200*	*972*
Type of turbine generator	*Bulb*	*Bulb*
Turbine generators (No)	*192*	*36*
Runner diameter (m)	*8.2*	*7.5*
Effective sluice area (m^2)	*21 600*	*5976*
Turbine generator caissons (No)	*48*	*12*
Turbine generators/caisson (No)	*4*	*3*
Plain caissons in lieu of embankment (No)	*50*	*2*
Annual energy sent out (average year) (TWh)	*14.4*	*2.8*
Capital costs (Jan 1984) (£M)	*5543*	*1150*

Table 2 Comparative generating costs (p/kWh) assuming 5% rate of return

	Cardiff Weston	English Stones
Tidal barrage	3.0	2.9*
Sizewell B PWR	2.9†	
New coal station	4.0	

*assumes no effect of siltation on economics
†CEGB (October 1985)

SSEB report and accounts continued)

erious concern. Damaged equipment costs in the year otalled £283 460 and some 55 000 consumers had their upplies interrupted by the actions of vandals. Quite apart rom the stupid and criminal nature of the actions of such eople, danger to life or serious injury could be created or innocent members of the public and particularly hildren, as well as the Board's own staff.

It also gave the chariman no pleasure to report, as had een anticipated last year, that the SSEB had experienced massive increase in the rates bill. An increase of nearly 5% had occurred to £34.6 M. Mr Miller stated that the Scottish electricity boards are now paying 16% of all the ates payable on industrial property and public utilities n Scotland and electricity costomers in Scotland are aying an average of £21 each in rates through their lectricity bill.

The report is a well presented document, the figures recise and clear. Performance indicators showing the esults over the last 10 years underline the progress made o endorse the policies of the Board towards an improved fficient and economic service for all its 1 654 759 ustomers.

John L Bindon (Member)

In November *Energy World:*

Energy monitoring and targeting by microcomputer

Paul K Martin
John T Sweeting

also:

Pt II: The Emstar Lecture

An energy efficient future: a strategy for the UK

John Chesshire

Engineers and lawyers Seek EEC recognition

Engineers and lawyers are seeking independent recognition for their professions in the European Community to give them greater control over standards of practice, reports the *Financial Times*.

The European federations of the national governing bodies of the two professions have agreed proposals which they hope will help them negotiate separate directives with the European Commission, rather than a general directive drafted by the Commission last year.

Such directives lay down the guidelines under which professionals can practise freely throughout the EEC.

Agreement to recognise the different professional qualifications in member states is one of the priorities in the internal market programme to lift national barriers on the free movement of goods and people within the EEC, which the UK Government is pushing during its presidency of the Community.

The Commission wants to speed up mutual recognition of professionals among member countries, which is why it has proposed a general directive. Negotiation of the separate professional directives — like those agreed recently for architects and general practitioners — has taken up to 15 years.

Engineers have been seeking a separate directive since 1969. The engineers' federation, keen to achieve mutual recognition in the belief that it will raise the status of engineers, hopes to use the 1969 proposal as a basis for negotiations. It will have to be substantially redrafted, however, to take account of changes in the profession since then.

Source: Financial Times

Consumer rights Gas council replaced

The Gas Consumers' Council, set up by the 1986 Gas Act, began life on Saturday 23 August, the Government's official appointed day. It will not only handle any complaints about British Gas or any other gas supplier, but will also champion consumers who have problems with gas cookers and other appliances as well as with the people who install them. This wide remit over all issues affecting gas consumers was the result of amendments to the Gas Bill in the House of Commons committee stage.

Unlike its predecessor, the National Gas Consumers' Council, the new Gas Consumers' Council does not have a remit over the price of gas supplied to homes. Tariff gas prices are governed by a formula in the Gas Act and this formula is operated by the Government's regulatory body for the gas industry, the Office of Gas Supply (Ofgas). Ofgas officially started on Monday 18 August.

The national Gas Consumers' Council and the 12 Regional Gas Consumers' Councils were abolished by the Gas Act on 23 August.

The new Gas Consumers' Council will maintain a strong presence in the regions. There will be regional complaints-handling offices operating mostly from the present addresses.

Source: Gas Consumers' Council

Japan and UK Joint gas venture

British Gas and Osaka Gas of Japan are to carry out a joint research programme for making substitute natural gas (SNG) from coal. The work is based on a new gasmaking process developed at the Midlands Research Station of British Gas at Solihull, West Midlands.

Initially, a three year experimental programme will be undertaken at a cost of over £9M.

Announcing the news at a research conference in Japan earlier this year Mr Gerald Clerehugh, director of research, British Gas, said, 'Laboratory studies at the Midlands Research Station have revealed a new generation of processes for making SNG by coal hydrogenation. By this method, methane — the main constituent of both natural gas and SNG — can be produced by rapidly gasifying powdered coal in hydrogen at high temperatures and pressures. This will enable us to handle the large and variable output of coal produced by modern mining techniques.'

'The next step', he explained, 'is to develop a new high pressure reactor which not only offers the prospect of lower gas costs but also provides an opportunity for co-producing valuable aromatic liquids, ranging from benzene to light tars'.

'To do this a pilot plant is being built that is capable of operating at 1000 psi and processing 100kg of coal feedstock an hour.

'The programme also includes using laboratory rigs in both Britain and Japan to build up information on a variety of coals under a wide range of operating conditions,' he added.

Source: Press release

Landfill gas UK's largest scheme

The UK's largest commercial-scale landfill gas collection scheme provided for at Stone, near Dartford*, has gone operational on schedule. The new plant has now been handed over as a going concern just 12 months after the contract was awarded.

The turnkey contract was secured against intense competition on a programme calling for fast completion. Eventually, the scheme should lead savings of over 30% on more tradition cement kiln fuels.

The £2 M project harnesses industri fuel gas produced in a large domest refuse site and transmits it to the wor three miles away. The gas is monitore for flow rate, temperature, pressur moisture content, methane and oxyge content. The whole system is ful automated and has been designed to me safety standards imposed by the Healt and Safety Executive and the Pipelin Inspectorate.

The plant will ultimately extract an transmit up to 7500 Nm^3/h of landfi gas, which represents a heating value c 10M therms a year, equivalent t approximately 38 000 t of coal. Initiall the plant is expected to supply 500 Nm^3/h of gas and production will b increased as more of the site become available for extraction and as th demand increases.

Landfill gas, or biogas as it i sometimes called, is generated by th bacterial decay of food and othe putrefying matters present in domesti refuse. It normally contains between 50% and 55% methane — the balance bein made up of carbon dioxide, nitrogen an oxygen. However, the quality of th methane produced depends upon the typ and quantity of refuse deposited as wel as factors such as temperature, moistur content, and the extent to which th refuse has been compacted.

Work started on reclaiming the 10 acre pit at Stone in 1976 and is due fo completion in 1988. Landfill at the sit consists of domestic refuse and othe waste materials. The amount of ga generated is expected to rise during th next four years and then stabilise until a least the end of the century.

The landfill gas is collected in well sunk to an average depth of 25m. It i then compressed and dried before being piped underground to the cement works.

It is thought that there are many landfill sites that could be profitably exploited to generate gas suitable for a wide range of industrial applications. In addition to the economic benefits, it has been shown that landfill gas collection eliminates any possible environmenta problems associated with gas migration to adjacent properties.

Source: Press release

Renewable energy 'A bright future'

Remote communities throughout Asia and the Pacific will benefit from improved renewable energy devices harnessing solar and wind power.

This was the assessment of alternative technology experts from 13 regional

*The scheme was provided for Blue Circle Industries by Babcock Woodall Duckham

ations who attended an international onference and training seminar held ecently in Australia.

Summarising the region's experiences n solar and wind power systems during ne last decade, conference organiser Mr ill Charters, the University of Melbourne, forecast a 'bright future' for enewable energy systems, which are ecoming competitive with fossil-fuel owered generators in remote areas.

From his recent study tours to five acific and five Indian Ocean countries, here conventional electricity generation ay be four to 10 times more expensive an in industrialised nations, Mr harters concluded that systems of wind nd solar devices could provide cheaper ower than conventional regional systems y the early 1990s.

Conference delegates had an unusual nsight into solar power's potential when ey inspected the first solar-powered car o cross the Australian continent from orth to south — a 3500km journey ompleted by teachers and students from Varragul Technical School in rural ictoria.

Delegates to the conference, which was rganised on behalf of the Commonwealth Science Council of London, were academics and technicians who have operated equipment in some of he world's most harsh environments.

Some of Mr Charters' conclusions:

- Some of the most advanced European systems were not 'tropicalised' adequately, and needed frequent maintenance to combat the salt-laden atmosphere of a Pacific atoll, or the heat and dust of inland India.
- World research in photovoltaic cells is going in two directions — towards sophisticated but expensive high-efficiency cells (where Australia leads the world), and towards cheaper but less effective cells which may be more relevant to regional needs.
- Manpower training at the technician level is critical.
- Stringent cost-benefit studies must weigh each country's economic and climatic conditions, and power requirements.
- Countries must move past superficial assumptions such as 'It's sunny in Africa — therefore, this technology will work there'. As an example of an apparent paradox, solar house heating is less viable in hot Australia than in cold Canada.
- The latest technologies are particularly promising. Solar cells are now mass-produced in many countries while the trend towards sealed battery systems has reduced maintenance problems. Australian-developed low-speed windmills can now operate in light breezes, from 2.5 m/s, making wind power available even in inland areas. Such windmills can generate more than 10 kW. Meanwhile, solar-powered electricity, currently sufficient to light village huts but not to drive high-voltage appliances, may soon run refrigerators for medical serums and vaccines. Solar-powered pumps are also now commercially available, there being three Australian manufacturers.

Mr Charters believes that developments in photovoltaic cell technology offer the possibility of decentralised power, thus helping countries avoid costly extensions to their conventional electricity grids. He estimates that by 2000 AD alternative technologies will be providing power to remote areas more cheaply than the lowest-priced conventional sources.

Source: Australian Information Service

Save energy... ...hide behind trees

A wind sheltered housing development will start at Milton Keynes early in 1987. The 51 home scheme for the Sutton Housing Trust at Shenley Lodge will be protected by specially planted shelter belts of trees.

It has been shown that wind sheltering can reduce energy bills for the householder. One research project at Milton Keynes concluded that an annual saving of about £27 a house could be achieved. A report by the Building Research Establishment has estimated that savings of at least 5% for wind sheltered developments could be made when compared to typical site layouts. When added to the savings generated by high levels of thermal insulation and a high efficiency heating system, the annual cost savings can be increased to over the 50% mark. The development, which is within the Milton Keynes Energy Park, consists of a mix of two and three bedroom family houses, and one and two persons flats for the elderly. A community building and a warden's house, linked to the flats by a speech alarm system, complete the scheme which provides the only fair housing to be let at fair rents in the Energy Park.

Shelter belts of trees are to be planted around the north, west and eastern boundaries of the site and across the site in an east-west direction. The trees, a mixture of evergreen and deciduous, will reach a mature height of about nine metres. Together with 'hit and miss' fencing along the southern boundary, the combined effect will be to filter and reduce wind speeds on the site, so modifying the local microclimate. As well as giving an energy saving it will provide more comfortable external spaces and local increases in temperature. These natural shelter belts will also have an obvious aesthetic value and will help reduce noise and air pollution.

Source: ECD Partnership

Solar power... ...on the farm

An experimental solar cell project in Ireland is being used to provide the power for milking a herd of about 100 dairy cows.

The installation, named the *Fotavoltaic project,* provides a 50kW photovoltaic array as an integral part of the roof of a new calving unit sited at Fota Island in County Cork.

The unit is unusual because the solar cells have been positioned on the south facing roof of this new calving unit. Most other photovoltaic installations rely on banks of solar cells, each about 1 or 2 m^2, arranged on the ground. By grouping all the cells together, the designers* say that they have created a 'free' roof for the calving unit and the battery stores underneath. The solution looks better, works well and has proven to be very cost effective.

The aim of the Fotavoltaic project, which is one of several such projects being funded by the EEC, is to gain experience at European latitudes and climates, of the effectiveness of medium sized photovoltaic power systems.

Powering a dairy farm was chosen as the Irish demonstration project because as well as dairy farming being an important Irish industry, the energy demand of most Irish dairy farms had the same seasonal variation as the available sunlight. In the Munster region 16 times more milk is produced in the summer than during the winter. Thus the total dairy industry (milking parlours, creameries, dried milk, butter, cheese factories, etc) had the correct seasonal variation. Consequently, accumulation of experience with a photovoltaic system applied to some aspect of this industry would be directly applicable to a realistic potential use of solar cells in Northern Europe, at a time in the future when their use would be economically justified.

The project was built with the financial support of the following organisations: Directorate-General for Science Research and Development of the EEC, MFT — Federal Republic of Germany, Electricity Supply Board, National Board for Science and Technology, Department of Industry and Energy, University College Cork.

Source: Press release

Health and Safety Latest report

The latest report on statistics of health and safety at work in 1983, with provisional statistics for 1984 was published in June by the Health and Safety Executive (HSE).†

It is the first statistical publication to be able to present four years of accident statistics collected under the Notification of Accidents and Dangerous Occurrences (NADO) Regulations 1980. The data are restricted to statistics of fatal and major injuries, and dangerous occurrences. With a four year run of figures, trends can begin to be observed in reported accidents.

The trends are not easy to interpret, since they may be affected by any increasing propensity to report as those

*Scott Tallon Walker

†*Health and Safety Statistics 1983,* price £7.50 is available from HMSO or booksellers.

with responsibilities to do so got used to the new requirements introduced in 1981. This is most likely to affect numbers of non-fatal major injuries in those categories where under-reporting was previously known to have occurred, for example in agriculture, construction and for injuries to non-employees including members of the public.

Subject to this, the reported figures show:

☐ The number of fatal injuries to employees in all sectors taken together has remained roughly constant, as has the injury rate.

☐ There has been a small but persistent increase in the number of reported deaths and major injuries, arising out of or in connection with work, to non-employees.

☐ The total number of reported major injuries (non-fatal) to employees has barely increased, but within the total, there are significant increases in major injuries both in numbers and rates to employees in important sectors of industry, *viz* agriculture, manufacturing and construction. Accidents to employees in manufacturing industry, in particular, are less likely to be affected by any increasing propensity to report; in the other two sectors this factor is likely to have been present.

☐ Decreases for some other industrial sectors.

☐ Accidents in mines and quarries declined very noticeably in 1984 as a direct result of the effects of the industrial action.

☐ There was an apparent decrease in reported dangerous occurrences.

The report also presents statistics on prosecutions and enforcement notices which have continued to be issued at roughly the same level over the period 1981 to 1984. Although, within the total there are year to year fluctuations in the numbers.

Also presented is the available information on occupational diseases. This suggests continuing downward trends for pneumoconiosis and byssinosis, with asbestosis remaining level and possibly increasing in 1982 and 1983. The number of death certificates mentioning mesothelioma continues to increase steadily, reflecting the increasing use of asbestos through the 1940s and 1950s and the long period elapsing between exposure and onset of the disease. The number of diseases notified under the Factories Act continue to decline but there is evidence of under-reporting.

The report is the first of a new but interim series which will cover the period from 1983 to April 1986, and presents statistics for 1983 adding where appropriate earlier statistics and provisional 1984 statistics. It contains sections on reported fatal and major injury statistics, occupational diseases, dangerous occurrences and enforcement, as well as studies on head injuries, injuries to construction workers categorised by occupation, and eye injuries. Statistics giving a general coverage of 'over three day accidents' have not been available since the industrial injury benefit scheme run by the Department of Health and Social Security effectively ended in April 1983, and subsequent reports will continue to produce updated versions of the necessarily incomplete data presently available under NADOR. New reporting regulation (RIDDOR) came into force on 1 April 1986.

Source: Health and Safety Executive

New database

More people die from occupational diseases than from accidents at work. Recent DHSS figures show almost 900 deaths a year from compensated occupational diseases. Estimates based on other sources of information suggest that many cases go unrecognised and unrecorded.

Almost all these deaths are the result of exposure to harmful substances in the workplace. The Health and Safety Executive (HSE) has announced a major step towards identifying the full extent of these exposures.

HSE has established a *National Exposure Database* (NEDB) to bring together its information on exposure to toxic substances gathered from a whole range of workplaces in the UK.

The computerised database has been developed over the past two years by HSE's Occupational Hygiene Consultant Group within the new Technology and Air Pollution Division.

Airborne sampling data plus additional detail concerning control measures gathered during visits to workplaces will be inputted by HSE specialist hygiene inspectors. The long term aim is to input similar data from industry so that NEDB becomes a national focal point for information on exposure.

The database will be used to improve the level and quality of exposure information available to bodies such as the Advisory Committee on Toxic Substances (ACTS) when setting standards. The information will also offer a more sound base for future epidemiological studies which link exposure to ill-health.

Source: Health and Safety Executive

Combustion research Spark spectroscopy

Several trace metals have been detected in coal particles using laser spark spectroscopy. Recent data collected by David Ottesen (Combustion Research Facility, California) show the presence of Na, K, Ca, Al, Mg, Si and Fe in individual coal particles. In this technique, single particles in a nitrogen flow are vaporised by a high power laser pulse, and the resulting atomic emission spectrum is analysed by a gated detector array. The measurements have been made in the ultraviolet and visible regions of the spectrum. In addition to these metallic species, copious amounts of carbon and the cyanogen radical, which is created by recombination when carbon-rich plasm are generated in a nitrogen atmosphe have been detected.

Line intensities for individual elemer in the plasma quickly reach a peak with one or two microseconds after the las pulse, and slowly decay over the ne several microseconds as the plasma coo Preliminary data for Fe, Mg, and indicate no statistically significant chan in relative line intensities from two to microseconds following the initial las pulse. This provides a convenie temporal region for the quantitati analysis of elemental composition.

Source: CRF News

Coal use in trains A new report

What is the feasibility of developing coal-fuelled locomotive to replace the us of oil? A year ago, Congress directed th US Department of Energy to assess th potential for reintroducing coal-fuelle locomotives in the US and to report bac its findings. That report, *Assessment o coal-fuelled locomotives,* was delivered i August.

The DOE's Morgantown Energ Technology Centre did the assessment i which some seven systems, bein developed by five locomotiv manufacturers, are described an characterised. Performance data strengths and weaknesses, and areas fo additional development were presente for each system.

The five basic engine types that wer considered for coal-fuelled locomotive include the reciprocating steam engine steam turbine, spark-ignited reciprocatin engine, diesel engine, and gas turbine The first two engines use coal to mak steam to drive the engine (indirect firing) the latter engines burn the coal or a coal derived gaseous or liquid fuel directly in the engine (direct firing).

The assessment suggests that viable coal-fuelled locomotive concepts exist fo both near-term (systems that could be commercialised in the next five years) and long-term (systems requiring additional R and D). However, the near-term systems are only marginally cost competitive a present projected oil prices.

The successful development and introduction of coal-fuelled locomotives could result in considerable displacement of oil by coal while providing fuel cost savings to railroads. (The US locomotive fleet consumes more than 3 bn gallons of diesel fuel annually). Fuel costs currently account for 75% of the costs to operate a locomotive. While exact fuel cost savings would depend on unknown fuel-oil prices, potential savings are great. A savings of approximately $21 bn would have been realised if the US locomotive fleet had been fuelled by coal from 1974 to 1984.

Development costs for coal-fuelled locomotives have been estimated from $12 to $50 M by developers, depending on the concept. For comparison, a current oil-fired diesel locomotive costs

pproximately $1.3M and uses approxi-ately $360 000 worth of fuel per year. is expected that, in spite of the current latively low prices for petroleum fuels, l prices will contunue to rise faster than al prices. The fuel cost savings sociated with the use of coal could gnificantly reduce the total life-cycle st of future locomotives.

There are major technical issues that ed to be resolved before coal-fuelled comotives are marketable, they are:

- For direct-fired systems, the choice is between improving the engines to withstand coal contaminants or removing them from the coal, both of which involve major technical problems and choices.
- Although features of current diesels are attractive, it is uncertain if major portions of current oil-fuelled diesels can be maintained. Locomotives require high power when starting, or on inclines, but often run at low power while stopped. Some proposed coal-fuelled systems can match these demands; others must be adapted to meet such demands while maintaining their efficiency.
- Another major uncertainty involves the packaging of a coal-fuelled power plant within acceptable size and weight limits for mobile application. Ideally, a coal-fuelled locomotive could fit within current size and weight constraints for locomotives without increasing the number of axles or requiring new track materials or construction techniques. Exceeding the packaging limitations might be technically possible, but would add higher costs.

ource: US Department of Energy

USSR
Coal production picking up

Coal production in the USSR is picking up again after a long decline, Soviet coal-mining minister Mikhail Shchadov told newsmen in an interview in connection with *Miners' Day*.

The planned output target for the first half of the year has been exceeded by more than 10 Mt of coal.

'Interest in coal in the Soviet Union is growing just like elsewhere in the world', Mr Shchadov said.

Its production in the USSR, currently accounting for one-fifth of worldwide coal production, reached 726 Mt last year and will keep rising to 785 Mt by 1990.

'The gains will be due to mine modernisation and a speedy development of coal fields in the east', the minister said.

The Soviet Union boasts more than 40% of the world's proven coal reserves, with the largest deposits found in Siberia, the Far East and the Asian part of the country where coal can be strip-mined.

In 1990, 46.7% of Soviet coal production will come from open pits.

But underground mines, accounting for the lion's share of Soviet coal production at present, will continue in the lead for long as they supply anthracite, hard coking coal which is a valuable product for industry.

Source: Novosti press agency

Explosives handling
New licence fees

Proposals to revise the fees for various explosives and petroleum licensing were outlined in a consultative letter by the Health and Safety Commission in August.

The fees concerned are for licences issued by the Health and Safety Executive for the manufacture, storage and importation of explosives, and licences issued by petroleum licensing authorities to keep petroleum-spirit, petroleum mixtures, calcium carbide and liquid methane.

Certain fees will be increased where they have become significantly out of line with costs, taking account of inflation since the last revision.

The biggest change in charges relates to licences to import or trans-ship explosives into Great Britain. The present basis of charging according to tonnage will be abolished. Under the new 'season ticket' procedure, the importer will be licensed instead of each consignment. A single flat-fee licence will be issued to an importer for any number of consignments of named explosives for a set period up to five years. The Commission believes this will reduce the costs to industry by many thousands of pounds each year.

The proposals would alter the legal basis for setting such fees to enable them in future to be included in a single statutory instrument, without formal consultation, covering all fees proposed by the Commission. The policy for a single statutory instrument began with certain fees in the *Health and Safety (Miscellaneous fees) regulations 1986.*

Source: Health and Safety Executive

Oil reservoir simulator
Now operational

Heriot-Watt University and Imperial College, London are now equipped with the latest release of a new generation reservoir simulator developed under a multi-million-pound R and D programme by the Department of Energy. The program, PORES, is to be used by senior students engaged in project work. PORES is a state-of-the-art extended black oil reservoir simulator.

Earlier this year, the program was loaded on the Imperial College VAX 8600 computer. The simulator is now operational. The program had also been loaded on the VAX 780 and MicroVAX II machines at Heriot Watt.

PORES harnesses a finite difference method to perform one, two or three dimensional simulations of oil and gas reservoirs. Development of the program, centred at the Harwell and Winfrith Research Establishments, was sponsored by the Department of Energy, Britoil and British Gas. It has been used extensively by the Department of Energy in the assessment of field development plans and close monitoring throughout field production life.

The program has also been found to be a valuable tool in a wide range of applications, from initial exploitation appraisals to depletion management. In addition, it has been used to good effect in many consultancy projects, including major reservoir studies.

Source: Press release

Brazil...
...faces electricity crisis

Brazil is facing a severe energy crisis that looks certain to force rationing on the country's industrial and agricultural heartland, the *Financial Times* reported in August.

Surging demand in Sao Paulo's booming industrial belt, combined with low hydro-electricity generation levels brought by droughts in the south, have combined to exacerbate already acute strains on the power network.

The region accounts for some 60% of total Brazilian demand on a national capacity of 41 560 MW.

After weeks of public warnings, Mr Mario Bhering, president of the state holding company, Electrobras, concluded last week that rationing was inevitable until November.

Electricity demand in Brazil has been running dangerously close to its maximum capacity for many years but the brake on the economy brought about by the foreign debt problems of 1982 delayed the long expected crisis.

This year, the consumer boom brought about by the February economic adjustment programme and the low water levels at key hydro-electricity plants are set to overload the system. To add to Electrobras's problems, the country's sole working nuclear power plant at Angra, about 150 km south of Rio de Janeiro, is out of action. The reactor, supplying about 5% of the southern region's demand, closed for temporary repairs and refuelling in January. But the Chernobyl disaster provoked a local judge to ban the reopening of the plant until a programme for emergency evacuation of the region has been drawn up.

As the growth in demand has surged, power technicians have been forced to bring on stream oil fired plants at an estimated annual cost of some Cz 3bn ($22M). Even this will not be enough to meet needs.

Scientists have complained that the Government has badly underestimated the growth in demand. A report in June showing likely growth of about 6.5% a year represents only half the real figure, they claim.

Source: Financial Times

Members' experience — your answers to that questionnaire

In the April issue of Energy World, we announced that Tony Galloway, a retired member, would be working part-time at Devonshire Street to help develop the register of members' experience and interests.

Here, he describes the results of the questionnaire, the design of the register, and the classification system which will be used initially.

In November of last year, a questionnaire was sent to all members inviting them to indicate their occupations, experience, and energy interests, for inclusion in the Institute's membership records. The purpose of the exercise was described in the May and June 1985 issues of *Energy World:* namely to provide the means by which members with specific knowledge or interests can be rapidly identified and contacted, either to seek their advice or to notify them of relevant activities.

An excellent response was achieved, indicating a high degree of interest among members. The purpose of this article is to describe the progress which has been made in analysing and classifying the replies, and to outline the plans for the future.

Occupation data

Most members had little difficulty in answering question 6, concerning their general field of occupation, by selecting from the 'occupation/interest' index provided. The main problem arose when a member was not involved in the supply or use of a specific fuel or fuels, coded numbers 1 to 7 in the index. However, most of such members appeared to be involved with equipment or plant associated with energy, and could be coded as number 8, *manufacture,* if this were retitled *plant and equipment.*

Table 1: Activity

Consultant
Research
Academic/teaching
Industrial training
Plant design/development
Plant operation
Manufacture/production
Contracting/servicing/maintenance
Energy management
Inspection/control
Fuel supply
Distribution
Marketing
Unemployed
Retired
Other (not elsewhere specified)

Code 6, *electric power generation,* was considered to be synonymous with *electricity* ie covering use as well as supply. An additional code, *other* was used to cater for the few areas where an energy product was not involved (eg water analysis or treatment, mathematics teaching, and so on). The final *product* list is shown in Table 2.

Table 2: Product

Solid fuels
Liquid fuels
Gaseous fuels
By-products related to fuels
Nuclear energy
Electricity
Alternative energy sources
Equipment/plant
Other (nes)

Similarly, most members were able to identify from the list provided the application in which they were involved. The large majority quoted several areas, although some confined themselves to mentioning only the most important. An additional code *manufacturing/construction* was added to accommodate those who did not quote a specific energy application, but who were evidently involved to some degree in the use of energy. The *other* classification was used for miscellaneous, mainly non-energy applications, eg general administration, computer modelling, etc. The final *application* list is shown in Table 3.

The greatest problems were encountered in classifying the answers to questions 4 and 5, which asked for details of the type of work that members were doing. Not surprisingly, a very wide variety of answers were given, and in a number of cases apparently similar jobs were described in totally different ways. Since only a limited number of classifications could be handled within the system, 15 of the most common activities reported were listed. Interpreting these liberally it was found possible to classify over 95% of responses with, it was believed, reasonable accuracy, using multiple entries when appropriate. For example, many respondents described themselves simply as consultants, but from other information given it was evident that their particular field of expertise was, for example, plant design or energy management. In other cases, the answers given to questions 4 and 5 led directly to identification with, or close approximation to, one or more of the short list of *activities* shown in Table 1.

All the responses to the questionnaire have now been classified, as far as possible, into three categories: *activity, product,* and *application.* Members' own descriptions were used wherever these could be identified within the final classification lists, and inferences were made only when necessary in order to achieve the nearest availab approximation. As a result, virtually members who replied to the questionnai have now been 'labelled' with three more characteristics which define th occupation and experience. Howeve people in similar jobs have sometim been described in different ways (becau of the principle of self-classification as f as possible), and possibly there are number of cases where the descriptio given had been misinterpreted.

It is evident, with hindsight, that would have been advantageous increase the number of options in ea classification list in order to be mo specific. For example, *exploration* a also *project engineering* could be added list 1, *instrumentation* and also *materia* to list 2, and safety and building servic to list 3. This can possibly be done in t future, within the limits of available da storage capacity, but for the present it proposed to consolidate and verify t data already coded within the system far defined.

Consequently, for the next survey, it hoped to send each member a print-o of the data entered in his or h membership record, and ask th significant errors or omissions notified.

Table 3: Application

Steam raising/boiler operation
Combustion
Engines/power generation
Process heating and incineration
Refractories/ceramics
Space heating and cooling/HVAC
Heat pumps
Environmental/pollution control
Fuel science and technology
Energy supplies/policy/economics/ forecasts
Energy efficiency/conservation/ recycling
Electric power and lighting applications
Manufacturing/construction
Other (nes)

Other data

Question 7 on the questionnaire ask members to state their other interests energy, and was intended to call for topi on which members would welcon further information or discussion. Agai a very large number of subjects we mentioned, and for classificatio purposes it was necessary to restrict t recorded data to those subjec mentioned most frequently. Table shows the list finally used, approximate in descending order of importance alternative energy sources/renewabl received about twice as many mentions

he next most popular topic, *conservation nd environmental.*

Members supported a wide variety of ther professional bodies, as evidenced by he replies to question 8. Recording was imited to the more popular ones relevant o the Institute's activities, and in the nain were those appearing on the Engineering Council's list of Nominated Bodies. Provision was made for up to hree entries, to cater for multiple membership, but it was not possible to record the grade of membership (which was often not stated).

Past or present membership of an Institute of Energy branch committee was recorded, present membership taking precedence over any previous service. Both past and present membership of Institute of Energy national committees were noted. In order to allow multiple membership to be accommodated only Council and the four principal standing committees could be recorded.

Many additional comments and suggestions were received in the space provided on the questionnaire form. A number of these referred to the limitations or interpretation of the questionnaire, which hopefully have been resolved by the procedures described above. Others made useful suggestions which helped to shape the final system. A few members, mainly from overseas, raised personal matters such as membership regrading or subscription levels, that were outside the scope of the present exercise. It has not been possible to deal with these individually, and it is suggested that any member who has urgent business, or who wishes to raise a personal matter, should write under separate cover to the secretary at Devonshire Street.

Table 4: Interests

Alternative energy sources/renewables
Energy efficiency, conservation, insulation
Environmental/pollution control
Heat transfer and recovery
Combustion systems
Steam raising/boilers
Waste/refuse derived fuels
Fuel science and technology
CHP/cogeneration
Energy policy, economics, forecasts
Energy management
Electric power
Nuclear energy
Computer control/instrumentation
Storage and handling

Future action

As mentioned above, it is proposed that the next stage should be to confirm that the appropriate data has been recorded for each member, and this will form the substance of the next survey at the end of this year. At the same time, once all the data has been entered into the computer, it will be possible to utilise the system to identify areas of interest or expertise within the membership. Such information will be invaluable to Council, Institute committees and headquarters staff to select from the membership those who, for example:

- ☐ Could provide informed comment or advice on specific energy matters;
- ☐ Could prepare specialist papers and articles of wide interest;
- ☐ Might be interested in joining Special Interest Groups;
- ☐ Might wish to participate in specific conferences and meetings;
- ☐ Could advise on education matters, act as referees, etc;
- ☐ Could act as a focus for recruitment activities etc;
- ☐ Are retired and might be willing to offer their services if requested by charities, local committees, and societies.

Additional applications will undoubtedly arise as the register is consolidated and extended as appropriate. However, the ultimate value will be very dependent upon the quality of information provided and the interest shown in its use. It is hoped to report future developments to members through the pages of *Energy World.*

K A Galloway
(Member)

Institute News continued on p 28

Engineering Council *Engineering Assembly 1986*

The 1986 meeting of the Engineering Assembly, held at University College Swansea on 15/16 July 1986, was opened by the Secretary of State for Wales the Right Honourable Nicholas Edwards MP, who delivered the keynote address.

The assembled engineers were then addressed by the director general of the Engineering Council, Dr Kenneth Miller, and the chairman, Sir Francis Tombs.

Luncheon, at which the speaker was the principal of University College Swansea, Prof B L Clarkson, was followed by a debate on young engineers, education and training and on industry. The day concluded with the Assembly dinner which was addressed by Sir Francis Tombs.

The morning session of day 2 was spent discussing regional affairs and communications and a debate on the register under the chairmanship of Sir Robert Telford, chairman of the Assembly Committee. The closing session (in private) included appointment of the Assembly Committee and the chairman's closing address.

The Assembly was well organised and the standard of debate noticeably higher than in the previous year.

Extracts from the keynote address of the Secretary of State for Wales and from the addresses of Dr Kenneth Miller and of Sir Francis Tombs are printed in the following pages.

Keynote address: the Secretary of State for Wales

This is the second meeting of the Engineering Assembly and the first to be held in Wales. Wales, and particularly the City of Swansea, is an appropriate place for a meeting of engineers. It was in South Wales that Richard Trevethick ran his first railway engine and the Swansea Valley was one of the first areas of concentrated metal smelting anywhere in the world. Engineers have played a great and central role in the development of the Welsh economy: in the development of the iron works, the coal mines and later the steelworks on which so much of the economy was built; in the construction of the lines of communication, the roads, railway, canals and docks; and in the creation of all services necessary for an industrial community. In one particular respect 1986 is an appropriate year for an Engineering Assembly in Wales, because it was in 1886 that the first goods train crossed beneath the Severn Estuary through the tunnel that is still a vital communications link. It is perhaps appropriate, therefore, that it should also be the year in which we expect to start work on what will be the largest submersed tube tunnel ever built in this country and the largest single road scheme yet undertaken in Britain: the crossing of the Conwy Estuary.

Today, engineers are playing a crucial part in the transformation of the Welsh economy — providing the infrastructure and the new lines of communication, developing the new industries, products and production lines, and assisting in substantial redevelopment such as, for example, the Maritime Zone of Swansea.

In this hall today there is no-one who can possibly doubt the importance of the engineer in the production of goods and services; the creation of wealth; and the construction of the infrastructure, without which modern society would be incapable of survival. And yet modern society — at least in this country — seems to undervalue your contribution. In a somewhat controversial speech to the Cardiff Business Club a year or two ago, I took as my text, some observations by the historian S G Checkland quoted by Martin Wiener in his book *English culture and the decline of the industrial spirit: 1850-1950.*

Wiener described 'a pattern of industrial behaviour suspicious of change, reluctant to innovate, energetic only in maintaining the *status quo'*, and sought to ascribe this to social attitudes based on a nostalgic longing for the rural ideal and generally comtemptuous of businessmen and engineers. Whether or not one agrees wholly with Wiener's analysis, it is a fact that engineers (and indeed businessmen and marketing men too) have had less status in this country than in some others; and perhaps they have been less eager to embrace technological change and entrepreneurial success. We live in a society that all too often undervalues the role and the work of industry and commerce and of the engineering profession. This is the reason for Industry Year 1986; and also a reason why a principal role of the Engineering Council is to stimulate awareness of the importance of the professional engineer. I am not, of course, speaking just of civil and structural engineering, but of every aspect of the profession including electrical and mechanical engineering. Mr Morita, chairman of Sony, in a television programme about Industry Year made the comment: 'inventing is easy: what matters is production technology'. I am not sure that inventing is easy, but it is certainly true that the Japanese are particularly good at production technology, and our shortcomings in this field have proved a major national handicap.

Here in Wales we are particularly successful in attracting inward investment which has helped us to raise standards, improved our own technology and competitive performance, provided jobs, and helped to check imports. However, far more important than our success in attracting inward investment is the manner in which existing industries adopt the new technologies and make full use of the vast opportunities they create. the sheer pace of technological change makes it difficult for many businesses to keep abreast of developments; and it is in order to help them that we established WINtech, an arm of the Wel Development Agency. WINtech's ma role is to act as a source of informati about technological advances, to ass firms to exploit them, and to act as stimulus and catalyst for technologic change.

We have also been seeking encourage many more effective lin between industry, the universities, and t providers of capital — the triangul linkage which had played such a cruci role in the industrial development of t most successful parts of the Unite States. Early in my time as Secretary State I visited the Greater Boston are and California to see what we could lea from the American experience. In t older industrial parts of Britain it particularly vital that we follow that pat and I am glad to say that we have ha some success. The Venture Capit market has been developing rapidly an taking a growing interest in what is goin on here in Wales, and the universit colleges have been playing an active ro in re-establishing their links with industr I say re-establishing because a universit college like Swansea has always had very close relationship with industry.

However, Swansea has had to adapt t the fact that the major industries of th area are no longer those of metallurg and it is energetically seeking to ensur that it is as well equipped to assis developments in electronics, i biotechnology, in solar energy, and in a the other industrial activities that hav now overtaken coal and steel as the mai providers of jobs. In my talks with th chairman of the University Grant Committee I have stressed the importanc of seeing that resources for research ar not distributed just on the basis of past o existing excellence; but actively encourag these new developments. As part of th general process that I have beer describing, here on the campus a Swansea the Welsh Development Agency has been working with the universit college in establishing an innovatio centre.

Swansea is also one of the colleges tha has benefited from the combined effort of Government and of your Council t encourage new initiatives in educatio and training under the so-called 'switch programme' through which the Government is providing £43 M ove three years to support about 4000 extra places for engineering and technology students at universities and polytechnics.

Another initiative is the *opening windows in engineering* scheme designed to train suitable young practising engineers to visit schools and talk to 13-14 year olds about their work. The task of persuading young people at school to follow mathematics and science-based courses is of central importance, and perhaps I can illustrate the point with the story of one high technology company with an extremely successful record of innovation and of export success: Renishaw make three-dimensional probes in their main research laboratories in Gloucestershire and a major new manufacturing facility in Cwmbran,

outh Wales. When they first went to Gloucestershire only a very small ercentage of the children from the local chools were taking A-level mathematics. The company's presence in the area has ransformed the situation and they have een vigorous in encouraging a proper pproach by the local schools and in ponsoring a considerable number of oung graduates. They have shown what an be achieved by just a single company n transforming the performance of the ducation system in a particular locality nd in establishing the right kind of links etween industry and the education ystem.

Renishaw is also a good example of the way in which a determined programme of nnovation in a specialist field can enable quite small company to obtain a dominant position in world markets. When I was in Japan in March I was encouraged to find the hold this company had on the Japanese machine tool market. During a visit to Mid Wales three weeks ago, I came across another small company carving out a niche for itself in the field of drive controls for electric motors, again by keeping one step ahead in the development of new technology. The examples one comes across are striking and varied: in Wales at the heavy end I could point to the aluminium industry, to BSC, and to British Coal — all examples of industries where the vigorous introduction of new techniques is transforming productivity and performance. It was also good to see, at recent opening ceremonies at Shotton and Port Talbot, that over 90% of the equipment being installed in these huge capital projects was made in Britain.

Almost at the other end of the scale I have, in the course of the last year, visited two companies producing very basic products: one, office furniture and the other engaged in wire drawing, both of which have entirely transformed their competitive position by investing in the latest equipment. The office furniture company began after World War II with most of its designs coming straight from the back of an envelope; today it uses the latest CADCAM techniques and has one of the most up-to-date paint shops in Britain. The wire drawing company illustrates how a very old and simple process can be transformed by the addition of a computer control system.

Or to give us two other examples: Laura Ashley manage a world wide business with a turnover of £130 M from their headquarters in the heart of Mid Wales by using the latest communication systems; and the Chemical Bank operate their European back room from Cardiff again using the latest communication systems and information technology. I am glad to say that even in Government we are not entirely failing in this essential task of adapting to the new world. My Department has recently installed an audio-visual conferencing facility, which means that large numbers of civil servants no longer have to spend their time travelling up and down from Cardiff to London in order to hold meetings with Ministers.

All this is good; but the challenge we face is immense. On the one hand there is the failure to match our competitors in production technology and indeed in marketing. It is a striking fact that all the Japanese companies making television and audio equipment that have established themselves in Wales in the last dozen years are already completely replacing their original production lines, which have in just a short time become outdated; British companies must not imagine that because they have put in one lot of new equipment, it will enable them to keep ahead for more than a relatively short period — the process has to be continuous. Surely, too, we must make a more determined effort to exploit successfully our brilliant inventive talents. Here in Wales we are anxiously watching to see whether Inmos — now part of Thorn EMI — can throw off the problems of the past year or two and successfully exploit the apparently brilliant potential of the transputor.

If we are to achieve this kind of industrial progress, there has to be a change in approach and social attitudes. This is where your Council has a leading role to play. There has already been a substantial change in attitudes. Here in Wales I am certain that more and more young people recognise that their future lies not in the traditional occupations, but in the mass of the new industries and service providers which offer great opportunities. One of the most striking features of the events of the last few years is the manner in which the labour force has adapted to the demands of these new industries. You only have to go around an ITECH to recognise that even those who apparently are not destined for academic success are capable of mastering skills that many of my generation find daunting. Here in the Principality, in addition to the change in attitudes, we have also seen a change in image, and a dramatic transformation of the environment; all are important. If people go around gloomily proclaiming that little can be done because old industries are in decline, they can blight the prospects for change and recovery. Our success in attracting round about 20% of the new inward investment to the UK for three consecutive years shows that the pessimists are wrong. The kind of transformation achieved in Massachusetts is possible here in Britain. The dereliction of the past is being swept away; you only have to look at the Lower Swansea Valley, once one of the most blighted industrial areas in the whole of Britain, to see what can be achieved.

Through a new Valleys Initiative, we are seeking to transform the environment in which people live and work in our industrial valleys. We have bold schemes for urban renewal in Swansea and in Cardiff. The proposal to build a barrage across Cardiff Bay (a project quite separate from the proposed Severn Barrage) has triggered off a vastly encouraging response. If you can create an area where there is a grouping of technological skills; where there are effective links between industry and universities and schools; and where people want to come because it is an agreeable place in which to live and work and play, one is likely to generate the inventiveness and dynamism which are needed if we wish to create the kind of country we would all like to see.

David Davies, born in 1818 in Cardigan and starting life as a saw miller, built many of the railways, roads, canals, mines and docks which laid the foundation of the 19th century economic explosion here in Wales. The record shows that he did it largely by instinct and natural brilliance, working almost literally from the back of an envelope. They were very remarkable men, those early engineers. We still use the transport systems built by Brunel and Telford. Their natural genius created structures able to carry far greater loads and volumes than they had ever envisaged. For the modern engineer the opportunities are just as great, though the tools may be CADCAM and computers. The challenge for your Council and for the whole of Britain is to make sure that we do not neglect the opportunities but match the astonishing performance of that earlier generation.

Address: Dr Kenneth Miller Director general, Engineering Council

I would like to give you an account of some of the activities of the Engineering Council since we met in Birmingham last September.

2nd list

One result of these many activities was the announcement at the end of November, of the 2nd list of Nominated Bodies. This was the list based on the criteria set by the Council, and in announcing it the Council was grateful for the thorough job done by the Nominations Committee and the assistance so readily given by the professional engineering institutions. The Nominations Committee consists of a group of senior men and women in the profession. The outcome of their deliberations is that 45 institutions have so far been nominated, 44 from the original list of 51 and one new institution, the British Computer Society.

SARTOR

The five Executive Group Committees and the Board for Engineers' Registration continue to do sterling work. They have recently agreed the codes of practice for accreditation of academic courses, and in particular an arrangement whereby there will only be one visit to each academic institution for the accreditation of a particular course. This will of course require the establishment of well-balanced accreditation teams with the inclusion of representatives from the interested engineering institutions. I believe this will be a major step towards achieving the broader based courses which our Industrial Affiliates are pressing for.

Schools

We are also looking towards influencing the school curriculum as well and late last year we published, in conjunction with the Standing Conference on Schools' Science and Technology, *Problem solving in the primary schools*. This initiative is aimed at ensuring that primary school-teachers bring home to youngsters the excitement and challenge of engineering, even at this early stage, by the stimulation of teamwork, new ideas, design and make, motivation and perseverance.

Technician Engineers/Engineering Technicians

We are now focusing attention on matters of particular interest to Technician Engineers and Engineering Technicians. We have established an Advisory Committee and consideration has been given as a matter of priority, to the identification of a more suitable title for Technician Engineers. I would have liked to have been able to report substantial progress, but support for various alternative proposals has proved to be so evenly balanced that no favoured alternative has so far emerged. The confusion to the lay public between Technician Engineer and Engineering Technician is so great, that I believe we must continue to search for an acceptable alternative to the Technician Engineer title. It is, I believe, important that the Council not only gives a high priority to Technician Engineers' and Engineering Technicians' affairs, but that it should also be seen to be doing so. We shall therefore be undertaking a recruitment campaign in the autumn to increase numbers of both these sections of the register.

Industrial Affiliates

The last year has seen the steady growth in the number of companies and organisations who have become Industrial Affiliates and as a result support us financially. When the Assembly met last September we had 91 Affiliates: the current total is 152 and we are continuing to recruit.

We look to the Affiliates for advice in identifying the requirements of industry for engineers and technicians, to assist in formulating policies for their education and training in the future and to assist in making engineering careers attractive to young people. The Engineering Council over the last twelve months has become increasingly active in the careers area in an effort to provide a clear focus on careers information and guidance. We are now closely linked with the organisation and running of the Engineering Careers Co-ordinating Organisation and we are in the process of establishing a comprehensive programme of activities.

There is no doubt that the backing and support from our Affiliates is greatly strengthening the influence we can have not just on Government, but also on the education system as a whole. This showed through clearly when the Prime Minister chaired a recent meeting with top industrialists to determine what they were doing to match the Government's higher Education Engineering and Technology programme. It was not just by chance that our chairman, Sir Francis Tombs, found himself leading for the industrialists, most of whose companies were Industrial Affiliates.

Industry

Three years ago the Engineering Council produced two booklets: *Appraising the technical and commercial aspects of a manufacturing company* and *Technical reviews for manufacturing process and construction companies*. As we reported last year, the demand for these two booklets which are helping to improve the City's and industrial companies' technological awareness has been most encouraging. I am pleased to report that we now have funding from the Department of Trade and Industry to carry out a Technical Review Demonstrator project and we hope in due course to have some good case studies to which we will give widespread publicity.

Career break

Another area to which we have drawn industry's attention is the career break which represented an important follow-up to Women into Science and Engineering (WISE), which we sponsored jointly with the Equal Opportunities Commission. The growing number of young women entering the profession means that we now have a bow-wave of young women approaching the preferred child-bearing age. We are persuading companies that it is in their own enlightened self-interest to develop appropriate career break schemes. This should ensure that industry does not lose invaluable engineering talent and does not effectively waste the money they will have invested in training individuals. We began this process last December with the publication of a Report on the Career Break, particularly as it affects women.

Regions

I come now to the area which I know is of great interest to all of you, and that is the development of the Regions. The Council has stated publicly that this is a key growth area for the future and we expect to appoint a Regional Executive within the next few weeks.

As you know we have set up a Regional Organisation Co-ordinating Committee under the chairmanship of Sir Robert Telford, whereby the chairmen of the Regional Committees together with Council members and staff will meet at regular intervals to discuss Council policy.

One of our key activities later this year will be the expansion of the *opening windows on engineering* scheme. This scheme has been in operation on a fairly modest scale for several years now, but only covers about 4% of the secondary schools. We are setting the ambitious target of reaching 80% of those schools within the next five years. One of the keys to the success of the scheme is that it is young engineers who go back into the schools to talk about their jobs and t challenge and excitement of engineerir This national launch will only successful with the co-operation of t younger engineers and I am delighted see so many of you here today as gues We are encouraging all the Regions involve young engineers in Regior activities and both I and the chairm look forward to the Assembly's openi debating session on young enginee when we hope the invited young engine will feel free to participate.

Communications

Many of our awareness activities recent have been directed to improving t understanding of the public as to t importance of engineering to the creatic of wealth and the essential corollary the importance of good engineers ar technicians to achieve this. We ha therefore strongly supported Indust Year 1986, and we have been pleased take an active part. We organise t Engineering Working Group of t Industry Year Executive, and we instrumental in producing the Industr Year pamphlet *Take action fo engineering*. This pamphlet identifie areas of action for individual engineer engineering companies and engineerir institutions. We have recently followe up one specific potential course of actio for individual engineers when we issue our pamphlet *On becoming a scho governor*. This greater involvement c industry in school activities is very muc in line with the recent call by the Secretar of State for Education and Science.

We continue to take every opportunit of making our case known to the medi and I believe we have had considerabl success in getting our message ove nationally. We have succeeded in drawin editorial comment on our press release on such subjects as *Take action fo engineering*, to which I have just referrec our response to the Government's gree paper on Higher Education in the 1990s the shortage of mathematics and physic teachers and the Review of Vocationa Qualifications. We have also succeeded i getting several articles placed in th leading newspapers. We were particularl pleased that the Daily Telegraph decide to run a series of weekly articles or 'Engineering'.

The image of the engineering profession is certainly improving and a minor indication of this is, I believe, the recent change in the passport applicatior form, which now refers to doctors, engineers, lawyers as examples of a 'person of standing', now recognised to countersign application forms. Small as this may seem, it nevertheless represents a significant change in the public's perception, and I am pleased to say that this was actuated as a result of the Engineering Council lobbying the Home Office.

I cannot but contrast the frequency with which engineering is now referred to in the media, compared with four years ago. Nonetheless there is still much to be done and it is equally important that we make an impact regionally; here I am

elighted to hear how enthusiastically the egional PROs are tackling their hallenging tasks.

It is equally important that we develop ur communications both between the ouncil and the Regions and direct to the egistrants. We shall be having a debate n the subject of Communications, and look forward to it. We now publish a lewsletter every six months, and the ost recent one of last April was xtended to 6 pages in order to include wo pages on Regional news. This will emain as a regular feature in future lewsletters.

Finance

inally I would like to mention the matter f finance. Our grant-in-aid from the overnment came to an end in mid-1985. his funding was, of course, pump riming and the Government did not ithdraw its support, as has been eported in some circles. This, together ith the selection of Council members rom the Council's List and Schedule, epresented the Council's establishment f independence from Government. We ow derive our income from the ndividual engineers on our Register, rom our Industrial Affiliates, from the urplus income generated from our ncreasingly popular examinations, and rom the contracts we have to run several chemes, such as the 'Young Engineer for Britain' and the 'Prince of Wales Award for Industrial Innovation and Production'.

With the increase in the fees and in the number of Affiliates, I believe we are now reaching a stable financial position. We can now operate in selected areas on a scale to make the impact which we believe is essential in order to achieve the objectives we have set ourselves both nationally and regionally.

We are grateful for the continuing support we are getting from the professional engineering institutions and for the growing support from our Industrial Affiliates. We believe we are making some impact on the education and training of engineers and technicians. The extent of the coverage in the press and the frequency with which engineering has become linked in the public mind with the creation of wealth is an encouraging sign of the changes that are slowly taking place in the public's awareness of the Engineering Council's contribution.

Address: Sir Francis Tombs Chairman, Engineering Council

We have gathered at this second Assembly to concentrate our discussions rather more than we were able to do last year, and I hope that this will permit a more purposeful debate.

Shortage of science teachers

A number of major issues will face us in spite of the successes of recent years. We have not, as yet, succeeded in achieving the number of undergraduate places in engineering which are needed if the UK is to compete with its old and new industrial competitors. Mainly this is caused by the Government not providing the necessary funding for universities and polytechnics, but there is a much more serious long-term problem in the number of properly qualified people applying for engineering places in universities and polytechnics. This is because the number of mathematics and physics teachers in schools is falling at an alarming rate, and we have been engaged in widespread discussions with the Prime Minister, the Secretary of State for Education and Science and others, on how to tackle this. Our publication *The shortage of mathematics and physics teachers* issued in May 1986 summarises those discussions and proposes a series of actions which are necessary; each of these will contribute towards the solution. The situation is approaching crisis proportions and requires urgent action.

The attitudes of schoolteachers, pupils and parents are also crucial and although there are many encouraging signs and initiatives, we must rely on individual engineers to carry the message into schools, and encourage individual companies to set up useful twinning with local schools to provide work experience for pupils and teachers alike. We shall be encouraging this through ECROS during the coming months.

Some signs are emerging of a willingness of Higher Education to move resources towards engineering, but positive action will be required, in view of the limited funding necessary, to concentrate into fewer Departments in order to use expensive laboratory equipment and scarce staff more effectively.

I do not believe that changes of this kind, unwelcome as they must be to individual institutions, can be achieved without earmarking Government funds for that purpose. This is a course which will be opposed by institutions and Government but which we would have to press vigorously, albeit for a limited period of perhaps five years, to achieve the desired change.

We shall also use our accreditation procedures to achieve these ends, and I have been encouraged by the constructive approach of vice-chancellors and directors of polytechnics in recent discussions.

Industrial Affiliates

The influence of industry on education is of tremendous importance and I welcome the support we have received from our Industrial Affiliates. Industry has much to contribute in the provision of training places, in the provision of visiting lecturers, by gifts of equipment and by providing consultancy and other work for lecturers. That these activities are being developed so vigorously is due, in part, to the efforts of the Engineering Council, but also to a growing awareness of the national need.

I cannot refer to our Industrial Affiliates without mentioning their substantial financial contribution of almost £500 000 per annum to Engineering Council activities. We are grateful for this and for their valuable advice and support, and in particular for their attendance at three meetings to discuss matters of mutual interest. Two of these dealt with continuing education and training and our requirements and problems in schools. These meetings are proving a most valuable source of linkage between Council policy and industrial practice.

Continuing education and training is of major importance, and I hope that all of you have read our recent publication *A call for action,* which has received widespread support from Government, education establishments and industry. This message has to be sold by Regional representatives to companies on a direct basis. Additionally I am grateful for the support of the engineering institutions who have, I believe, a crucial and growing role to play in the provision of appropriate courses and in devising means for their recognition.

We have recently published, in conjunction with the Design Council, a booklet entitled *Managing design for competitive advantage,* which seeks to describe to companies the advantages to be obtained from integrating design at all stages in their activities.

Industry's response to the Government's investment of a further £43 million in engineering places at universities and polytechnics was highly encouraging and led to further discussions at a meeting chaired by the Prime Minister on the need for additional initiatives in production engineering, manufacturing technology, mechanical engineering and heavy power electrical engineering. A Joint Working Party has been set up between the Department of Education and Science and the Engineering Council to consider an early initiative in production engineering for which a need is widely acknowledged and heavily supported by our Industrial Affiliates. Discussions are taking place too on the construction of broader based courses for which industry has indicated a need.

Education

Education continues to occupy much of the Council's time and we welcome the many initiatives which are taking place and the many signs of progress and awareness emerging from education institutions. As I mentioned earlier, the shortage of mathematics and physics teachers is of crucial importance to the future of engineering education, and the Department of Education and Science is continuing consultations on ways of addressing this problem.

Some of you will have read in the press of our sharp reaction to the proposed review of vocational qualifications. This concerns a proposed new body intended to harmonise and consolidate vocational training qualifications, and is very welcome at the lower levels of qualification, perhaps up to level two, but unwelcome where adequate means of accrediting of such qualifications already exist as, for example, in medicine, law

Engineering Council (continued)

and engineering. In these areas the activities of an overlaid body could only result in bureaucracy and extra expense. As a result of having failed to make our point adequately during the work of the Committee conducting the Inquiry, we reacted strongly and unfavourably — both in discussions with the Government and, subsequently, in the press. Our action received support from other professional bodies and, as a result, action in these areas is likely to be restrained. The Council will now consult with the engineering institutions on the contribution of the new body in relation to levels 3 & 4.

A major success during the year was the acceptance by FEANI of the qualification of Chartered Engineer as a standard for European Registration. This success owes much to the work of the British National Committee and is a welcome underwriting of the work of the CEI, and, subsequently, the Enginering Council, over the past years. Two of our Council members, Jim Stevenson and George Adler, are members of the British National Committee and are to be congratulated on their persistent and persuasive work.

The Engineering Council has now settled down to a steady workload of accreditation of education and training on the one hand, and influencing Government and other bodies on the other. Our voice is increasingly heard and respected, and for that we owe a great debt of 'gratitude to the chairmen of the Council's Standing Committees, to the other members of Council that take part, to the many advisers who help us and to our permanent staff whose dedication has contributed to the success.

Standing of engineers

The standing of engineers in this country is now greatly increased — although much progress has yet to be made, notably in terms of financial reward. The shortage of engineers, combined with growing demand of industry for engineers, will ensure that this development takes place.

The director general, Dr Kenneth Miller, has been very active in the press and on radio in promoting the cause of engineering and there is no doubt that this has contributed greatly to an increased public awarenesss.

At national level, therefore, we have much to be proud of. But much work remains to be done at Regional level, and I am grateful for the involvement of Sir Robert Telford, not only as chairman of the Regional organisations but also as chairman of the Organising Committee for this Assembly.

Institute of Energy
1986 November meetings

Scottish

4 Nov (Tu). Economic and technical aspects of low temperature heat recovery on industrial boilers and process plant, by Mr Dickson and Mr Nicol (James Howden). Royal Scottish Automobile Club, Blythswood Square, Glasgow at 1830 h (tea/coffee and sandwiches at 1800 h).

North-Western/Merseyside sub-branch

5 Nov (W). The role of the electrical supply industry in innovation in industrial energy utilisation, by Dr A T Churchman (research director, Electricity Council Research Laboratories, Capenhurst). MANWEB HQ, Chester at 1830 for 1900 h. Joint meeting with other institutions.

North-Eastern

5 Nov (W). Dinorwig pump storage scheme by R H Pope (CEGB, Generation Development and Construction Div, Barnwood). Cleveland Scientific Institute, Corporation Road, Middlesbrough at 1830 h (refreshments available from 1730 h). Joint meeting with IEE and CIBSE.

Midland

6 Nov (Th). Energy efficiency in the paper industry, by B C Bateman. University of Aston in Birmingham, Senior Common Room at 1900 h.

Midland

7 Nov (F). Annual dinner dance. The Belfry Hotel, Wishaw.

Yorkshire

7 Nov (F). Annual dinner. The Ardsley Moat House, Ardsley, Barnsley at 1915 for 1945 h.

East Midlands

11 Nov (Tu). Afternoon meeting. Visit to British Sugar, Newark for presentation by British Sugar on the company's CHP policy. Followed by works tour (refreshments after meeting). Joint meeting with CHPA.

North-Eastern

12 Nov (W). Seminar/demonstration: *Enhanced access service to training for energy management in buildings using customised computer software and microcomputers.* Dept of Construction and Building Services, Charles Trevelyan Bldg, College of Arts and Technology, Maple Terrace, Newcastle upon Tyne at 1400 h. Joint meeting with Tyneside Energy Managers Group. For details contact Mr. Maycock, Newcastle upon Tyne College of Arts and Technology (tel 091 2738866).

South Coast

12 Nov (W). Current trends in heat pump design and application. Speakers: Dr M E Horsley (Portsmouth Polytechnic) and representatives from Southern Electricity and British Gas. Prof J Swithenbank (president, Institute of Energy) will chair this discussion session and give a short introduction. Crest Hotel, Southsea, Hants from 1500-1700 h.

National/Yorkshire

19 Nov (W). Conference: *Fuel additives — the alleviation of deposits, corrosion and particulate emissions from industrial and hospital plants.* AHED House, Osse at 0930 h.

North-Western/Merseyside sub-branch

19 Nov (W). One-day seminar: *Energy education initiative.* 30 selectively invite delegates. Crest Hotel, Runcorn.

East Midlands

25 Nov (Tu). Afternoon meetin Decentralisation of process steai systems, by D Davies (Nordsea Ga Technology). British Gas EM Trainir Centre, Long Eaton, Derbyshir (refreshments after meeting). Joir meeting with Derby Energy Manage Group.

Merseyside sub-branch

26 Nov (W). The present state of fluidise bed technology, by Dr J Topper (Britis Coal). Feathers Hotel, Mount Pleasan Liverpool 3 at 1800 for 1830 h.

North-Western

27 Nov (Th). The disposal of radioactiv waste, by a speaker from NIREX University of Salford at 1500 for 1530 (refreshments after meeting).

Northern Ireland

27 Nov (Th). The S.W.O.P.S. project, b M Broughton (BP). Ashby Building Queens University, Stranmillis Roac Belfast at 1930 h.

Merseyside sub-branch

28 Nov (F). Ladies evening. Grang Hotel, 14 Homefield Road, Aigburth Liverpool 19. Details from D Connell (t 051 7089469).

Personal

William C Chatman became chi executive of Foster Wheeler on 1 Octob 1986. Mr Chatman joined Foster Wheel in June 1952 as a process design enginee progressing over the next several years chief process engineer for light oil pla design. Following several years in sales transferred residence to Europe for fi years in the 70s, serving in England f three years as divisional director of sale

In 1982, Mr Chatman was electe executive vice-president of Foste Wheeler International. Following seni sales and operations executiv appointments in England, Italy, th United States and, most recently, Franc he returned to England in January 198 to become managing director of Fost Wheeler. As chief executive Mr Chatma will now be responsible for the activiti of all of Foster Wheeler's UK-base companies.

(continued on p 3

Branch report — Midland

Industry and the West-Midlands

At a Midland branch meeting on 18 April 1986 Martin Kenrick of Archibald Kenrick and Sons, based in the West-Midlands, discussed the relevance of Industry Year 1986 to the region.

Mr Kenrick began by making the assumption that energy sales, past, present and future, are directly affected by industry and its success or failure. He went on: this means it is correct and, indeed, highly relevant to talk about the need for wealth creation and the prospects for successful wealth creation in the coming years.

I want, therefore, to look at Industry Year and why it is so important to us; to look at the West-Midlands industrial scene; and to have a stab at some thoughts about our future.

First Industry Year — 40 years ago the UK was second only to the USA in terms of standard of living. Yet now we are virtually bottom, by any measure. We invest less per head; we spend less on training; our output per unit of investment is less than anyone else; our productivity is lower; our profitability is poorer; our standard of living is lower.

But, you cannot claim that this is all someone else's fault; these wounds are self-inflicted, but — why?

We are, as a nation, resourceful, inventive, intelligent and resilient. In industry there are examples of technological excellence, unmatched anywhere else. The Japanese recently conducted a survey into the 100 most successful industries — industries mark you, not companies — and their origins. They discovered that over 50% has originated in the UK.

In a nutshell, we do not lack talent. So where does the real problem lie? Those of us involved in Industry Year believe that the problem is one of culture and attitude. For years we have denigrated industry. Industry is dirty and undesirable — definitely not the calling for a gentleman — 'rather the Bar, the City or even the land, but, pray, not into industry'.

Industry is bottom of the pecking order for all the best/most capable students. Regular surveys show this to be true. The quality of any activity depends upon the regard in which that activity is held.

Thus Industry Year came into being to try to start the process of changing attitudes. There are three major objectives.

- ☐ To increase awareness of the contribution that industry makes to our way of life — how we are all dependent, ultimately, on industrial success.
- ☐ To encourage industry to increase its links with the educational sector.
- ☐ To encourage industry to articulate its role in the local community and to take positive action in this area.

It is vital that industry grasps this opportunity. There are lots of ways of doing so — open days; plant visits; work shadowing; industrial tutors; help with mini-enterprise activities; secondments and so on. The vital things to remember are:

- ☐ Your message should be aimed not only at school children but also teachers and parents.
- ☐ Choose activities that suit your company — don't try to do everything, and
- ☐ Choose to form lasting links. Industry Year will have failed if we all sigh with relief at the end of December 1986. We must keep going and build on this year's efforts.

Now let's have a look at the West-Midlands. In March 1983, the Birmingham Chamber of Industry and Commerce produced a document called *Reversing structural decline in the West-Midlands. A strategy for action*. This was part of an effort to persuade the Government that there was a real problem in the area that needed tackling and that we should be given regional assistance.

Some of the statistics quoted, mostly from Government sources, are as relevant now as they were then and give you a fairly clear picture of what has happened. (For the cynical, I accept that, for every two statistics that support a hypothesis there are a further half dozen that destroy it).

Between 1975 and 1982, 324 000 jobs were lost and 313 000 of these came from manufacturing, the main sector with large energy needs.

While nationally, manufacturing only accounted for 29% of total output, in the West-Midlands it accounted for 40%. 32% of investment made nationally went into manufacturing, while almost 50% in the region went into manufacturing. The point I seek to make is that of the fundamental importance of manufacturing to the region and therefore the impact that recession or decline has had on all of us who inhabit and work in the area.

Unemployment hit the region very hard. Compared with an increase in unemployment during this period (1979-82) of 267% in the SE, the West-Midlands level increased by 356%. Both horrific figures, though I suspect that the starting point was a lot lower in the SE than in the West-Midlands.

A final statistic: between 1975 and 1982 2 291 000 jobs were lost nationally; 324 000 came from West-Midlands, that is 14% of the national figure for a region employing only 10% of the population. Nationally, 80% of the unemployment has come from manufacturing, but this has meant 96% in the West-Midlands.

It is just worth mentioning that the service sector has increased its numbers employed during this period by 12 000, a drop in the ocean against the 324 000 jobs lost.

What then does all this mean for the future of industry in the West-Midlands and therefore for the prospects for the energy producers? Frankly, your guess is probably as good as mine, but here are a few thoughts anyway:

Manufacturing will continue to be the backbone of the region, but the companies will generally be smaller. We shall not see a return to the days of the large companies such as Duport, Lucas, Rubery Owen and so on.

We shall not see significant increases in employment opportunities within the manufacturing sector. Investment will be in plant and 24 hour working in the future and not in people.

I do not believe we shall see a major shift, within the region, into hi-tech industries. We shall continue to be metal bashers, albeit more efficiently.

Companies will seek energy cost reductions through dual sourcing, or whatever. A lot of my company's plant, for example, can be run on oil, gas or propane. When you consider that our own energy costs represent some 5% of turnover, then any savings are worth going for. Your plan, I suggest, is to help us reduce those costs in percentage terms, remembering that 24 hour working will use more energy than we are likely to be using at present.

The service sector cannot replace manufacturing as an employer, nor in terms of national output, and the sooner everybody, including the Government, realise this, the better.

I hope that the Government and the City will realise the importance of manufacturing to the national economy and our standard of living; Local authorities will be more sensible on rates; benefits will come to the West-Midlands from the NEC, the Convention Centre, Science and Research Parks, the Freeport and maybe the 1992 Olympics; service/energy industries will keep their charges down. Whatever other sources of cheaper energy exist need rapid investigation; the Conservatives have only a narrow majority at the next election.

Manufacturing is vital to the West-Midlands and vital to all. If you seek a way of helping, there are two ways that come immediately to mind, control your prices and promote the Industry Year objectives now and in the future.

Martin Kenrick

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South Coast branch

Wednesday 12 November 1986

Current trends in heat pump design and application

Crest Hotel, Southsea, Hants from 1500-1700 h

REGISTER OF ENERGY COURSES

Members are invited to make use of the Institute of Energy's national register of energy courses, through which we can supply salient details of forthcoming courses of all types. As well as the member's name and address, we need to know (a) the specific subject in which he is interested; (b) his present level of technical qualification; and (c) the preferred geographical location. Only details of suitable courses will be sent in reply.

Course No 9-352

Title: Basic petroleum engineering.
Duration: 10 days.
Location: Imperial College, London.
Starting: 8 December 1986.
Content: Compositions of petroleum fluids. Properties of gases — simple equation of state — z factors. Correlations. Gas viscosities, densities, compressibilities, viscosities of brine.
Properties of black oil and volatile oil systems. Gas-oil ratios; formation volume factors, densities, compressibilities and viscosities. Correlations. Simple material balance concepts. Phase equilibrium — compositional analysis and balances. Definitions and measurements of reservoir rock properties — porosity and permeability. Pressure, potential and steady state flow. Fracture porosity and permeability. Capillary pressure, fluid saturations and distributions. Concepts of relative permeability; measurement and calculation of relative permeability. Multiple phase flow — fractional flow. The gas-oil ratio equation.
Electrical and radioactive properties of rocks — well logging methods and tools. Qualitative interpretation of well logs. Estimation of data, accuracy and reliability.
Introduction to reserve estimating. variability, statistics and uncertainty exploration and development ventures. Volumetric estimates of reserves.
Mechanisms, drives, recovery efficiencies.
Well test methods. Simple concepts of pressure analysis — limitations and methods.
Reservoir analysis for oil and gas reservoirs — material balance methods.
Water influx — effects on recovery efficiency.
Prediction of future performance by analytical methods. Concepts of reservoir modelling and simulation.
The vertical lift characteristics of wells. Productivity index and inflow performance.
Overall well performance and field development planning.

Institute news (continued)

W J R Ryder (Fellow), who was appointed an executive director and deputy chairman of the Henry Boot and Sons group of companies in June, has now been appointed to additional executive directorships within the group. He is now chairman of Henry Boot Northern, Henry Boot Scotland and Henry Boot Southern. He has also been appointed a director of other subsidiary companies of Henry Boot: Henry Boot Training, Banner Plant and Banner Scaffolding.

New members

Fellow

Richard Hayes Teague, Hamworthy Engineering, Poole, Dorset *(transfer)*
John Frederick Walsh, CEGB, South Eastern Region, London *(transfer)*
Herbert William H West, British Ceramic Research, Stoke-on-Trent

Member

Patrick John Bellew, Buro Happold Consulting Engineers, Bath, Avon
Martin Biffin, University College, Cardiff *(transfer)*
Anthony Paul Blagrove
Ian Fitzgerald B Cameron
Leigh Jonathan Carless, NIFES, Edgbaston, Birmingham
Stephen Cook, Sir Frederick Snow & Partners, London *(transfer)*
Philip James Dyer, NIFES, Glasgow
Ewen Alexander Fraser, Derick Sampson & Partners, Glasgow
Swapan Kumar Gangopadhya, Calorex India Pvt, India
Alan Stuart MacGlade, Wallace Whittle & Partners, Glasgow
Indar Surrendranath Maharaj, T C Durley Hill & Partners, Kent
Paul Keith Martin, Energy Design & Surveys, Beds
David John May, Leicester Polytechnic
Iain Donald McGregor, NIFES, Glasgow
Aubrey Christopher Whitfield Patterson, NEI Parsons, Newcastle upon Tyne
David Charles Pickering, British Gas plc, London
David James Raymond, Harland & Wolff, Belfast, N Ireland
Richard John Shennan, Max Fordham & Partners, London
Baldip Singh Sidhu, British Gas plc, Solihull, W Midlands
Ian Charles Wiles, British Gas plc, London

Technician Engineer

Keith Michael Whittaker, Wakefield Health Authority

Associate

Richard Deighton Armstrong, W R Mil Consultancy Dev, Sheffield
Michael John Bentley, Eastern Electricit Board, Luton, Beds

Graduate

Archibald Hannay Bell, United Glas Containers, Merseyside *(transfer)*
Andrew Daryl Dickinson, British Gas pl East Midlands, Sheffield
Christopher Martin, NIFES, Glasgow

Student

Ian Richard Evans, Chapman & Partners, North Cheam, Surrey
Gary Alfred Herbert, Barrett & Wright London
Kevin Shane Tomsett, University o Aston

North-Western/Merseyside sub-branch

One-day seminar: Energy in education initiative

(see page 32)

Registration fees to Engineering Council

Some members have enquired about the arrangements for paying registration fees to the Engineering Council. It is widely believed that when the £7 fee is paid to the Institute, it is passed on to the Council. In fact this is not how the system works, and the Institute can be in or out of pocket according to the run of the figures.

The calculation is based on total registrants for the previous year: $N = N_1 + N_2$,

where N_1 is the number of registrants having Institute of Energy membership alone,

N_2 is the number of registrants having dual membership, and

N is the total number of registrants.

The payment to the Engineering Council is then:

$0.93 (7 \times N_1 + 3.5 \times N_2)$

Points to note are:

(a) We pay half the fee for all our dual members, no matter where they may choose to direct their own fee payment.

(b) A discount of 7% is made on the total, representing retired and hardship cases.

(c) The numbers used are those for the previous year.

The impact of *(a)* depends on the decisions of individual members in dual membership (about 40% of the whole, mostly MechE and IChemE). Many belonged to their other institution before joining the Institute of Energy, and it may be natural for them to pay their registration fee through the former, especially if they are under the impression that it makes no difference. We notice that some smaller institutions have been urging their members to pay through them. Incidentally, if all our dual members paid elsewhere, the total sum at stake is over £12 000.

(b) seems to work out roughly correct (about 7% of our members are indeed in those categories).

As for *(c)*, it means that we pay a year in arrears, and it could be treated as such in the accounts although in practice it is not. In cash terms, the effect is that we lose when membership is dropping and gain when it is rising.

Coal combustion

A four-day international symposium on *Coal combustion* will be held from 7 to 10 September 1987 at Tsinghua University, Beijing, China. The symposium is sponsored and organised by the Institute of Thermal Engineering and Science, Tsinghua University *in association with the Institute of Energy*.

The countries being specifically invited to co-ordinate contributions and papers are the UK, the USA, West Germany and Japan. English will be the working language.

The symposium will cover:

1. *Fundamentals of coal combustion.*
2. *Modelling of coal combustors and furnaces.*
3. *Coal-fired burners, combustors and furnaces.*
4. *Fluidised-bed combustion.*
5. *Coal gasification.*
6. *Pollutant reduction in coal combustion.*
7. *Experimental technique and diagnostics in coal combustion.*

Abstracts of up to about 1000 words are invited from intending UK-based authors and organisations. These should be submitted by *30 November 1986* to: P Mills, Combustion Systems Limited, Coal Research Establishment, Stoke Orchard, Glos GL52 4RZ.

Coal liquid mixtures

The Institution of Chemical Engineers, in association with organisations in Sweden, is arranging the third European conference on *Coal liquid mixtures,* which will be held in Malmo, Sweden, 21/23 Sept 1987. The conference will provide an international forum for discussing technical and commercial developments in CLM technology.

The organising committee are seeking to provide a balanced programme to include coal selection, slurry preparation, combustion systems, new applications and demonstration burns. Particular attention will be given to identifying the current status and future needs of CLM research particularly in relation to operating experiences from commercial plant. Papers are invited on any aspect relating to economic or technical developments of CLM including experiences gained from its use in industrial and utility combustion plant, recent fundamental research findings and new or novel concepts in its preparation and application.

Abstracts of about 300 words should be sent by *30 November 1986* to Mrs Julie Tayler, conference officer, Institution of Chemical Engineers, 165-171 Railway Terrace, Rugby CV21 3HQ (tel 0788 78214; tlx 311780).

Engineering trade mission to Iraq and Kuwait

The Engineering Industries Association (EIA) are organising a trade mission to Iraq and Kuwait from 5-17 March 1987. The mission, which has British Overseas Trade Board (BOTB) support, will be based in Baghdad for one week followed by three working days in Kuwait. Companies may elect to visit Iraq only. Return travel and 12 nights accommodation in first class hotels will cost £1170. The BOTB travel grant is £315 for companies visiting Iraq and Kuwait on a BOTB supported mission for the first, second and third times, and £160 for a fourth visit. The closing date for applications is *5 December 1986.*

Further information from Anna Small, export director, EIA, **16** Dartmouth Street, Westminster, London SW1H 9BL (tel 01-222 2367). *Please note that the wrong number in Dartmouth Street was given in the August/September issue of* Energy World.

Attention all Sheffield graduates!

Would all former graduates of the Department of Chemical Engineering and Fuel Technology please inform us of your current address so that details of the annual dinner dance to be held during *February 1987* can be forwarded to you.

Please contact Mrs Valerie Patrick, Department of Chemical Engineering and Fuel Technology, University of Sheffield, Mappin Street, Sheffield S1 3JD (tel (0742) 768555 ext 5252).

CONFERENCES

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

November 1986

EXPOCLIMA

European heating, drying, ventilation, air-conditioning and refrigeration exhibition, Brussels (Belgium), 3-7 November 1986 (symposium on *Air conditioning and refrigeration,* 5 and 6 November).
Details from Brussels International Conference Centre, Parc des Expositions, Place de Belgique, B-1020 Brussels (tel (32-2) 478.48.60; tlx 23.643).

Economics of refining

Conference, London (IoPet), 11 November 1986.
Details from Miss Caroline Little, conference officer, Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR (tel 01-636 1004; tlx 264380).

Techmart 86

Exhibtion and seminars, Birmingham (NEC), 11-14 November 1986.
Details from: (exhibition) Helen Lord, sales manager, Barclays *Techmart 86,* Exhibitions and Events Division, NEC, Birmingham B40 1NT (tel 021-780 4171 ext 433); (seminars) *Techmart 86* seminar secretary, NEC, Birmingham B40 1NT (tel 021-780 4171 ext 433).

Recent advances in solid/liquid separation processes

International conference, Battelle (Columbus, Ohio, USA), 12 and 13 November 1986.
Details (in UK) from Ms Renate Siebrasse, Battelle Institute Limited, 45 Hanover Square, London W1R 9AJ (tel 01-493 0184).

Marginal fields

Conference, London (Park Lane Hotel), 13 and 14 November 1986.
Details from Miss Lesley Claff, Meeting Point Conferences Ltd, 19 Newport Court, London WC2H 7JS (tel 01-734 0453).

Cogeneration: assessment, application and economics

Conference, Palm Springs (CA, USA), 18 and 19 November 1986.
Details from Association of Energy Engineers, Suite 340, 4025 Pleasantdale Road, Atlanta, GA 30340, USA (tel (404) 447-5083).

Landward oil and gas

Conference, London (London Hilton), 24 and 25 November 1986.

November 1986 (continued)

Details from Mallory Barker, IBC Technical Services, Bath House (3rd floor), 56 Holborn Viaduct, London EC1A 2EX (tel 01-236 4080, tlx 888870).

Power electronics and variable speed drives

International conference, Birmingham (Metropole Hotel, NEC), 24-26 November 1986.
Details from IEE, Savoy Place, London WC2R 0BL (tel 01-240 1871; tlx 261176 IEE LDN G).

Oil supply and price

Conference, London (IoPet), 27 November 1986.
Details from Miss Caroline Little, Institute of Petroleum (see address above).

December 1986

NEMEX 86

National energy management conference and exhibition, Birmingham (NEC), 3 and 4 December 1986.
Details from Tony Ball Market Consultancy, 22 Stephenson Way, London NW1 2HD (tel 01-388 3561).

Acid rain — the relationship between sources and receptors

Conference, Arlington (VA, USA), 3 and 4 December 1986
Details from Bill Wagner, Acid Rain Clearing House, Centre for Environmental Information Inc, 33 South Washington Street, Rochester, NY 14608, USA (tel (716) 546-3796).

Industrial power engineering

International conference, London (IEE), 3-5 December 1986.
Details from IEE (see address above).

Chemical and physical processes in combustion

Combustion Institute (Eastern Section) fall meeting, San Juan (PR, USA), 15-17 December 1986.
Details from Combustion Institute, 5001 Baum Boulevard, Pittsburgh, PA 15213, USA (tel (412) 687-1366).

January 1987

Oil and gas pipeline technology

Tenth European seminar, London (London Hilton), 20 and 21 January 1987.
Details from Mallory Barker, IBC Technical Services (see address above).

February 1987

Technical and geohydrological aspects of waste management

Ninth annual symposium, Fort Collins (CO, USA), 2-6 February 1987.
Details from Geotechnical Engineering Program, Civil Engineering Department, Colorado State University, Fort Collins, CO 80523, USA (tel (303) 491 6081).

Tropical peat and peatlands for development

Symposium, Indonesia, 9-14 February 1987.
Details from IPS, Unioninkatu 40B, 00170 Helsinki 17, Finland (tel (0) 1924340).

Autopartac 87

Exhibition, London (Olympia), 15-17 February 1987.
Details from: Stephen Bozdan, Morgan-Grampian Exhibitions, 30 Calderwood Street, Woolwich, London SE18 6QH (tel 01-855 7777).

Control systems for fossil-fuel power plants

Seminar/workshop, Buckhead (GA, USA), 24-26 February 1987.
Details from Ms Sharon Luongo, conference coordinator, Electric Power Research Institute, PO Box 10412, Palo Alto, CA 94303, USA (tel (415) 855-2000).

April 1987

Hanover Fair 87

Hanover, FRG, 1-8 April 1987.
Details from Deutsche Messe und Ausstellungs, PO Box 285, Sanderstead, Surrey CR2 0AJ (tel 01-651 2191).

CEF 87: Use of computers in chemical engineering

Conference, Sicily (Italy), 26-30 April 1987.
Details from Dr P Schwarz, Piazza Boldrini 1, 20097 San Donato Milanese, (MI), Italy.

May 1987

Technology and utilisation of low-rank coals

Fourteenth biennial lignite symposium, Dallas (TX, USA), 18-21 May 1987.
Details from David Watt, symposium coordinator, 14th Biennial Lignite Symposium, Energy Research Centre, University of North Dakota, Box 8277, University Station, Grand Forks, ND 58202, USA (tel (701) 777-5253).