ENERGY WORLD

The magazine of The Institute of Energy

Number 205
January/February 1993

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Feature focus on energy in buildings

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COVER

A showhouse in the Energy World village, part of Milton Keynes' Energy Park, adorns this month's cover. The Salvesan house (named after the developer) features an octagonal, two storey conservatory which connects the two wings of the house, and faces directly South. Hot air can be drawn off from the top of the conservatory into the living areas, and recovered from the kitchen and bathroom. External balconies and overhanging roof protect the conservatory from high sun angles in summer, automatically opening louvres at the top, allowing hot air to escape.

Photograph by kind permission of the National Energy Foundation.

Investing for our Grandchildren

IT IS becoming clear that the whole Western world is reaching a point where perpetual economic growth must end, like all exponential growth curves. Ever since the Luddites, the answer to the objection that technology causes unemployment has always been 'we will invent new needs for the public, so that the displaced labour can find jobs in the new resulting industries'. This argument justifies the policy of replacing men and women by machines, wherever it increases profits for the company; but it necessarily implies a continual rise in individual and national consumption of raw materials and energy.

Recently the struggle to absorb the labour displaced by technology has become increasingly unsuccessful, especially in Britain, in spite of loans, built-in obsolescence, fashion changes and other devices.

Economic growth is inevitably being forced to a halt by various factors, including:

- the excessive rise in the use of non-renewable resources, especially fossil fuels causes the most cheaply accessible ones to be exhausted, and dangerous pollution to be emitted;

- the customer begins to regard extra gadgets as a nuisance rather than a benefit, and to grow fond of the old ones;

- for some people the attempt to 'keep up with the Jones' begins to be replaced by other more self-fulfiling aims;

- some people begin to feel ashamed of their consumption of resources when so many people in other parts of the world are destitute. They see the West like a spoilt child who refuses to give up his extravagances even though his parents are going broke and his brothers and sisters are starving.

Thus the hope of the economists that we shall emerge from every depression with a new expansion is doomed sooner or later. Already the rising unemployment in all the developed countries is serious and in this country, the failure of small businesses and loss of manufacturers has reached disaster level.

The only hope of bequeathing to our descendants a stable world is to switch investment from short-term projects to those which are uneconomic on high interest rates, but give employment now and leave a world for our descendants at least as good as that we inherited. This requires inter alia:

- reduction of pollution of all kinds to absorbable levels;

- reduction of the consumption of fossil fuels towards the level sustainable when all mankind has a fair share and the greenhouse effect is eliminated. Ultimately only renewable energy will be sustainable, but that objective is not so urgent;

- recycling of everything possible, both to avoid problems of waste disposal, and to conserve raw materials;

- elimination of noise, traffic jams, dereliction and mess;

- maintenance of all services.

Examples of projects which satisfy these aims as well as giving thousands of worthwhile jobs are:

- combined heat and power schemes in all towns where there are old power stations nearby. A start could be made at once in the seven towns that have already worked out schemes. This would mean a) refitting existing power stations with fluidised coal combustors, which emit hardly any SOx and NOx; and b) installing distribution systems for steam and boiling water. The emission of CO_2 would also be greatly reduced by the higher overall efficiency;

- even though they may be uneconomic at high rates of interest, invest substantially in renewable energy systems: wind, wave, solar, tidal, tree coppicing and combustion of agricultural and other waste. The installation of biogas generators to turn town sewage into sterile fertiliser would have a double benefit;

- subsidise fuel economy equipment in homes, offices, factories and farms;

- repair town infrastructure, eg, main drains;

- subsidise recycling of all reusable materials;

- provide a subsidy to public transport sufficient to improve substantially the attractiveness to the user.

Such a shift from immediate expediency towards a sustainable technology is the only hope of restoring full employment and moving towards 'Equilibrium Engineering'. I first expressed Thring's Law for Perpetual Growth Economics at an Institute of Fuel Conference in Southampton, 20 years ago. This states: *'What is right for our Grandchildren is always uneconomic, and almost always impolitic.'* We must move from perpetual growth nonsense towards equilibrium between man and the ecosphere.

Prof M W Thring ScD FEng FIMechE FIEE FInstP FIChemE FInstE

Large hydro project for W Australia

HYDRO electricity from the Ord River could be lighting Western Australia's far North within three years.

The government plans to develop up to 16 MW of hydro electric power plant on the Ord diversion dam at Kununurra.

The plan is designed to bring down the cost of supplying electricity in one of the remote areas of the State, and underlines the government's commitment to renewable energy.

"The scheme will cost about $20 million and will be the biggest in the State," said Fuel and Energy Minister, Geoff Gallop.

Dr Gallop's announcement follows Premier Carmen Lawrence's plans for a range of programmes to help the public to reduce their energy bills.

New plans for Corpus Christi

ARGENTINA is looking into the further exploitation potential of the Parana River for power generation.

Feasibility studies for a scheme between the existing developments at Itaipu and Yacyreta, at Corpus Christi, were completed ten years. These demonstrated the viability of a 4600 MW hydro-electric power station at the site, but were shelved due to lack of public sector finance.

A recent resurgence in the regional economy and a move towards privatisation of the power market have revived interest in the scheme, and UK consultants Knight Piesold have been appointed to undertake a new study of the site.

Initial work is focussing on the regional power market, a reappraisal of project costs, system modelling and appraisal of the project as a private sector development.

This represents the first stage of a long-term procedure leading to the preparation of a project prospectus.

Court ruling against aboriginals on James Bay project

CANADA'S Federal Court of Appeal has ruled that execution of the Eastmain 1 hydro electric project is authorised under the James Bay and Northern Quebec Agreement and the project is part of Le Complexe La Grande (1975).

It was concluded that the signatories to the agreement, who included the Crees aboriginals of Quebec, gave irrevocable consent to the construction of the works in La Complexe La Grande.

The Crees claimed that the Eastmain 1 project proposed by Hydro-Quebec constitutes an addition and/or substantial modification to the complex.

The court also rejected the Crees' demand that the James Bay Agreement be interpreted in such a way that any ambiguities should be construed in their favour. According to the court, modern treaties must not be interpreted in the same way as old ones.

The Crees have also asked that three environmental assessment procedures be applied to the project simultaneously. But the justices stated to the contrary, that Eastmain 1 is a project under provincial jurisdiction, authorised by the government with the consent of the Crees. So federal government has no reason to intervene. They also pointed out that by signing the agreement, the parties had deliberately wished to avoid double environmental assessments.

Finally the court acknowledged that Hydro-Quebec had conducted a complete environmental impact study whose results were submitted to the Crees.

In accordance with this decision, Hydro-Quebec will continue its efforts to reach an agreement with the Crees on the mitigation and compensation measures that execution of the Eastmain 1 project may necessitate.

Bombay gas project: go ahead

A JOINT agreement between the Gas Authority of India Ltd and British Gas plc will supply natural gas to Bombay.

Each company will have a 35% share, and will invest about £100 million in the project over the next ten years.

The new network will serve more than 600 000 customers.

Waste plants in the wasteland?

PLANNED energy from waste plants may be threatened by EC law, according to leading London law firm, Nabarro Nathanson.

EC law is aimed at drastically reducing waste levels, and all generators entering the market would be well advised to assess whether their plans are still viable.

Brussels has indicated a hierarchy of preferred options for dealing with waste. Minimisation is top of their list, by eliminating excess packaging and ensuring containers are reusable.

Victoria Phillips, environmental lawyer and author of a report in Nabarro Nathanson's *Energy and Natural Resources Bulletin*, said "Four existing plants, converting waste material into power are already in operation in the UK, and there are reported to be at least 15 more in the pipeline. They will obviously need a steady supply of the right type of waste to burn. However, this may be available in sufficient quantity if various directives and policy documents are complied with.

Ms Phillips' article goes on to point out that it is as yet unclear how the UK government intends to reconcile its obligations under EC law with its support for energy from waste schemes. The conflict may need to be clarified at European Community level.

Pragmatic approach called for

POLITICIANS and civil servants in the EC should adopt a cautious and pragmatic approach to change, particularly when developing policies which will effect business, said John Collins of Shell UK in London recently.

He was speaking at the Oil Industries Club on 'The ideal of a pragmatic Europe'. He cited two major policy areas which required such an approach — the liberation of the gas markets and the environment.

Of the situation in the EC, Mr Collins said: "Current proposals to liberalise gas markets are based more on theory than on practical understanding. I believe that the costs and benefits should be more carefully considered and pursued."

On the environment he said that business accepted its responsibilities, but feared implementation of ill-judged measures which could cause economic damage.

"The environmental debate is characterised by great uncertainty and lack of understanding," he went on. "We are uncertain about the exact nature and long-term effects of man's impact on the natural environment; uncertain whether perceived threats are really serious or merely chimeras. If there is one area of policy which requires a cautious, flexible, pragmatic approach it is the environment. Until recently, the debate was conducted in apocalyptic terms. Things have improved, I am glad to say."

Turning to the gas debate, Mr Collins said that for the past 30 years the European gas industry had been successful in developing a supply infrastructure, providing 16% of the area's energy needs. Shell companies supply some 10% of Western European gas demand, and while they are convinced of the advantages of market-orientated systems, they see both practical and philosophical flaws in the various proposals concerning the European gas industry.

Thirty-nine articles of faith in British coal

by Peter Heap

IT WAS almost like a religious revival. There they were, twelve apostles of Parliamentary democracy, propounding a new 39 Articles of Faith which would rescue the British coal industry from the wilderness to which it had been consigned by the powers of darkness, otherwise known as the free play of market forces.

When the Parliamentary Select Committee on Trade and Industry presented their report *British Energy Policy and the Market for Coal* to one of the biggest press conferences held in recent years at the Palace of Westminster, their Chairman, Richard Caborn, MP for Sheffield Central, delivered their message with the fervour and conviction of an Old Testament prophet: "If the Government adopts the whole of our recommendations they would not only lift British Coal out of its current crisis, but they would also lay the foundations for its future development and prosperity. And although the report is not a blueprint for the future of our energy industry it does offer a substantial framework within which a balanced policy could be developed in the medium and long term."

Not a blueprint? The Government minister who would ignore the clear signposts laid down in the 39 recommendations could do so only at the risk of imperilling his career and the future of his Government.The committee conclude that a larger market for British coal is feasible and that the benefits of expanding the market far outweigh the costs. Central to their proposals is a five-year diminishing transitional public subsidy to allow British coal to compete with imported coal prices, starting at about £180 million in the first year and reducing to about £20 million in the final year. The subsidy would cost less than half the Government's proposed redundancy and retraining package announced last October and would secure an extra 19 million tonnes of coal sales a year, 16 of which would be to the electricity generators. Further, they argue, provided the Government accept the recommendations, British Coal would have an opportunity to expand their market even further.

Level playing field

The committee want to see a wide range of legislative, licensing and regulatory initiatives designed to create a level playing field in the energy market and end British Coal's current artificially disadvantaged position. Heady stuff! And a far cry from the laissez-faire economics that ruled in the '80s.

They want to see an assured place for British Coal in the franchise market in return for an extension in the REC's franchise; excess Fossil Fuel Levy diverted from nuclear towards coal subsidy; a re-negotiation of the discriminatory French link contract which would restore the link to its original purpose of providing a two-way tidal flow at peak times; clean-burn technology mandatory for Orimulsion; a tightening of controls on new consents for environmentally damaging opencast mines; consideration given to the use of combined cycle gas turbines for mid-merit and peak capacity; far more careful consideration given to applications for further new gas-fired stations and the nuclear review brought forward to 1994.

A detailed study of the committee's report would more than repay its cost. It is the first comprehensive study of energy markets in Britain for more than 10 years: it is the first time the House of Commons has referred an issue of political magnitude for such a detailed investigation: it could be the starting point for a regeneration of the British mining industry.

But, as chairman Richard Caborn warned: "To be blunt, without political will and action from the Government no amount of enterprise from British Coal will succeed. Equally, unless British Coal seizes every opportunity offered, Government action will come to nothing."

We have been warned.

Energy study for the capital

A STUDY is being carried out within the framework of the EC regional and urban programme into London's energy usage and requirements.

Among the aims of the study are to identify opportunities for improving efficiency and reducing air pollution; to identify ways of using waste for energy production and to provide a basis for forecasting future energy demand.

The final report will be presented in September 1993. The main contractor, the London Research Centre is currently working closely with the 33 London Boroughs.

Most of the funding has come from the EC, through DG XVII's programme for Urban and Regional Planning. Additional funding has been provided by London Electricity plc, Warren Spring Laboratory, with technical contributions from the Building Research Energy Conservation Unit (BRECU), the Energy Technology Support Unit (ETSU) and the Transport Research Laboratory.

The Steering Committee for the project includes members from the Energy Efficiency Office and the CBI.

BG to shed jobs

REDUNDANCIES at British Gas are likely to be the result of the restructuring of the company's headquarters in London, announced in January.

In future HQ will be responsible only for strategic direction and overall financial control. Other activities presently carried out at Rivermill House will be either devolved or eliminated.

British Gas intends to redeploy 2000 of their staff at headquarters this Spring, but are unable at present to give any likely redundancy figures. Two research stations, in London and Solihull will also shut.

Resource plan for Shetlands

AN INTEGRATED resource planning exercise is being carried out in the oil-disaster hit Shetland Islands by the utility which supplies Shetland's power: Scottish Hydro.

The Shetlands are not connected to the national grid, and the 54 MW diesel-fired power station which supplies their power at the moment is due to shut in three to four years.

Scottish Power hope the study will show them whether they can meet the demand for power from renewable sources and energy efficiency measures. A wind turbine at Susetter Hill already provides 2% of the islanders electricity needs, presenting Scottish Hydro with a real opportunity to achieve cost reductions, and a cleaner form of power generation for the Shetlanders.

New section for GMB

UK GENERAL union, the GMB, launched a new industrial section in January.

The new section will represent the union's 100 000 workers in the gas, electricity, coal, nuclear and water industries, and will be headed by national secretary Donald Macgregor.

HSE prosecute

BRITISH NUCLEAR FUELS plc is being prosecuted by the Health & Safety Executive's Nuclear Installations Inspectorate (NII) for four alleged contraventions of site licence conditions at Sellafield.

NII alleges that an unauthorised modification was carried out, causing disabling of gamma monitor interlocks. They also claim that operations were carried out for which adequate instructions had not been produced; gamma monitor interlocks were not properly connected or in good working order; and there were not adequate arrangements for testing of interlocks.

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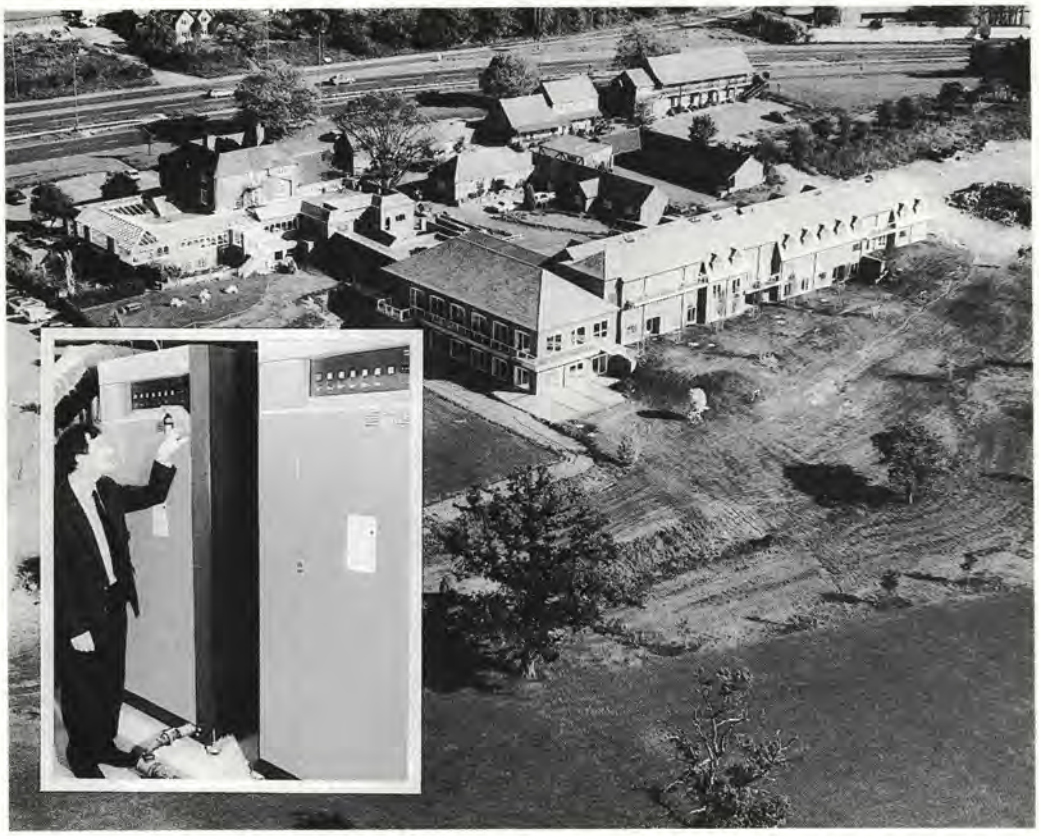


Windmill Village (pictured above) is a new 100 bedroom hotel, which has become fully operational this month, with the help of two Optimagas boilers (inset)..

Major new energy initiative in London, June 1993

ENERGY is the title of a topical new exhibition and conference, due to be held at the National Hall and Conference Centre, Olympia in London from 22-24 June.

The exhibition will be open from 10 am to 6 pm daily, and will include not only suppliers of electricity, gas, oil, coal, water, nuclear and renewables, but also a comprehensive range of associated equipment and services.

The three-day conference will attempt to deal frankly and positively with a wide range of energy issues. Scheduled speakers include Sir John Harvey-Jones, Lord Wakeham, Lord Ezra, Robert Evans, Neil Clarke and Howard Davies, Director General of the CBI. Sessions will be chaired by Sir Robin Day and Peter Sissons.

The conference is divided into six sessions — two a day for the three days. The first two will deal with 'Privatisation — its effect on you the buyer' and 'Are there valid lessons for the future from the political decisions of the past?'

The second day will tackle 'Your energy choices' and 'Suppliers future strategies revealed'. The final day covers 'Energy and the environment — the cost factor.'

This new concept has been welcomed by Lord Ezra, who said: "ENERGY will be the first showcase for the whole of the UK, with all suppliers of energy and associated equipment and services having a unique opportunity of exhibiting under one roof."

And Peter Rost, former Conservative MP, Chairman of the Major Energy Users' Council and a Director of Energy Enterprises, commented: "It is designed to focus on the major problems facing the energy industry, particularly increased competition among suppliers; the need to reduce energy consumption; the growing prominence of European energy and environmental legislation in board room decision taking.

"Our research showed that despite the importance and individual size of our UK energy industry, no international platform currently exists from which to promote products and services. Of the major energy users we questioned, 81% wanted to see all suppliers at one event, to cost and compare options available to them. A similar percentage said they would visit an exhibition which majored on the different ways of conserving and utilising energy."

The event is co-organised by Philbeach Events Ltd and Energy Enterprises. For further details write to Energy Conference Exhibition, Philbeach Events Ltd, Earls Court Exhibition Centre, Warwick Road, London SW5 9TA.

Phone taps into natural resource

THE FIRST wind-powered public telephone box was recently installed near Sandhaven, North East Scotland.

Promised to be the first of many environmentally-friendly telephone boxes over the next few years, the wind-powered box is the work of Corby-based Marlec Engineering and British Telecom.

Marlec has gained a Queen's Award for exporting its small wind turbines worldwide. The company has specialised in units of up to 1 kW capacity, taking it into some remote areas, and some bizarre commercial deals.

An order for 500 units to provide power to isolated homesteads in Mongolia was paid for in sheepskins!

Wind turbines like the Sandhaven model generate AC electricity, which is converted to DC and stored in batteries. Power can then be called upon when needed to run 12 V low energy equipment, such as lighting and telephones.

For the past two years Marlec has been collaborating with Leicester University's Engineering Department to introduce the latest electronic power control technologies into the design of wind turbines and associated equipment. This was accomplished through the government-backed Teaching Company Scheme, which arranges for university graduates to work alongside UK companies.

The scheme aims to give graduates a unique insight into business, while providing firms with valuable support from highly-qualified individuals, who in Marlec's case was Hugh Faulkner.

Under joint supervision of Marlec Managing Director, John Fawkes, and Leicester University's Dr Gordon Smith, Hugh has helped to establish an electronics department to support all Marlec products. On completion of his associateship in March, he will head this newly created department.

Making better buildings and making buildings better

*by K A Shaw FIEE**

PERHAPS some clarification of the term 'installation engineering' is necessary at the outset. Installation engineering may be defined as the utilisation of electrical power within buildings. For it to be a safe and efficient system, the design and selection of equipment and fittings to be installed together with the method of installation all must be carried out by engineers who have a diverse range of skills.

I was fortunate to spend most of my career within a multi-disciplinary practice and therefore had the opportunity of working closely with civil/structural engineers, mechanical engineers and, to complete the team, architects. In most instances the separate disciplines received separate appointments from clients, but there were many instances where a multi-disciplinary commission was received. The great benefit of working alongside others in a multi-disciplinary practice was the sympathy and understanding which you developed for many of the problems faced by others — many of the problems being unwittingly caused by the designer of the electrical installation.

To return to the title 'Making better buildings and making buildings better', the aim of any consulting engineer is to meet his clients' requirements to their ultimate satisfaction. If the proposed building site is a 'greenfield site' or a vacant city plot, then the concept is a totally new construction and we have the opportunity of designing a 'better building', one that is better than those with which the client, and perhaps ourselves, have been involved previously.

The category of 'making buildings better' comes from the refurbishment of existing buildings where the carcase, and particularly the facade of the building is in good condition, with perhaps some historical or aesthetic significance, but the engineering services for the building have become either outdated or inadequate for the client's current needs. This is a fairly common category as the basic construction of the building may have a lifetime approaching 100 years, whereas the engineering services may be good for only 25 years.

The following article is taken from an address to the IEE Power Division in October 1991. The author, a Fellow of the IEE, was at the time a partner in the Glasgow-based consultancy Harley, Haddow Partnership, from which he has since retired, and on whose work this paper is based. The author's experience as a consulting engineer in the field of 'installation engineering' within the multi-disciplinary practice shows the immense variety inherent in this kind of work.

The consultant's role

The consulting engineer's role is therefore to design better buildings, in whichever category, utilising all available technological improvements coupled with innovative design, which may be the result of research and development from various techniques.

It is not sufficient for the designer merely to obtain an honours degree, become a chartered engineer and thereafter assume the role as consultant. It is essential that his or her academic career is combined with practical workshop and on-site experience to such an extent that the candidate can eventually demonstrate 'individual technical responsibility'.

The strides being taken by technology demand that the intending consulting engineer is regularly educated in continuing professional development (CPD) schemes, combined with updates on British Standards, Health & Safety Executive requirements, Building Regulations and many other aspects, including, for the consulting electrical engineer concerned with buildings, the IEE Wiring Regulations.

The IEE recognises the importance of a good basic training before a candidate can become 'chartered'. The trainee consulting engineer may receive his practical experience within the contracting industry and be able to discover the joys and hardships on site of installing and commissioning a system — designed by others. Currently there are more and more consulting engineers practices which provide graduates with approved training within their own offices, and 'on site' experience is obtained where supervisory duties have to be carried out, or where the consulting engineer is asked to provide resident engineering staff for the duration of the contract. The Engineering Council has drawn up a training and site experience scheme, referred to as Standards & Routes to Registration (SARTOR), and this provides a basic accreditation for training and site experience in order to achieve chartered status.

Many consulting engineering practices co-operate with contracting organisations so that the candidate may obtain training in all fields.

The rules of the game

The conditions of engagement, as prepared by the Association of Consulting Engineers (ACE), provide suitable formulae for the engagement of a consulting engineer, the obligations of a client, the professional services to be provided and a basis of payment for these services.

As the Association covers the requirements of all forms of consulting engineers, there are various issues of the conditions of engagement to suit the engineering discipline, eg civil/structural or engineering services, and also to suit the extent of the consultant's involvement. On this latter point, the client can appoint the consultant on the ACE Abridged, Performance or Full Duties form of the conditions of engagement, depending on the client's requirements, which are often dependent on the extent of his own available manpower or specialist expertise or the type of installation contract envisaged.

The 'rules of the game' for the consulting engineer engaged in installation engineering are detailed in Part 4A of the ACE

* *Consultant, Harley Haddow Partnership, Glasgow*

for a capability to translate their proposals into practice it should be remembered that good advice can also be counter the proposal, perhaps directing the client on a more suitable route. Communication skills are an important adjunct to an effective consulting engineer.

Wiring regulations

No paper could have been prepared in 1991 and discuss installation engineering without making reference to the IEE Regulations for Electrical Installations, 16th Edition.

This edition should not cause consulting engineers and installers the same degree of trauma as did the 15th edition which, almost unbelievably, was issued some twelveyears ago. The 16th edition is the same size and the cover is the same colour as the previous issue, but beware, much of the contents are significantly changed.

Much of the support information contained in the 15th edition has been omitted from the 16th Edition Wiring Regulations, which came into force on 1 January 1993, but the IEE have provided a series of Guidance Notes containing the necessary data.

There is an enhanced numbering system based on the previous system for the regulations of the 16th Edition but, to assist users, some independent authors have prepared cross-reference material which could be very useful initially, until the user becomes familiar with the revised format.

The general intent of the regulations has certainly not changed, but there must have been problems of interpretation over recent years as much of the wording is now more commanding and demonstrates an ever increasing responsibility on the consulting engineer/installer. A major modification is in the assessment of voltage drop, although the basic requirement is still for the safe functioning of equipment. The requirement is now based on the voltage drop between the origin of the installation and the fixed current-using equipment, and it should not exceed 4% of the nominal supply voltage. The consulting engineer will require to pay careful attention to this matter as the supply voltage can still vary by plus or minus 6%, the minus 6% being a potential problem area where a total drop of 10% might occur. Careful design, will, however, result in the provision of a 'better' building.

We now have the benefit of a new section on 'Special Installations or Locations — Particular Requirements' which covers swimming pools, saunas, construction sites, caravans, caravan parks, highway power supplies and street furniture. This section either supplements or changes the requirements as contained in other sections and has therefore to be read in conjunction with the requirements of other sections. This part is indeed an enhancement to the 15th edition and is surely an eye-opener to those unfamiliar with installation engineering, as it illustrates the immense coverage of therRegulations.

Vibration gets a mention for the first time. Our practice is, as previously mentioned, multi-disciplinary and the civil/structural section has, for many years, been responsible for the design of structures in seismic areas. Vibration is, therefore, not an unknown problem but it is hoped that, for the UK at least, it is intended as guidance for installations affected by man-made vibrations. There are of course areas in the UK prone to subsidence and the regulations allow for this by stating that the installations require to be 'suitable for the movement of the structure of the building'.

Another new entry is the reference to 'Foreign National Standards', and perhaps a definition of 'foreign' requires clarification.

How do we monitor consulting engineers and design contractors from outside the UK, designing and installing here to their own national standards, and not in compliance with ours?

There is now an increasing amount of suspect equipment supplied from abroad. One is liable to receive 'factory-built assemblies' with live terminals not protected, isolating facilities not provided and a host of single green cables (phase and earth) none of which comply with our standards. The consulting engineer must exercise great care in preparation of his specification otherwise compliance with the signing of Completion and Inspection Certificates becomes a problem, if not impossible.

Managing the project

The successful contractor has been appointed and the pre-contract meeting held to introduce all the responsible parties.

You may be fortunate to have a project manager, a lead consultant or architect to take the reins but, whatever the case, someone has to take the ultimate responsibility and provide the client with the correct installation, preferably on time and at the agreed cost.

It is all too easy to consider that your particular aspect in the provision of engineering services should be provided with your absolute selected location, access, cable routes and means of maintenance. However, present day buildings are becoming increasingly complex with a proliferation of necessary services for heating, ventilation, air conditioning, plumbing, communications systems, security systems, fire alarm and detection systems — all of which points to early preparation of detailed co-ordination drawings which not only should serve to avoid the clashing of services but also should maximise the use of available space.

It is now up to the electrical contractor to implement your design to your satisfaction and to the client's precise requirements, and it is at this stage that you should remind yourself that both of you were engaged, possibly as a result of submitting the most competitive offer. This is not the time for contemplation, all actions must be positive, instructions clear and the works carried out without delay.

The works must be properly managed with regular site meetings, timeous production of minutes, agreed procedures for site instructions, regular visits of supervision, prompt approval of payments for work completed, agreed procedures for testing, commissioning and handover — together with many other matters to ensure a successful installation.

On completion, the electrical contractor will provide you with correct records of the installation, test results, spares and 'as fitted' record drawings, together with operating instructions for specific sections or equipment.

Having 'handed over' for operational use, it is as well to enter a note in your diary for 11 months time to contact the client and revisit the site for a final look around before expiry of the Defects Liability period and the final amount of retention monies are paid.

The finished article

Leisure ice — we are now generally familiar with leisure swimming pools but is this not the 'electric ice age'? Gone are the days when the simple area of rectangle ice was sufficient for our entertainment. In line with the present day swimming pool design, which incorporates palm trees, islands, flumes and wave machines, we now have free-form ice and in fact two-level ice in one of our special projects.

Many ice rinks now operate in conjunction with swimming pools and other sporting activities in order to provide for the increasing leisure needs of our population. This combination of extreme cold and warmth gives the ideal formulae for the application for one particular facility. In an ice rink installation the heat rejection from the ice plant is passed through a closed-circuit cooling tower and, as it is still low-grade heat, water-to-water heat pumps are utilised in order to use the resultant heat in the ventilation plant. The main use of this recovered heat is to provide heating to the structure at high level to ensure that condensation does not occur.

Any excess of recovered heat can always be used up to supplement the domestic hot water supply for the kitchen services or shower facilities. Where there is an adjoining swimming pool, the pool itself will always welcome recovered heat. It is interesting to note that the electricity supply companies are not anxious about the type of fuel used for the main boiler plant which creates the initial load, but they are anxious about the heat

Conditions of Engagement and are carefully considered by client and consulting engineer prior to an appointment being offered and accepted.

In general, the duties may be summarised as follows:

- establish a brief — in discussion with the client;
- carry out a feasibility study and report;
- prepare a preliminary plan with sketch proposals and budget costs;
- further discussions with client with approvals or amendments as necessary;
- proceed to final design and tender documentation;
- carry out cost check;
- discuss with client and receive approval or amendments;
- select list of tenders;
- issue tender documentation;
- prepare a report on tenders received giving recommendations for acceptance;
- advise tenderer of client's acceptance;
- discuss programme for the works;
- provide site supervisory/resident engineering staff or check the adequacy of site supervision by others;
- witness testing and commissioning;
- arrange for handover and completion certificates;
- check the works prior to expiry of the Defects Liability period.

The stages for these duties are well defined in the Conditions of Engagement, and the client is able to check at any point the extent of professional services carried out and therefore the extent of payment due. In this way, if a design proposal is proving to be too costly, it can be aborted, or if the client can provide his own supervision, the consulting engineer is only required 'to make such visits as considered necessary by the consulting engineer'.

The selection of a consulting engineer can be undertaken in various ways.

The ACE has details of all member practices and can give advice to clients on firms who have the necessary expertise for the work in prospect. The final selection will normally be by fee competition, but it should be against a well-prepared project brief. In some instances the brief is in vague terms and the time for submission extremely limited, which results in a wrong appointment for the wrong reason. Fortunately, most clients are in the category of 'informed clients', ie, they have engaged consulting engineers previously and they have qualified staff who know what is required in sufficient detail to prepare a proper brief.

Some clients favour the commissioning of a single professional in a lead consultant's or project management role and the selection and engagement of the sub-consultant is left with them. We have found this quite frequently in our practice, particularly where the value of the civil or structural engineering works is substantial and our other partners within the practice take the leading role as civil/structural engineering consultant and appoint us as their sub-consultants for the engineering services. This gives the client an easier mode of control as the communicating channel for all requirements is via the one body.

Other routes for selection are via management consultants, construction management and a variety of design and build schemes, all of which can be quite acceptable provided that great care is taken at the outset to ensure that all aspects of the appointment are understood by the parties concerned. ACE has a Professional Practice Committee which can give advice on such matters.

In any event, in the selection of a consulting engineer, it is important for clients to include comparison of resources and expertise in the selection process and not simply consideration of a fee quotation.

There are, however, many other 'rules of the game' with which the consulting electrical engineer specialising in buildings must be totally familiar, namely:

- Regulations for Electrical Installations (the Wiring Regulations);
- Health & Safety at Work, etc. Act 1974;
- Electricity at Work Regulations;
- Building Regulations;
- Fire Precautions Act 1971 (Modification) (Revocation) 1989;
- British Standards;
- European and international standards.

But a few technical requirements plus, of course, various conditions of contract, such as JCT, IEE/IMechE/ACE model forms.

It takes a considerable number of years of experience to become conversant with such a plethora of publications, but nonetheless it is essential in order that the project can be totally 'in accordance' with the requirements of safety and thereby acceptability.

The task of keeping the practice up to date is one normally partly allocated to your qualified librarian who will ensure that all references are continually updated, that you are suitably informed when amendments are issued and that, when you are commissioned for a special project, you have all the stautory requirements on hand for immediate reference. CPD also plays a considerable part in this task.

Having reviewed the 'rules', let us now consider who would ask us to 'play'.

Who is the client?

In the same way as we have a variety of buildings and a bigger variety of users, we find an endless variety of clients. Clients may occupy similar types of building but, depending on their individual operations, they will undoubtedly have differing requirements. Our practice classified clients in the following categories:

- public utility: power station, water treatment works;
- local authority: schools, colleges, leisure facilities
- commercial: offices, banks, hotels;
- industrial: factories, petrochemical, fisheries;
- government: prisons, defense works, hospitals.

We find, however, that clients do have common aims with regard to their basic priorities:

- flexibility in use and, if possible, poten tial for extensions;
- automation — the intelligent building;
- innovation — tempered by optimising capital and recurring costs;
- good environment;
- security;
- maintainability.

In new build, our 'better' building category, the building may be an entirely new development with no opportunity to examine how the client operates or the problems that need to be overcome. You are dependent on the communication of the client's requirements to you and your correct interpretation of these requirements. It is also vital to know the correct questions to ask. At this stage, all discussions have to be carefully recorded, notes made of visits to other sites, telephone calls and minutes of meetings, formal and informal. When the project flows with ease from start to finish, it is a sign that communication between client and consultant has been excellent.

In the case of a refurbishment project, making a 'building better', you may at least have the opportunity of observing the client in operation, and in this respect you will be able to have a greater input to the preparation of the brief, but in all other matters the procedure is quite similar.

There are many reasons for considering refurbishment. Perhaps the premises requires upgrading to satisfy current legislation or to improve the technical efficiency of operation. The end result should certainly give a more contented and productive workforce. Effective refurbishment can prove to be more cost-effective than a move to new premises by utilising corporation tax incentives through lease purchase agreements. As in all types of projects, a detailed financial appraisal must be undertaken and, strangely enough, finance appears to carry a greater weight than historical or aesthetic appearances.

Whatever the requirements of a client are, they have to come to the consulting engineer for professional advice and they are due to be given that advice without bias or commercial influence. Although most clients are looking

pumps which give them a constant load.

The illumination of ice halls varies in design with the aesthetics of the structure. Generally the light sources require to be efficient and carefully sited to give a uniform level of lighting along the line of play.

Play, in the North, means curling, and two levels of lighting are normally required, one for normal matches and the other for televised events. Maintenance of the luminaries has to be carefully considered and the consulting engineer should have early discussion with the user in order to have facilities within the project for maintenance of all equipment.

The remaining electrical services are merely the standard requirements for plant, small power, kitchen, fire alarm system and intruder alarm systems, but an essential requirement is first-class public address and music systems, the latter being linked into a disco lighting system where the degree of sophistication is limited only by budget.

The potential of an energy-saving design is always attractive in a refurbishment project. An opportunity arose when John Menzies plc required to upgrade their shop premises at Dundee.

Detailed studies at the 1500 m^2 store revealed that frequently in winter the store would need heating at the front, near the entrance, and at the same time need cooling at the rear of the shop — this being due to the shop's deep-plan format and the high levels of occupancy and lighting.

The solution to the problem gained the company a Beta Award in recognition of the significant contribution to energy efficiency using electricity. The design called for two separate air-to-air heat pumps to be installed along with a simple but innovative control system. This basically removed the excess heat from the deep-plan area to supplement the requirement for heat at the entrance area. The control system ensured the maximum use of free cooling from outside air by adjusting automatically the balance of fresh, exhaust and recirculated air. Carbon dioxide sensors within the shop were used to control the precise quantity of fresh air input in relation to the number of occupants.

Additional energy savings were made by discharging the warm air over the outside coils of the heat pumps when they were being used in the heating mode. When the units operate on the cooling cycle a heat exchanger allows preheating of the shop's domestic hot water thereby making use of heat which would otherwise be wasted.

The design of the installation was so successful that the client decided to use similar systems in a number of their other outlets throughout the UK, not only in refurbishment schemes but also in new developments.

Europe — our neighbours

Consulting engineers have worked outside the UK for a number of years. In the past, emphasis has been on the 'overseas' or 'international' scene, principally in the Third World where engineering expertise was required and funding was from World Bank resources. These projects were to develop essential supplies of water and power to enhance whatever natural resources were available and thereby upgrade the standard of living.

In Europe we have a different situation entirely. In many countries the expertise is well established, the standard of living is as high as in the UK and there appears to be ample resources for progress in such matters as research and development — and certainly at a higher level than in the UK. Our future in Europe must not be looked on as a threat, more as an opportunity. But as European countries bring their wares to the UK, who will have the task of monitoring the resulting installations?

The content of engineering services in buildings has increased in recent years. Installation engineering has close links with the developments in electronics technology and as such there has been continuous progress in the provision of new facilities in buildings such as building management systems, security systems, data and communication systems and many others. Even in the domestic market we are on the brink of home bus systems via which domestic equipment, with integral electronics, communicate with each other.

In addition to the technology explosion there is considerable attention being paid to the protection of the environment — but perhaps not enough. The Environmental Protection Agency may be able to establish the necessary legislation as its policy is widespread, from eco-labelling to environmental education, but meantime we must keep our aims on the highest plain possible.

The consulting engineer has the continuous challenge of finding the most effective and innovative design solutions in keeping with current standards for the efficient use of energy. Effective solutions will cause a reduction in load capacity as well as in running costs. Research has established that improvements to buildings by energy efficient design could lead to a 15% reduction in total carbon dioxide emissions in the UK.

An assessment of the potential market for environmental technology in the UK alone, in 1991, was some £140 billion over the coming decade — so there is a future, a future to make better buildings and a future to make our existing buildings better. ❑

Combustion in clinical incinerators

*by David C Gunn BSc (Eng) MSc SFInstE MInstGasE CEng**

Clinical incinerators are important combustion appliances which need to meet emission regulations of increasing severity. In present designs the principles of overfeed and underfeed ignition, well established for coal firing, do not appear to have been appreciated in the incinerator field. It is suggested that important advantages could accrue from using overfeed rather than underfeed ignition and complete rather than partial combustion in the primary chamber.

WASTE materials all too often contain unpleasant, frequently dangerous substances with a very wide size range, varying from large pieces down to dust.

Hospital waste is particularly rich in these characteristics: as well as wrappings, plastics and general household waste it may contain parts of human bodies, liquids such as urine and blood, incontinence pads, wet mattresses and 'sharps' such as broken glass, hypodermic needles and so on. All this must be reduced to a completely burned, sterile ash. The gaseous products from the combustion process will contain prescribed substances such as particulates, acid gases, dioxins and furans. These must be minimised to below specified levels before the gases are emitted to atmosphere. The minimisation process involves complete combustion of the gases arising from the 'fuel' followed by quite complex and very expensive 'clean-up' plant.

There are manufacturers of clinical incinerators throughout the world, some with solid hearths onto which to load, generally the plastic bags, each containing about 2.5 kg, is pushed by a ram; others which are rotating, refractory-lined cylinders inclined slightly to the horizontal. Most clinical incinerators operate on the so called 'starved air' principle, in which the solid fuel is gasified and partially burned in a primary chamber. Gaseous phase reactions are completed in a secondary chamber, and remnant solids burned as completely as possible in an air-rich zone at the discharge end of the hearth.

From a study of present clinical incinerator types, the author is of the opinion that we are all low on the learning curve of combustion in these appliances, and that substantial improvement in performance could result from the application of solid fuel combustion principles that have been established by intuition, practice, research and development over many years. The object of this article is an attempt to bridge this gap.

According to established principles, coal can be fired in the following modes:

- hand firing, mainly large coal, 25 mm upwards;
- mechanical stokers with fixed grates, small graded coal, 13-25 mm;
- mechanical stokers with reciprocating grates, small graded coal, 13-25 mm;
- chain grates, small coal 0-13 mm;
- pulverised fuel, small coal.

The last is not relevant to the current discussion, but is the main channel now for burning coal in power stations.

The first stage of combustion is to ignite the fuel. In the domestic fire, sticks and paper are placed on the grate and covered with small pieces of coal, the paper ignited and an incandescent fire allowed to become established after which more, larger coal is added. This must have been the process used from the earliest times, and is natural to all who light fires, be they in a domestic hearth, a boiler or the garden bonfire. An obvious name for the process is 'overfeed ignition' because the fuel is fed on top of a stable, ignited fuel bed which is the source of the energy needed to ignite the fuel.

Another process of ignition is to lay the coal on the grate and put the sticks and paper on the top and igniting them; it will take a very long time to obtain a stable fire. In the words of Prof Ian Fells "take nobody's word for it": try it and see. This is 'underfeed ignition' where the fuel is ignited beneath the source of heat input.

The difference in ignition rates is very marked but both processes are used in industrial mechanised firing appliances. Sometimes features of both modes of ignition are used together, as for instance when the fuel bed, after ignition, is artificially disturbed as in a rotary kiln or the 'Martin' stoker often used in municipal incinerators.

The ignition process is rapid with overfeed combustion, because the raw fuel is heated by convection from the hot gases from the already ignited fuel as well as by radiation from that fuel. These hot gases will be depleted of oxygen which has all been used up in the burning fuel beneath; thus the raw fuel is heated in a reducing atmosphere. The result is that smoke and tar are distilled off to await further combustion over the fuel bed in

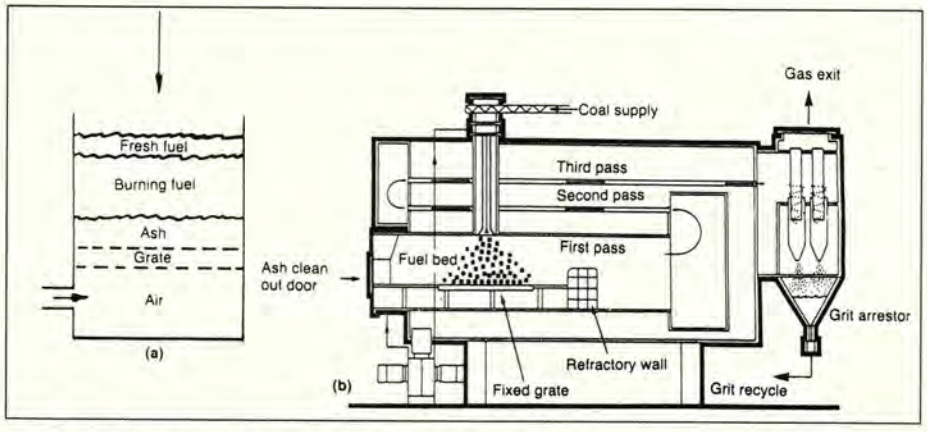


Fig 1: Overfeed combustion: a) principle, and b) typical application (fixed grate)
(Source: Industrial Boilers, Longman Scientific and Technical, London 1989)

**Director of Energy and Environmental Projects, White Young Consulting Engineers, Leeds*

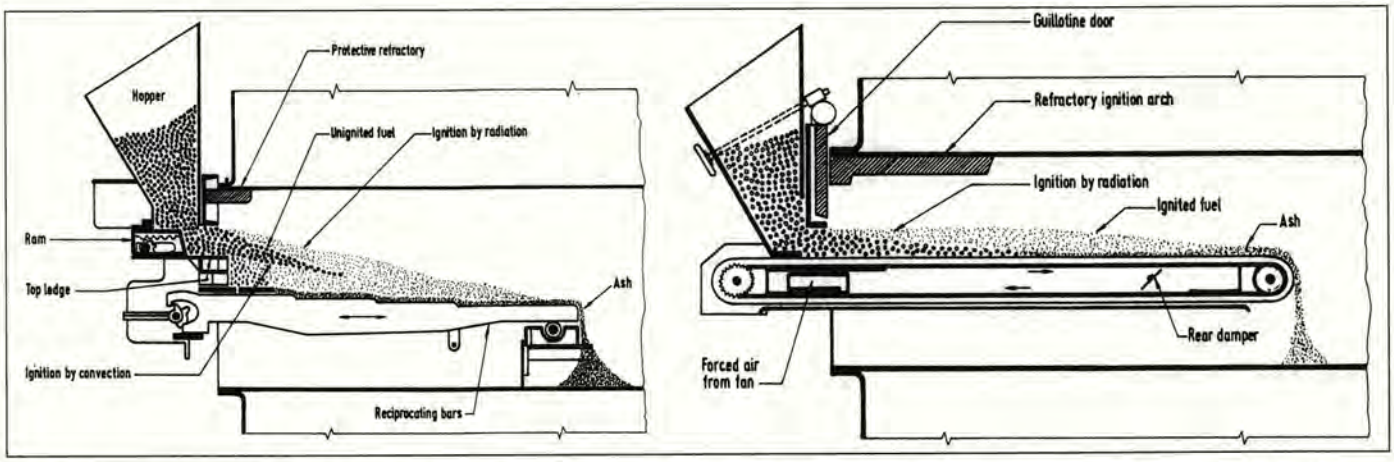


Fig 2 (left) illustrates the principle of the coking stoker, widely used in shell boilers. Fig 3 (right) illustrates a section of a fuel bed on a chain grate where the fuel is ignited by radiation from the pre-heated ignition arch.

the presence of secondary air added over the fire.

The complete mixing of this secondary air with the distillate is highly important, otherwise combustion will not be complete and smoke emission will take place. The raw fuel will also be heated by radiation from the flames over the fuel bed, so that there will be an underfeed component as well as overfeed, the two modes occurring together. There are thus two ignition planes, one overfeed, the other underfeed. This is known as 'composite' ignition. Overfeed and composite ignition are characterised by rapid ignition and a tendency to emit smoke.

In the case of a clinical incinerator there is a separate, independent, secondary, high temperature combustion system with its own supplementary gas or gas-oil burner, and an adequate supply of secondary air which will burn off products of incomplete combustion, including smoke and tar vapours. Thus the smoking characteristics of overfeed ignition can be controlled.

Underfeed ignition

Fuel on a chain grate is ignited by radiation from a pre-heated ignition arch. The unignited fuel is below the ignition plane, so that the oxygen in the air is not consumed as it is in overfeed combustion. Thus combustion of the volatiles is partially sustained within the fuel bed, without emission of smoke and tarry gases.

Underfeed combustion therefore produces less smoke than overfeed, but secondary air is still needed to consume products of incomplete combustion such as carbon monoxide. Since there are no hot products of combustion arising from burning fuel to heat the unignited fuel, the convection component is absent and ignition relies solely on radiation. Assuming that the radiation and convection components are about equal it would be reasonable to suppose that the ignition rate in the overfeed mode is about double that in the underfeed. This is borne out in comparing the performance of underfeed and overfeed systems in shell boilers where grates based on the overfeed mode can be more or less half the length of those based on underfeed.

It is axiomatic that the faster a material can be ignited, the sooner will it burn out and the greater will be the throughput of an incinerator of given size. It would therefore seem desirable that the ignition of the material should be in the overfeed mode.

A further advantage in obtaining a stable and intense fire as soon as possible, is that there will be a large reserve of transferable energy to supply the latent heat necessary to evaporate the aqueous liquids. These occur very locally and can delay the ignition of unignited or weakly ignited material. This could be a major contributor to unburned material in the ashes.

Most clinical incinerators consist of a primary chamber in which the material is ignited and gasified. The products of partial combustion then pass to a secondary chamber in which gaseous phase combustion is completed.

The primary chamber is raised to a temperature of about 850°C, the material being ignited by radiation only from the hot walls of the chamber and from the ignition burner or burners placed above the load. The details differ between manufacturers, but it is clear that the ignition mode is underfeed and therefore relatively slow.

In a simple modification of this system using the principle of the coking stoker, the charge is pushed by a ram to drop over a deep lip which may be some 200 mm deep, onto the hearth instead of over a shallow lip, as is the case with most present incinerators. This lip, which could be made from heat resisting cast iron, contains a number of horizontal ports through which gas flames from a simple, non-powered gas burner, together with air, are drawn in by induced draught. The flames impinge upon and ignite the incoming material. Further material will be pushed on top of that already ignited and itself will ignite in the overfeed mode.

The partially-burned material resulting from the first charge will need to be pushed along the hearth and meet with more air for further combustion. In present designs such air is admitted through vertical ports cast in the hearth material. Such ports are liable to become blocked with partially-burned material and slag: they will need frequent cleaning. This can be an operational difficulty. The author suggests that the air admission along the hearth could be achieved by horizontal slots or ports at the junctions between multiple hearths. Such an arrangement could be made easily accessible for cleaning, but blockage would be much less likely than with the vertical holes, as gravity and the movement of the charge along the hearth would have no influence.

It will be seen that, when more than one hearth is used subsidiary rams will be needed, both with present and the modified designs. For the modified design, air supplies will be needed near the rams. This can be done by holes provided in the rams. The intake of air also cools them, which is a desirable feature. If needed, water sprays can be sited at these holes to set up local endothermic reactions to cool the fire should it become too hot and cause slagging.

Complete combustion in primary chamber

As has been said, most clinical incinerators seem to operate on the 'starved air' principle in which the material is only partially burned in the primary chamber, combustion of the gases being completed in the secondary system. Why has this system been used when incinerators for municipal waste operate with complete combustion in the primary chamber?

Referring to EPA 1990 Process Guidance Note IPR5/2 *Clinical Waste Incineration* item 3.1.5 states: "The main advantages of a

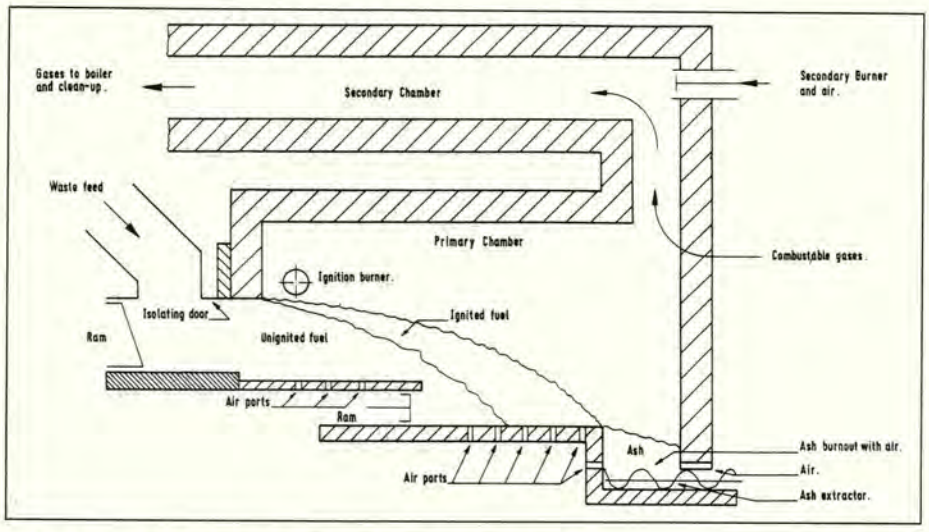


Fig 4: starvd air incinerator (notional) with underfeed ignition.

controlled air/semi-pyrolytic incinerator are: the relatively low combustion air flow through the primary combustion chamber during normal operation results in low gas velocities and hence low entrainment of ash in the flue gases; given adequate sizing of the burners and combustion air fans, they can handle a wide range of wastes.

"The disadvantages are:

- under-fire air ports are prone to plugging due to slag formation. Fixed carbon burn-out can result in temperatures above the slag formation temperature;
- the presence of moving parts, ie, rams, in the high temperature zones can result in reliability problems; and
- good ash burn-out (ie, low residual carbon) can be difficult to achieve.

The whole of Annex 1 in IPR 5/2 is well worth reading.

The temperature in the primary chamber will be much higher if the products of combustion are burned within it and the destruction of undesirable substances, both solid and gaseous, that much more complete. Some clinical incinerators work on the principle but most seem to use 'starved air'. The time may now be opportune for an independent authority to appraise critically the virtues of each system. The author believes that if you want to destroy something, hit it hard!

With the present need to clean up the gases before the chimney is reached and for the time/temperature relationship for the gaseous reactions, 2 seconds at 1000°C in an oxidised atmosphere, any solid combustible carried over from the fuel bed should certainly burn off. Any suspended ash would be captured in the clean-up plant. Carry-over therefore is of little consequence in the modern context. Complete combustion in the primary chamber could lessen the overall size of the plant but care would need to be taken to use suitable refractories; high alumina (>85% Al_2O_3) or mullite (71% Al_2O_3) provide high refractories and good resistance to slag attack.

It has been suggested that the overfeed principle of ignition, if applied to clinical incinerators, would have considerable advantages over the existing systems where the slower, underfeed method is used. These advantages would result in quicker ignition, more rapid evaporation of liquids, quicker burn out and a more compact primary chamber.

It has also been suggested that complete rather than semi-pyrolytic combustion in the primary chamber would destroy the unwanted substances more rapidly and more completely, thus lessening the duties of the secondary chamber.

The embodiment of these two factors could improve the performance of existing of clinical incinerators. ❑

The Eco House

Eco House is the Leicester Ecology Trusts's environment- friendly show home, whose aim is to demonstrate to the public ways of reducing the environmental impact of their homes. The manager of the project tells the story ...

*by Alan Hobbett**

ON 22 October 1992, David Maclean, Minister for the Environment and Countryside cut the Eco House birthday cake to enthusiastic applause. The audience comprised Eco House sponsors, supporters and guests had gathered to celebrate two successful years of one of Britain's first environmentally-friendly showhomes.

Tucking into the vegetarian cheese and organic wine provided by the Leicester Ecology Trust, the projects' initiator and manager, Mr Maclean praised the Trust's endeavour to raise the environmental awareness of the people of Leicestershire. The Trust hoped to achieve this task through the Eco House project, by encouraging householders to make the fundamental link between their homes and lifestyles, and the wider environment.

The Eco House is a former park keeper's lodge on the periphery of Leicester's largest public park. Taken over by Leicester Ecology Trust in 1990, the Eco House was a successor to the Trust's earlier low energy house. This has been a local authority decant house, retrofitted to show the potential for increased energy efficiency in older buildings. Many of the ideas from the earlier project were adopted by the new with a widening of its remit to include all matters of environmental concern connected with people's homes. So in addition to energy efficiency, other issues addressed include conservation of resources, wildlife, organic gardening, food production, water, environmental consumerism, recycling and health. Given that the use of energy is regarded by many environmentalists to be the single most important environmental issue today, and one which is easiest for households to address, it remains the project's dominant theme.

Although half the energy consumed in Britain is used within buildings, the greater part within domestic buildings, the fundamental connection between energy use and the environment is not one automatically

** Eco House Manager, Leicester Ecology Trust*

made by the public. The connection hinges on the way our energy is produced and the efficiency with which it is used.

Whenever we burn fossil fuels, the primary source of energy within the industrialised world, pollutants are released into the atmosphere. Some 80% of Britain's mains electricity comes from fossil fuel burning, which, despite the efforts of the President of the Board of Trade, largely means coal. In the process, millions of tons of carbon dioxide, the major greenhouse gas, are released into the atmosphere along with a cocktail of other pollutants, such as ozone, methane (a greenhouse gas many times more potent than CO_2, a point often neglected by advocates of gas-produced electricity), oxides of nitrogen and sulphur dioxide, the major cause of acid rain.

In terms of efficiency of use, when one considers that if each of Britain's households were to substitute one conventional 100 watt bulb with an equivalent low energy one, the amount of energy saved in a year would be equivalent to that produced by a large power station, then the enormous environmental impact of domestic consumption, and potential for energy saving, is clear.

The issues of energy production and energy efficiency are dual concerns of the Eco House project. A renewable energy room addresses the first of these and contains displays and information on current modes of production and sustainable alternatives. The technology associated with harnessing renewable sources of energy is, in many cases, already proven and their potential considerable. Two recent studies have demonstrated the future global relevance of renewables. A Greenpeace study, undertaken by the Stockholm Environmental Institute, projects a combination of hydro, biomass, solar, wind and geothermal, providing 28% of energy supplies by the year 2010, 62% by 2030. Another study, by the United Nations Solar Energy Group for Environment and Development (UNSEGED) suggests that around 50% of energy supplies could come from cost effective renewable energy sources by the year 2050.

A number of renewable options are demonstrated and applied at the Eco House, including a small wind generator, photovoltaic cells, solar water heating and passive solar gain. Of these perhaps the most practical source for the householder is solar gain. Indeed, in almost all homes 10% of the building's heat is provided by the sun without even trying. Other sources tend not to be cost efficient on an individual basis, although this can vary according to an individual's situation.

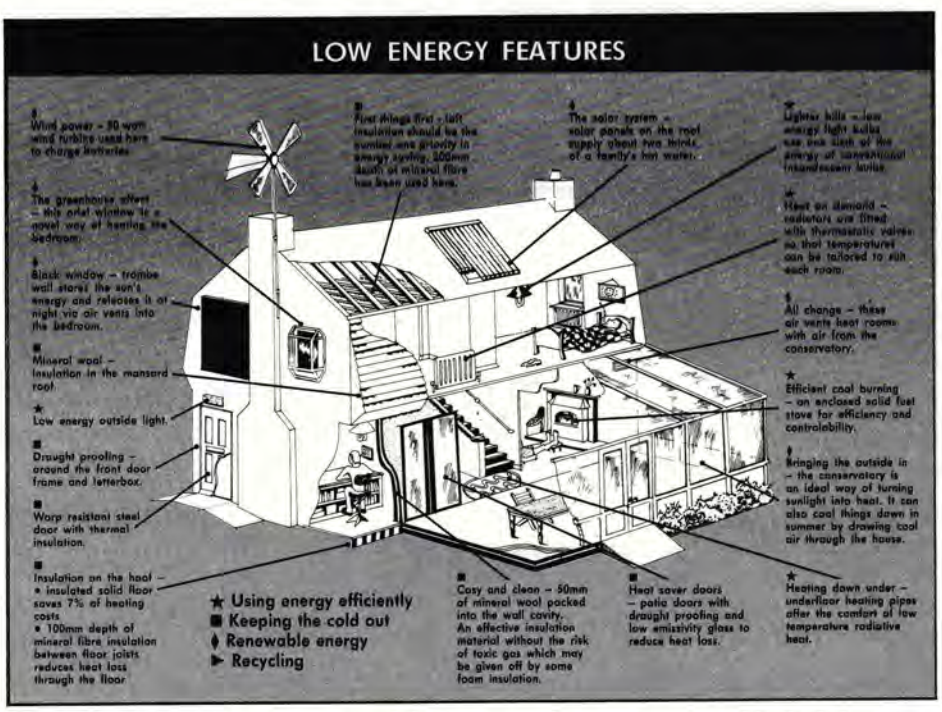
With regard to consumption, the project aims to show how energy can be used more efficiently. At present most of the energy consumed in British homes is used for space heating (62%), followed by water heating (22%), cooking (7%), appliances (5%) and lighting (4%). Through insulation and more efficient heating systems and controls, energy can be used more efficiently in the home. A gas condensing boiler, for example, can have a thermal efficiency of up to 90%, whilst an electric storage heater would have difficulty reaching 30%. In some countries electric space heating is prohibited for this reason. At the Eco House information is provided on the financial and environmental benefits of particular features, showing for example, the pay back periods for different methods of insulation, and suggesting priorities for action.

Prior to retrofitting, the Eco House scored two on the National Home Energy Rating (NHER), now it scores eight, less than can be achieved on new build, but not bad for a 1930s three-bedroomed detached. Costwise the improvements represent about £700 a year saved on fuel bills and in environmental terms its a few tons less of CO_2. If one considers the collective potential, the savings could be huge. By raising the nation's housing stock just one point on the NHER scale, savings of £2.2 million would be made, that's 4.5% of the total UK energy costs and 24 million tons less CO_2.

The Eco House project aims to raise environmental awareness and act as a demonstration of what individual households can do to lesson their environmental impact, often saving a considerable amount of money in the process. The effectiveness of the project in terms of how many people have actually taken such action is difficult to gauge, although requests for specific information and the purchase of energy-saving products from our shop, suggest that many have. In terms of raising awareness we are confident that for those visiting the project, the relationship between homes and lifestyles and the wider environment will have become clear.

At the Ecology Trust we are convinced that the Eco House represents a public educational resource of considerable local value, and its success in securing continued funding from both the public and private sectors suggests that others do too. In trying to reduce detrimental environmental influences the potential for individual action is not inconsiderable and is often overlooked. But raising the awareness of individuals, and encouraging individual action is in itself not a panacea for our energy ills. The scale of the problem is such that concerted government action is required across the industrialised world if we are to avoid an environmental catastrophe of global proportions, meanwhile we'll keep selling the lightbulbs! ❑

● *The Eco House is open from 2 pm to 5 pm Wednesday to Friday, 10 am to 5 pm at weekends. Guided tours may be arranged both during and outside of normal opening hours, and cost from £20 + VAT.*



The above diagram shows just some of the low energy features incorporated in the Leicester Ecology Trust's Eco House. Other features include: double glazing, exterior insulation with 50 mm of mineral fibre, a shower (instead of a bath), a heat pump to upgrade heat from waste hot water, a gas condensing boiler, internal wall insulation, kitchen units made from reclaimed timber, and a heat recovery system installed in the loft, providing fresh air without losing too much heat.

The North-South, East-West energy divide

*by Prof Ian Fells FEng**

The theme of the 15th World Energy Congress, held in Madrid last September, was 'Energy and Life'. The disintegration of Eastern Bloc political systems and the frantic swing to privatisation and market-led economies, the aftermath of the Gulf War, the continuing energy poverty in large parts of the developing world, the increasing energy demands of the fast growing economies of the Pacific Rim countries, worry over the safety of some Eastern Bloc nuclear reactors, the significance or otherwise of the greenhouse effect and the frightening prospect of a world population doubling within many peoples' lifetime provided interwoven strands which dominated much of the discussion at the World Energy Congress. Prof Fells' article first appeared in the November/December 1992 issue of ATOM.

ENERGY, economy and the environment make an uneasy *menage a trois,* and David Simon of BP, in a keynote address, was quick to point out that good economic growth was essential to provide the wealth necessary to protect the environment. Indeed, a desire for more wealth to provide, amongst other things, the energy necessary to achieve enhanced expectations of many living in the developing countries and, more immediately, to relieve the dire poverty in Sub-Saharan Africa and parts of South East Asia was a theme developed by many speakers.

Dr Pachauri of the Tata Institute in India destroyed a number of shibboleths, pointing out that the use of biomass (fuel wood) in India caused misallocation of household time, sickness among women and diminished educational opportunity for children who collect the wood, and that it would be better to replace renewable fuel wood with imported kerosene. He also indicated that technology transfer was not required, but instead, joint technology development to provide indigenous solutions. He particularly emphasised, as did Helga Steeg, Director of the IEA, that with the increased population "energy demand will rise drastically, in particular in the world outside the OECD".

This all requires a flow of money from North to South to set up a network of research institutions for work on renewables and their utilisation. It is tragic that an African family uses five times more energy than a European family to cook the evening meal. Indeed, in the developing world the average efficiency of energy use is only 2%, but it is not much better, 5%, in the industrialised world either, which gives a global average of 3.5%, a horrifying waste of energy resources.

The problems of the developing world permeated many sessions. As Ager Hanssen of Statoil pointed out, "70% of the world's population lives at a per capita energy consumption barely one quarter that of Western Europe, and one sixth that of the USA. Lack of energy restricts services basic to human needs, limits economic growth, starves improvements in the quality of life and inhibits local environmental protection".

The theme of the Congress, 'Energy and Life', is highlighted by the ubiquitous problems of chronic energy poverty in many parts of the world. Improved literacy, health care and education are essential before fertility decisions can be taken. These are slow processes and in a world where more than

A woman and her child in the Mucheke township, Zimbabwe. The family have improved the efficiency of their wood stove by using a low grate in front of a brick built wall.

*Professor of Energy Conversion, University of Newcastle upon Tyne

50% of the population does not have an electricity supply, which severely restricts lighting and therefore reading, progress in education is agonisingly slow. This theme of providing help of various kinds to enable the developing world, with its fast-increasing population, to catch up with the energy-rich industrialised world has been a recurring and increasingly important element in recent World Energy Congresses, particularly since India in 1983. But to this North-South imbalance has been added a disturbing and unanticipated new divide: that between the essentially market-led, democratic industrialised West and the newly liberated Eastern Bloc.

The former centrally-planned economies have disintegrated politically. There is a desperate shortage of energy of all kinds, despite the old USSR being formerly the world's biggest producer of oil and a major producer of natural gas. The oil and gas supply system is a decayed, technological nightmare and requires massive financial investment and Western technical assistance if it is to meet the future demands made upon it. What Western banks and financial institutions will be prepared to invest in a bankrupt system, where nationalist elements, submerged for decades, are erupting with frightening violence, threatening to set back international co-operation in energy transfer and supply many years? Indeed, the European Energy Charter itself could be under threat from an outbreak of nationalism in the East which seems to be contagious and affecting some EC nations.

The most immediate worry stemming from the emergence of the Confederation of Independent States (CIS) is the realisation that many of the nuclear reactors of the RBMK and WWER types have flaws and management inadequacies which make them a serious accident risk. It took the Chernobyl accident to make Western politicians and opinion formers realise the magnitude of the problem. A special session was convened at the Congress in Madrid in 1989 to discuss the problem, and Professor Adamov of the Russian Power Engineering Institute made a plea for technical and financial assistance to make a start on implementing necessary engineering work. He complained of endless delegations visiting the station and commenting on inadequate safety, but not actually doing anything practical.

The financial requirement was estimated at around $200 million per unit! But Professor Adamov emphasised that stations cannot be closed down as there is a grave shortage of electrical power supply, with a difficult winter in prospect. In the Ukraine nuclear power provides over 30% of total electricity. Suggestions were made that some stations could be converted to natural gas and, betraying complete lack of understanding of the problems, some delegates suggested

It took the accident at Chernobyl to wake up Western politicians to the accident risk posed by RBMK and WWER type reactors.

increasing the price of electricity to reduce demand. It was a bad-tempered session, which could bode ill for the future. Indeed, one of the main recommendations of the World Energy Council is that OECD countries should immediately provide the funds necessary to ensure the safety of the stations.

The question of nuclear power and its role in the world energy supply spills over into the debate on the greenhouse effect. There is no doubt that the average temperature of the biosphere has risen by about 0.5°C during the last century. This warming compares with the anthropogenic increase in levels of carbon dioxide and methane over the same period of time. It is probable, but not scientifically proven, that the phenomena are cause and effect. There is a school of thought that recommends waiting until the effect is scientifically proved or disproved, although proving a negative is philosophically and practically extremely difficult. The mood of the Congress was to adopt a 'no regrets' policy and move to curtail and stabilise carbon dioxide production in line with Agenda 21 of the Rio Conference whilst, at the same time, conducting further research into the roles played by the oceans and water vapour in controlling the greenhouse effect. This, although very difficult to achieve, is driven by the strong desire to achieve sustainable development.

Dr Gerhard Ott, Chairman of the World Energy Council, emphasised that "neither energy production nor environmental protection are aims in themselves. They are means, or services to enhance the well being and sustainable development of mankind". That a global strategy is necessary to achieve this aim there is no doubt, and James Schlesinger pointed out that "As a general proposition, concern about the environment has now displaced national security as the principal driving force behind energy policy." With this almost universal imperative to protect the environment and achieve sustainable development come a number of warnings, however.

In a period of deep recession in Western industrialised countries there is a strong political resistance to impose any kind of restraint on energy use by the imposition of taxes, which will increase costs to industry and so reduce competitiveness, particularly if such action is unilateral and the 'playing field is not level'. This causes politicians to grasp at any statements discrediting the validity of the greenhouse effect. In America and elsewhere this syndrome has been dubbed the 'White House effect'.

The world will come to depend more and more on fossil fuels to maintain economic growth, particularly in the developing world, despite improved efficiency of energy use. Both the developed and developing worlds must collaborate to reduce greenhouse emissions. As Maneka Gandi said in an emotional address: "The countries of the South cannot close their eyes to the problem of growing damage to the global environment and must show enthusiasm for a new mode of partnership". This all points to the importance of three essential strands in a strategy of reducing greenhouse gas emissions: renewable energy, nuclear energy and improved energy efficiency. All three technologies have tremendous potential, but will take decades to implement. The fourth strand of reducing population growth was largely avoided and piously left to improved education of women in the developing world, which could be a very long-term strategy.

Jack Darnell of Bechtel presented an interim World Energy Council study on renewable energy resources, pointing out that at the present time biomass and large-scale hydro provides 18% of world energy. The current contribution of all other renewables is about 2%. Looking ahead to 2020 and using a 'business as usual' scenario, the total renewable input will represent about 1.8 times the current level, but will still only account for 21% of the global energy supply. Using an ecologically-driven scenario this figure rises to 30%, with the contributions from new renewables reaching 13 or 14% by 2020 rather than the 4% of the 'business as usual' scenario.

Darnell warns that the "market-based economic systems which thrive in today's economic climate are short sighted and exclude important side effects and longer-term ramifications." The environmental impact of renewables was discussed by a number of people and the importance of costing externalities of all the different energy supply sys-

tems was seen as crucial to developing a level playing field for energy costings, if true comparisons are to be made. Unfortunately no one quite knows how to do it. Ways are being sought to involve the private sector in financing renewable energy despite the long pay back periods, possibly through government-backed bonds.

Renewable energy could make a very considerable contribution in many developing countries. Unfortunately, as Sydney Gata of Zimbabwe points out: "In the developing world renewable energy does not receive adequate government support because it does not have the same high political profile as an oil refinery or electricity generation". This problem of political visibility is crucial to initiating action and presents major problems in the area of energy efficiency, as well as renewables.

Nuclear power is similar in some ways to renewable energy in that it requires high capital investment. It has already internalised many of its external environmental costs by including in the price of nuclear electricity decommissioning and spent fuel reprocessing costs, which puts it at some disadvantage compared with coal-generated electricity, which does not include costs of acid rain damage or the all-pervasive greenhouse effect. Nevertheless, nuclear power suffers from a crisis of public confidence and several papers tried to get to grips with educating the people to understand risk and benefit analysis.

Growth in nuclear power, which currently provides 4% of world energy is expected to rise slowly to 8% in 2020. Much hinges on the safety question hanging over the Eastern Bloc nuclear power stations. As Professor Adamov says "In Russia we are well aware that it is not the future of our nuclear power alone that hinges on the safety of the Russian plants".

Energy efficiency is the real Cinderella of the energy portfolio. Despite the appallingly low world average energy efficiency of 3.5%, even well-informed people continue in their extravagant ways. The cluster of expensive chauffeur-driven, top-of-the-range gasolene injection limousines which congregated outside the Conference Centre every lunchtime could easily have been replaced by turbo-charged, diesel-powered vehicles of similar marque. The increased efficiency of the diesel engine, the lower price of fuel and the environmental advantage of a modern diesel engine are all points well known to the users of the limousines, so why do they not switch to diesel?

This points to the acute social problem of getting people to take energy efficiency seriously. Even fiscal incentives do not achieve what is required, still less what is, in theory, possible. "For Germany — studies conclude that energy savings of at least 30% can be achieved in industry, without any further technical progress": Gerhard Reuter of Kraftanlagen Aktien GmbH. Or Claudio Aranzadi: "There can be no doubt that an instrument of maximum priority is the promotion of energy savings and efficiency, to achieve lower levels of consumption without reducing economic activity or the welfare of citizens".

The reference case in the draft Global Report of the World Energy Council *Energy for Tomorrow's World* assumes a world rate of decline in energy intensity of 1.8% per annum, averaged over the period 1990-2020. This will be extremely difficult to achieve and is nearly twice as fast as that achieved over the past 15 years. Perhaps the only incentive powerful enough to jolt the man in the street, and via him the politicians, to save energy is a clear belief in the reality of global warming engendered by further noticeable instabilities developing in the weather machine. By this time, of course, it may be too late.

Even the daily struggle with the manifestly inefficient transport system, which is largely a slave to individual transport via the motor car, has not yet given sufficient incentives to change to a more energy-efficient system. Jananne Sharpless of Air Resources Board, USA, in the session on transport pointed out "even if cars became cleaner and more efficient in future, the growth in the number of cars estimated over the next decade cannot be sustained by the transportation system we have today". "The issue is really giving up personal mobility", said Roberta Nichols of Ford. Transport has just overtaken electricity generation as the biggest producer of anthropogenic carbon dioxide, yet we continue to let cars clog the streets of our great cities to the fury of the passengers and the degradation of the city. Madrid must one of the most chaotic, ill-disciplined cities in Europe, as far as transport is concerned, with cars casually double and triple parked on street corners and zebra crossings. It took one and a quarter hours in bottom gear to travel by coach from the Conference Hall the few miles to the Crystal Palace, where the King and Queen officially opened the Congress.

It was not at all clear to delegates, as the Congress progressed, that although, as the King said: "Quality of life depends to a great extent on the availability of energy" that even in energy-rich nations like America, quality of life is improving. The untrammelled use of energy and a policy which has, in the past, treated the environment as 'a free good' cannot lead to a clean, comfortable lifestyle: quite the contrary! A strategy which leaves energy policy to market forces is simplistic beyond belief, and the environment suffers because of short-termism and a refusal to face long-term facts.

A paradox developed early during the

The World Energy Council's draft report *Energy for Tomorrow's World* was published last year. Initiated in 1989, it divided the world into nine regions, setting up teams in each region to report on real energy options, and an agenda to achieve them. Its preliminary findings were as follows:

- Energy use is likely to increase significantly over the next three decades, mainly in the developing world, although the overall picture will mask nil, even negative, growth in per capita energy consumption in many developing regions.
- Energy technology R&D should be expanded as it holds the key to the future.
- A major drive is required to increase energy efficiency and conservation.
- More effective measures are required to reduce local, transfrontier and global pollution, with particular emphasis on local pollution.
- A 'minimum regrets' strategy is required to respond to the possibility of enhanced global warming and climate change.
- Just as energy resources are able to satisfy future energy requirements, so adequate capital exists which must be attracted by encouraging and mobilising local investment to secure sufficient energy.
- Major institutional changes are required to effect improved and more efficient energy policies. This is particularly so in developing countries.
- Encouragement must be given to ending subsidies, and where possible, to the absorption of all costs within prices, including certain environmental costs.
- Developing countries will need financial and technological support on market terms to meet social and economic goals.
- Fossil and other traditional sources of energy will provide the bulk of future requirements well into the next century. Renewables could also be widely used, but governments will be required to develop them to the point of economic viability.

Congress, where the newly liberated Eastern Bloc countries' delegates expressed their desire and intention to privatise their energy industries now and reap the ideological gain, not to say the financial gain and efficiency improvement. But as Helga Steeg remarked: "State ownership is not necessarily an obstacle to commercial behaviour". One can rush pell mell to the short-term haven of market-led strategy and lose the long-term benefit of strategic planning. Perhaps this is a price we must pay for too much democracy, which we may live to regret. The horrors and inefficiency of five years' centralised planning have disintegrated, leaving a bankrupt legacy, but we must replace them with something better, and that means a strategy which uses market forces to achieve desired environmental ends. A flexible strategy, which learns as it goes along, is not an impossibility.

One lesson was mentioned by Tony Churchill of the World Bank, who declared that "it is a cruel hoax to help poor folks by subsidising energy; it leads to rationing and consequently a black market and yet higher prices". Governments must do better than they have done in the past, and not abdicate their responsibility to a simplistic, market-led energy policy; rather, as Michael Kohn stated "The key steps for government are to formulate energy policies that recognise the value of the market ... if economic instruments are implemented they should have a clear net environmental benefit and should not be used for revenue purposes".

The World Energy Council does not stand still, and last years' stimulating Congress illustrates a move on the part of the 100 member nations towards sustainability and protection of the environment, whilst assuring economic growth and energy availability for developing nations. The thinking, and publications, of the World Energy Council are vital to the future of us all, and should be disseminated widely. ❑

International actions required:

- There is a need for international institutions to grapple more strenuously and urgently with organising 'minimum regret' programmes and adaptive measures to deal with possible climate change on an international basis.
- The WEC calls on the United Nations (as at the end of the 1989 Congress) to provide a mechanism for a better dialogue between industrialised countries and the developing world on technological transfer, management, training, and the mobilisation of investment funds to deal more urgently with the energy needs of developing countries.
- WEC endorse the recommendation to emerge from the special session on nuclear power in Eastern Europe and the CIS that each OECD country should immediately assure the funds necessary to support its supply of goods and services to help identify the appropriate improvements to the nuclear plants in those countries, and for alternative energy sources where those are indicated — a multi-billion dollar effort, calling for the exercise of determined political will.

Energy, Transport and the Environment

by Johanna Fender

The Institute of Energy recently turned its attention to the subject of transport: its demand for energy and the subsequent effects upon the environment, for its latest seminar.

The programme had a broad scope, taking in both private and public transport, in the UK and Europe, with many references to world demand for energy as transport fuel, and looked to the future in all areas of transportation. The subject range was reflected by the array of speakers, who hailed from DG XI, British Rail, Oxford University and Imperial College, London, the Transport Research Laboratory and the Department of Transport, amongst other such august institutions.

The scene was set by a welcoming address from Roger Freeman MP. Despite his official title, 'Minister of State for Public Transport', the emphasis of his paper lay in individual choice, ie privately-owned cars, inherently at odds with an integrated and efficient public transport system.

Mr Freeman began his paper by stating "It is not Government policy to dictate how people should travel" going on to proclaim that "market forces are the most effective way of promoting greater energy efficiency in transport". He did suggest, however, that a helping hand from the Government would point the market in the right direction, with the use of taxes and enforceable performance and emissions standards. These he described as 'market signals', the major signal to the motorist being the price of fuel: "it is important to continue to influence the cost of fuel through taxation," he said.

The Government is planning to achieve a 30% improvement in new car fuel efficiency by 2005, through technical improvements in car design, and a shift from larger gas-guzzlers to smaller cars. He looked forward to the results of an EC working party looking at encouraging the production and purchase of the fuel-efficient cars: through differential vehicle taxes and fuel tax increases.

On the subject of road-pricing Mr Freeman showed extreme caution, saying that the Government was "keeping an open mind at this stage" on the subject. A green paper due in early 1993 would consider existing motoring taxes and "more direct charges".

Amid the chaos of a pre-Christmas London, disrupted by IRA bombs, bomb hoaxes and rail accidents, the Institute of Energy held its final seminar of 1992 on the subject of *Energy, Transport and the Environment.*

On vehicle standards, Mr Freeman drew attention to the emissions check now contained in the MOT test, and speed limiters on coaches and lorries. From July 1993 lorries in excess of 16 tonnes will be required by law to have speed limiters, bringing both safety and fuel-saving benefits.

Information to the public, allowing them to make their responsible, market-led decision about how they will travel, was seen as another important factor in the Government's transport equation, to which end the Department of Transport (DoT) produces a booklet giving the fuel consumption of new cars, on a regular basis. The subject of public transport was mentioned only briefly, with no indication as to how the infrastructure could or should be improved and no suggestion as to how motorists might be persuaded to switch. When detailing Government-supported investment in transport for 1992/3, it transpired that a massive £2 billion would be spent on trunk roads and motorways, with an estimated £1.5 billion going to British Rail, and around £600 million to London Underground.

DoT research was briefly summarised as concentrating on the following areas: cold start effects on fuel consumption and emissions; alternative fuels and engines for road vehicles, and vehicle modification for improved fuel consumption. The DoT do not appear to be swayed by the increasingly convincing arguments for a vastly improved public transport system.

Amazingly Mr Freeman failed to mention the forthcoming privatisation of the railways, and what effect this might have on the costs and geographical coverage of the rail system. He merely stated that "the Government wants to see more traffic transferred from road to rail." This sounded hollow without suggestions of how it might be achieved.

Dr Philip Goodwin of the Transport Studies Unit at Oxford University described 'Policies to Reconcile Economic Issues'. He recognised the desire in developed countries to increase our use of private motor vehicles, but brought a sense of realism to the proceedings when he stated: "There is a new and simple rule, now generally agreed among transport professionals ... it is not possible to build enough new road capacity to match the projected increases in traffic ... Supply will not be matched to demand. Therefore demand must be matched to supply — and demand management forces itself to centre-stage in transport policy."

One demand management tool, road pricing, was considered a lesser evil by Dr Goodwin: "somebody has to pay the hidden costs of environmental damage and congestion, and the market would undoubtedly work better if that someone is the person or company who causes them." He felt road pricing could be made more palatable if presented to the public as a user charge, rather than a tax, whose benefits (such as public transport, road maintenance, environmental improvements) would be both visible and attractive.

He emphasised that the key to this 'new approach' to transport policy is harmonisation: a harmony achieved firstly by a very substantial improvement in quality and scale of public transport provision. He added, a little ominously, "this is almost completely agreed in principle, though there is not yet agreement on how to achieve it."

A realist to the end of his presentation, Dr Goodwin concluded: "we simply have to wean ourselves off total dependence on the car." ❑

● *Papers and synopses of presentations given at the seminar are published in the Institute of Energy Seminar Series, priced £10. Available from The Conference Department, The Institute of Energy, 18 Devonshire Street, London W1N 2AU. Tel: 071 580 0008, fax: 071 580 4420.*

Branch activities

WE have been informed of the following branch meetings:

South Wales & West of England

An examination of the realities of recycling
Joint meeting with the IChemE, Tuesday 2 March, 6.30 pm for 7 pm. School of Engineering, Exeter University. Member contact: Dr M A Patrick, tel: 0392 263263.

Waste energy recovery and integration with air separation plant
AGM & prestige lecture by Barry Lavin of British Oxygen, Thursday, 1 April, 6 pm for 6.30 pm. British Gas Offices, Glenfrome House, Eastgate House, Bristol. Member contact: Harry Hibbard, tel: 0272 276407.

Meeting the energy challenges of the 1990s and beyond through innovative electrical technologies
20th Idris Jones Memorial Lecture and Luncheon, by Jeremy Attree, Marketing Manager, Electricity Association, Friday, 30th April, reception 10.45 am, lecture and lunch 11.30 am. Cardiff Castle. Limited ticket numbers, available from Doug Mustoe, tel: 0656 654070.

Annual lunchtime lecture and luncheon
Talk by Dr Slater, HMIP, Friday 18 June, 11.15 am. British Coal Research Establishment, Stoke Orchard, Cheltenham. Member contact: Bob Wardell, tel: 0242 673361.

Midland branch

Natural Gas Vehicles — the cleaner alternative
Joint meeting with IMechE, Tuesday, 23 February, 6.30 pm. The Automotive Engineering Centre, University of Birmingham.

Innovations in Coal Technology
Joint meeting with CIBSE, Wednesday, 24 February, 6 pm for 6.30 pm. The Birmingham Chamber of Industry and Commerce, 75 Harbourne Road, Birmingham.

The electricity generation business and the EPA
by Mr M Skinner, Thursday, 4 March, 7 pm. University of Aston.

Environmental issues concerning renewable energy sources
by Mr L Martindale, Thursday, 1 April, 7 pm. University of Aston.

The Jim Ellis Memorial Lecture
Thursday, 29 April.

AGM, May 1993.

Pictured above, second from right, is Mr Ian Scarr Hall (Member), Chairman of George S Hall Ltd, specialists in energy and facilities management. Mr Scarr Hall is displaying his company's recently acquired accrediation to British Standard 5750 part 2 certificate. Pictured with Mr Scarr Hall, from the left are Mr Ray Jones, Mr Easy, and far right, Lord Auckland, a non-executive director of the company.

London & Home Counties branch

AGM and The Future of Coal in the UK
Talk by Malcolm Edwards, Thursday, 18 March, 5 pm (AGM) 6 pm (talk). The Royal Institution.

Visit to Tower Bridge and Thames Barrier
Visit on Thursday, 22 April.

Sad news

WE RECEIVED very sad news concerning one of our Members in December.

Douglas Dunn, 47, a Member since October 1971, died from heat stroke only 250 metres from an oil installation in Libya.

Mr Dunn died during an attempt to bring rescue teams to a colleague, who had remained with their stranded truck, fearing he would be unable to make the arduous walk.

An industrial chemist, Mr Dunn and his colleague, corrosion specialist Kenneth Walsh, became stranded when the road they were using became too rough for their vehicle. After struggling unsuccessfully to free the truck and being unable to make radio contact, Mr Dunn set off to find help, marching through the desert in temperatures of around 30°C.

A North Shields Coroner recorded a verdict of accidental death.

On the move

INSTITUTE OF ENERGY Member Derek J Bargh took up a new position, as Executive Director, Power Generation with Prospect Industries plc, as of 1 January 1993.

Until the end of 1992, Mr Bargh had been Head of Business Development (UK) with GEC Alsthom's Boiler and Environmental Systems Division.

Prospect Industries is a relatively new group, initially formed in 1989. However, its principal operating companies, Dunn International Ltd, Davenport Holdings Ltd, Greenbank Industries Ltd and Ipswich Electronics Ltd are well-established in the UK.

Technical Committee

THE AIM of this committee is to respond to queries and invitations to comment received from Government and other outside agencies. Additional volunteers are now required to act as experts and adjudicators, particularly in the building and industrial process sectors. The time requirement is minimal, with most of the activity taking place via telephone or fax.

Would interested members please contact the Secretary, Jim Leach, at Head Office.

Considerable detail

'Handbook of Practical Coal Geology" by Larry Thomas
Published by John Wiley & Sons, Chichester, 1992, 338 pp, £24.95 P/B

WITH THE future of the world's coal industry at a strategic crossroad, this book is a most welcome addition to the energy discussion, being timely and most stimulating. It is well written and is both precise and concise. Thomas, a leading coal resource consultant, expertly details the reasons why and the locations where coal, as an energy source, is being mined or explored.

The publication contains up to date information on the type and quality of coals on an international basis. The nature and origins of coals, with their individual physical and chemical characteristics as well as their classification, are fully described.

A most absorbing aspect of the book is its analysis of the geographic distribution of coal, indicating such important factors as age of the coal and production statistics for the major coal trading countries. Another highly commendable feature is an elaboration of the essential exploration techniques and procedures, together with standards of working practices, such as geology, geophysics, geotechnology and hydrogeology. Computer applications in the handling and storing of geological data are outlined. The section on coal sampling and coal reserve calculations is most authoritative, and is probably one of the best produced for a long time. Thomas skillfully discusses the relationship between the coal geologist and others in the extractive process, such as mining engineers. He also takes into account the important considerations of coal quality and its consequences on the environment, which are vital issues to the future of coal as a fossil fuel resource.

The book is a must for coal geologists, energy technologists and economists alike, as well as for all those who wish to be better informed on the current discussion of the future of coal. It will probably become a bible for coal geologists in their operational duties, giving excellent information on the properties and classification of coal as well as the terminology used. It is of particular interest in the present dilemma of the British coal industry. On the international scene, it has considerable detail on reserves and coal production on a global basis, putting the world market into perspective.

This handbook is comprehensive, most readable and is logically presented with excellent photographs and illustrations. It is supported by an excellent bibliography, a fine glossary, lists of international and national standards used in a coal analysis and evaluation as well as technical tables.

Thomas has produced probably the best practical handbook of its kind for many years. It should be made compulsory reading for those who are today deciding the future of the coal industry, at whatever level, by making technical issues more understandable as well as clarifying the coal and energy scenarios.

Dr Alan Stainer

A useful study

'Energy Management in Africa' by M R Bhagavan and S Karakezi
Published by Zed Books, London, in association with the African Energy Policy Research Network (AFREPREN), 1992, 180 pp, £29.95 H/B

AFREPREN was established in 1989 in Botswana to promote research aimed at achieving appropriate energy policies for the countries of East, Central and Southern Africa. AFREPREN supports research projects in 16 countries on biomass, coal, electricity, oil, renewable energies and energy planning.

In their introduction to this book, the editors list several important reasons why energy management is critically important to sub-Saharan Africa. Shortage of new capital is one, and the growing disenchantment over the recurrent need to rehabilitate national energy infrastructures is another. But the strongest reason is that energy efficiency provides the opportunity of using energy savings to increase energy supply at a fraction of the cost required for new energy production, while simultaneously reducing the negative environmental impacts incurred with current energy practices.

Three main sectors are examined. Energy management in the transport sector concentrates on road traffic, as air, rail and sea are still very poorly developed. Simple remedies are suggested. Maintenance of an aging fleet of buses, lorries and trucks is extremely poor, and there are no incentives to reduce the levels of fuel consumption. Fuel price subsidies are common and need drastic cuts. Incentives should be given to encourage a switch from petrol to diesel, and from higher capacity to lower capacity engines. Case studies are given for Lesotho and Ethiopia.

The second sector is manufacturing industry, where the case study is based in Kenya. While there is apparently enthusiastic agreement about what needs to be done, and energy auditing and training programmes are completed, it has proved very difficult to persuade the industrial owners to put energy-efficient measures into effect. The final sector looks at energy management in electricity generation in Mauritius. It is clear that in the short to medium terms, the supply of electricity has to increase sharply to provide economic growth. A partial substitution of low-cost imported coal and bagasse for petroleum is suggested, with a possible 60% of future electricity demand being met by this route. A further strategy would be to install pumped hydro generation to convert a third of unused base-power to peak power.

The main value of this book will be felt in Africa, but it will be a useful book for Western-based development groups to study, as it highlights past mistakes in energy policy which were often caused by expatriate 'experts'.

Dr Cleland McVeigh

A reminder of ethics

'The Engineer's Conscience' by M W Thring.
Published by the author, Brandish, Suffolk (available from Cranfield Bookshop) , 1992, 240 pp, £9.00.

PROFESSOR THRING is a respected Senior Fellow of the Institute of Energy, and the contents of this book have been at the centre of his thinking for many years. He is still active — he recently volunteered to contribute to a current Watt Committee on Energy study on combined heat and power.

The book was originally published in 1980. Many of the topics covered have received considerable publicity over the past few years, with belated and hesitant action on the environmental front, which is transforming the direction of the engineer's work, particularly in the energy industries. Environmental matters have to be taken seriously in all of the developed, and developing, world.

There is no doubt the arguments of the first six chapters are widely discussed and accepted, although some aspects (population control, the ideal of attempting to equalise prosperity over the whole world population) have not been given serious consideration — yet!

The engineer, at a time of recession, with unemployment among professional engineers comparable to the national average, does need reminding of ethical issues. However, because most engineers work for industrial companies, the opportunities for giving weight to these factors are not frequent.

This is an inexpensive book, and members of the Institute of Energy and engineers in other disciplines must find much here that is thought-provoking. Much of the material shows its age, but the views of Professor Thring do justify a reprint at a time when the important, wider issues facing our world are often swamped in the media by trivia.

N G Worley

Motoring and the environment

I WAS very interested to read the article 'Motoring and the environment' (*Energy World*, November 1992).

I would, however, like to take issue on one point. In referring to CNG being used as a vehicle fuel, it says that "CNG suffers from the fact that its main constituent, methane, is an even more active greenhouse gas than carbon dioxide".

True, methane is the main constituent of CNG, particularly so with CNG available in New Zealand, but why should it be emitted into the atmosphere as methane, when it is produced to be used as a fuel, emitting carbon dioxide, yes, but not methane?

Incidentally, readers might like to know that, in addition to our on and offshore natural gas being used as a premium fuel, some is converted into synthetic petrol for vehicle transport purposes. Around 2 000 tons of synthetic petrol is produced each day, and New Zealand is around 45% self-sufficient in transport fuels, even exporting some.

Whilst the government, or gas industry, no longer subsidises costs of converting petrol vehicles to petrol and CNG, it has been estimated that an average car would have to travel 20-25 000 miles to recover the cost of conversion.

I have owned three cars so converted, and when originally adjusted to run efficiently on CNG I found no loss of power, and noticed very little difference when switching over, whilst driving, from CNG to petrol. Oil and spark plugs remain cleaner for very much longer, and a small compressed CNG cylinder fitted in the boot (and taking up only one third of boot space) gives an additional 200-250 miles running distance.

I am seeking references as to the economics, viability etc of producing SNG. If readers can provide me with any information (sent to the address below) it would be greatly appreciated.

F H Charles MBE FInstE
1 Kansas Grove, Upper Hutt,
New Zealand.

Energy and transport

IT IS surely incontrovertible that on grounds of energy economy (and hence reduction of greenhouse gases), and of road congestion and damage, that the majority of freight transport should be by rail. Any sensible government would seek to promote this by all means in its power: taxation, policy, investment and subsidies.

The objection that it is inconvenient and uneconomic to transship goods between road and rail vehicles for the beginning and end of journeys no longer applies. Lorries can be directly loaded onto the rail platforms that will necessarily transport them through the Channel Tunnel, and whose use can be extended throughout the country.

In the longer term special short range electric vehicles could be developed which could charge their batteries during the rail journey, for quiet, pollution-free deliveries in cities.

Meanwhile the Government and British Rail seem to be doing all they can to achieve the opposite result!

Eleanor Macnair *(Fellow)*
Monkton Combe, Bath

Renewables' viability

IN RESPONSE to my letter (*Energy World*, November 1992), Donald Swift-Hook has made one tangible criticism.

My guess for the cost of a wind turbine producing a maximum of 249 kW at a wind speed of 26 mph should have been something less than £1000/kW. Whether this would have given the manufacturer's ex works price or total installed cost is unclear.

In a recent *Tomorrow's World* on BBC1, it was said that three wind turbines installed in a remote part of Ireland had cost over £1.5 million. The turbines in question were smaller than 249 kW, so from the BBC statement it would seem that a 249 kW turbine would cost in excess of £0.5 million.

From the annual cost of running a wind turbine, ie, capital repayments, interest, insurance, maintenance, depreciation and so on, it would be a matter of simple arithmetic to calculate the cost of a kWh if wind speed, and hence output, remained constant at 26 mph and 249 kW respectively. All else being equal, power output varies as the cube of the wind speed. Assuming that efficiency does not reduce with wind speed below the 30% I have used to calculate maximum output, then a factor by which to multiply the cost per kWh at a steady wind speed of 26 mph to the cost at any wind speed is given by:

$$\left(\frac{26}{\text{wind speed mph}}\right)^3$$

To illustrate the significance of this cube law I have produced the following figures, taking the annual cost to be 15% of a capital cost of £0.5 million.

steady wind	multiplication	Cost/kWh at steady wind speed (p)
26	1	3.44
24	1.27	4.37
22	1.65	5.68
20	2.20	7.55
18	3.01	10.36
16	4.29	14.75
14	6.41	22.02
12	10.17	34.97
10	17.58	60.43
8	34.33	118.09

These figures are not intended to show actual costs, but to illustrate how costs rapidly increase with lower wind speeds.

Ignoring factors such as increased transmission losses, I agree that depending upon capital and annual running costs, a wind turbine could be economically viable, provided that wind speeds are over, say, 20 mph most of the time. However, from TV forecasts it would appear that this is extremely unlikely, so in spite of Prof Swift-Hook's reply I am still of the opinion that wind turbines will never be economically viable and significant suppliers of our power requirements.

Gwilym D Daniel *(Member)*

Eskom replies

WITH reference to the article 'Eskom weighs nuclear/hydro projects' (*Energy World*, September 1992), we would like to set some facts straight.

From the Eskom 1991 Annual Report, it can be seen that the total assigned sent-out rating is 36 228 MW, of which 5061 MW (14%) are in reserve storage, ie 'mothballed'. The total electricity sold was 138 687 GWh of which 16% went to households (22 190 GWh). So far the facts as of December 1991.

Now the electrification programme envisages 1 million houses to be electrified over the next seven years. The increase in load factor is expected at around 2.5%, corresponding to an increase in electricity consumption of 3467 GWh. This represents a 15.6% increase in electricity sales for domestic purposes. Such an increase will require an additional 779 MW, well within the 5061 MW currently in storage. Thus no new generators have to be installed to cope with increased demand in domestic electricity consumption during the next seven years.

The statement "Eskom plans to increase domestic electricity from 30% to 70-80% in the next ten years" is confusing and inaccurate, as is the statement " a further annual increase of between 1500 and 3000 MW will be needed". This would mean that every fifth month for ten years a new generating unit would have to be brought on line — the equivalent of four new large power stations in ten years!

However, Eskom is a pro-active organisation, and anticipates an increased demand for both industrial and domestic power. It is therefore investigating various options for generating 'cleaner' electricity more efficiently, including gasification of coal fired in gas turbines; nuclear power; alternative sources in remote areas, such as wind and solar, as well as the feasibility of building hydro-electric plants in Central Africa.

In South Africa, hydro-electric stations are not a viable option, given the progressively worsening water shortage. Eskom operates two such stations, but only during peak demand periods and emergencies, subject to availability of water in the dams. These two stations account for only 1.5% of Eskom's total generating capacity.

Dr S J Lennon
Scientific Services Manager, Eskom

What's in a name?

THE Engineering Council has expressed alarm over the proposed name change of the Incorporated Association of Architects and Surveyors (IAAS) to the Association of Building Engineers.

They have been in touch with the Privy Council, the DTI and the Charity Commissioners, as Denis Filer, Director General of the Engineering Council explained: "Neither of these bodies are recognised by the Engineering Council as institutions who may qualify professional engineers to the Council's standards; members of the new body are likely to be described as 'building engineers', which will cause great confusion in the minds of the general public."

Less than 3% of IAAS members are qualified to standards laid down by the Engineering Council and professional institutions.

"It is just not good enough to confuse professional titles in this way," continued Mr Filer, "Our doors are always open to organisations who have members adhering to the educational, training and experience standards set down."

Young Woman Engineer announced

THE COVETED title of 1992 Young Woman Engineer of the Year was announced last month at a special ceremony in London.

Dawn Fitt, 25, from Worcester received the award from Sir Austin Pearce CBE, Chairman of the Trustees of the Science Museum. Joint runners-up were Hannah Reynolds, 25, and Pamela Dean, 26.

Sir Austin congratulated the finalists: "Engineers make things happen and shape the future — I am proud to be one" he said. "Look at the wonderful work being carried out at Great Ormond Street Hospital — many children are alive today thanks to the engineers involved in the electronic equipment. However, more engineers and scientists are required to make this continue to be possible. Electronic and electrical engineering is a challenging career for women — all the finalists here today will be making a major contribution to society in the future and I wish them every success."

Dawn Fitt was presented with a cheque for £500 and a silver rose bowl. She was one of the first female apprentices in the history of her employer, Fronde Consine, Worcester. In her present position as Commissioning Engineer her responsibilities include supervision of installation and commissioning of the company's control systems and dynamometers.

The Mary George Memorial Prize, given to the entrant showing particular promise as an Incorporated Engineer, was presented to Tara Knight, 22, from Newport, Isle of Wight. She is Senior ATE Engineer with Siemens Plessey Systems at Cowes. A Graduate Member of the IEEIE, Tara received a cheque for £100 and a silver salver.

'Single body' proposed

A NEW single body for the engineering profession has been proposed by the presidents of the four largest professional engineering institutions to the Unification Steering Group.

The joint proposal has been broadly endorsed by the Engineering Council, who agree that a new single body should provide leadership, vision and confidence, acting as a focal point for the profession.

However, they point out a divergence on some issues of principle, notably that in order to be powerful, the new single body will need to control and govern a structure set up to carry out its purposes. This will entail the subsumation of the Engineering Council and its charter, along with a significant transfer of power from the separate institutions to the new body.

The Council warned:"A return to an organisation akin to the former Council of Engineering Institutions (CEI) must be avoided. The new body must necessarily be above, not on a par with, the institutions. In order to achieve unity, individuals, whether Chartered or Incorporated Engineers or Engineering Technicians, must regard themselves firstly as members of the engineering profession and secondly as members of a particular discipline within the profession."

The Council disagreed with one key aspect of the proposals. "It is felt that while the broad proposals made by the four presidents foresee a new central body, the detailed proposals relating, in particular, to its operating framework and its membership make it difficult to see how it could operate effectively if its aims are to be achieved.

"In order to create a focal point, subordination of others to that body will be necessary."

It is considered essential that membership of the council of the new body should include outside members, as is the case for all other professional bodies within the UK, and that they should act on their own behalf and that of the new body, not be representative of any body or sector of interest.

The general thrust of the proposal, that membership of the new body's council be confined to the institutions on a numerical basis, has been rejected by the Engineering Council. They believe the new body's council would become the creature of the institutions, sidelining the priority interests of industry and education.

They stressed that further investigation was needed to cover areas such as manufacturing, construction, process and extraction.

Independent R&D funding suggested

AN INDEPENDENT funding body should be established as part of a national strategy for restructuring and refocussing science and technology research towards the needs of manufacturing industry.

The new organisation, suggested by the Engineering Council, would help to ensure that strategic research underpinning the success of UK industry is given priority over large-scale science in the allocation of government funds.

In addition, a major reorganisation of the research councils should be undertaken to rationalise the funding available for 'blue skies' research. Existing mechanisms for technology transfer should also be revised and standardised. The suggestions were contained in a formal response to the consultation exercise launched in August 1992 by the Office of Science and Technology.

Present funding mechanisms for support of R&D are characterised by a lack of clear strategy and constantly changing policies. Funds currently available to support relevant research is equivalent to around 1% of GDP, and half of this goes to the Ministry of Defence.

The Council has also suggested three core criteria for judging specific R&D projects. Projects should involve:

- new exploitable scientific discoveries;
- a knowledge base capable of exploitation by a number of industrial companies;
- the training of personnel in areas that are being exploited.

In addition, the Council suggests that the number of engineers and scientists involved in government decision-making should be increased. Every effort should be made to ensure that a high proportion of qualified engineers and scientists, who understand the need for a financial return, work in relevant government departments.

The present funding structure involving both the DTI and the many separate research councils is another area requiring attention. The Council states unequivocally that this system militates against being able to make comprehensive assessment of research priorities.

As an example of the current imbalance in the allocation of funds the Council cites the fact that financial support per research worker in nuclear physics is 30 times that in engineering. It concludes that the government needs assistance and sound advice on engineering prospects and priorities. The government should, therefore, consider whether an existing body, such as the Royal Academy of Engineering, or some new organisation should be established for this purpose.

February 1993

Central Eastern Europe: challenges and opportunities
Conference, 24 February, London.
Details from Conference Department C2, Mid Career College, PO Box 20, Cambridge CB1 5DG. Tel: 0223 880016; fax: 0223 881604.

March 1993

CERI North American natural gas conference
1-2 March, Calgary, Alberta, Canada.
Details from CERI Conference Division, tel: (403) 282 1231; fax: (403) 289 2344.

Affordable new low energy housing for housing associations
Seminar with workshop, 3 March, Windsor; 10 March, Bristol.
Details from IBIS Information Services, tel: 0727 825209; or Maggie Procopi at BRE, tel: 0923 664524; fax: 0923 664097.

Gas monitoring in the water industry
Forum, 3 March, Bromley, Kent.
Details from Sira Communications Ltd, South Hill, Chislehurst, Kent BR7 5EH. Tel: 081 467 2636, ext: 373; fax: 081 467 7258.

1993 EC Wind Energy Conference and Exhibition
8-12 March, Lubeck-Travemunde, Germany.
Details from WIP-Munich, Sylvensteinstr 2, D-8000 Munchen 70, Germany. Tel: -49 89 7201235; fax: -49 89 7201291.

Pyrolytic characteristics of coals for combustion
Colloquium, 11 March, Imperial College, London.
Details from Prof Felix Weinberg, tel: 071 589 5111, ext 4360.

Rheological testing of difficult materials
Workshop, 16 March, Stevenage, Herts.
Details from Miss P Madhvi, Warren Spring Laboratory, Gunnels Wood Road, Stevenage, Herts SG1 2BX. Tel: 0438 741122; fax: 0438 360858.

The new electricity market: challenges and opportunities
Conference, 18 March, London.
Details from Jackie Murphy/ Tracy Clarkson, The Economist Conferences, 40 Duke Street, London W1A 1DW. Tel: 071 493 6711; fax: 071 931 0228.

Energy efficiency in hotels and catering
Seminar, 18 March, Cardiff.
Details from Robert Dugon, EEO (Wales), tel: 0222 823126.

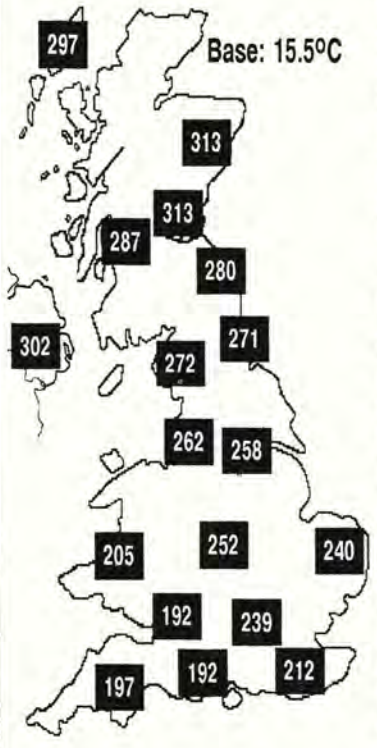
Fundamentals of energy management
Two-day refresher course, 18-19 March, Austin, Texas, USA.
Details from Association of Energy Engineers, 4025 Pleasantdale Road, Suite 420, Atlanta, GA 30340. Tel: 404 447 5083; fax: 404 446 3969.

Regulatory strategies: controls and responses in British regulation
One-day course, 19 March, London.
Details from The Short Courses Office, LSE, Houghton Street, London WC2A 2AE. Tel: 071 955 7227; fax: 071 955 7676.

Coal for development
Conference, 24-26 March, London.
Details from Coal for development, c/o The Event Organisation Co, 8 Cotswold Mews, London SW11 3RA. Tel: 071 228 8034; fax: 071 924 1790

Hedging the risk in energy price
Conference, 29-30 March, London. Details from IBC Financial Focus Ltd, tel: 071 637 4383; fax: 071 323 4298.

DEGREE DAYS: NOVEMBER 1992



These regional figures, calculated from daily outside air measurements, provide an index of demand for space heating over the month and thus enable excessive consumption to be detected.

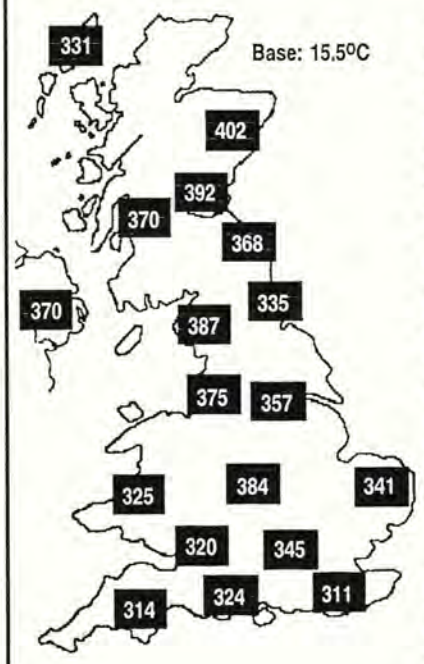
A well-controlled heating system should manifest a straight-line relationship between monthly fuel used and the local degree-day value; any significant deviation from this 'target characteristic' is likely to signal the onset of avoidable waste (such as a stopped timeswitch or open isolating valve).

Readers can get more information on the use of degree days from Vilnis Vesma, 17 Church Street, Newent, Glos GL18 1PU

Source: Degree days direct

DEGREE DAYS: DECEMBER 1992

Source: **Degree days direct**



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Readers can get more information on the use of degree days from Vilnis Vesma, 17 Church Street, Newent, Glos GL18 1PU (0531-821350)

 Because different observing stations are used, the figures given here will not necessarily agree exactly with those from other information providers.

CONFERENCE PROGRAMME

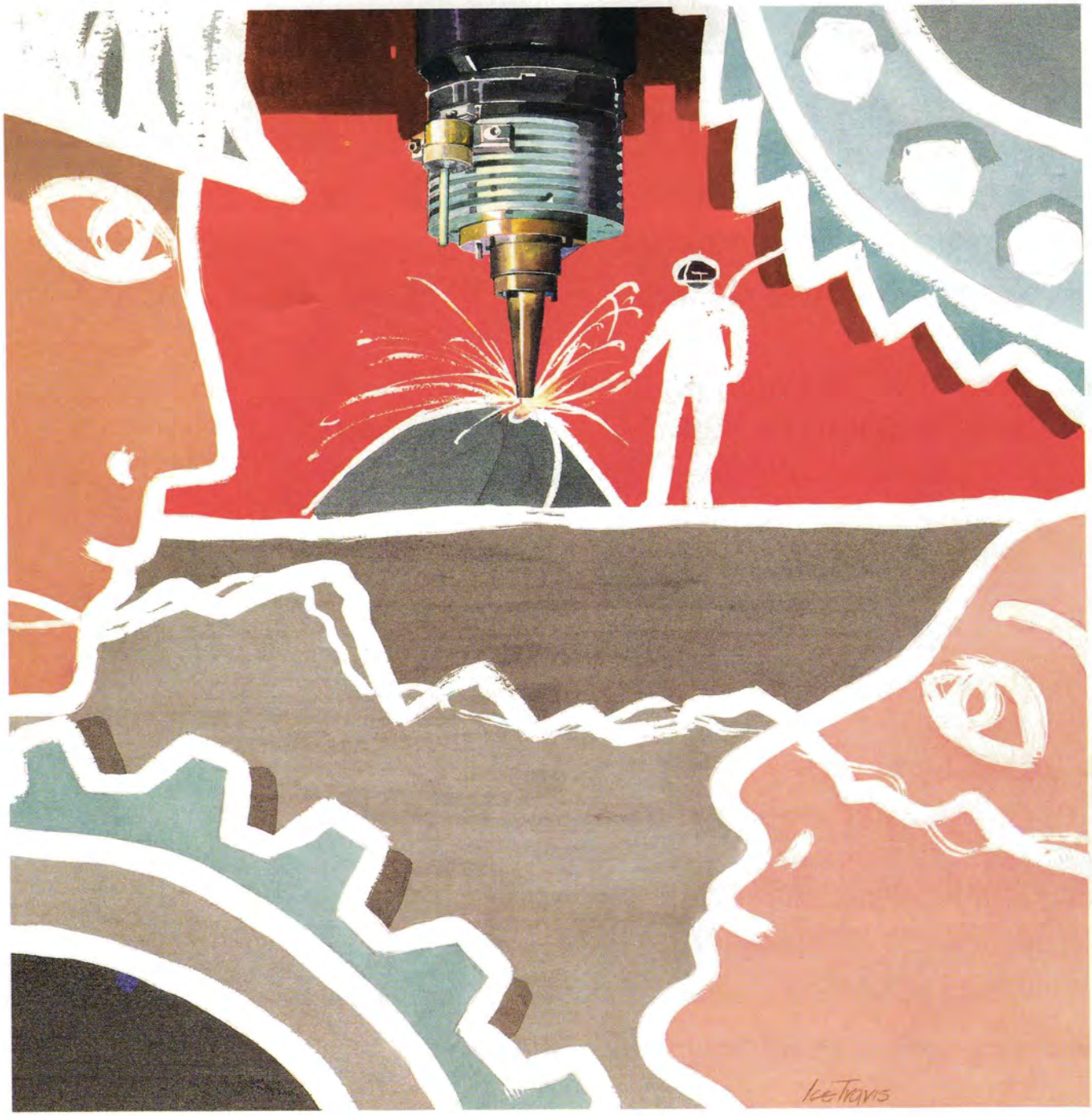
● **Fuels For Power Generation**	London	20 April
● **Industrial Air Pollution Control: Are We Getting It Right?**	London	25 May
● **How Climate Change Will Change Your Business**	London	June
● ***International Symposium on* Combustion & Emissions Control**	Cardiff	21/22 Sept
● **Making Energy Privatisation Work — The Future of Regulation**	London	17 Nov
● ***2nd International Conference on* Ceramics in Energy Applications**	London	1994

Events co-sponsored by The Institute of Energy:

Waste Management — Duty of Care
31 March 1993, London
Contact: Combustion Engineering Association on 0865 879119

ProcessTECH 93
14/15 March 1993, London
Contact: Institution of Mechanical Engineers on 071 222 7899 Ext. 233

First International Conference on Combined Cycle Power Generation
January, Calcutta, India
General enquiries should be directed to:
Professor Prabir Basu, Technical University of Nova Scotia, PO Box 1000, Halifax, Nova Scotia, Canada B3J 2X4. Tel: 1-902-420 7531
Paper Co-ordinator for the submission of abstracts from European Countries:
Dr J R Howard, Tel: 44-21-705 1946



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