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Contents: March 1986

nstitute of Energy *ranch conference*

orkshire

Apr (W). One-day symposium: *mbined heat and power.* University of effield. Joint symposium with hemE.

986 April meetings

idland

Apr (Th). Pyrolysis, by R M V Beith rector of research & development, ster Wheeler Power Products). niversity of Aston in Birmingham at 00 h.

orkshire

Apr (W). One-day symposium: *mbined heat and power.* (see above).

ondon and Home Counties

Apr (Tu). Investing for energy, by P Warner (president, Institute of Energy d director of corporate engineering, EI). Royal Institution, Bernard Sunley eatre, Albemarle Street, London W1 at 1730 h (tea at 1710 h) followed by buffet supper (by application only).

Scottish

16 Apr (W). 1815 h: AGM. 1930 h: annual dinner. Guest speaker: Mr David Hunt (Parliamentary Under Secretary of State for Energy). Royal Scottish Automobile Club, Glasgow.

North-Western

17 Apr (Th). AGM. Staff House, Salford University at 1700 h for 1730 h.

East Midlands

18 Apr (F). Annual dinner. George Hotel, Nottingham.

Midland

18 Apr (F). Luncheon club meeting. Warwickshire County Cricket Ground.

South Wales and West of England

23 Apr (W). AGM. Chairman's address: *Waves, winds and tides,* by R G Herapath. South Wales Institute of Engineers, Park Place, Cardiff at 1800 h.

Yorkshire

23 Apr (W). AGM. AHED House, Ossett at 1430 h.

East Midlands

24 Apr (Th). AGM. BSC, Scunthorpe at 1400 h (time to be confirmed).

North-Eastern

28 Apr (M). Applications of gas turbine combined cycle for LNG carrier, by S Hilda and T Kugano (Ishikawajima Harima Heavy Industries). Lecture Theatre, School of Naval Architecture, University of Newcastle upon Tyne at 1800 h (tea and biscuits before meeting). Joint meeting with NE Coast Institution of Engineering and Shipbuilding.

National

29 Apr (Tu). Annual luncheon. Inn on the Park, Hamilton Place, Park Lane, London W1 (nearest underground, Hyde Park Corner) at 1230 for 1300 h. Principal guest and speaker: the Rt Hon Peter Walker MBE MP (Secretary of State for Energy).

Examples of Japanese energy management

Two factors stand out: a degree of planning and high employee involvement

Steven Fawkes PhD

Energy conservation plays a major role in Japan's energy policy and Japanese industry has been very successful at reducing both total energy requirements and the use of oil-derived fuels. This article looks at two case studies of energy management in Japanese industry, the Bridgestone Corporation and Nippon Steel. Both are large groups of companies but the approaches used, and the results achieved, are believed to be fairly typical of Japanese industry. The article concludes by drawing out specific features of Japanese energy management that appear to make it so effective

The first example is the Yokohama plant of the Bridgestone Corporation. This company was founded in 1931 as a tyre manufacturer and since then has grown into Japan's largest tyre producer and diversified into chemical and rubber products for home and industry. Bridgestone sells its products in over 150 countries and has established manufacturing facilities in five countries outside Japan.

Currently Bridgestone invests over 4% of annual sales in research and development and in the field of industrial rubber products the figure is even higher. Development of new chemical and industrial products is a major objective of the company's diversification programme. At present, such products account for 17% of total sales turnover and a corporate goal is to increase this figure to 20% in the near future.

According to the company it 'believes the only way to achieve this goal is to develop and manufacture products that save energy and natural resources and which improve the health and well-being of all our customers throughout the world'. It is not unusual for Japanese companies to have such noble sounding objectives, and they are taken very seriously throughout the organization.

The Yokohama plant

Built in 1938 the Yokohama plant is the company's second oldest manufacturing facility. Chemical and industrial rubber products are the output as opposed to tyres, some of the best selling products are belts, houses, foam products, golf balls, and a variety of household and leisure items.

Energy saving at the plant

Currently the plant spends Y1.12 billion (£3.6 M) on energy, Y350 million (£1.7 M) on fuel and Y588 M (£1.9 M) on electricity.

Table 1 Energy/output, 1971 and 1984

	Indices	
Utility	*1971*	*1984*
Electricity	100	62
Steam	100	25

Table 2 Units of energy/tonne of rubber product

		Consumption		
Utility	*Units/tonne*	*1978*	*1984*	*% reduction*
Electricity	kWh	1604	1295	19
Steam	tonne	5.9	4.2	29

The effect of energy efficiency improvements dramatically illustrated by indices of steam and electric used per unit of output. Table 1 shows a reduction of 7 in steam used per unit of output since 1971 and a 3 reduction in electricity per unit of output over the sa period. Table 2 shows the actual units used per tonne rubber product in 1978 and 1984.

The five year plan

In 1979, after the second oil crisis, a five-year energy p for the plant was drawn up. The targets were a reducti in steam per unit of output of 50% and a reduction electricity per unit of output of 20% by the end of five-year period. These targets were not quite achieved have subsequently been reached.

The current plant-wide target for both fuel a electricity is a 5% reduction in energy per unit of outp per year. In the past annual reductions of 10% have be achieved but it is recognized that savings have beco harder to achieve. Last year the achievements were 5.9 for fuel and 6.9% for electricity.

Metering and monitoring

In the plant there are about 50 steam meters, w consumption being broken down into sections, areas a in some cases individual machines. Originally steam w only metered in sections and there has been a considera investment in sub-metering. For electricity there are o 600 meters for comprehensive monitoring.

Monitoring is complicated by the very large number products and short production runs. A microcompu program, written by the energy conservation enginee produces print-outs of consumption on a daily basis w monthly totals for each metered section of the plant. T program also produces targets and comparisons betwe targets and actual usages on a daily and monthly bas

Responsibility for energy conservation

Responsibility for energy conservation lies with both t line management and the specialist energy group in matrix style organizational form. The line manageme are responsible for minor plant and operational chang and their responsibility is pushed out to the shop flo where there are Quality Circles dedicated to ener conservation work.

*Senior Energy Control Officer, London Borough of Tower Ham (previously SERC/ESRC student)

pecialist engineering staff are responsible for larger jects and the two groups work closely together. Out 1800 employees at the plant, working a four-shift em, there are four energy conservation engineers 'king in design and other energy-related matters such nonitoring.

This year (1984/85) there is a plan for environmental provement, process by process. This follows the uence used in energy conservation work of selecting *heme* (eg environmental improvement), setting a ntifiable *target,* allocating responsibility to *people* and ing a *schedule* with these people. In this way very ailed plans are worked up by co-operation between the ineering and production sections.

estment criteria

ergy conservation investment proposals are assessed in same way as all other proposals with no bias towards rgy conservation. The acceptable payback criteria is ee years and specific energy conservation investments e accounted for 5-10% of total investment at most. wever much of the other 90 to 95% has been energy-serving in nature but not justified on these grounds.

tro-fit versus new plant investment

ter the first of the 'oil shocks', as the Japanese call the crises of 1973 and 1979, most energy saving came about ough retro-fit projects and operational changes. Now, wever, most attention is focused on ensuring new plant energy efficient.

ergy saving in the group

ere are 12 factories in the group and each year there a conference where representatives from each plant sent their energy saving achievements. At these etings the company president presents a prize to the st factory and competition is fierce. Despite this the tories do exchange information about projects in two ys; they exchange monthly reports from all other tories and the energy engineers have two conferences ear.

Although there is a nascent energy managers group vement in Japan, it is not very active. Because of the ong loyalty to companies and the intense competition Japanese industries, it is difficult for energy managers exchange useful information with companies outside group. For this reason the Bridgestone companies do t always enter the annual competition, equivalent to National Energy Manager of the Year award in this untry, sponsored by MITI (the Ministry for ernational Trade and Industry).

ppon Steel

e second example of Japanese energy management is vided by Nippon Steel. Nippon Steel was born in 1970 the merger between Yawata Iron and Steel Co and Fuji n and Steel Co, then Japan's two largest steel mpanies. With a crude steel output in 1982 of 27 M ns, Nippon Steel is the largest steel company in the free rld. Its sales in 1982 were Y2 724 416 M (£8874 M), capital stock Y328 531 M (£1070 M), and its employees mbered 69 000 working in 10 steel works and numerous fices. There are some 200 operating companies in the oup, working in Japan and abroad.

While remaining a world leader in steel production, ppon steel is also aggressively diversifying into fields th higher added value. These include engineering, arine contracting, urban development, geothermal ergy, chemicals and new materials including carbon re, super-alloys, ceramics and composites.

In Japan the iron and steel industry accounts for 13% of total energy consumption and Nippon steel for 4.5%. Thus the industry, and the company, were very important in the nation's response to the oil crises. Following the 1973 oil crisis the company worked out an overall energy conservation programme aimed at reducing its heavy dependence on oil and to conserve energy at each production stage. As a result energy consumption per ton of crude steel produced in 1983 by the company was 16% less than that before 1973. Over the same period the share of oil-derived fuels in the total energy use fell from 19% to 4%, largely due to all coke operation of blast furnaces and a massive switch to alternative energy sources such as by-product gas.

Energy policy

Nippon Steel's energy policy is based on two global statements of philosophy, namely that 'as a steel company who use a lot of energy we must reduce the total amount of energy used' and 'because of Japan's dependence on imported oil we must reduce oil use'. At a more practical level the policy is (1) to reduce the use of high cost energy, namely oil and purchased electricity, and replace it with lower cost coal and self-generated power; and (2) to reduce the use of high cost coal and use more low cost, and hence low grade, coal. The last objective introduces many new technical problems and Nippon steel is actively researching and developing new technologies such as pulverized coal.

Energy management

Each of the 10 steel works has a Utility and Transport Engineering Division responsible for the development of hardware. The group has a central energy planning department which monitors consumptions, provides advice and organizes two types of conferences. The first, the Energy Measures Technical Conference, is held twice a year and is attended by the top engineers from headquarters and the top managers from each plant. The chairman is the vice-chairman of the corporation, an engineer by training. Subordinate conferences, called Energy Measures Technical Promotion Conferences, are attended by section managers from the works and engineers from headquarters. In addition each works has an Energy Measures Committee which meets between two and 12 times a year.

The first five year plan, starting in 1973, concentrated mainly on improving operational techniques and retro-fitted measures. Now, however, incorporation of energy-saving measures into new plant is the main concern. The target reduction in energy per unit of output in the first phase of the plan was 10% by 1977 and the achievement was 10.4%. A target of 10% over seven years was adopted for the second phase and this was achieved inside five years. For the five-year plan commencing in 1984 a target of 8% was adopted, recognizing the problems of diminishing returns; 2.8% of this is to come from operational improvements and 5.2% from investment measures.

Since 1982 reduced world oil prices have meant that energy saving and cost saving pressures are no longer acting in the same direction. Increases in energy use may result in reduced costs because of the reduced price differential between coal and oil.

Monitoring

Each plant has a computerized Energy Control Centre which is linked to extensive metering throughout the plant. This allows energy use to be optimized. Monthly energy reports are produced in each works and also sent to the central energy staff at headquarters.

Shop floor involvement in energy saving

Many of the ideas for operational improvements have come from shop floor employees. Nippon Steel encourages this involvement through its 'J-K' (Jishu Kanri) movement in which employees are encouraged to examine problems in their area, or adopt a goal such as productivity improvement. This JK activity is similar to the more widely reported Quality Circle (QC) and Zero Defects (ZD) movements.

Each plant has one or two energy engineers who promote energy conservation throughout the plant. They are not design engineers, design being undertaken by the design engineers at plant level. At the Tokyo headquarters there are five energy conservation staff, two who work on budgeting and ensuring new plant is energy efficient; one who works on energy conservation research and development; and two who promote energy conservation throughout the group.

Savings through process change

Much energy saving has come about through new processes such as continuous casting (CC) and the Continuous Annealing and Processing Line (CAPL) which are continuous production lines that both save energy and speed up production. After casting and cutting steel billets used to be cooled for inspection and then reheated for rolling. Improved quality control has made this stage unnecessary with resultant large energy savings. Steel now passes directly from continuous casting to hot rolling.

As a result of the energy saving efforts at Nippon Steel the company has reduced total energy use from 1009 PJ (10^{15} J) to 669 PJ. The proportion of oil products, including LPG and LNG, has fallen from 18.7% to 3.6%, the proportion of purchased electricity has fallen from 9.0% to 5.7% and the proportion of coal and coke increased from 72.3% to 90.7%

Payback criteria for investment

The acceptable payback criteria is three years but most implemented projects show a two year payback. After 1979 priority was given to energy saving projects but since the stabilization of oil prices this is no longer done.

Summary

In studying Japanese energy management two factors stand out, the degree of planning and the high level of employee involvement. Planning for energy management is far more extensive than is usual in Britain and is bottom-up rather than top-down; that is to say plans are evolved from the shop floor upward. This, coupled with frequent job rotation, encourages systematic planning and decision-making. It also encourages employee participation.

Good housekeeping measures in particular require a high level of employee participation and this is generated through Quality Circles (QC) and similar movements. Although these partly rely on Japanese culture and corporate loyalty recent experiments in Britain suggest they can also be successful here.

These two factors stand out as most important in explaining the success of Japanese companies in improving energy efficiency. As these factors need not be inherently Japanese, British companies could benefit from adapting them to their own particular needs.

Acknowledgment

The author would like to acknowledge the assistance of R & D Management in providing the travel award that made his trip to Japan possible, and the assistance of the Japanese organizations involved.

e Second European Conference: Coal Liquid Mixtures:

The technology is there, if not a market — ut breakthrough is imminent overseas'

e many good shows the second *Coal Liquid Mixtures* conference* was brought to ıdon after a very successful first outing in Cheltenham in 1983. The London Press ıtre was the glamorous setting for the bigger CLM2 production that presented 30 ːrnational papers over three days. The conference attracted more than 200 delegates from different countries with strong delegations from America, Sweden and Asia

)r Derek Pooley, (Chief Scientist, *Department of ːrgy)* raised the curtain with a warm welcome for the ːgates, particularly those from overseas. To set a mood the conference, he gave a realistic personal view of industrial energy scenario for the near future, pointing that the choice of primary fuels in Europe would be wide as it ever has been, with no real shortage of oil l an expanding market for gas. The major criteria of ːction by customers would be cost, convenience, urity of supply and environmental acceptance. One ıg he was sure of was that there would be no place in future market for expensive coal. However, looking he great advances that were being made in coal slurry l technology, he could see the new fuels featuring ɔngly on the list of available fuels for the future.

Prof John Beér, (*MIT,* USA) reported on the status of ıl slurry fuels in North America where technical ances were running ahead of commercial application. vertheless there had been some impressive monstrations of the burning of coal water slurry fuels, a 12 MW industrial boiler at the Du Pont plant in ːmphis and a 22 MW utility boiler conversion at the atham Power Station in Canada. Both trials were ısidered to be a success but the current depressed oil ces were delaying further large trials even though a mber of large fuel preparation plants had been built.

Lars Rey, (*Nycol,* Sweden) described the market tential for coal slurry fuels in Europe. His closing ɔrds, 'In Europe the coal slurry fuels of tomorrow will ve to be clean, easy to handle, invisible and they will ve to meet precise specifications', aptly set objectives all involved in developing the fuels.

Dr Terada, *(Babcock-Hitachi)* described the Asian scene in Japan, China and Korea. One large plant in Japan ɔduces nearly 1 Mt/y of coal-oil fuel for use in electricity ıeration, and Japan also claims the world's largest monstration project for utility use of coal water fuel the Nakoso Power Station, where 15 t/y of fuel are ːpared and burned. Large demonstration burns have o been successfully completed in China and Korea ıere there is great confidence in coal water slurry fuel d much activity in its development.

The optimism of the overview speakers was reinforced two surprise announcements to the conference of new mmercial developments in Europe.

Dr Romani, *(Snamprogetti)* gave details of the large ntract just awarded to his company to build a 5 M t/y al-water fuel plant in Siberia and to construct a 260 km pipeline to deliver the fuel to a power plant at Novosibirsk. Mr Ambler *(NCB Marketing Department)* announced the collaboration between *NCB, Babcock Power, Foster Wheeler* and *Elf-Aquitaine* to consider the building of a 50 000 t/y coal water slurry preparation plant at Rufford Colliery in Nottinghamshire with financial assistance from EEC.

The technical papers were presented in four sessions: *fuel preparation; equipment development; combustion; demonstration and economics,* and they dealt almost entirely with coal water slurries.

The preparation of the fuel involves cleaning, grinding and mixing with chemical additives to produce stable slurries with acceptable rheological properties. The opening paper in this session was an erudite presentation by Theodore Tadros *(ICI)* that clearly demonstrated how the science of surface chemistry could be applied to ensure the economic use of chemical additives. An American author described the preparation of lignite slurries when, ironically, the lignites have to be dried before slurry preparation to meet the optimum 30% water content. A new idea from the American United Coal Company suggested a slurry of coal in coal tar as an alternative to heavy fuel oil for diesel engines. The NCB approach to the preparation of coal water slurries was given by Robin Boeuf and Fred Vickers, who described how best to use the fine coal fractions produced at washeries to make satisfactory CWM fuels.

rganized by the Institution of Chemical Engineers, in association h the Institute of Energy, Sept 1985. Proceedings are available m the Institution of Chemical Engineers, price £30.00. Tel: Rugby 88) 78214

A report on the work on CWM at the Zhejiang University, China, was read by Dr Guoquan. It contained some novel ideas recommending fluidized bed combustion for high ash coals.

The equipment development section dealt mainly with burner designs. There has been considerable improvement in the combustion systems generally arising from better atomization and new furnace geometry that produce stable flames and longer burner life. A novel development in combustion in Canada was revealed by Gordon Trivett where they had developed a domestic, fluidized bed boiler to burn coal water fuels.

The papers on fuel combustion fell into two categories, mathematical modelling and boiler fouling. The models presented were first generation, nevertheless their prediction of combustion performance was quite impressive. Delegates were visually impressed with the high speed colour photography used at Leeds University and MIT to film the coal water fuel flame.

Alan Jones *(CEGB)* and Amin Anjum, *(Foster Wheeler)* reported on tests in model furnaces that identified coal properties and furnace conditions responsible for boiler fouling and demonstrated how ash fouling can be minimized. The *Foster Wheeler* results also indicated low levels of NO_x and SO_x in the exhaust gases from coal water slurries. This may prove to be an important advantage to coal water fuels over dry pulverized coal.

The final session was concerned with economics a demonstration projects. Bob Gregory of IEA summari the recently published *IEA Economic Study on C Water Mixtures.* His forecast was that oil prices wo settle in the 4.5 to 5.5 $/GJ range during the peri 1985-1995 whilst coal would remain at 1.7 to 2.45 $/G At these coal prices CWM fuel would cost 2.9 to 4.6 $/ giving a price advantage of 0.9 to 1.4 $/GJ over oil. W this incentive CWM could capture up to 10 % of t market for heavy fuel oil giving a sales potential of 60 t/y in OECD countries.

A number of demonstration projects were reported Phil Read *(Canada),* Lars Stigson *(Sweden)* and Illuminati *(Italy)* and the size and success of these ventu were a fitting climax to a conference called to monitor t progress of a new technology.

In his summing up, the conference chairman, G Davies, commented on the confidence expressed by t speakers and was impressed by the way basic scienti and engineering principles had been applied to surmou most of the problems presented by the new fuel. It appe that we now have the technology but not, as yet, a mar but breakthroughs are imminent in Italy and Sweden. suggested therefore that the European conference sho reconvene in two years time in either of these t countries.

G O DAVIES
(Conference chairman)

Control system selection for the dispersed state

J S Jenner T Eng*

prime responsibility for any energy manager could be the evaluation and selection of an automatic ntrol system or strategy, matched to the particular needs and limitations of his organization. The de range of building services control systems and equipment which are currently marketed claim the pability to achieve significant energy saving. The dilemma of the energy manager is increased by the versity of controls, from the basic time switch to the fully distributed intelligence energy management stem

rge factory complexes, hospitals and university npuses have estates which consist of buildings and ociated plant rooms that are in close proximity to one ther. In this situation there are usually many control ps which must be monitored and controlled and there n existence a tightly knit and responsive maintenance anization. On the other hand the dispersed estate of anizations such as banks, building societies, retail chain res and county councils have an altogether different of circumstances involving many establishments, each which contain few control loops and which are remote m one another. The most complex situation is erienced by the county councils who administer several ndred establishments providing a variety of services to community. The estate of a typical county council will lude buildings of widely ranging sizes from libraries tertiary colleges. The building construction will also y widely, from buildings of the Victorian era of solid struction to structures erected in the 1960s with curtain lling and latterly, buildings erected to conform with rt FF of the Building Regulations.[1]

membering the objective

e sole objective when selecting a control system is to e money through improved energy efficiency, whilst intaining adequate comfort conditions. In common h many other fields of endeavour this is far easier said n done, but one must remember this objective when luating all the alternatives.

At the risk of stating the obvious, controls will only be ective if there is first of all some item of plant which provide control action to initiate the desired response. hould therefore be noted that building services control tems are not the panacea for all ills within the existing lding stock. If there are deficiencies in the design of buildings and/or heating systems, or if both are dequately maintained, the first step must be to remedy minimize the effect of these problems.

ison with the client

ore work is commenced on the design of a new heating l ventilating system, or the re-design and replacement existing systems, a meeting should be arranged with client. The following people should attend such a eting:

- ☐ The head of establishment or professional advisor
- ☐ The site caretaker or professional advisor
- ☐ The architect
- ☐ The building services engineers
- ☐ A representative from the maintenance dept
- ☐ The energy manager

The agenda for the meeting should include a discussion on the design brief, the pattern of the building's use for each day of the week, for each area of the building and the requirements for building services during holiday periods.

Capital investment

It is a fundamental requirement for successful energy management that an energy audit of the consumption and costs of each establishment over a period of years is undertaken and that an energy monitoring and targetting scheme is adopted. The generally accepted criteria for capital investment in energy saving measures is a simple payback of capital in under five years. Since the useful life of many control systems on the market today is five years, then a considerably shorter payback of two to three years is required. If the total estate is subdivided into categories based on average heating /HWS service, cost of establishments ranging from say £50 000 pa to £2 500 pa, it will immediately be seen where the greater amount of capital should be invested for the best results, (Fig 1). The greatest energy saving will be that where buildings are occupied intermittently.

Maintenance management

Very few organizations differentiate between establishments regarding the quality and quantity of preventative or call out maintenance required for heating and HWS services. Establishments which consume in excess of £50 000 pa for Heating/HWS services are maintained to the same extent as those which consume only £2000 worth of energy. Maintenance personnel have made a valid complaint that design and energy efficiency staff continue to install a variety of control equipment from several different manufacturers, which make it difficult for them to keep abreast of developments and product variations without extensive training. The end result is that control accuracy is difficult to maintain. This fact could significantly increase the energy cost of an establishment since overheating a building by 1°C can increase the energy bill by up to 6%.[2]

The only solution is to create a control strategy whereby the more sophisticated controls are confined to the large energy consumers. An increased maintenance commitment for these large users must also be accepted with the appointment of a specialist maintenance

(continued on p 9)

e author is an energy conservation officer with the County hitects Department of West Glamorgan County Council

Fig 1 Control system selection for the dispersed estate. Energy cost base

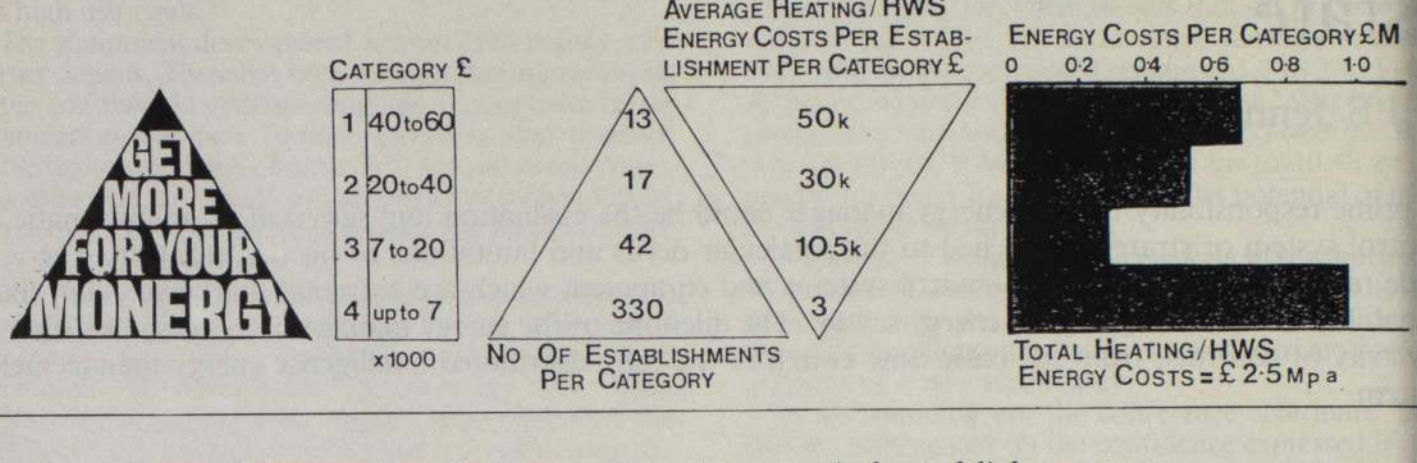


Table 1: Control comparison for intermittently occupied establishments

Category	*Description*	*Capital cost £*	*Energy saving %*	*Maintenance*	*Special conditions*	*Levels of access*	*Reasons for low performance*	*HWS fixed time control*	*Comments*
5	Manual control	Nil, or part of school or caretaker incentive scheme	Variable	Failure of plant can result, when for example boiler thermostats are set too low — back end corrosion results	Person must be motivated	N/A	Building not zoned or heating system inadequate	N/A	This method of control is not generally accepta today due to the duties of caretak and their irregul hours of work
4	Time switch control with room thermostat frost thermostat installation cost	60 20 20 100	Base	Non specialist maintenance. Test and replacement can be undertaken by maintenance staff	A separate frost protection thermostat must be installed to over-ride the time switch	One	Adjustment of control set points can be undertaken by site staff and excess energy consumed as a result	Separate time switch required for HWS control	Time switch reliability is very high, with life expectancy in ex of 10 years. Override is limit to next on/off period. Room thermostat accur ±2°C. The time switch is always half an hour out sequence and lef for summer/win time
3	Optimum start control with room thermostat or compensation installation	130 20 170 500	10	Repair is only prompted by total failure of optimizer and/or compensator. Inaccuracies are not detected. Specialized maintenance required	Care must be taken in selecting the location of the internal detectors which must be in a typical room. Optimizer must be sited away from sources of capacative or inductive inteference	One	Manual override of the control function or tampering with set points	Separate time switch required for HWS control	Equipment life expectancy is fiv years. Control accuracy is usual ±1°C. Typically this control is nc reset for summer/winter time
2	Self learning optimum start/stop control compensator boiler sequencing installation	700 400 600 1200	15	Equipment performance should be monitored regularly to ensure accuracy and prevent overriding of functions. Specialist required for controls recommissioning and repair	As above, because of self learning optimizer should be in total control of all services. Room influence detectors for compensators can be fitted	Two	Control points cannot be reset but manual override is possible	Fixed time programs within some optimizers for HWS, etc	Equipment life expectancy is five years. Control accuracy is ±1° Second level acc prevents tamperi with program. Some controllers can be interroga for start/stop tir temperatures, performance, th boiler sequencer connected to boi isolation valves t conform to regulations. This control must be set for summer winter time.
1	Distributed intelligence energy management system/multi function controller several optimum start stops several control loops for compensation/ sequencing etc installation	2000 1200	15	Automatic monitoring of performance is possible with alarm generation. Specialist maintenance is required	As above. Future communication with remote controller is possible from a central station	Several	Controls not matched to plant. Maintenance section not responsive to alarms. System not used to full potential	Fixed time programs catered for within controller	Equipment life expectancy is fiv years, but after t time only the software module replaced if necessary — par complete with relays will remai Future communications will permit a comprehensive maintenance/en management function if desir Monitoring of performance of plant is excellen

anization to recommission controls on a regular basis, ppropriate. This action should be coupled with the ning of site staff.

ablishment categories and controls

e case study in Fig 1 shows a typical situation for a local hority where the top 30 establishments consume roximately 50% of the total cost of heating and HWS rgy for the authority. It is therefore logical to ommend that the more sophisticated control strategies ether with an increased maintenance commitment uld be given to the higher category (1 and 2) ablishments. The selection of a general control strategy intermittently occupied buildings of each category ble 1) was based upon the following criteria:

Capital cost
Energy saving
Simplicity or complexity of control
Maintenance type and cost
Performance monitoring

m the diagram it can be seen that over 80% of the ablishments in this case will remain on basic controls.

nclusions

vill be seen that there is a strong case for guidelines for trol system selection for various establishments within ispersed estate. The guidelines cannot be rigid but must amended to comply with situations which exist at each site. The role of the design engineer in selecting the appropriate control system, especially with respect to zoning of heating is crucial, of equal importance is the requirement for regular maintenance. There is a case for a planned preventative maintenance programme using a distributed intelligence energy management system for category 1 establishments. If such an approach is undertaken then there is less likelihood of the re-occurrence of the conversation the author once had with a school caretaker. The dialogue was as follows:

Energy manager: *Good morning! How is your new optimizer working, any complaints?*
Caretaker: *None at all, it works well*
Energy manager: *What time does it switch off during the day?*
Caretaker: *Oh! it doesn't switch off, it keeps the building nice and warm by running all the time!*

The optimizer in this case failed but the failure had not been reported by site staff.

In conclusion it shall be seen that controls must be carefully selected to meet the particular circumstances of each location, and control system performance must be monitored on a regular basis.

References

1 Guide to the Bulding Regulations Part FF, RIBA
2 Department of Energy Fuel Efficiency Booklet No 10, p4

The utilization of waste-derived fuel

Report on the lecture given by Alan Tweedale to the Combustion Engineering Associatic (Northern region)*

Mr Tweedale commenced his lecture by referring to the continuing need for fuel conservation in spite of the present glut, which has arisen from world recession coupled with now falling prices of the conventional fuels. He was therefore very enthusiastic about the scope for waste-derived fuels. Excluding specialized wastes, normal industrial and commercial combustible wastes amounted to 3 Mtce per year. He emphasized the need to prolong conventional fuel resources for future generations. The various channels by which WDF could be used were then described. These were:

- ☐ Incineration followed by heat recovery eg, Edmonton and Nottingham
- ☐ Methane drainage from rubbish dumps, eg at Aylesford
- ☐ RDF pellets, eg Doncaster, Eastbourne
- ☐ Aerobic digestion of mixed sewage sludge and waste
- ☐ ECO shredded waste, finely milled, burned as a suspension in secondary to an oil burner.

Of these, incineration was at present the most developed, the Edmonton plant produces up to 15.5 MW electricity and Nottingham 5.5 MW.

Shredded waste utilization is more widely used in America than in the UK (ECO fuel is high in both capital and running costs), and the fuel is not easily transported, so that utilization on the site of generation is needed. Several examples exist however in this country, at works in Hull (Courtaulds), Kearsley, and Derby. At the plant in Derby the waste is burned by FBC, a small water tube boiler being used to raise 15 000 lb steam/h. The material used, some 10 000 tpa, consists of waste paper, cardboard, packaging etc.

Eastbourne is a very successful example of the production of pelleted RDF. The pellets are sold to Brighton power station, to the local authority and on garage forecourts for use in closed domestic stoves.

At Kearsley power station (now de-commissioned) shredded fuel was burned on chain grates, using the sandwich system of firing with coal, about 20% RDF being used and fed on top of the coal.

Pellets have been used at Southend to generate steam in an alternatively coal fired boiler the rating of which on coal was 12 000 lb/h steam. On RDF 8000 lb/h w achieved. Fluidized bed combustion was used.

The flow of pellets in bunkers is more difficult achieve than with singles coal, owing to their cleava planes they tend to lock. Bunker sides need to be inclin at 70° to the vertical and vibrators should not be use as they tend to compact the fuel. Deposits on the h transfer surfaces were hard but flaky and were rich aluminium. Some unburned hydrocarbons were pres in the products of combustion, but were eliminated increasing the turbulence of the secondary air. It w considered that a circulating fluidized bed would ha been better in order to promote mixing.

At Wallasey an energy capsule comprising a 15 000 lb fluidized bed boiler has been installed, with grant aid, burn pellets.

Extended tests on a shell boiler fired by a chain gra have achieved 75% of the coal fired rating, pellets alo being used. Little deposition on the heated surfaces of t boiler occurred with no aluminium present, the ash w easy to handle. This looks like being a very satisfacto installation in the long term.

Pellets seem to be stable in storage for several wee and do not seem to attract vermin. They are not genera available as the market is not ready for them yet on a lar scale basis, also fine tuning of the combustion system needed. Fluidized bed combustion seems to be the b answer for shredded waste. The economics of RI depend very much on the ability to credit the plant wi the cost of waste disposal which would otherwise occu

Mr Tweedale made the point that modular, packag boiler houses were a better proposition for RDF than a attempt to convert existing plant. Prior to using RDF t heat load pattern should be ascertained and the minimu base load established. RDF burning plant should matched to and operated at this latter figure. Comple replacements of conventional fuels are not likely to considered by many industrialists.

D C GUNN

*AHED House, Ossett, 29 October 1985

SECOND INTERNATIONAL CONFERENCE

Small engines and their fuels in developing countries: 23/24 Sept 1987

Conference organized by the Energy Group, Engineering Dept, University of Reading, Intermediate Technology Power and Institute of Energy

Abstracts of papers (250 words) should be submitted by 30 August 1986. If accepted, the full written paper (about 5000 words) must be submitted by 16 Jan 1987. Papers should be related to one of the following topics: *Engines* (in range less than 10 kW preferred, but no more than 100 kW, technical and economic appraisals), *fuels* (production, utilization and economics); *case studies*.

Enquiries: Dr G Rice, Conference Chairman, Dept of Engineering, University of Reading, White Knights, PO Box 225, Reading RG6 2AY, UK.

*nference report**
LASS-85

Third International Conference on uid Atomisation and Spray systems LASS-85) was held on 8-10 July, 1985, ie Mechanical Engineering building at perial College, London. The nference was organized primarily by Institute of Energy but in association n sixteen other societies including the mbustion Physics Group. The anizing Committee was chaired by Dr l Eisenklam. More than 200 delegates n at least 18 different countries were acted to the conference which uded 80 contributions scheduled into concurrent sessions over three whole s and a more informal poster display l on the middle day. In addition, a ge commercial exhibition of spray dware and drop sizing equipment was ilable for perusal for the second two s of the proceedings.

Combustion well in evidence

Atomisation plays a role in a wide ctrum of applications, a fact borne out the diversity of session titles and ividual contributions. Medical and icultural interests justified a session ece, whereas combustion was well in dence with specialized sessions on *sel and Transient Sprays* and *Spray ucture, Transfer Processes and mbustion.* In addition, most of the er sessions were of interest to the nbustion scientist/ engineer, notably *omiser Design and Performance* and *omisation of Specialized Fluids,* the er including considerations of burning usual fuels such as pitch and coal-water xtures. There was also a considerable sion dealing with *Measurement and ta Analysis Techniques* which included to the minute' assessments of mostly er based spray characterization hniques.

There were, of course, too many papers to be able to produce a comprehensive review within the available space, but there were contributions with a combustion flavour that warrant mention. Three papers *(Babu, Rizk* and *Lefebvre* and *Nieukamp)* presented either empirical correlations or analytical methods to predict the drop size and discharge characteristics from pressure jet atomisers while four other papers *(Hurley* and *Doyle, Aigner* and *Wittig, Inamura* and *Nagai,* and *Tate)* looked at various aspects of internal and external-mix air-blast atomisers. There were also papers dealing with ultrasonic and rotary atomisers and an intriguing new design that makes use of the low sonic velocity in air/liquid and, more particularly, air/liquid/suspended solid mixtures *(Chawla).* This atomiser has apparently been proved up to large industrial scale on thick slurries and requires only low air and liquid pressures (a couple of bar for the large versions).

Coal-water slurries featured among the specialized fluids currently attracting attention and papers by *D'Alassio, Meyer and Chigier* and *Zanelli/Barbieri* (poster session), dealt with various aspects of their break-up and spray evolution. Continuing the theme of difficult fuels, *Miura* presented a new design of atomiser (an inverted Y-jet) designed to cope with highly viscous materials such as pitch.

Models for predicting structure of oil flames

There were a couple of papers describing models for predicting the structure of oil flames. *Swithenbank,* for example, presented the results of an Eulerian/Lagrangian calculation method to model two heavy oil flames produced by coarse and fine atomisation respectively. Poorer agreement between theory and experiment for the coarse spray highlighted the need for inputs describing the evaporation/pyrolysis of multi-component heavy oils and the subsequent combustion of coke particles. *Tambour* applied a similar analytical approach to study the evolution of drop size distributions in a combusting spray. Using experimental measurements made at UMIST to test his theory he concluded that under certain operating conditions, drop coalescence may play as important a role as vaporization in the evolution of the spray. Coalescence as a major mechanism in spray evolution was viewed with scepticism by some delegates, but others confirmed that coalescence had been observed, particularly in dense diesel sprays.

Structure of diesel sprays

There were three invited papers dealing with the structure of diesel sprays *(Sato),* Droplet size and biological efficiency of pesticides *(Courshee)* and Computational fluid dynamics and its application to Liquid atomisation and spray systems *(Spalding).* The paper by Prof Spalding showed how CFD could be used to model flow patterns within atomisers and provide statistical descriptions of developed sprays. The three common idealizations currently used to reduce the dimensionality of the analysis for sprays were reviewed and then a new model was proposed in which two of the idealizations are essentially combined. Prof Spalding considered the new model to provide a more realistic simulation of the ignition and burn-out behaviours of fuel jets.

A R JONES (M E L, Marchwood)

*Proceedings of ICLASS-85 can be obtained directly from the Institute of Energy, 18 Devonshire Street, London W1N 1AU, at £50. This report by courtesy: *Combustion Physics Newsletter 24,* Autumn 1985.

Handbook of energy systems engineering: production and utilization

Edited by Leslie C Wilbur
John Wiley & Sons, New York
1775pp. £76.70

This is a large and weighty (nearly 3kg) publication, one of the series published by Wiley on mechanical engineering practice 'written for the practising engineer'. It is intended as a reference book with two kinds of information: numerical data in tabular and graphical form and descriptive material typical of the state of the art.

It therefore is one of a series of five volumes, the others covering *Design and manufacturing, Fluids and fluid machinery, Mechanics, Materials and structures and Instrumentation and control.*

This makes the reviewer's task somewhat difficult because topics which may appear to be less comprehensive than would be considered to be desirable may be more adequately dealt with in one of the other volumes. However, each volume is designed to stand alone.

The preface draws attention to the rapid changes in the field covered by the series. There have been rapid changes in many areas of the energy field and the problems of making sure that the material is up-to-date at the time of publishing is not made easy by the difficulties and time consuming processes of obtaining texts from a large number of authors, ensuring that there is editorial consistency and getting the whole into a state for publication. It is unavoidable under these circumstances that some of the tabulated data and other information only run to two or three years before the publishing date.

On the other hand 1985 was a particularly opportune year for a publication of this kind because many of the rapid changes and re-appraisals that were made necessary by the 1970's oil crisis, the public apprehensions on the acceptability of nuclear plant and the emissions from fossil plant appear to have produced sound technical material which can be used for decisions on the future shape of energy supply and use. The ways that energy is used and generated for the future will be built on the technical work and assessments of the past 10 to 15 years.

The book is therefore timely and fills a niche for engineers and managers involved in energy decisions. It is intended as a 'mini-premier adequate to enable the reader to grasp vital concepts at a decision making level and to give the non expert in a given discipline a reasonable degree of literacy'.

The material was written by university and polytechnic staff, consultants and engineers in major industrial and utility companies. With the exception of one from Canada all of the contributors a from organizations in the United Stat of America. This does not mean th developments outside North America a not included but it does mean that the is an emphasis on American work.

As the book is primarily intended f American readers, and the editor has n imposed firm guide-lines on the units be employed, the book uses 'customar as well as SI units with some sections on employing one or the other. Th undoubtedly complicates the use of t handbook by British engineers who a more used to books employing consiste SI units.

The handbook is made particular useful by the comprehensive sets references which would enable t engineer who finds the materi inadequate for his purposes to obta more information. In the fields covere by this book, where the technology is n simply the application of standards an time-honoured rules, good reference lis are essential.

With these general points it is useful indicate the scope of the handbool There are 18 chapters and an index. T reviewer's comments are of necessi selective.

Chapter 1 — *Demographics.* Th chapter deals with energy demand, an resources, coal, petroleum, natural ga uranium and thorium and renewab energy in detail in the USA but als

Energy minister launches the Institute's 1986 reference book/buyers' guide

Monergy '86 aiming to save £7 billion energy wastage

The 1986 edition of *Energy World reference book and buyers' guide* was launched by David Hunt, Parliamentary Under-Secretary of State for Energy, at the Royal Institution of British Architects on 27 January.

Mr Hunt said, 'I am delighted that the publication has its own section devoted to Energy Efficiency Year and I am sure that *Energy world* will be a great asset to all those involved in energy matters'. He went on to highlight the Monergy '86 campaign which is aiming to save the £7 billion currently being wasted in energy by industry and commerce.

The book, first published in 1985, provides up-to-date information on the wide range of energy equipment and services available. It also gives the best sources of further information and advice in energy.

Left to right: Dr H M Lodge (Secretary of Institute of Energy), Richard Kyle (Manor Hous Press), Gordon Payne (Editor, Energy World Reference Book and Buyers' Guide), Brian Lock (Chairman, Editorial Advisory Panel), David Hunt MBE (Parliamentary Under-Secretar of State for Energy), Sharon Dorrell (Publications department), Dr George Thurlo (Immediate Past President of the Institute of Energy)

rld-wide. Although the data run only 1982 I personally will find the layout d material presented here the 'first oice' for finding information in this ld.

Chapter 2 — *Optimization of energy* . The sections here deal with energy nservation techniques, energy nagement principles, effective heat lization — the management of energy w and waste heat recovery and use, ergy storage and transportation stems. Bearing in mind the role of a rimer' the sections on energy nservation and management are well d out and establish the principles of this portant field clearly and logically awing attention to money saving as well energy saving, very appropriate for lonergy' year. The section on nsportation I felt was not particularly eful dealing with train, car and bus ansport for passengers and velopments in the United States of ban rail systems. The important mparisons of freight transport road, l, ship or air and the efficient operation vehicle fleets, does not appear to be vered. Pipelines (gas, oil and coal rry) which are important in the energy ld are dealt with in other chapters.

Chapter 3 — *Energy utilization laws d principles.* This chapter deals with ermodynamics (here the mixture of mbols and words in some of the equations was disconcerting, the switch from capital to lower case letters, although explained at the end of the section was somewhat confusing and the cross referencing too, in particular to chapter 18, time consuming and not always fruitful). This section deals with ideal cycles and systems without explaining to the reader the amount and reasons for practical applications having energy conversions well below the ideal. The presentation is clear and well illustrated by diagrams and examples. The units and examples are SI although the text often refers to 'customary' units too. The data required for calculation are not given in the reference table section in chapter 18. The section on heat transfer again uses SI units and includes useful recommendations for calculating practical configurations. In the convection section it is interesting to note the recommendation of Russian correlations for tube bank heat transfer and pressure losses.

The section on boiling and condensation and the references in this area do not contain several which the reviewer considers more recent and relevant. The heat transfer section would benefit with a list of symbols (and their units) and clear definition of the dimensionless groups used. The final section in this chapter covers fluid dynamics including transients, vibration and some useful material in measuring devices. The difficulties of measurement in this field are considerable and a short section on this would have been of practical value.

Chapter 4 — *Energy system technology.* Here American units (US gallons are used in pumps) are employed throughout with some reference to metric (not SI). The chapter provides practical descriptions of equipment (note that the basis is 60 cycle drive) with drawings and photographs, not all of which are clear to the reader, as there is no description of construction. The chapter covers pumps, centrifugal, reciprocating and jet, fans (a particularly good section), valves, piping and lubrication, instrumentation and controls with good material on temperature and pressure measurement, gas compressors, cooling systems, water treatment, shell and tube and other heat exchangers. Throughout, the sections are basically descriptive but some sections give information which give methods of design selection and sizing. Heat pipes and rotary heat exchangers have a brief mention but there are no references, which is unfortunate because these are increasingly used in energy systems.

Chapter 5 — *Prime movers.* This chapter covers steam turbines and engines, gas turbines, internal combustion, jet and rocket engines. Once

(continued on p 14)

roblem solving: science nd technology in primary chools

ne Engineering Council/SCSST, ecember, 1985, 32pp.

his report encapsulates the findings of working party convened by SCSST to sess the state of teaching in primary ience and technology and examine the lue of problem solving activities in this ea of study.

After a consideration of the primary nos and the present situation of science d technology teaching in primary hools, the report summarizes what the rking party considers to be good actice. The report concludes with an amination of the implications for aching, teacher training and the ovision of resources not only for the imary situation but for the transition to condary education. The emphasis roughout is on the role of problem lving activity.

There is nothing new in the report but does provide a serious and coherent erview of the situation which is realistic d accurate. However it is not sufficient restrict information to what is ppening. Very positive guidance and couragement is needed to develop the nfidence of teachers and this is not rthcoming in this report. The authors viously hope that it will stimulate tivity by others.

My feeling is that the expertise of the rking party, which is considerable, should be directed to considering ways and means by which teachers can be given practical help and encouragement to develop the proposed approach.

D Browning

Improving US energy security

Edited by R J Gonzalez, R W Smilor and J Darmstadler
Ballinger Publishing Company, Mass, USA (1985), 308pp.

The fluctuations in the price of oil have had a considerable impact on the economics of the western industrialized nations. This new book based on research at the University of Texas examines how future price shocks are likely to arise as the result of conditions entirely different from those of the 1970s that caused real crude oil prices to rise sharply.

The 12 chapters, which reflect the consensus of experts, span the fields of energy economics, technology and policy, are divided into four parts.

The first part analyses the dynamics of oil pricing and distribution, the importance of the US strategic petroleum reserve, the accuracy of energy forecasting OPEC stability and the effectiveness of the International Energy Agency. There is also an examination of the need for a diversified mix of energy resources for strong future energy security.

Part 2 looks at the factors which ensure efficient and cost-effective energy systems, and it surveys the latest developments in natural gas, fuel substitution, electricity demand, conservation and US domestic oil production.

The technological horizon is examined in Part 3. The papers provide a degree of caution, the authors concluding that the technical breakthroughs in cogeneration, coal conversion, synthetic fuels, conservation and natural gas will not yield benefits without simultaneous innovations and reforms in industrial management and government policy-making linked to new dynamic R and D programmes, reduced capital costs and favourable regulatory standards.

The concluding section assesses current and proposed initiatives to protect oil and other energy sources from upheavals in international politics and markets, and shows what kind of national and international policies are required to ensure US future energy security.

Currently the world is witnessing a substantial oil price slump. This situation, however, is unlikely to last indefinitely and eventually the US could face similar problems to those that existed in the 1970s.

President Reagan and the future occupants of the White House would be wise to consider the main conclusions of this useful report and incorporate them in the long-term energy strategy of the US.

This book provides considerable food for thought and I recommend that petroleum and other energy analysts should add it to their reading lists.

Andrew W Cox

again the units used vary with the subject. There is no cross-reference or link to the basic thermodynamic material in chapter 2. For example chapter 2 suggests that both spark ignition and compression ingnition cycles are closest to the Otto basic cycle while this chapter refers the latter to the 'Diesel' cycle. However, all of these sections contain a lot of useful, descriptive, selection and design material for the prime movers covered. There is an interesting short note on advanced concepts such as nuclear arc and ion rockets.

Chapter 6 — *Coal technology.* This covers coal formation and properties (relatively poor and technically indadequate) coal mining, beneficiation, transportation, unloading, storage, combustion (stokers and fluidized bed but nothing on circulating beds) but little comparison between types, pulverized fuel systems are dealt with under steam generating equipment, emission control systems — rather inadequate on data, requirements (but see chapter 8) and performance, coal conversion and alternate fuels, coal/oil and coal/water mixtures.

Chapter 7 — *Nuclear technology* oddly between coal and oil. Remarkably comprehensive and with reasonable reference to developments outside USA. No reference to new developments in small and ultra-safe reactors. This is particularly unfortunate as there are some significant developments in USA, Canada, Sweden and USSR which could be of interest in world markets for supplying steam and hot water, particularly for district heating. The section on enrichment is also limited in information, however, covering in brief descriptive paragraphs all the main techniques.

Chapter 8 — *Petroleum technology* includes conversion to SI. Very comprehensive review on oil particularly fuel oil and oil refinery technology. Exploration and discovery, crude oil processing, transportation, covers pipelines and tankers (briefly), storage, fuel oil handling and burning, pollution reduction and waste removal systems. However, there is little on trends to blended fuel oils and their problems.

Chapter 9 — *Gas technology.* Short section covering exploration and discovery, natural gas (USA) liquefied gas, synthetic and substitute gas (including BGC and Woodall-Duckham (gas intergrate) transportation (pipelines, not tankers), storage and safety, burners, emission control and regulations, fuel cells (brief and very general section).

Chapter 10 — *Hydroelectric power.* Theory and sites, hydraulic turbines and associated equipment, dams.

Chapter 11 — *Solar derived power.* The sections here are direct solar energy, wind power, biomass conversion and ocean energy.

The direct solar section has general descriptive material but unfortunately no performance data on various designs of solar panel which is unfortunate in view of the wide use commercially and domestically of these devices. Their links to cooling and refrigeration systems are interesting and there is half a page on 'passive solar'. In view of the importance of this topic in making buildings better environments this does not do justice to the subject. Another surprising omission is the topic of solar ponds. The solar photo-electric cell has much more detailed treatment including links to utility grid systems. Central systems receive good coverage. The wind energy, not surprisingly in view of the wide application in parts of the USA, is an excellent section. Biomass both in direct combustion and anaerobic digestion is fully covered even to the extent of describing home wood stoves and their design and operation in 'environmentally responsible' ways. Refuse derived fuels are not covered specifically, ocean energy dismisses briefly tidal energy with no mention of the French Rance plant or the Canadian installation in the Bay of Fundy. This is surprising in the light of the tabulation of sites in chapter 1. Wave power too is poorly treated, the technology and research work in the field justify more information than is given here. Again chapter 1 draws attention to the potential in the form of a world map. The other sections on wind assisted ships, tidal current energy are extremely brief. It is interesting to note that there is a paragraph on salinity gradients. Ocean thermal energy conversion receives full treatment.

Chapter 12 — *Geothermal energy sources.* Here the emphasis is on district heating and electricity generation from steam and hot water from the ground. There is a useful section on the environmental hazards. The section however, completely ignores the related and potentially more significant area of energy extraction from dry rocks.

Chapter 13 — *Energy aspects of environmental control.* This chapter covers the design and operation of home boilers — coal oil and gas (some of the material and illustrations give unnecessary and difficult to use details of equipment) more on wood burning systems. There are sections on heat pumps, refrigerators and air conditioning.

Chapter 14 — *Electricity generation, distribution and use.* This covers electric power generation economics, power generation cycles and central power stations. The section on cycles has material on binary (mercury topping cycle of historic but little contemporary interest), the various losses associated with extraction, changes in exhaust pressure and feed heating. The treatment covers fossil and nuclear plant. Combined gas/steam cycles and co-generation have brief mention, they are dealt with in more detail in chapter 2. There is a long section on electricity distribution.

Chapter 15 — *Advanced energy systems.* The first section is on hydrogen, somewhat less topical now than in the 1970's. The coverage is comprehensive. There is a short but adequate section on fusion power. However, there is nothi either here, or in the solar section, on t space station plant transmitting energy earth by microwaves. The final section this chapter covers methods of usi lasers for studies of energy system including the use of holograms in ener studies.

Chapter 16 — *Guide to available cod* stands and reference material. A usef section listing the American codifyi bodies and the main energy relat documents.

Chapter 17 — *Engineerin mathematics.* This section is similar sections covering this field in mo engineering handbooks.

Chapter 18 — *Graphs and tables.* unit conversion table with a usef summary of SI units and their U equivalent. The rest of the tables u mainly US units but not exclusively.

Index — in using the index it was n always possible, at first try, to fi reference to material in the book.

In summary, a mountain information which I shall find frequent useful. There are some areas which I fe should receive a wider coverage and so unfortunate omissions. Future editio could undoubtedly tidy up t presentation, bring together subjects sp between several chapters, impro consistency between authors and perhap rationalize the units employed.

N G Worley

Publications received an noted

Draft standard glossary of terms relati to the sampling, testing and analysis solid mineral fuels (ISO/DIS 1213/2.

British Standards Institution

The draft is available for public comme and your views and technical commen are invited (by 30 April).

Copies can be obtained from Sal Administration (Drafts), BSI, Linfo Wood, Milton Keynes MK14 6L Subscribing members will be invoiced f £2.50, non-members should enclo remittance of £6.25.

□

lectricity industry
EP awards

London recently, the electricity supply lustry's PEP (Power for Efficiency and oductivity) awards were presented by r Peter Walker, Secretary of State for ergy.

To qualify for entry, a company has to monstrate that adopting an electrical ocess or service has helped to improve oductivity in one or more of three ways. ese are: a decrease in the amount of ergy used per unit of production; an provement in product quality; an provement in the working vironment in terms of greater cost ficiency or better working conditions. addition, to ensure that the efforts are cognized of both large and small mpanies, the awards are made in two tegories: manufacturing units with up 200 employees, and those employing ore than 200.

Entries are judged within 14 regional mpetitions organized by the Electricity oards in England, Scotland and Wales, oducing a total of 28 regional winners, om whom the national winners are lected. Each regional winner received a ophy and a cheque for £500. A total of 4 companies entered the 1985 regional mpetitions, compared with 349 in 1984.

In total, the regional winners show enefits worth £2.4 M/y for an vestment of around £2.8 M. These gures give an average payback of about 4 months. Included in the savings are ore than £1.2 M on energy costs, nearly) M kWh delivered energy or more than 00 t of oil equivalent. These figures are en more encouraging than last year, hen the 1984 regional winners invested total of £2.6 M and reaped the benefit f £1.58 M annual savings, including 00 000 energy cost savings.

National winners in each category ceive a trophy, a certificate and a eque for £1000. National second and ird place winners in both categories ch receive a certificate.

In the first category (up to 200 mployees) Dunkirk Metals of ottingham won the first prize with riston Alloys (Croydon) and Milbank loors (Essex) winning second and third izes. Greggs of Gosforth won the first ize in the second category with Brittania efined Metals (Kent) and United Glass ntainers (Clackmannanshire) winning cond and third prizes.

The judging panel for the national wards were: Mr A K Edwards MBE, eputy director general of the CBI; Dr E Finer, director for industry and mmerce at the Energy Efficiency ffice; Mr A Plumpton CBE, deputy airman of the Electricity Council and airman of the national panel; Mr J E aylor, central director marketing of the lectricity Council; and Mr N N Walmsley, managing director of Capital Radio.

The 1986 PEP Awards scheme is already in preparation, the rules and conditions of entry being the same as those applying in the 1985 scheme. Entry for the 1986 competition opened on 1 February. Further details and closing dates are available from Electricity Boards.

Source: Electricity Council

Energy saving research
Design engineers will benefit

It is claimed that substantial energy savings can be made by using soft magnetic materials in the construction of electrical equipment. These materials, which comprise a range of new technology electrical steels and amorphous alloys, promise significant reductions in specific energy loss compared to conventional silicon steels.

ERA Technology, which early last year published a report describing the properties and applications of amorphous alloys (ERA report no 85-0087), is now undertaking a performance assessment of the new technology materials, including laser scribed steel.

It is also proposed that a study of amorphous alloys is taken a stage further in order to determine the performance sensitivity of the alloys to mechanical stress, vibration and electrical supply harmonics.

The object of the research is to help the design engineer to select the right material for a particular application. The study will therefore determine also the limits on fabrication methods and operating conditions so that optimum performance can be obtained.

The project will be of major interest to companies manufacturing transformers, rotating electrical machines and electrical steels. Major users of electrical equipment will also benefit considerably from the work.

Source: ERA Technology

PWR vs AGR
SSEB supports AGR

The *Guardian* reported that the South of Scotland Electricity Board has continued its clash with the central generation board over its plan to build a PWR nuclear power station at Sizewell by telling the Parliamentary Group for Energy Studies that the reactor could increase electricity charges and did not offer any economic advantage.

Workers would be exposed to higher radiation doses than encountered in the British designed gas cooled nuclear reactors, known as AGR, which have already produced high performance at the Hinkley and Hunterston nuclear power stations, the board says.

The Scottish board is to introduce the AGR at the Torness nuclear power station under construction near Edinburgh.

The evidence to the parliamentary group, published in February, says that there is no justification for changing from AGR reactors, especially when the PWR faces a significant change in design.

The Scottish board charges the CEGB with becoming increasingly committed to PWR and says that the design of the Sizewell station has been taken to an advanced stage based on the Westinghouse plants in the United States.

In the US no PWR station has commenced construction since the Three Mile Island incident in 1979. The Sizewell B inquiry sat for 340 days, hearing evidence on the PWR proposal. Relatively little attention was given to the AGR.

At best, the PWR could do little more than break even with the AGR in economic terms. The reality was more likely to be — additional costs and uncertainties.

The AGR had proved itself. 'A decision to change now would have far reaching implications and in practice could not be reversed'.

Source: The Guardian

Health and safety
Electrical hazards

A special survey by HM Factory Inspectors has revealed areas of concern in the ageing electrical distribution systems used by many of Britain's factories*. In a review of the survey, published in January, the Health and Safety Executive sets out the findings and makes recommendations for employers to adopt better planning, supervision and maintenance.

The principal aim of the survey, a study of factory distribution systems coupled with knowledge gleaned from inspectors' previous investigations into electrical switchgear accidents, was to assess the adequacy of switchgear, fusegear and associated protection devices. Installations which incorporated both high voltage (exceeding 650V) and medium voltage (not exceeding 650V) were included.

Medium voltage presented a less satisfactory picture than high voltage, in part due to the age of much of the equipment surveyed which dated from the early 1940s.

The survey found that standards of

**Safety of electrical distribution systems on factory premises,* OP10, from HMSO or booksellers, price £2.50

maintenance varied throughout industry and concluded that 10% of all installations were inadequately maintained.

Dangerous or potentially dangerous conditions were identified in 12% of installations, all on medium voltage equipment. These conditions included grossly exceeded fault capacities of switchgear, pilfered copper earthing connections and even deliberately circumvented protective equipment.

High voltage systems whilst performing better than medium voltage did show some problems and in one year, 27 accidents and dangerous occurrences involving oil-filled high voltage switchgear were reported.

The report stressed that planning and record keeping to anticipate problems rather than waiting for an incident before taking remedial action can pay dividends, 'the costs of installation improvements,' says the Executive, 'were more than offset by the benefits obtained in the form of better system reliability and operation, besides eliminating the cause of the accident.'

The conclusions of the review emphasize the need for monitoring of fault levels, good routine maintenance, keeping of records, the competence of persons responsible for electrical systems and safe systems of work to be reviewed and improved.

Source: Health and Safety Executive

'Hot rocks' energy
Research threatened

The future of Britain's experimental scheme to get energy from 'hot rocks' in Cornwall hangs in the balance reported the *Guardian* in February.

The United States Government and companies are interested in 'buying up' the scientists involved.

Government funding runs out in September but despite repeated attempts to get reassurances about future funding from the Department of Energy, the 60 people involved are now considering selling their expertise elsewhere.

The team is producing 5 MW of electricity, at the Rosemanoes quarry at Stithians near Penryn by using a 2800 m borehole into hot rock. The team pump in cold water and get hot water out at between 70 and 90°C. Ultimately a 5000 m borehole would produce water at 180°C which is ideal for large scale production of electricity.

Dr Tony Batchelor, of the Camborne School of Mines, who is director of the project says: 'In fact we have nothing concrete to sell to the Americans — all we have is expertise.

'Because the Government has not been forthcoming about a grant we have had to look round for other possibilities. The Americans have shown a lot of interest. We are trying to keep the team together and this may be the only way of doing it'.

The Department of Energy said that there was no reduction in support for the project and future funding was still being considered. It has been funded since 1977.

Dr Batchelor said that Britain was only interested in producing electricity from hot rocks and it had to compete with nuclear power in cost. Research and development costs of nuclear power were not considered in the Department's sums while all the costs of hot rock technology were.

The Common Market took a different view and was helping the Cornish project because it was interested in district heating schemes and using the heat for greenhouses or fish hatcheries.

Unfortunately the grant of £1.5 M from the European Economic Community was dependent on the continuation of the Government grant which is £2.5 M a year.

Hot rock used to produce electricity is mostly found in volcanic areas, particularly in the US. Interest in Cornwall was partly because it is not volcanic and radiation produces the heat. American interest was intensified by the fact that the Russians were ahead in this technology.

Source: The Guardian

Australia
Coal to oil

The first stage of a project to produce synthetic petroleum from brown coal in Australia is expected to start operating in October.

Construction of a Aus $400 M pilot plant at Morwell, eastern Victoria, began in 1981 and has been funded through the Japanese Government.

The plant is expected to convert 50t of dry coal a day into 30t of solvent refined coal, an intermediate product that will be used in the second stage of conversion. The second stage will begin operation in 1986.

The developers say the project could provide about 100 000 barrels a day of synthetic petroleum when full-scale commercial operation begins next century. Such an operation would require an investment of up to Aus $8000 M.

Source: Australian Information Service

Ireland
Highest electricity prices

Ireland still endures the highest electricity prices in the EEC even though the last NUS international electricity survey recorded rises for 1984/5 below the rate of inflation. But, since the survey was conducted, the ESB has announced that it is to seek a further 5% rise over the next twelve months. In comparison with Irish RPI figures this is not a big increase but it does keep Ireland at the top of the EEC price league.

The 5% increase is designed to rectify the operating deficit reported by the ESB for the year ending 31 March 1985. Although this deficit has risen by a record £27 M in this period the ESB reckon tha with this 5% tariff increase, the compar can turn in an operating profit by 198

The ESB has been at the forefront c public attention for other reasons toc Whilst trying to push through the internal reorganization proposals, th Officers Association and th AUEW/TASS threatened and too industrial action claiming the ESB ha failed to discuss the proposals with unio representatives.

The ESB claim the proposals are vit to ensure further tariff rises remain belo the rate of inflation and costs are kept t a minimum. The unions say the proposa will reduce the quality of service to th customers.

In its defence, the ESB is quick to poir to limiting factors that just do not affe Ireland's EEC trading partners. Th electricity grid is isolated and canno benefit from surplus capacity as EE countries can by buying across border In addition, the ESB says the position i exacerbated by the need to suppl Ireland's widely dispersed population.

But this view has been challenged, no least by politicians who claim the ESB i currently generating about 75% mor capacity than is demanded, even at pea times.

Nevertheless the outlook for busines consumers is changeable as the ESB hop to introduce in the near future separat tariff rates for domestic and industria users.

Source: Utility Newsbriefs

World Bank
Funding for electricity

Uruguay is launching a project to mak hydroelectric generation more efficien and electrical service more reliable. Th World Bank is lending the country $45. M to help finance the project, which i expected to help reduce fuel consumptio in the country.

The national power company i spearheading a drive to rehabilitate hydropower plant in central Uruguay extend the transmission network, an upgrade the distribution system. Th project, expected to be completed by th end of 1992, will cost approximatel $138.1 M. $40.4 M will be provided b the power company towards the cost o the project and co-financing of $52.5 M is being arranged.

Similarly Ghana's efforts to improv the reliability of the supply of electricit to the country's vital industries wi receive support from the Internationa Development Association. The IDA, th concessionary lending affiliate of th World Bank, will assist the project wit a credit of $28 M.

The project will finance th rehabilitation of the generating an distribution facilities of the Electricit Corporation of Ghana (ECG) and th Volta River Authority (VRA), two majo power suppliers in the country. I

dition to the IDA credit, funding will o be provided by the ECG, VRA, the lian Government, and the United ngdom.
urce: World Bank News

Wind energy
Vorld market evelopment

the 1970s when the rapid escalation in prices forced a reassessment of other rgy resources, wind generated power s seen as a possible solution for veloping countries and remote, isolated mmunities or islands where the ditional cost of transport made fuel ces particularly high. Amongst the veloped countries, America and nmark initiated major programmes to velop wind energy conversion systems. Britain an early estimate of the British nd resource at 16 TWh/y, or 7.5 M rrels of oil per year, suggested that the ource was too large to be ignored and vind energy programme was initiated, ected mainly towards the development gawatt sized wind turbine generators. Wind power is one of the most omising renewable energy resources d the Department of Energy R and D dget of £6.5 M for 1985 represented ore than 50% of the total budget for newable energy research.

Denmark, with little indigenous fuel couraged their wind industry to velop small wind turbine systems. At esent there are approximately 1500 ivately or communally owned systems Denmark with a total capacity of 50 W.

In the past two years the European nd industry has concentrated much ore on foreign markets, particularly in alifornia. The United States overnment formulated a policy to courage the use of renewable energy sources in the 1970s which, in addition providing direct financial backing for e development of megawatt size achines, introduced a system of tax edits at the federal and state level to courage private investment in newable energy resources.

In the early 1980s, as California veloped an increasing concern about mospheric pollution from oil fired nerating plant, the tax credit system as seized upon as a tax shelter for higher racket tax payers who invested tensively in wind turbine generators laced on *wind farms* to generate power sell to the utilities. During the three ars to the end of 1985 approximately 00 MW of wind plant has been stalled.

In Britain the development of wind rbine generators smaller than megawatt ze was taken up by individual anufacturers. In 1981, before the US ind farm market developed, a large orld market for medium sized wind rbines at 200-500 kW was identified for tility use as fuel savers on small diesel networks. 300 kW wind turbine generator was designed for this purpose and the first was installed on Orkney during 1983. Although one of the largest machines sold commercially, it was designed for ease of installation and maintenance in remote situations.

With the massive developments in California the price of wind turbine generators has decreased to the point where they can compete with some conventional generating plant without the need for grants or tax credits. India and Israel have followed the Californian lead in establishing wind farms and many other American states are planning wind farms, while California itself has plans for a further 5000 MW of wind power within the next few years.

The use of wind turbine generators in Europe is also spreading and it is predicted that by the year 2000, wind power could provide 10% of Europe's electricity. In this period of power planning uncertainty the short lead time for wind plant is likely to give the industry a major advantage.

Apart from India, there has been little uptake of wind plant by the developing countries which were initially seen as a major market. This is largely due to a lack of funds, but now that reliability of wind turbine generators has been established it is likely that funding agencies will support their installation in the future.

An indication that this is happening has been given by the ordering of a 250 kW wind turbine generator as a demonstration unit in Barbados*, funded by the Inter-American Development Bank and the Government of Barbados.
Source: James Howden Group

Concrete
Ash could be the cure

There is growing evidence that the byproduct ash from coal-fired power stations will play a key role in fighting 'concrete cancer' reported *Power News* recently.

The cancer — alkali silica reaction (ASR) — is a damaging chemical reaction that takes place when cements with abnormally high alkalinity are mixed and react with aggregates containing certain forms of silica. Although a rare combination, it forms a gel which absorbs water, swells and cracks concrete.

Pulverized fuel ash is already renowned as a low-cost cement replacement for concrete. Now this talcum-powder like substance looks capable of avoiding ASR which stalks roads, bridges and other concrete structures.

Shape is the key. PFA — or fly ash as it is known internationally — consists of tiny, rounded dust particles, which make concete more workable than conventional all-cement concrete with less mixing water.

Some air and water is trapped in the concrete as it is mixed, most of which is removed during placing. However, most water used in the mix will be chemically absorbed leaving small holes in the concrete called pores. Less water, smaller pores.

There is also less shrinkage when PFA is used simply because the heat produced by the PFA-cement mixture on setting is less and takes longer.

The message, then, is clear — the smaller the pore, the more difficult it is for water, chemical or gaseous pollutants to enter and cause damage. Water, for example, will not freeze in a pore below a ten thousandth of a millimetre — normally use of PFA will produce residual pores measuring considerably less than that. Without water ASR stops.

There is, then substantial evidence — notably produced by the Hawkins Committee, on which sit leading UK concrete experts — that the presence of PFA will reduce the damaging expansion of alkali aggregate reaction, commonly called concrete cancer.

The committee said 'Damage to concrete is unlikely to occur if any ordinary Portland cement is replaced by 25% or more pulverized fuel ash, provided that the alkali content of the concrete provided by the cement is not more than $3 kgm^{-3}$'.

The same fine pore structure prevents atmospheric carbon dioxide getting in and reducing the concrete's alkalinity. It is this alkalinity that provides an environment in which corrosion of reinforcement — that expansive reaction that forces off the cover concrete — cannot occur.
Source: Power News

Battelle
Power plant study

A study to describe financial and strategic factors affecting the promising power plant market in developing countries is being offered by researchers at Battelle.

Called *Power Plant 2005,* the study will focus on 17 countries in four regions, including Southern Europe and Africa, Latin America, and Asia. The study will be supported by a number of organizations, and is directed, in particular, toward governments, utilities, financial institutions, suppliers of primary energy, engineering companies, main equipment suppliers, and general contractors.

Results will help participants plan competitive strategies for the development of electricity in selected countries. 'Energy demand in developing countries is likely to increase dramatically over the next twenty years,' says J J Derouette, who will direct the research. 'In contrast, in industrialized nations, the power plant market will shrink, with existing overcapacity and low demand creating intense competition among large power plant contractors.'

In conducting their study, researchers will examine the interaction of such

*James Howden of Glasgow

driving forces as electricity demand, financing capability, primary energy sources, project management organization, and local competition. These factors, along with existing generating capacity and transmission lines, make up the electric power development system in each country.

For each country, power plant forecasts, including type, size, timing, and possible location of power plant projects through 1995 will be made, based on existing government electricity programmes, the country's present situation, and the structure of existing generating capacity. In addition, most likely project management organizations, local competition, and major success factors for key contract allocations will be identified.

Macroeconomic models then will be used along with the results of the 1995 forecast to develop forecasts through the year 2005.

Finally, the team will assist participants in determining significant regions that could play a key role in the development of their own strategic plans.

Countries to be studied are:

- ☐ Region 1 Turkey, Pakistan, China, Republic of Korea.
- ☐ Region 2 India, Thailand, Indonesia, Philippines.
- ☐ Region 3 Mexico, Colombia, Brazil, Argentina.
- ☐ Region 4 Portugal, Yugoslavia, Greece, Egypt, Nigeria.

Cost to participate in the two-year multiclient study is 70 000 Swiss Francs (approximately £23 000) for regions 1 and 2, and 60 000 Swiss Francs (approximately £20 000) for regions 3 and 4.

Source: Battelle

Combustion research
Coal char burning rates

Reginald Mitchell, Dan Tichenor, and Ken Hencken of the Combustion Research facility in California, have recently developed a particle sizing-pyrometry-system capable of measuring the size, temperature, and velocity of the chars of coal particles burning in a laminar flow reactor. By using the measurements in the governing mass, momentum, and energy conservation equations, the overall particle burning rates per unit external surface area were determined. From these overall burning rates, the chemical reaction rate coefficients were determined.

The value of the activation energy (obtained from a least squares fit to data obtained in 3% and 6% oxygen environments) suggests that the particles burn in a regime in which their overall burning rates are limited by the combined effects of pore diffusion and the intrinsic chemical reactivity of the particle material.

Source: CRF News

Culm combustion...
...using FBC

The successful conversion of some 900 M tons of anthracite coal refuse into useful energy is feasible as demonstrated by recent tests in an advanced coal combustor. The US Department of Energy (DOE), working with East Stroudsburg University in northeastern Pennsylvania, has successfully burned culm bank material as fuel for over 4000 hours in a fluidized-bed combustor.

Culm is the rock-laden waste that remains when anthracite is mined and the higher quality coal is separated out. More than 150 years of anthracite mining in Pennsylvania, where nearly all of the nation's anthracite is located, has left huge banks of culm. This waste material has an energy equivalent of more than 1 billion barrels of oil. In many areas of the state, piles of anthracite culm tower several storeys above local homes and buildings.

The fluidized-bed combustor being tested at East Stroudsburg University produces up to 40 000 lb steam/h for heating buildings on the university campus and for miscellaneous uses including air conditioning, domestic water heating, and kitchen services. The combustor extracts useful energy from the small amounts of anthracite coal left in this residue. A pound of anthracite culm releases between 3000 and 6000 Btu's when it burns, compared to as much as 12 000 Btu's per pound from pure anthracite.

The large proportion of non-combustible material in the culm would hamper combustion in a conventional boiler. A fluidized-bed combustor, however, functions differently. Air blows upward through a bed of solid particles, typically sand or limestone, heated to about 1550°F. The mixing of the bed, an action resembling a boiling liquid, accounts for the name fluidized bed.

Culm particles ignite quickly when injected into the hot, churning bed, and heat is transferred from the bed to boiler tubes. Since only 1 to 2 % of combustible material is needed to maintain the necessary temperatures in the be fluidized-bed combustors can bu materials of very low heating value. Ro and other refuse that cannot be burn fall to the bottom of the combustor whe they are removed with the ash.

The fluidized-bed combustion conce is also applicable to other wastes, such petroleum coke and low-grade oil shale shale residue as well as higher quali fuels such as bituminous and su bituminous coals.

Source: US Department of Energy

National Gallery
New heating system

A new heating and hot water syster designed by the Property Servic Agency, has just been installed in t National Gallery, London. It will help preserve works of art by keepi temperatures and humidity at the rig levels. The public will be able to view t gallery's treasures in controlle temperatures in both summer and winte The heating system also serves t adjoining National Portrait Gallery ar has the capacity to supply heat and h water for the proposed extension.

The system took two years to insta and cost £600 000. It uses new technolo to give a versatile service and save mone the total cost of the project should recovered in three years.

The new system replaces one over years old which has half the heat outp and cost almost twice as much to run. T three new boilers are housed in basement extension of the Nation Gallery and have a maximum output 6925 kW, running at 83% efficiency.

The system's nucleus is a sequenti electronic modulator which is sophisticated version of the domest thermostat, giving a delicate control heat output and humidity. Ever functioning unit has an auxiliary as bac up, and the boilers have a dual fuel supp to enable a switch from gas to oil if the is a break in the supply.

The Property Services Agency is t largest single design and constructio organization in the United Kingdom. I main task is to design, construct an maintain office and simila accommodation to meet the needs government departments, to provide lan and other facilities for the Armed Forc and Government Departments and f the economic and efficient use management of all those facilities.

Source: Property Services Agency

Yorkshire branch

Wednesday 9 April 1986

Combined heat and power

Symposium organized jointly with Institution of Chemical Engineers
University of Sheffield

nergy efficiency 1986

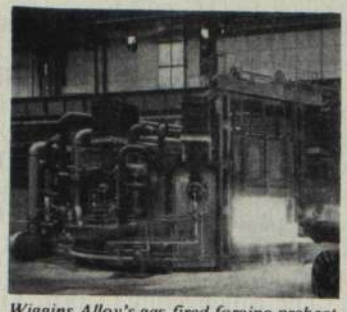
odification of furnace to ve energy

ggin Alloys, the British division of **:o Alloys International,** have ried out a significant modification reduce running costs on a natural -fired rotary furnace used to heat forging billets. The company ect to cut fuel consumption by up 50% and claim that the capital cost be repaid in two and a half years. As a result of consultants' ommendations, Wiggin Alloys ided to equip the furnace with a v type of regenerative burner tem, supplied by Hotwork velopments. The design, eloped specifically for furnace lications, harnesses the thermal rgy of the plant's waste gases to heat incoming combustion air to mperature of 1100°C. A high-ciency heat exchanger is loaded h many refractory ceramic eres, which maintain a constant of heat transfer to the furnace air ply.

ader enquiry no 3/1

mputerized boilerhouse

ew computerized boilerhouse was ned at **Anchor Chemical Group's** nt by Mr David Hunt, liamentary Under Secretary of e for Energy. It is claimed that



Wiggins Alloy's gas-fired forging preheat furnace

annual savings will be over £150 000 a year.

The boilerhouse, which replaces one destroyed by fire in September 1984, uses gas as the basic fuel for firing the boilers with a gas oil standby. The computer-controlled system monitors combustion conditions in the boilers and makes automatic adjustments as needed. A heat recovery system is installed in the flue and use is made of residual heat in the hot water formed as the steam output is used.

The building housing the boilers and engineering facilities has been well insulated and the centralizing of the stores facilities allows the company to extend its computerized stock control system to engineering items.

Reader enquiry no 3/2

ect-contact water heater

rdsea is now the only company can supply the full range of the direct-contact water heater eloped by British Gas and Thurley rnational. Nordsea originally aborated in the design of this cient heater, and were awarded a ice to build the smaller sizes up to kW. Now in addition they can r the larger capacities above 200 The range has been named *dsea-Cascade* since the Thurley P Division products were uired by Nordsea. The ex-Thurley lucts are complementary to the dsea range of equipment.

fficiencies of 98% have been eved with this unit with an age efficiency over six months of . It is claimed that savings eved over the original steam m are £350 per week — resulting payback time of only 12 months.

der enquiry no 3/3

t recovery thermal eels

recovery thermal wheels have tly been manufactured and lied by **AAF** for Gatwick ort's new North Terminal.

irteen RLW thermal wheels, in different sizes, are mounted on ront of the air handling units to er energy from the extract air of terminal's air conditioning n. Each wheel, the largest being n diameter, is manufactured alternative layers of flat and gated aluminium foil with a al surface treatment, to aid the fer of moisture as well as heat. wheels and support housings are for ease of assembly on site.

W thermal wheels work on the ar flow principle, and are ble in sixteen different sizes with capacities ranging from 0.14 to 72 m^3/s and efficiencies up to 88%. A built-in purge system minimizes cross contamination between the supply and extract air.

Reader enquiry no 3/4

Airflow line burners

Maxon Combustion Systems have added the series 'LV' Airflo line burner to the existing range of series 'NP' and 'RG' Airflow line burners.

This modular raw-gas burner is for direct-fired air heating of variable air volumes. The design is optimized for low or varying air stream velocities giving dependable operation with minimal air system pressure drop. The burner assembly is mounted in the air stream to be heated in such a way that part of the air stream passes through the burner mixing plates and is used as combustion air. It is claimed that carefully controlled aeration patterns give progressive mixing, superior cross-ignition and flame retention with clean, odour-free combustion.

The burner has a high turndown (up to 25:1) and can operate on natural or propane gas. There are four burner types available: for low or high heat release per length of burner and for low or high temperature applications.

Reader enquiry no 3/5

Advanced solar collector

A vacuum solar collector manufactured by **Thermomax** offers, it is claimed, improved performance, durability and ease of installation as compared with conventional 'flat-plate' collectors.

The new collectors use an evacuated glass tube to prevent convection/conduction heat losses and to safeguard the absorber from outside adverse influences. Transfer of heat from the absorber to the outside is by means of a specially designed 'heat pipe' resulting in an efficient and safe heat transfer.

Two models of collectors are currently available: one with a maximum working temperature limit of 95°C for domestic hot water and heating; and another for high-temperature applications (up to 140°C) for industrial process heat, air conditioning, sea water desalination and for driving small turbines.

Reader enquiry no 3/6

New approach to the examination of colliery waste

Derek Parnaby Cyclones International are well known for their closed-cycle washing system for the recovery of coal from waste tips. This recovery is enhanced when the quantity, composition and characteristics of the waste material to be handled can be established in advance and the plant then designed to match them. Parnaby are now the sole UK agent for new equipment developed by a Belgian company, Geosurvey.

By passing an electric current through a mass of material, its resistivity and polarization can be measured. From these data, layers and volumes that have uniform characteristics can be determined. With recent developments in electrode design and positioning, and the computer analysis of readings, it is now possible to produce three-dimensional simulations of structures of interest and thus provide a framework within which more cost-effective conventional sampling can be undertaken.

Using such methods, the depths and extent of coal seams in mines can be determined accurately. The precise position of the bed rock below tips can also be established, to give the total volume of material available for processing. Within the tip, burned material can readily be distinguished from unburned material and variations in grain size and porosity provide further means to delineate zones of uniformity.

Reader enquiry no 3/7

Trade publications

Air mass flowmeter. A new leaflet describing the Type 1642A air mass flowmeter has been produced by **Lucas Dawe Ultrasonics.** The instrument is for use in the research and development of internal combustion engines, or other applications where both steady and pulsating flows are encountered. Using the corona discharge principle it measures true mass air-flow independent of pressure, temperature and velocity profile. The exceptionally fast response time of less then one millisecond and bi-directional capability make the instrument suitable for investigating the dynamic behaviour of rapidly changing flows. The wide dynamic range means that the unit will cover air flow measurements from idle to full speed and load, for most passenger car engines.

Reader enquiry no 3/8

Automatic intermittent steam boiler blowdown valves. A leaflet has been published by **Thermal Technology,** describing their new range of automatic intermittent steam boiler blowdown valves. In areas where water is slightly hard and condensate return rates are high, continuous blowdown systems cannot be justified on both technical and economic grounds. In these cases continuous blowdown rates become too low and this is when automatic intermittent blowdown should be considered. It is claimed that the installation of Thermal Technology's automatic intermittent system enables accurate programming of boiler water characteristics by reducing the reliance on manual blowdown and controlling dissolved solids concentrations.

Reader enquiry no 3/9

New products from Kent. The most recent developments in a wide range of instrumentation produced by **Kent Industrial Measurements** are shown in a full colour illustrated brochure now available. The brochure describes how Kent have introduced a whole new range of microprocessor-based instrumentation, a family of transmitters and converters and a series of new flowmeters and liquid and gas analysers.

Reader enquiry no 3/10

□

ENERGY WORLD — COMMERCIAL
(Photocopy acceptable)

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

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

Name .....

Address .....

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Organization .....

Engineering Council
Engineering Assembly appointment

The Engineering Council has appointed *Sir Robert Telford* FEng to two key posts in its development of regional policy. He is to be the first chairman of the Engineering Council Regional Organization Co-ordinating Committee and chairman of the Engineering Assembly Committee with immediate effect. Sir Robert, who is life president of the Marconi Company, is a member of the Engineering Council.

The key to new jobs

Courses in higher education which respond to national market needs by providing the right numbers of people with vocational qualifications will enable innovators and entrepreneurs to create the new jobs of the future. This was stated by the Engineering Council in February in its response* to the Government's Green Paper *The development of higher education into the 1990s.* The Engineering Council approves the general thrust of the Green Paper which spells out the Government's concern at the relative economic performance of the United Kingdom in world markets.

In its statement, the Council also called for a radical new system of rewards for successful universities and polytechnics. It says that universities and polytechnics which raise finances from areas outside their basic grant should be given increases in their basic grant, even at the expense of other higher education institutions which do not show the same initiative. In this way, says the Council, every university and polytechnic department should regard itself as a 'Centre of Opportunity' and through this dynamic but self-balancing system the relative positions of universities and polytechnics may be changed.

The Council says that if the projection of the total supply of graduates of all kinds is as bleak as the Department of Education and Science figures indicate, the skills shortage is likely to get worse. Measures must therefore be taken to stimulate the supply of scientifically educated students coming forward from the schools.

So far as assessing market needs is concerned, the Engineering Council draws the Government's attention to its Industrial Forum which comprises the 120 or so Industrial Affiliates of the Council through whom professional and skill demands could be monitored.

The Engineering Council says that a prerequisite to any policy on higher education is the overriding need to maintain and increase the flow of pupils able to pursue engineering, mathematics and physical sciences in higher education. The Council says: *'The number and quality of mathematics and physics teachers in the schools is giving rise to concern if not alarm.'* The Engineering Council describes the problem as urgent and proposes a battery of measures to help solve it, including differential salaries for teachers of physical sciences and mathematics.

Among other salient points the Engineering Council makes in its detailed response to the Department of Education and Science are:

- ☐ Government departments should cease working in watertight compartments and collaborate on education and training.
- ☐ Properly designed, broader-based engineering courses should be developed.
- ☐ More engineering training places are needed and this should be tackled nationwide with all firms contributing.
- ☐ Central action should be taken to encourage much better collaboration between the universities and polytechnics in each region, particularly regarding costly equipment.
- ☐ A job for life and once-off education are things of the past. A radical change of attitude on the part of many employers, of individuals and of providers of education and training will be needed.
- ☐ The Council supports government policy to ensure that all pupils have a broad and balanced curriculum up to the age of 16 and to provide a broader curriculum for the 16 to 18-year-olds coupled with a need for higher education institutions to broaden their entry requirements.
- ☐ Because the cuts of the last few years have fallen unfairly and disproportionately on university and polytechnic departments of engineering, earmarking of funds is necessary albeit only on a short-term basis.
- ☐ Consideration should be given to the funding of all engineering degree courses in universities and polytechnics from one source to ensure proper distribution of resources between universities and polytechnics.

*A copy of the Council's full response can be obtained from the Engineering Council, 10 Maltravers Street, London WC2R 3ER (tel 01-240 7891)

New members
Fellow

Kenneth Gerald Aldridge, NIFES, Bishops Stortford, Herts *(transfer)*
William Bartok, Exxon Research & Engineering, New Jersey, USA
Bimal Biswas, Foster Wheeler Corp, Ne Jersey, USA
Colin Richard Chapman, CEGI Nuclear Power Training Centre, Brist *(transfer)*
John Dingle, Oxford Petroleu Consultants, Oxford *(transfer)*
David George Jefferies, Londc Electricity Board, London
Edward T McHale, Atlantic Researc Corp, Virginia, USA
Godfrey John Stancombe, Royal Sau Naval Forces School, Saudi Arab *(transfer)*
Alan West, North Thames Gas, Londc *(transfer)*

Member

Nigel John Beer, South Staffordshi Waterworks, Walsall
Richard Martin Brailsford, Oscar Fabe St Albans, Herts *(transfer)*
Patrick Roger Thomas Conagha Ewbank Preece Design Partnership, Gl
James Joshua Costello, Hulley Kirkwood, Glasgow
John Martin Crane, Troup Bywaters Anders, London
Anthony John Garland, Sir Herbe Humphries & McDonald, Norwich
Geoffrey John Hardwick, British Ga London
Richard Gordon Harling, Senior Gree Wakefield, W Yorkshire
Eryl John Husband, CEGB, Hartlepo Power Station, Hartlepool
Alan Donald MacInnes, Babcock Powe London
Dennis Read, SCM Chemicals, Grimsb
Ian Vaughan Rogerson, W S Atkins Partners, Epsom, Surrey
Peter Martin Samain, Haden Technic Services Corp, USA
Chin Bok Saw, University of Newcast upon Tyne *(transfer)*
David Robert Wilks, North Thames Ga Slough, Berks

Technician Engineer

John Caine, NIFES, Altrincham Cheshire
Grant Moncur Dallas, Building Desig Partnership, Glasgow
William Hallett, NIFES, Glasgow
Richard John Wills, London Region Transport, London

Associate

Dennis Butcher, Fuel & Combustic Technology, High Wycombe, Bucks
Michael George Fereday, Southern Ga Distribution Dept, Southampton
John Malone, Strathclyde Region Council, Paisley, Renfrewshire

(continued o p 2

rry O'Neill, Botswana Power
rporation, Botswana
rman Acton Smith, Eastern
ctricity, Luton, Beds
il Graham Whitfield

raduate

chael Andrew Clarke, Airdale Intl Air
nditioning, W Yorkshire
domir Jerzy Gabriel Serafin, British
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shan David Francis De Silva,
iversity of Sheffield
artin Peter Grant, University of
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ehdi Navaei
cholas Paul Reynolds, University of
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len Ann Robertson, University of
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i Keung Tam, University of Newcastle
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illiam Stuart Todd, University of Leeds
azel Dawn Townley, University of
ton in Birmingham
ter King Lam Wong, Wolverhampton
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niel Bienstock (Fellow), deputy
rector, Project Management, Pitts-
rgh Energy Technology Centre, and
norary secretary, US chapter, Institute
Energy, was presented with an award
Maheshwar Dayal, secretary to the
overnment of India and secretary,
epartment of Non-Conventional
ergy Sources, for aiding India in
lizing its biomass and coal so as to
crease its dependency on oil. Mr.
enstock manages seven programmes in
omass and coal conversion in India
der funding by the US Agency for
ternational Development.

W T Cosby OBE (Fellow) has retired
om his position as vice-president and
neral manager of the European division
American Air Filter, based in
sforth, Newcastle, having completed nineteen years with the group.

He will maintain his relationship with the organization as a non-executive director of Cramlington-based AAF and Elex AG of Switzerland, both members of the now discontinued European division. In his new role, Dr Cosby will spend some of his time in the field of environmental pollution control, an area in which he has spent most of his working life.

He is also a Fellow of the Institution of Gas Engineers and of the Institute of Directors.

P F Leivers (Fellow) has informed us that to mark 21 years in practice, P F Leivers, Consulting Mechanical & Electrical Engineers based in Nottingham, have changed their name since 1 January 1986, to Leivers Associates. Malcolm F Leivers (Member), eldest son of the founder, has been taken into partnership. Two senior engineers, Colin Hopcroft and John R Lee, become associates. The changes in management structure reflect the continuing growth of the business and the responsibilities carried by senior members of staff.

The practice specializes in mechanical and electrical building services. Whilst the bulk of the work initially was mainly industrial, in recent years this has been overtaken by an increasing workload from the public sector. Design work in the commercial sector also appears to be particularly strong at the present time.

Prof S Warne, who is associate professor of geology at the University of Newcastle, Australia, has been awarded the Kurnakov Medal by the Institute of General and Inorganic Chemistry of the Soviet Academy of Sciences for his research in thermal analysis of coal and oil shale.

Her Majesty The Queen has appointed **Sir Frank Whittle** KBE CB FRS, the jet engine pioneer, as a member of the Order of Merit. Founded by King Edward VII in 1902, the order is restricted to 24 holders at a time. Sir Frank, who is 78, is the 19th holder of the Institute of Energy's Melchett Medal and received his Medal in October 1949 at the Institute's annual dinner and dance then held at the Connaught Rooms.

Obituary

J A Kilby (Senior Fellow) died on 11 October 1985. He joined the Institute as an Associate in 1947.

D R Prothero, (Member), managing director of TI Parkray, died of a heart attack on 23 August 1985 at the age of 60. He joined the Institute as a Student Member in 1945.

Mr Prothero, who obtained his academic qualifications at Birmingham and Sheffield Universities, joined Radiation at Birmingham as a development engineer in 1948. He was transferred to Park Foundry in 1955 to set up a solid fuel laboratory for the development of products on a proper modern scientific basis. This was reflected in the successful range of Parkray room heaters introduced in the 1960s. He had been appointed in 1961 technical manager covering the design and development of Parkray room heaters.

In July 1964 he was promoted to general manager and after joining the Board on 1 January 1965, he became managing director on 1 January 1971.

Mr Prothero pioneered the use of smokeless solid fuel in the domestic appliance heating industry and was once described as 'a specialist of great vision'. He was a staunch believer in the use of solid fuel for domestic heating and his views and judgement on the subject were sought and respected throughout the industry for many years. He had been chairman of the Association of British Solid Fuel Appliance Manufacturers since September 1983, representing them at the Domestic Solid Fuel Appliance Approvals Scheme and the British Standards Institution.

J R Taylor (Fellow), who died last year, had been a member of the Institute since 1935.

N J C White, who died last year, had been an Associate of the Institute since 1978. After five years with the British Sugar Corporation, he joined Harp Lager Brewery (Southern) at Alton, Hants as an assistant maintenance engineer in 1971. He had special responsibility for the maintenance of all process plant including energy services, steam raising, refrigeration and emergency power.

B A Wilkinson, (Associate) died in Jersey in 1985. He had been an Associate of the Institute since 1961.

Institute of Energy annual luncheon

The Institute's annual luncheon will be held at the Inn on the Park, Hamilton Place, Park Lane, London W1 on Tuesday 29 April 1986 at 1230 for 1300 h. The principal guest and speaker will be the Rt Hon Peter Walker MBE MP (Secretary of State for Energy). A loose insertion was enclosed in all UK copies of the January and February issues of *Energy World.*

London and Home Counties: April meeting

The president of the Institute of Energy, *P C Warner* (director for corporate engineering, NEI), will speak on *Investing for energy* at the April meeting of the London and Home Counties branch. All are welcome at the meeting which will be held on **Tuesday 15 April 1986** in the Bernard Sunley Theatre of the Royal Institution, 21 Albemarle Street, London W1. The lecture will start at 1730 h, but tea and biscuits will be served in the Long Library from 1710 h onwards. The meeting will also be followed by a buffet supper (by application only).

South Wales and West of England:

1. AGM/chairman's address

The annual general meeting of the South Wales and West of England branch will be held on **Wednesday 23 April 1986** at the South Wales Institute of Engineers, Park Place, Cardiff at 1800 h. At this meeting *R G Herapath* will give his chairman's address. He will speak on *Waves, winds and tides.*

2. 14th Idris Jones Memorial Lecture

Please see loose insertion (blue) enclosed in all UK copies of *Energy World.*

3. Lunchtime lecture

The South Wales and West of England branch have organized the annual lunchtime lecture at the NCB Coal Research Establishment, Stoke Orchard, Cheltenham, Glos for 12 noon on Wednesday 18 June 1986. J E Talbot (chief systems engineer, British Aerospace) will speak on *Higher, faster, safer.*

Tickets and further information from A A Randell, NCB, CRE (tel 024 267 3361).

Efficient energy utilization: conference, Stockton-on-Tees, 14 May 1986

The Department of Civil and Structural Engineering and Building, Teeside Polytechnic are holding their fifth annual one-day energy conference at the Swallow Hotel, Stockton-on-Tees on *Wednesday 14 May 1986.* The cost is £25.00 (including VAT), which covers lunch, morning coffee and afternoon tea.

Provisional timetable

0900-0930	Reception desk opens.	
0930-0935	Welcome to hotel by director, Dr M Longfield.	
0935-0945	Opening remarks by chairman for morning session, *P C Warner* (president, Institute of Energy).	
0945-1030	Paper 1 —	D Hunt MBE MP (Parliamentary Under Secretary of State for Energy). *Government help with energy efficiency.*
1030-1045	*Coffee*	
1045-1115	Paper 2 —	M C Snedker (Cornwall and Isle Scilly Health Authority). *F recovery and management in National Health Service.*
1115-1145	Paper 3 —	K Platt (energy manager, Lon Borough of Lewisham). *En efficiency in local authorities.*
1145-1230	Discussion	
1230-1400	*Lunch*	
1400-1405	Introduction by chairman for afternoon sessio *Barton* (chairman, Teesside Energy Mana Group).	
1405-1435	Paper 4 —	F Kaye, P A Managem Consultants, London. *Indus energy efficiency.*
1435-1505	Paper 5 —	A Marriott (technical direc British Paper and Board Indust Federation). *Energy efficiency in paper and board industry.*
1505-1550	Discussion.	
1550-1600	Closing remarks.	
1600	*Tea*	

Further information from M G Burbage-Atter (confere organizer), Teesside Polytechnic, Department of Civil a Structural Engineering and Building, Middlesbrou Cleveland TS1 3BA (tel 0642 218121).

Value for monergy — improving ca flow through energy efficiency

This CBI/ACE conference will be held on Tuesday 3 Jun CBI Headquarters, Centre Point, London. Emphasis wil placed on the financial aspects of energy efficiency proje Chairman: John Banham, Audit Commission. Keyn address by the Rt Hon Peter Walker MBE MP (Secretary State for Energy).

Further information from Dorothy Harris (tel 01- 7400).

Process optimization: conference, University of Nottingha 7-9 April 1987

This international conference is being organized by Midlands Branch of the Institution of Chemical Engineers association with the AGM of the institution and the ann research meeting.

Call for papers

Authors are invited to offer papers on any aspect of proc optimization, but in particular on the subjects detailed bel

Project selection —	product and multi-product choice; selection; optimum use of available resour batch *vs.* continuous operation.
Systems —	flowsheets; mass and energy considerati reaction and separation routes; effl disposal; reduction of hazards; operati flexibility.
Detailed design —	modelling for optimization; cont development; layout; reliability analysis.
Plant operation —	energy saving; control improvemer operational research; maintenance schedu gathering and use of data; updating comp systems; product scheduling.
Hardware improvements —	debottlenecking; extensions; additio streams; intensification.
Techniques for optimization —	mathematical methods; data bases; ex systems and fault trees; critical examinat

(continued on p

REGISTER OF ENERGY COURSES

embers are invited to make use of the titute of Energy's national register of ergy courses, through which we can pply salient details of forthcoming urses of all types. As well as the mber's name and address, we need to ow (a) the specific subject in which he interested; (b) his present level of hnical qualification; and (c) the eferred geographical location. Only tails of suitable courses will be sent in ply.

ourse No 00-338

tle: Basic heating plant controls.
uration: 4½ days.
cation: British Gas School of Fuel Management, Solihull.
rting: 14 April 1986.
ntent: The operation and application of the different types of valves used in gas control systems. Flame

Course No 00-338 (continued)

Content: detection systems, thermoelectric valves, flame rectification and UV detection. Requirements for semi-automatic and fully automatic control systems. Non-return valves and pressure switches. Burner and process requirements for controls.

Course No 11-349

Title: Diesel particulates.
Duration: 3 days.
Location: Leeds University.
Starting: 22 April 1986.
Content: Introduction. Possible chemical pathways to combustion-generated PAC. Carbon formation and the influence of hydrocarbon structure. Particle size analysis. Diesel particulate sampling and the use of dilution tunnels.

Course No 11-349 (continued)

Content: Solvent extraction, sample preparation and PAC analysis. UHC and PAC emissions, their relationship to diesel fuel composition and the influence of an exhaust catalyst. The analysis of diesel fuels and exhaust smoke samples for PAC using high resolution capillary column GC with the on line triple detectors. Sulphate formation and analysis. The influence of lubricating oil on diesel particulate emissions. Diesel catalyst technology with special reference to the control of particulates. Diesel particulates — engine experience and EPA regulations. The Ames Test — an outline of the testing of compounds for carcinogenicity and mutagenicity.

cial announcements (continued)

Abstracts of 250-300 words should be sent by *31 May 1986* Miss Julie Wearne, conference officer, Institution of emical Engineers, 165-171 Railway Terrace, Rugby CV21 Q (tel (0788) 78214 ext 44).

nhanced oil recovery: mposium, Hamburg, 27-29 October 87

er conferences in Bournemouth (1981), Paris (1982) and ne (1985), the fourth European symposium on *Enhanced ecovery* will be held in the Congress Centrum, Hamburg, eral Republic of Germany, from 27-29 October 1987. The posium will include technical papers, poster sessions and ndustrial exhibition.

he papers, posters and exhibition will cover the major R processes: chemical, thermal and miscible/immiscible flooding. The emphasis will be on:

aboratory investigations.
lathematical modelling.
ield application and economics.
OR-equipment and materials.

official symposium language will be English.

he symposium is organized by Deutsche Gesellschaft für eralölwissenschaft und Kohlechemie eV (DGMK) in peration with the European EOR-symposium steering mittee. The exhibition will be directed by Hamburg Messe Congress GmbH.

he deadline for submission of abstracts and rental of ibition space is *31 October 1986*. Further information *(for nical papers and poster sessions):* Dr Manfred Albertsen, DGMK, Nordkanalstraße 28, D-2000 Hamburg 1, (tel) 23 23 39; tlx 211 446); *(for the industrial exhibition):* lter Rosin, c/o Hamburg Messe und Congress GmbH, giusstraße 13, D-2000 Hamburg 36 (tel (040) 35 69 21 70; 212 609).

1986 Powrmatic/NIFES National Energy Management Award

In addition to receiving £1000 and a trophy, the 1986 top energy manager will win a continental holiday to the value of £1000. This bonus is specially offered by the co-sponsors in support of the Government's Energy Efficiency campaign, Monergy '86.

The national winner, who traditionally receives the Powrmatic/NIFES trophy at the *National Energy Management Exhibition and Conference* in November, is selected from a short list of ten regional winners. Each of these wins an engraved gold pen and a cheque for £50.

The competition is open to everyone responsible for the efficient use of energy — ranging from large energy management schemes to original individual measures implemented before the end of 1985. The panel of judges is particularly looking for the application of sound principles of energy management, taking into account the comparative size and resources of each entrant's organization.

Entry forms can be obtained from Powrmatic/NIFES National Energy Management Award, Garnett Keeler Public Relations, 60/63 Victoria Road, Surbiton, Surrey KT6 4NW (tel 01 399 1184). *Closing date: 2 June 1986, 1600 h.*

Stop Press....

As we were going to press we were very sorry to hear of the deaths of the following members: *Ken Barker* (Fellow), chairman of the Yorkshire branch in 1983; *Dr George Coles* (Senior Fellow), senior honorary vice-chairman of the East Midlands branch and a past branch chairman; *Donald Hicks* OBE, (Senior Fellow), a former director-general of the British Coal Utilisation Research Association; and *Arthur Strong* (Fellow), chairman of the North-Eastern branch in 1977 and branch honorary secretary from 1973 to 1976 and from 1978 to 1986. Fuller obituaries will appear in later issues of *Energy World*.

CONFERENCES

The following conferences, courses and meetings are organized by bodies other than the Institute of Ener
For Institute conferences please see page 1

April 1986

Enhanced oil recovery

Symposium, Tulsa (USA), 20-23 April 1986.
Details from SPE Meetings Dept, PO Box 833836, Richardson, Texas 75083-3836, USA (tel 214/669-3377; tlx 730989 SPEDAL).

Principles of heat recovery and waste heat utilization

Meeting, Essen (FRG), 22 and 23 April 1986.
Details from Haus der Technik eV, Hollestraße 1, Postfach 10 15 43, 4300 Essen 1 (tel 0201/1803-1; tlx 857 669 hdt).

May 1986

International Hevac 86

Exhibitions and seminars, Birmingham (NEC), 11-15 May 1986.
Details from Industrial and Trade Fairs, Oriel House, 26 The Quadrant, Richmond, Surrey TW9 1DL (tel 01-940 6065; tlx 8951389).

Computer aided process design and modelling of natural gas processes

Conference, London, 13-15 May 1986.
Details from Mallory Barker, IBC Technical Services, Bath House (3rd floor), 56 Holborn Viaduct, London EC1A 2EX (tel 01-236 4080; tlx 888870).

Biotechnology for fuels and chemicals

Eighth symposium, Gatlinburg (TN, USA), 13-16 May 1986.
Details from Charles D Scott, Oak Ridge National Laboratory, PO Box X, Oak Ridge, Tennessee 37831, USA.

Electromagnetic acoustic transducers and their applications

Symposium, Northampton, 14 May 1986.
Details from Conference Dept, British Institute of NDT, 1 Spencer Parade, Northampton, NN1 5AA (tel (0604) 30124; tlx 31611 OTSSG).

Environmental pollution

Seventh European conference, Funchal (Madeira), 15-16 May 1986.
Details from Dr V M Bhatnagar, Alena Enterprises of Canada, POB 1779, Cornwall, Ont K6H 5V7, Canada *or* Prof N H Seemayer, Med Inst für Umwelthygiene, Univ Düsseldorf, Postf 5634, D-4000 Düsseldorf 1, FRG.

Instrumentation and control systems — insurance for tomorrow

ISA 1986 power symposium, Cleveland (OH, USA), 19-21 May 1986.
Details from Marie Long, manager of meetings, ISA International Headquarters, 67 Alexander Drive, Research Triangle Park, NC 27709, USA (tel (919) 549-8411).

Environment and safety

Sixth international conference and exhibition, Birmingham (NEC), 20-22 May 1986.
Details from International Environment & Safety, Newgate, Sandpit Lane, St Albans, Herts AL4 0BS (tel (0727) 51993).

Coal slurry

Eighth symposium, Orlando (FL, USA), 27-30 May 1986.
Details from Centre for Conference Management, 8th *Coal slurry* symposium, PO Box 18209, Pittsburgh, Pennsylvania 15236, USA (tel (800) 441-0875 (in Pennsylvania); (800) 441-9927 (outside Pennsylvania).

June 1986

Environmental quality and ecosystems stability

Third international conference, Jerusalem, 1-4 June 1986. *Includes solid waste disposal and re-cycling.*
Details from Prof Zvy Dubinsky, conference chairman, PO Box 4413, Tel-Aviv 61044, Israel (tel (03) 653616; tlx 35562).

Ultrasonic testing of austenitic material

Symposium, Northampton, 3 June 1986.
Details from Conference Dept, British Institute of NDT (see address above).

Fluidized bed combustion: review, plans, prospects

International conference, Essen (FGR), 3-5 June 1986.
Details from VDI-Gesellschaft Energietechnik, 4000 Düsseldorf 1, Postfach 1139, FRG (tel (0211) 6214 (216)).

Dechema

Annual meeting, Frankfurt (FRG), 5 and 6 June 1986.
Details from Dechema, Postf 970146, D-6000 Frankfurt 97, FRG.

Latin American petroleum show

Caracas, Venezuela, 10-12 June 1986.
Details from Maggie Thomas, Spearhead Exhibitions, Rowe House, 55/59 Fife Rd, Kingston upon Thames, Surrey KT1 1TA (tel 01-549 5831; tlx 928042 SPEARS G).

June 1986 (continued)

Industrial dust explosions

Symposium, Pittsburgh (PA, US
10-12 June 1986.
Details from K L Cashdollar, Pittsbu
Research Ctr, Bureau of Mines, P
18070, Pittsburgh, PA 15236, USA
(412) 675-6753).

Energy 86

International exhibition, Moscow, 16
June 1986.
Details from Yvonne Sulfrian, Gl
International Group, Woodcroft, Bu
Hamlet, Suffolk, CO8 5DU (tel (07
228086; tlx 98424 glahe g).

June/July 1986

Carbon 86

International conference, Baden-Ba
(FRG), 30 June-4 July 1986.
Details from Prof F von Sturn, Si
Elecktrographit, Postf 1160, D-8
Meitingen/Augsburg, FRG.

July 1986

Solid liquid dispersions

Residential school, University of Brist
14-18 July 1986.
Details from Ms L A Hart, Royal Soci
of Chemistry, 30 Russell Square, Lond
WC1B 5DT (tel 01-631 1355).

August 1986

Clean air

Seventh world congress and exhibiti
Sydney (Australia), 25-29 August 19
Details from congress secretary,
world *Clean air* congress, Conventi
Dept, PO Box 489, GPO, Sydney, N
2001, Australia.

October 1986

Petroleum geology of NW Euro

Conference, London, 26-29 Octo
1986.
Details from Conference Co-ordinat
70 Richmond Road, Twickenha
Middx TW1 3BE (tel 01-891 4951).

December 1986

Energy economy 86

Exhibition and conferences, Amsterd
(Netherlands), 9-11 December 1986.
Details from RAI Gebouw
Europaplein, 1078 GZ Amsterdam,
Netherlands.

Course (overseas)

Applied coal technology. Amsterda
Netherlands, 6-8 December 1986.
Details from DELTA-H Institute,
Box 1053, Springfield, New Jers
07081, USA (tel (201) 654-9633;
238-667 ATT DELTA).