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rsonal viewpoint

Charters get in the way...

ɔbservers of our national scene can miss the current debate on our failing manufacturing industrial sector, the quality (and ntity) of science teaching in our schools, the need to attract the more able young people into true national wealth creation and lecreasing public support of scientific research.

'e should ask whether our learned institutions are serving both their professions and the country if they fail to lobby ctively in addressing the problem. Should the case for the Alvey Programme, for example, have come from the Institution of trical Engineers and should perhaps a sane view of energy for the nation be lobbied by this Institute? In his paper to the tute on Investing for Energy, P C Warner has summarised most of the key energy issues. Many will be aware of the current mpt to produce a national strategy by the Institution of Mechanical Engineers. Can this be defined as *effective* lobbying cs coming so late when priorities are clear?

dded to this debate is one on training and educating engineers in the tertiary sector. The apocryphal stories of non-technical ons rising to lead former large industrial and technological organisations in the UK may indeed be a reason for our national failure. To quote Churchill, 'Headmasters have powers at their disposal with which Prime Ministers have never yet invested.' This explains perhaps why so often the study by the young and able of the humanities is so preferred today to, the subject of engineering. Sir Geoffrey Chandler in his Industry Year Lecture to the Institute referred to the human factors nd our industrial decay. The analysis is there, the prognosis clear, but still not enough is known of the remedy.

ven when we have trained those in the areas essential to our recovery, we cannot hold them or keep them interested as Sir rge Porter has pointed out in his annual address as president to the Royal Society. The recent unsuccessful application to the opean Court of British scientists working on JET and similar projects at a huge salary disadvantage to their European eagues, highlights why we have a brain drain on our hands.

here is a singular failure in the UK to recognise the nature of current industrialisation patterns which have influenced today's ld. Almost uniquely these patterns are identified with *electricity-based* industrialisation. Yet in the dialogues on education, we ld find that electricity utilisation figures hardly at all and as a scholarship subject it can be found only as a minor part of er engineering itself in decline scholastically. If there is no identifiable curriculum subject, no wonder the principles of tricity utilisation are not realised or understood.

ractising members of this Institute could no doubt parallel the argument with energy utilisation in general, but electricity is energy form behind the two phases of industrialisation of this century, that of power-generation and that of information and trol. Britain still has, it appears, a death wish to hold on to the earlier industrial models based on a mechanical view of the ld.

is not the intention of this Viewpoint to add to what Sir Geoffrey Chandler defined as the British disease of blaming other ple. One wonders whether in all the arguments presented by so many eminent persons, a remedy readily acceptable and able of being enacted has arisen. Perhaps all that can be done is to react to the particular circumstances and groupings in ch those of us feeling concerned can make some contribution in steering the nation out of the storms which are being licted. (I must confess to accepting the suggestion that the financial institutions in Britain do have a responsibility which porately exceeds that of concerned individuals).

hus I return to the earlier question. Most persons reading this Viewpoint are members of the Institute and perhaps also nbers of other professional (engineering) institutions. Should we be content with the traditional role which over several ades the Institutions have assumed — that of learned societies? Often the argument posed against action has something to do (Royal) Charters — if this is so, change or drop the Charter. Let us set about defining what the Institutes/Institutions ıld be doing with the people we have now and let us take the actions so clearly required. It is a salutory thought that those will be in the vanguard of putting matters right up to the year 2020 are already through their first tertiary education years. If ning is done, then the flood of new economics/accountancy graduates now emerging will have no wealth to manipulate — are certainly unlikely to have the background to create it.

low the crunch question... how do we start the action? This could be a similar anti-climax to the position reached in wpoint July 1986 by A J Williams... a call to act, but how? You must choose your own routes, but one route as a member of ofessional Institute/Institution should lead to the clamouring for effective lobbying mechanisms of Government (and to tribute to them) now... and if Charters get in the way, we all know the remedy!

f R D Langman

Third in a series of papers given to the World Energy Conference last year: this paper formed part of the session on the intereactions between energy choices and socioeconomic factors

The influence of energy on social and economic change

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Understanding the relationship between energy and economic development is fundamental to the consideration of most of the important issues of energy policy, affecting energy forecasts (or alternative scenarios), and largely serving to define the benefits to be obtained from successful pursuit of energy policy objectives. Nevertheless, the nature of these relationships remains, at least in the authors' view, the subject of substantial confusion and misunderstanding, rich in extravagant assertion but too often lacking in clear evidence or analysis.

This paper considers the interactions between energy and economic developments, set in the context of economic and social change. In doing so, it challenges assumptions that are sometimes made that energy growth enjoys, almost uniquely, an unchanging or pre-ordained relationship with economic development.

Macro-economic developments in relation to energy

Generally speaking, the actual mechanisms that translate energy use into economic growth, or *vice versa,* are to be found at the point of consumption, and are normally analysed in relation to the range of factors determining consumption behaviour. The factors include incomes, relative prices, and social and technical change.

An exception arises where there is a substantial international trade in energy, or where the economic rent inherent in energy production has a major impact on tax revenues, and the energy sector can provide the state with substantial taxation revenues as a result. Large scale revenues accruing to national exchequers, or simply appearing as trade deficits or surpluses, have obvious effects on national economies at an aggregate level, that can usefully be considered separately from their particular effects on individual consumers.

The most obvious example is oil. Its particular significance arises from its uneven geographical distribution and (generally) the disparity between the costs of production and the much higher price at which it is sold. As a result oil accounts for about 10% of total world trade, and it is inevitable that any substantial change in its price will have substantial financial repercussions for the international payments system. It is possible to argue about the extent to which the oil price shocks of 1973/4 and 1979/80 were responsible for international recessions through their disruptive financial consequences, but there can be no doubt about the sheer volume of macro-economic 'shock' that they brought in their train.

At a national level, individual countries have had to adjust to new balance of payments equilibria, as a result of higher oil import prices, and sometimes, as in the UK, additionally as a result of a rapid build up of indigenous production to an export surplus. In most cases, the ma economic impact of oil, at least as a 'first order' eff has been obvious.

None of these consequences, however interesting important, have anything to do with the intrinsic quali of energy. Indeed it could be argued that the partic consequences of oil price shocks can be seen as essenti the same, in nature if not in degree, as those of gen commodity price increases. These consequences dese an analysis that is essentially financial and mac economic in character, the significance of oil as a ma fuel within the context of the energy sector being of o peripheral importance.

Energy consumptions/economic growth relationsh

Turning to the relationships that can be considered spec to energy, it is important to examine some of the popu hypotheses that have been formed about the relations between energy requirements and availability, economic growth. Essentially these rest on belief i fundamental and unchanging relationship betwe energy and economic growth. These relationships o calculated, provide the basis for speculation about fut energy needs, usually postulated on the assumption constant economic growth rates in line with immedi historical experience. This assumption implies, inevital an exponential growth in the size of the economy an very large future energy input to it. The policy implicati equally inevitably, is to require large investment in fut provision of energy supply.

This naive view was a commonplace one of offi energy projections in the 1970s. UK official thinking the period for example is well documented in the 1 Flowers Commission Report,[1] which described excess official estimates of future UK primary energy needs, international examples abound. Interestingly assumption has often been implicitly accepted by opposition to the official position, and the proponent 'radical' alternative energy policies. The alternative vi however, was simply to turn the original proposition its head. If permanent economic growth requi permanent energy consumption growth, then halt energy consumption growth, or finite supplies, wo necessarily produce zero or negative economic grow 'Zero economic growth', often associated with the C of Rome, became, for some, the answer to the proble Other enthusiasts went further and appeared to advoc a return to a utopian agricultural past.

Both sides, however, had failed to grasp the essen fact that their common hypothesis, of an unchang energy/economic growth relationship, was in reality b on foundations of sand. Two fundamental argume serve to establish this, and should have sufficed to ma the point evident at the time. The first is that, purel

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tical terms, it could usually be demonstrated that the onships, properly examined, were not particularly e. (See for example Boley[2] and Rhys and kinson).[3]

condly, it is generally appreciated by economists, if y others, that economic measures, such as GDP, are ly aggregated expressions of the value of traded omic activity within a particular community, prising a mixture of very different human activities. en over a longish period of time, they may become stical abstractions bearing little connection to the ical volumes that actually determine energy umption. Put another way, the structure of an omy may be more important for its energy umption than its recorded GDP.

nis second argument was quickly seized upon by the e astute opponents of official energy projections in ate 1970s. In the UK, Gerald Leach[4] played a leading in arguing why the connections between energy and nomic growth should not be taken as fixed. At one these arguments could be caricatured as 'more string rtets and fewer motor cars'. More seriously, many mentators pointed to the growing importance of the ice sector in the UK, and to the devastation of the ufacturing sector in 1980 and 1981. Leach went her and endeavoured to show how energy sumption could be reduced much further by deliberate ption of energy conservation and energy efficiency niques.

or practical purposes, and for all those actually cerned with the development of energy policy, vever, the issue was no longer one of principle. Many he relationships that could be observed historically e breaking down or were becoming unstable. vitably the attention of energy forecasters turned to uch greater emphasis on how energy was actually used, n less emphasis on abstract relationships with economic asures — a move in which the electricity industry, in UK at least, had always been in the forefront. The questions are empirical ones. To what extent if at all ıld future economic growth require higher energy sumption? Leach's work could be recognised as a ful indication of what might be achievable in terms of rgy conservation, but fuel industry forecasters were cerned with what would happen in a (perhaps erfect) real world.

n the developed world the question is not likely to eive a clear answer. Statisticians are likely to continue ecord economic growth in some form, and societies decide for themselves on the relative importance of ng quartets and motor cars. In the UK, household rgy consumptions undoubtedly show some signs of ıration and may not grow substantially as incomes rise. the commercial sector (shops, offices and public ldings of all kinds), by contrast, there are indications substantial continuing growth, reflecting in some asure the growth in the physical size of this sector, and increasing contribution to the national economy. In industrial sector it is increasingly the structure of ustry that dictates the pattern of energy consumption, l its overall contribution to GDP is a less useful guide energy trends than hitherto.

Similar patterns can be observed in many developed nomies. The links between economic growth and gregate energy consumption, although they may netimes be important, can no longer be taken for inted. It can be argued, realistically, that energy nsumption and economic growth have to some extent en de-coupled, and that the one no longer automatically esupposes the other.

The developing world represents a rather different situation. Here, the links between economic growth, living standards and energy consumption are likely to remain strong. Electrification for example is likely to remain a key indicator of living standards, for some time to come, and it still seems implausible to suggest that given the benefits of electrification, there will not be a strong association between growth in living standards and electricity consumption for various household services, such as lighting, television, and other uses. Similar parallels can be drawn in the areas of personal transport and its links with oil consumption, and between industrialisation, where it occurs, and energy consumption in all forms.

In this respect the difference between the developed and the developing world is shown very clearly in Table 1, which displays selected national and regional figures for oil consumption trends in the decade that followed the first oil crisis. On the whole, the developed countries effected substantial savings in their oil consumption through a mixture of fuel substitution, energy conservation, and recession. The developing world, by contrast, generally continued to show rapid increases in oil consumption, in spite of the multiple increases in oil prices, and the economic consequences of oil imports for individual country balance of payments positions.

Table 1: Oil consumption in 1973 and 1983 for selected countries and regions

	Oil Consumption M t			% Change
	1973	1983	Change	
North America	901.7	773.1	−128.6	−14.3
Latin America	160.3	217.3	+57.0	+35.6
UK	113.2	72.5	−40.7	−36.0
W Europe (total)	748.9	586.6	−162.3	−21.7
Japan	269.1	207.2	−61.9	−23.0
Middle East	62.2	90.5	+28.3	+45.5
Africa	49.5	79.3	+29.8	+60.2
South East Asia	72.3	114.5	+42.2	+58.4
Total Non-communist World	2330.1	2148.6	−181.5	−7.8
Centrally Planned Economies	467.9	652.8	+184.9	+39.5
Total World	2798.0	2801.4	+3.4	+0.1

Source: BP Statistical Review of World Energy

To summarise this general examination of these broad macro-economic and energy relationships then, a number of points can be made. It is clear that the energy sector can have a substantial impact on economic developments, although these are due less to the quality of energy as energy, and more to the disproportionate importance of oil within world trade. On the other hand the links which might allow energy consumption to be deduced from trends in macro-economic variables appear increasingly suspect. It is certainly economic factors that are at work, for example in changing economic structures, and these can have a fundamental effect on energy demand. Global aggregates however cannot be assumed to have particularly stable relationships to global energy requirements Empiricism and healthy scepticism are necessary to analysis of the links between economic and energy growth.

However economists have continued to search for more fundamental links between energy and economic development, at the level of a more micro-economic analysis, by investigating whether energy use had a direct role in promoting productivity and growth. Electricity has a particular position in the technological spectrum as a higher quality, 'premium', fuel. As such it has shown a continuing growth in importance within the energy sector on a worldwide basis, demonstrated in Table 2 below. It is therefore sometimes selected for special analysis in the context of productivity and growth. The following sections of this paper deal with this more 'micro-economic' examination of the connections between energy and electricity, on the one hand, and productivity and growth on the other.

Table 2: Average annual growth rates — Total primary energy consumption and electricity consumption

	1950-60	1960-70	1970-82
UK			
Total Primary Energy	1.7	1.9	−0.6
Electricity	7.5	6.2	0.7
Europe (excludes USSR			
Total Primary Energy	4.4	5.2	1.4
Electricity	8.4	7.5	3.9
World			
Total Primary Energy	5.1	5.1	2.2
Electricity	9.2	8.0	4.5

Source: UN Series J Statistics

Micro-economic effects on productivity

The energy price rises and particularly the oil price rises of the post-1973 period have coincided with a period of much slower economic growth in the world as a whole than was typical of the two decades which preceded 1973. Economic growth has been slower in both developed and developing countries. Part of this slower growth is undoubtedly attributable to the macro-economic effects of the energy and oil price rises and the policy response of governments as discussed above.

However, it is also clear that the energy price rises have had micro-economic effects which have been detrimental to economic growth. The first and most obvious of these effects is that the rise in energy prices relative to the price of labour and capital has the effect of making part of the existing capital stock economically obsolete. Techniques of production which were appropriate in an era of cheap energy become outdated economically when energy prices rise and consumer demand moves away from goods which involve energy intensive methods of production or involve high energy consumption in use leading to excess capacity in industries producing these goods. In essence, this is a once and for all 'shock' effect which involves a writing off of parts of the capital stock and their replacement by techniques of production appropriate to the new price regime and the changed structure of consumer demand.

There has, however, been considerable discussion and analysis of whether there are longer term effects of higher energy prices on economic growth (see, for example, Schurr, Sonenblum and Wood (Eds)).[5] Various theories have been put forward and considerable econometric analysis undertaken to examine the links between economic growth and energy prices. The most straightforward theory put forward (Berndt)[6] is that energy and capital are complementary and are used to substitute for labour. Growth in labour productivity in part therefore depends on substituting capital/energy for labour. A rise in the price of energy relative to labour reduces the rate of labour substitution and hence reduces the rate of labour productivity growth. It is this approach that we will consider further below. Nonetheless, other more complex approaches must be noted. For example, it had been argued that in the post-1973 period in many countries it was not only the rate of labour productivity growth which fell but also the rate of growth of capital productivity. Jorgenson[7] argued that technical progress is energy using and hence an increase in the relative price of energy will tend to reduce the rate of technical progress and hence the rate of growth of both labour and ca productivity.

Other writers (eg Schurr)[8] have laid particular stres the role of electricity and other high quality fuels in promotion of labour productivity and capital product growth. For this reason in our analysis below we have considered separate data on the usage of electricity

Our analysis is in two parts. The first is concerned UK data. The aim here is to consider labour producti data for various sectors of the UK economy, energy in terms of energy use per unit of output and electri data, also in terms of energy use per unit of output. data periods are considered, 1963 to 1973 and 197 1983, in order to examine what changes in underl trends exist for each of these series. Support for the that energy/capital form a package which is increasingly to promote increased labour producti could then be found if a change downwards in tren energy use or electricity use in the later period compa with the earlier period is associated with a downw change in trend in labour productivity.

The second part of the analysis makes use of data the manufacturing sector of five major industrial countries. The purpose here is to compare lab productivity performance, energy usage and electri usage per unit of output in order to gauge whetl between countries, there appears to be a link betw energy usage or electricity usage and producti performance.

UK evidence

Before considering the disaggregated data for the sectors of the UK economy that we have considerec is appropriate to examine the overall picture for the economy in terms of its labour productivity, energy us and electricity usage. The data given in Table 3 belo for the whole UK economy less the energy industries. reason for the exclusion of the energy industries is pa one of convenience and partly because the growth of off-shore sector of the UK economy during the 19 would tend to obscure any relationship through the adv of a high productivity, low energy use industry.

Table 3: UK whole economy less energy industi (% change)

	1963-73	1973-8
Value added per person employed	31	7
Energy use per unit of value added	−11	−19
Electricity use per unit of value added	21	6

These overall statistics would tend to support the v of a link between energy use per unit of output and lab productivity growth. Labour productivity growth substantially slower in the later period than in the ear period; energy use per unit of value added declined a faster rate in the later period and electricity use per u of output grew at a slower rate in the later period. only point which might appear to contradict the ini hypothesis is that energy use per unit of output declin in both the early period and in the later period. This n appear to run counter to the view that increased use energy/capital is a complementary way of promoting a achieving labour productivity. The explanation proba lies in two factors. First, there probably exists a continu trend towards increased efficiency of energy in use so t the actual amount of energy used in production proces (ie useful energy) increased while the amount of delive energy falls. Secondly, during both these periods increasing proportion of energy was supplied in m refined forms, particularly electricity, and this a notes increases in the apparent overall efficiency with h energy is used. These two points are supported by ideration of the electricity use per unit of value added es which show increases in both periods, although slower rate in the later period. Hence when one iders a single fuel (and therefore where relative iency in use effects between fuels are excluded) energy per unit of output increases in both periods.

hile the overall position in the UK tends to be portive of the existence of a link, exploration of more ggregated data is much less convincing. Table 4 gives data for the UK for productivity in terms of value ed (at constant 1975 prices) for each of the 10 sectors idered.

ble 4: Value added per person employed (% change)

	1963-73	1973-83
culture	110	46
l, drink and tobacco	38	28
nicals	95	25
and steel	31	27
neering	44	12
iles, leather and clothing	65	25
ding materials	64	14
ting, paper, etc	45	−3
er manufacturing	28	−1
ices	19	2

rce: Central Statistical Office and Department of Employment

learly, this shows a much slower growth in labour ductivity in the 1973-83 period than in the 1963-73 od. Although in the case of the food, drink and acco industry and the iron and steel industry the uction in growth was very limited indeed.

he second stage is to consider what has happened to gy use per unit of value added (at constant 1975 prices) r the same period (Table 5).

ble 5: Energy use per unit of value added (% change)

	1963-73	1973-83
iculture	−3	−47
d, drink and tobacco	−6	−8
micals	−39	−35
and steel	−10	−25
ineering	−8	−16
tiles, leather and clothing	−31	−16
ding materials	−34	−22
er, printing, etc	−18	−33
er manufacturing	24	−2
ices	−3	−4

ource: Department of Energy and Central Statistical Office

Of these sectors, five (agriculture, iron and steel, ineering, paper printing, etc and other manufacturing) w a substantially faster rate of decline of energy use unit of value added in the later period than in the lier one. In the chemicals industry, energy use declined nost as rapidly in the second period as in the first, in tiles leather and clothing and building materials, the line was slower in the later period than in the earlier iod and in food drink and tobacco and services it was adly the same.

Consideration of the changes in labour productivity and changes in energy use together shows that in the iron l steel industry, productivity growth post-1973 was adly similar to that pre-1973 and, therefore, although decline in energy use accelerated in the later period, vas not associated with a substantial decline in labour ductivity. We are, therefore, left with only four sectors of the 10 which clearly fit the theory that the fall in labour productivity growth was associated with the decline in energy use. These sectors are agriculture, engineering, paper printing, etc and other manufacturing. Within manufacturing industry, where one would expect the links to be closest, three groups fit the theory and five do not.

Table 6: Electricity use per unit of value added (% change)

	1963-73	1973-83
Agriculture	5	−20
Food, drink and tobacco	35	−10
Chemicals	−5	15
Iron and steel	30	39
Engineering	10	20
Textiles, leather and clothing	5	2
Building materials	3	31
Paper, printing, etc	17	52
Other manufacturing	34	40
Services	34	16

Source: Department of Energy and Central Statistical Office

The evidence from the UK is, therefore, not particularly satisfactory with the results rather mixed but with a strong implication that the links are not close. Clearly, there may be structural changes within industry groups which are affecting the results. Nevertheless, at this level of disaggregation, support is lacking for a strong link.

Within the energy sector and particularly with respect to a link between labour productivity and energy use, electricity is often seen to have something of a special role. It is, therefore, appropriate to consider whether there is more support in the data for a theory which suggests that electricity use per unit of value added is more closely associated with labour productivity changes. Table 6 gives electricity use per unit of value added for the two time periods.

In the 1963-73 period, only the chemicals sector showed a decline in electricity use per unit of value added; in all other sectors electricity use rose. Post-1973, three sectors only showed a significantly slower rate of growth (or a decline) than in the earlier period, agriculture, food drink and tobacco and services. All other sectors showed rates of increase faster than or similar to the rates of growth in the earlier period. Hence, there is little evidence from this data that the decline in labour productivity growth has been associated with a slowdown in the rate of penetration of electricity.

On the basis of this disaggregated UK evidence as a whole there does not appear to be any great support for the contention that the marked slowdown in labour productivity growth has been associated with changes in energy usage or electricity usage per unit of value added. The theory that slower labour productivity in the 1973-83 period can be explained at least in part by the micro effects of higher energy prices leading to less substitution of energy using investment for labour appears only to be supportable for a minority of sectors of the UK economy. In the other sectors either productivity growth continued much as before (eg the iron and steel industry) while energy demand fell at a faster rate or energy demand per unit of value added declined at much the same rate in the two periods while productivity growth was much slower in the later period (eg the chemicals industry) or energy demand declined at a slower rate in the later period while productivity growth was much lower (eg engineering industry).

There is therefore something of a clash between the apparent support given by the overall data for the view that energy and capital are complementary and promote increased labour productivity and the considerably less support given by the disaggregated data. One explanation for this has been implicitly referred to above, namely the shift in demand and hence in production away from goods which require energy intensive forms of production post-1973. Such structural shifts would affect the total energy use figures but would affect to a much lesser extent the individual sector figures and accordingly result in a more significant change in trend pre and post-1973 in the total energy use figures than in their component parts.

International evidence

Partly because of the availability of data, the approach that has been adopted to consider evidence from five major industrialised economies is, instead of using energy trends in labour productivity, energy use and electricity in the pre and post-1973 period, to consider variations in trends between countries over one single time period — 1972-81. Table 7, below, gives the data we have derived for the manufacturing sector in each country.

Table 7: Productivity, energy use and electricity use (% change)

	Japan	*France*	*Italy*	*Germany*	*US*
Value added per person employed	113	45	43	38	25
Energy use per unit of value added	−54	−38	−33	−22	−24
Electricity use per unit of value added	−39	+8	−8	+6	−12

Source: Value Added — Internal Estimates.
Energy and Electricity Use — OECD.

Consideration of the first two rows of Table 7 illustrates almost a complete contradiction of a 'close link' theory. By and large productivity has been negatively correlated with energy demand growth. Countries experiencing faster than average productivity growth have tended also to achieve greater than average declines in energy use per unit of value added; slower labour productivity growth countries have tended to see less than average declines in energy use per unit of value added.

With respect to electricity use the position is less clear cut. However, the data can hardly be taken to support the view of close link when the fastest growing economy (Japan) has the largest rate of decline of electricity use per unit of value added and the slowest growing economy (of this limited sample), the US, has the second fastest rate of decline of electricity use.

A number of possible hypotheses can be put forward to explain the particular pattern of labour productivity growth and energy use in the manufacturing sector put forward here. One clear possibility would be that structural change within the manufacturing sectors of the various countries is a prime cause. In particular, the economies achieving fast productivity growth may have been altering their structure towards lighter, higher value added industries or products at a faster rate than other economies and this could be an explanation of the high rates of labour productivity growth and the rapid falls in energy use.

A second possibility is that economies which are successful in one direction (ie in achieving rapid labour productivity growth) tend to be successful in other directions as well (eg improving the efficiency with which energy is used). This second conclusion could be of significant importance in terms of energy demand forecasting.

Implications for energy forecasting

Both the above conclusions run counter to the view discussed earlier in the paper that a relatively stable relationship can be expected to exist between en demand and economic activity at a relatively aggr level. The message for the energy forecaster is disaggregation is necessary in order to encompas effects on energy demand of changing economic stru and that it would not be surprising if energy use per of GDP is inversely related to the rate of GDP gro The latter could arise for at least the two reasons ref to above, namely that fast growing economies may ch their structure of production away from energy inte activities more rapidly than slow growing economies that high rates of investment may lead both to fast of increase in labour productivity and rapid improven in efficiency in use of energy.

Some energy forecasters may find difficult contemplating the implications of these conclusion their practical work in the field. The recent undertaken by the electricity supply industry in Eng and Wales and submitted to the public inquiry int CEGB's proposal to build a PWR at Sizewell (Dav was based on such an approach. Energy use considered at a highly disaggregated level. Assessm were made for 10 industry groups (each involving different categories of energy use), for 17 categori energy use in the household sector and for eight diff sectors in the commercial sector (involving six categ of use). For the 10 industry groups and the commercial sectors, this process also involved assessm of economic activity within these sectors. In this s assessments were made on the basis of altern scenarios for the development of the UK economy UK energy demand. The results of this study in b terms are relevent to our analysis here. In particul was shown that:

- ☐ Significant economic growth could occur in the without any increase in total energy demand.
- ☐ Alternative views on economic structure lead to different results in terms of energy use per unit of G
- ☐ The faster the rate of economic growth, the greate improvement in the efficiency with which energ used.

Clearly none of these results could have been der from a forecasting approach which relied on ei consideration of energy demand in relation to econo activity at an aggregate level or one which relied relatively constant relationships between economic act and energy use. In some respects it is more re-assuring the forecaster to rely on methods which give rise relatively narrow range of alternative outcomes as as being more convenient. Nonetheless, if reality, a believe, does not conform to this view, forecasts b on such methods will be misleading.

Conclusions

This paper has reviewed at a general level and specific level the various interactions between en demand growth and economic growth. It has conclu at the macro-economic level that there are cle relationships between economic growth and energy p changes but that this has little to do with a 'special r for energy in the economic growth process but much n to do with effects of energy price shocks on the w economic system, engendering, as they did, instabi inflation and balance of payments problems (both def and surpluses).

At the micro-economic level we have considered relationship between energy prices, energy use improvements in labour productivity. We would acc *a priori,* that changes in the price of energy relativ

(continued on p

he role of petrography in the classification nd combustion of coal*

C Hough† and Dr A Sanyal†

word *maceral* was coined in the thirties to describe the microscopically recognisable organic stituents of coal. Further identification of the differences in their chemistry, their relation to : and their natural associations both with each other and with adventitious mineral matter has lted in coal petrology becoming the well-established science that it is today, serving the mining, preparation and carbonisation industries. More recently, the combustion industry has adopted petrology for its own use. After some speculation, it is beginning to acknowledge petrology's tribution to the ranking and classification of coals for the international market and is quickly reciating the evidence for the influence of macerals on the combustion characteristics of coal. s paper examines in general the role of petrography in the combustion industry's developing d for more widely applicable coal classification systems and improved combustion evaluation niques.

r sections will consider three aspects of coal petrology macerals, microlithotypes and the reflectance of nite. Analysis is carried out on representative thin ons of coal examined under an appropriate immersion lium using a reflected light microscope. British ndard 6127[1] explains the procedure for bituminous l and anthracite, and Stach *et al*[2] cover the whole ject of petrology in depth. It is considered necessary e only to briefly outline the properties and origins of erent macerals, the variety of microlithotypes and the ificance of vitrinite reflectance.

cerals

three maceral groups: vitrinite, exinite and inertinite er widely in origins and chemical composition. A ng of maceral groups, individual maceral names and mmary of their plant origins is presented in Table 1.

ble 1: Maceral Nomenclature and Origins

ral p	Maceral	Description	Origin
	Telinite	cell wall material derived from vegetable matter	trunks, branches, stems, leaves and roots
nite	Collinite	homogeneous structureless material filling cell cavities	humic gel precipitated from solutions of humic matter
	Vitro-detrinite	fragmental plant or humic peat particles	peat or plant particles degraded at an early stage by pressure
	Sporinite	flattened discs of original spores	spores and pollen grains
	Cutinite	outer layers of leaves or cuticles	leaves, needles, shoots and thin stems
ite	Resinite	secretions from plants resinated in plant metabolisms	essential oils and resins in plant tissue
	Alginite	algal remains	certain types of algae
	Lipto-detrinite	detrital remains of cutinite, resinite, alginite and sporinite	other members of the exinite group
	Fusinite	cell wall material	charred trunks, branches and stems
	Semi-fusinite	intermediate stage between fusinite and telinite	partially charred trunks, branches and stems
inite	Macrinite	groundmass into which other macerals are embedded eg sporinite	variable
	Inerto-detrinite	fragmental fusinite, semifusinite, macrinite and sclerotinite	degradation of other members of the inertinite group by load pressure
	Sclero-tinite	tubular or cellular fungal hyphae	exclusively fungal remains

For coal of the same rank vitrinite group macerals contain relatively more oxygen, exinite group macerals contain more hydrogen and inertinite group macerals have more carbon. In addition, exinite has the greatest volatile yield and inertinite the least.

Microlithotypes

Coal macerals rarely occur by themselves but are usually associated with macerals of the same group or of the other two groups. Such associations are termed *microlithotypes.* Macroscopically recognisable bands of coal are called *lithotypes.* Table 2 details nomenclature for both. Microlithotypes may also be contaminated with mineral matter in an intimate mixture of macerals and mineral inclusions. These mixtures are termed *carbominerites* irrespective of the macerals present. Analytical convention, however, determines that a particle containing 20-60% of clay, carbonate, quartz or a variety of minerals or 5-20% of sulphide minerals is described as a carbominerite, in recognition of differences in mineral densities.

Vitrinite reflectance

The coalification process from peat through to anthracite causes numerous chemical alterations as rank increases. By measuring the reflectance in oil of vitrinite alone, the true rank of coals can be determined, irrespective of other macerals that might be present. This technique has proved especially valuable in the detection of blends. The production of a vitrinite reflectogram as in Fig 1 identifies simple or complex blends where traditional analysis might fail to do so.

Coal classification

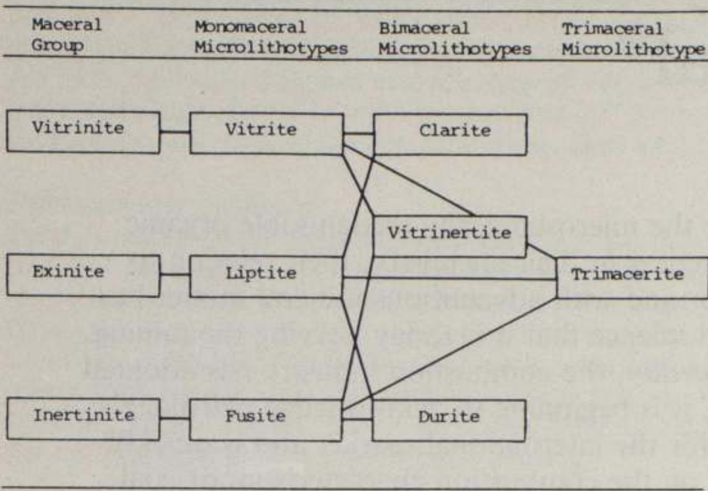
Existing systems

Existing coal classification systems utilise two basic parameters, volatile content and calorific value (CV), where volatiles decrease and CV increases with increasing rank. The NCB, ASTM and ISO systems each use these characteristics to rank and classify coal. Many countries which have their own internal classifications do likewise. The ASTM classification has perhaps been the most widely used on the open market, bringing an international understanding to the terms lignite, sub-bituminous,

*The paper was presented on 25 September 1985 in Sheffield at the Continuing Education Course on Coal Technology and Utilisation which was sponsored by the Institution of Chemical Engineers.

†Babcock Energy

Table 2: *Microlithotype and lithotype nomenclature*



Microlithotypes

Lithotypes
Vitrain — Vitrite and Clarite
Clarain — Vitrite, Clarite, Fusite, Durite and Trimacerite
Durain — Durite and Trimacerite
Fusain — Fusite

bituminous and anthracite. Coal has long been priced on the basis of CV with volatile content, together with a notional appreciation of the effects of ash, the combustion industry's sole means of predicting combustibility. Various systems use additional parameters to make finer distinctions according to potential use, but petrology has until recently been ignored.

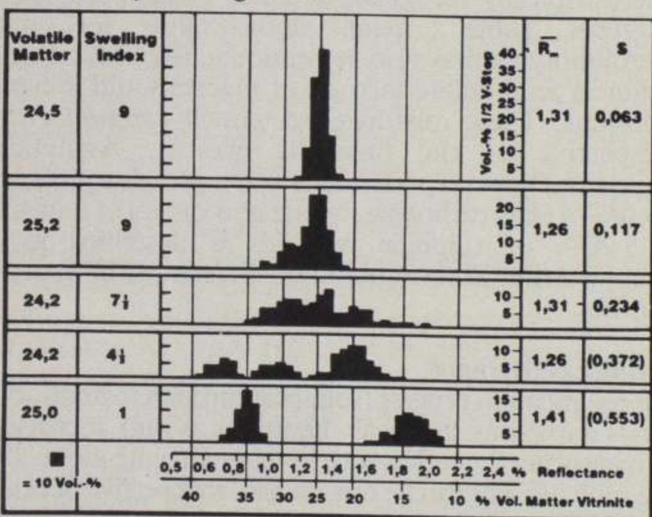


Figure 1 Vitrinite reflectograms[2]

Petrological differences between coals

Boilermakers are increasingly faced with designing for lower quality fuels. Design has accommodated variable volatile and ash contents as cheaper solutions to energy demand are sought but it is also becoming apparent that many relatively new coals being used for steam raising are very different petrographically, from their predecessors. Many of these new fuels are southern hemisphere coals which were formed in geological, climatic and biological conditions very different from prevailing conditions during northern hemisphere coal formation. They tend to be inertinite rich in contrast to northern hemisphere coals and often possess fine minerals dispersed throughout. Classification systems developed for northern hemisphere coals cannot differentiate petrographically. Two coals, ostensibly similar but with vastly different petrographic analyses, might therefore be classified as being of the same type when full-scale, utility boiler combustion experience suggests otherwise. It is in answer to problems such as this that new classification syste truly international ones, are being proposed.

New proposals

The United Nations Economic Commission for Eur Coal Committee is in the process of finalisin classification system[3] based on six parameters:

(i) mean random reflectance of vitrinite
(ii) free swelling index
(iii) volatile content (included in the ASTM classificati
(iv) reflectogram characteristics
(v) inertinite content
(vi) gross calorific value (included in the AS classification)

The system allows coal to be categorised accordin utilisation, for hydrogenation, gasification, coking steam raising purposes. In addition to properly identif the process suitability of coal, such a classification impose a greater sensitivity on the international mar as coal quality is placed under even closer scrutiny. advantages to the combustion industry, which is of required to design to a paper analysis with in-b conservatism, cannot be over-emphasised. It will immediately possible to more accurately assess coals particular designs. Coals which might otherwise have b treated similarly, including complex blends with weigh average properties, can now be considered separately the most appropriate design.

The combustion of coal

Combustion characterisation

Many designs for the combustion of coal for steam raisi purposes are available. Fixed bed (stoker), fluidised b or pulverised fuel options are each suited to particu needs or coal quality but the problems of ignition a burnout are common.

Volatile content is the parameter most commor believed to indicate reactivity. Low rank, high volat coals are therefore preferred from an ignition point view. When low volatile coals are fired, designers mindful of the need to pay close attention to excess and fuel sizing, to combustion air temperatures and, the case of pulverised fuel firing, to the choice of burr and firing system. Many combustion systems also spec ash and moisture limits. To over-estimate igniti characteristics requires remedial engineering action sustain combustion. In pulverised fuel-fired furnac poor flame stability and inadequate turndown witho auxiliary fuel support will result. To under-estima ignition characteristics results in expensive, compensatc design.

The problem of burnout is most commonly approach by varying residence time within the coal bed or furnac The design parameters that affect ignition can also expected to affect burnout in a similar fashion. Failu to judge burnout correctly results either in a failure to m efficiency guarantees, with the associated prohibiti penalties, or in longer residence times and an over-pric product. Once again, design parameters are bas primarily on volatile content and the boilermaker's ov pragmatic approach.

The application of petrology to combustion characterisation

The literature on the relationship between coal petrolo and combustion dates back to the late sixties, althou it has long been suspected that the effects of the relati reactivity of macerals observed during carbonisati might extend equally to combustion. Yavorskii *et al* 1968[4] reported that combustibles in ash were largely t result of incompletely burnt fusain (inertinite) particl chain grate stoker. In a pulverised coal boiler, some of carryover combustibles originated from oxidised ›graphic coal components, independent of carryover; less oxidised components in the coal, the more plete the burnout. Lightman and Street of the Central tricity Generating Board (CEGB) in their publications 968/9[5,6] carried out laboratory examinations of char nation. Vitrains and clarains (vitrinite rich) tended to n thin-walled cenospheres whilst clarains (inertinite tended to form thick-walled cenospheres with higher on contents, observations that were qualitatively ported by field reports. Australian CSIRO studies in)[7] identified vitrinite as being 'reactive'. Nandi *et al* 977[8] reported that pilot-scale studies on two North erican coals showed unburnt carbon to be directly ted to the inertinite content of the original coal. Finer ding had little effect on the inertinite-rich coal burnout res. Shibaoka and Ramsden in 1978[9] demonstrated e laboratory that vitrinite and exinite swelled on rapid ting, with effective volatile release and quick ibustion. Inertinite particles did not swell. Scaroni and i[10] observed high heterogeneous combustion rates for i-fusinite (an intertinite group maceral) during drop e experiments. Ghose in 1984[11] reported a direct link veen inertinite and unburnt carbon contents with the -scale pulverised fuel-firing of Indian coals.

his growing body of evidence lends strong support to use of petrographic analysis as a reliable indicator of ignition and burnout characteristics of unknown coals, ign parameters apart. The combustion industry igner can draw two conclusions—

That individual maceral counts in terms of vitrinite, exinite and inertinite can be used as an indication of elative ease of combustion, where vitrinite and exinite promote good ignition and burnout and inertinite does 10t.

That microlithotype counts are a further indication of elative ease of combustion, where associations of vitrinite and exinite are considered advantageous to the combustion process and inertinite associations and high carbominerite concentrations are considered detrimental.

t should be mentioned that in South Africa, in ticular, some of the inertinite group macerals are nsidered 'reactive'. Increasingly, the semi-fusinite ntent is divided into 'reactive' and 'inert' proportions. e reactive part, together with macrinite, is then counted with vitrinite and exinite when determining the total ctive content of the coal. This procedure is still the oject of much discussion.

ecific examples

aceral and microlithotype analyses can be used on a nparative basis for design purposes. Where a boiler for nown coal has particular features that exclusively suit fuel in question, subsequent designs for coals with nilar petrographic analyses can incorporate the same tures with greater confidence than previously possible. is applies particularly to pulverised fuel-fired furnace nfiguration. Table 3 shows proximate and petrographic tails for two African coals. Coal A was feedstock for x 600MW pulverised coal power plant where each iler incorporated an opposed-firing system which had oved satisfactory from both ignition and burnout points view. Because of the similarity between the two trographic analyses, a future 2 x 220MW pulverised coal wer plant design for the firing of Coal B was similarly posed-fired in an attempt to offset anticipated flame ability and burnout problems.

Petrographic analysis can also be directly employed in ubleshooting exercises where the firing of apparently similar coals produces differing performance effects. As described by Sanyal in 1982,[12] two coals (one Polish and one South African — see Table 4) fired in the same 600MW pulverised coal-fired boiler resulted in markedly different furnace performance. Performance analysis revealed that when firing the South African coal, a greater amount of heat absorption occurred in the upper half of the furnace. In comparison, firing the Polish coal resulted in a more even distribution. This difference was attributed to petrographic differences between the coals. The South African coal with its higher inertinite content was believed to possess relatively delayed combustion characteristics.

It must be emphasised that comparative analysis of this type takes no account of the design influences outlined at the beginning of this section and that combustion performance is subject to many variables.

Table 3: Specific Example 1 — African Coal Analyses

	Coal A	Coal B
Proximate analysis		
Volatiles %	25.8	22.9
Ash %	21.6	8.9
Fixed carbon %	52.6	68.2
GCV MJ/kg	24.96	31.97
Petrographic analysis		
Vitrinite %	33.4	31.2
Exinite %	4.6	0.8
Inertinite %	62.0	68.0

Future developments

There are a number of ways in which boilermakers can capitalise on the relationship between petrographic analysis and reactivity to build up a quantitative database for future use.

1 Individual companies can set up their own analysis facility. Initial cost and the time taken to acquire in-house expertise are more than offset by no longer having to rely on external organisations for priority work.
2 Entrained flow reactors (drop tube furnaces) can be employed to give information on the char morphology of coals of direct relevance to the boilermaker. Chars can be produced at temperatures and heating rates close to real life allowing realistic observations on ignition and burnout characteristics to be made in relation to original coal and char analyses.
3 Laboratory observations can be correlated with pilot or full-scale experience to enable designers to more accurately assess combustion parameters and to develop improved techniques for the prediction of turndown, oil or gas support levels and burnout figures.

Milling and grindability

For completeness, the influence of varying petrography on coal milling should be mentioned, as size distribution

Table 4: Specific Example 2 — Polish and South African Coal Analyses

	Polish	South Africa
Proxima'e analysis		
Volatiles %	31.3	25.1
Ash %	14.3	14.8
Fixed carbon %	54.4	60.1
GCV MJ/kg	28.77	28.02
Petrographic analysis		
Vitrinite %	65.7	30.0
Exinite %	6.7	6.0
Inertinite %	27.6	64.0

has an important effect on combustion. The Hardgrove grindability index is most frequently used within the combustion industry to assess the mechanical strength and milling behaviour of a coal. This index varies with coal rank but is also subject to other influences, notably moisture. Petrographic influences are also felt during the crushing and milling of coal.[2] In run-of-mine or crushed coal, the microlithotypes durite and trimacerite show a tendency to concentrate in the coarser size fraction whereas the mono-maceral microlithotypes, which are of lower strength than bi- or trimaceral microlithotypes, show a tendency to concentrate in the fines. During the milling of coal to the fineness required for pulverised fuel-firing, the high degree of brittleness which is characteristic of vitrinite macerals concentrates vitrinite in the fines. In general, it can be said that the finer fractions of crushed or milled coal will exhibit greater reactivity on two counts; increased surface area for oxidation and increased proportions of reactive macerals and microlithotypes.

Conclusions

The inclusion of petrographic details in coal classification systems will enable coals to be adequately classified on a worldwide basis for the first time. Coal quality need no longer be judged on the basis of volatiles and heating value alone but on the basis also of recent advancements in combustion characterisation.

For many years, the combustion industry has had to assess the ignition and burnout potential of coals using volatile content primarily, coupled with its own experiences. The application of petrography to coal combustion processes allows boilermakers to more confidently assess the combustibility of new fuels of which there is little or no experience.

As classification systems continue to recognise petrographic differences and the links between coal petrology and combustion characteristics are further established, future coal specifications can be expected to include maceral analyses and reflectograms as standard practice, imparting valuable information to the designer.

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(The influence of energy on social and economic change continued)

labour will have the effect of making parts of the capital stock economically obsolete and this will affect labour productivity in the short run as well as affecting the overall level of economic activity.

However, examination of UK data and international data does not suggest a strong relationship between labour productivity growth and use of energy. In essence, the theory that energy and capital are complements in achieving labour productivity growth are not supported by the data and the international data lends credence to the view that economies which are most successful in achieving labour productivity growth are also successful in reducing energy per unit of output.

Given that these links are weak, this further supports the view that the assumption that energy growth and economic growth are essentially linked, at least as far as developed industrial economies are concerned, is further weakened. It leads the energy forecaster form a reliance on econometric analysis leading from economic activity to energy demand to a much more disaggregated analysis of energy use. This may be inconvenient from the point of view of the amount of analysis required but in our viw is essential if mistakes of the past are not to be repeated. We have indicated how in a recent study prepared by the electricity supply industry in England and Wales disaggregated methods have been used and how the resu of these studies support our views.

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Energy Efficiency Year achievements

Hon Peter Walker MBE MP
Secretary of State for Energy

m glad to have this opportunity of contributing to ergy World *whose readers are of crucial importance in campaign to stop energy waste in Britain.*

1986 was Energy Efficiency Year when we made greater orts than ever to get across my Monergy *message:*

get more for your money
get more out of energy
get more for your Monergy

But to achieve my aim of seeing Britain top of the world ergy efficiency league, we must continue to keep the bject on our agenda. There is a vital job to do in every tor of commerce and industry, in every home, in every blic sector body, in central and local Government.

An enormous amount was achieved in Energy ficiency Year. You may have seen the special report I ve had prepared. Briefings by Energy Ministers around country continued a series in which over 20 000 key ecutives have participated to date (many appointing ergy managers and taking other direct action afterwards reduce energy wastage). Hundreds of exhibitions, minars and events at schools, and special meetings were ganised — an impressive 1900, compared with my iginal target of 1000. A hard-hitting publicity campaign my Energy Efficiency Office was backed by industry, mmerce and the nationalised industries by promotions d advertising worth at least £40 M. The *Monergy* slogan d logo made a deep impact on the public consciousness d people everywhere are continuing to respond to the ergy efficiency challenge; hundreds of thousands of ople responded to our advertising and mail-shots. pplications for the energy efficiency surveys supported my Energy Efficiency Office increased by 18% over Year, with especially high numbers of applications for extended surveys.

We have seen a great increase in the number of low come homes insulated under the community insulation oject. Under the Home Insulation Scheme loft sulation work was 30% up and hot water jacket fittings by 100% in 1986 as compared with 1985. 90% of all schools in the UK applied for, and received, the EEO's ecial primary and secondary school packs. Touring eatre groups brought the energy efficiency message to out 90 000 school children.

In industry and commerce we have seen the successful loption of the novel idea of *Monergy* walks. Simply by alking round works or buildings with the chief executive professional energy consultant has been able to point it immediate considerable energy savings. In some 600 these walks, £36 M worth of easily achievable energy vings were identified. Every energy manager could ganise one — the potential savings are enormous.

eyond 1986

it the success of 1986 needs to be carried through to cceeding years. We know very well that there are ntastic savings to be made and organisations could crease their profitability and competitiveness to a arked degree. Even individual households could profit. ne UK national energy bill is some £37 billions each year, nd many studies show that up to 20% of this could be ved. So £7 billions a year *plus* is the prize. The overnment role lies in providing information and advice,

Peter Walker, Secretary of State for Energy

and through publicity making everyone aware of the opportunities. The rest is up to individuals and organisations as consumers of energy in whatever capacity.

The Government will continue to operate on the assumption that everyone will see where their best interests lie, and will take the appropriate action to use energy more efficiently.

I am aiming to put the UK at the top of the energy efficiency league with a programme which I can summarise as follows:

1 *Continue co-ordination* of fuel supply industries, insulation companies, heating and lighting equipment manufacturers, energy consultants, the building industry etc.

2 *Energy managers'* status to be enhanced. My Energy Efficiency Office will put even greater emphasis on ensuring the flow of key information to energy managers in Britian, and that seminars are organised to serve their special needs.

3 *Monitoring and targeting* schemes to be introduced in many more sectors. In chemicals the introduction of such schemes has saved £30 M/y. M&T systems involve identifying who in an organisation uses energy, making them responsible for that use, providing them with monitoring systems and yardsticks, and finally giving them targets to meet.

4 *The Energy Efficiency Survey Scheme* should be used more by everyone. Under this scheme, up to 50% of the cost of an independent energy survey may be recovered up to a maximum grant of £10 000.

5 *Demonstration Scheme* projects to be increased and marketed even more vigorously.

6 *The public sector* must be encouraged to do even more. Government Departments will continue to monitor and use energy more efficiently. All local authorities need to examine their energy use and for instance explore the possibility of expanding their use of *contract energy management* systems.

7 *The domestic sector* — there remains much to be done in millions of homes. We shall provide the widest

(continued on p 12)

Institute of Energy conference notice:

1st European Conference and Exhibition on The influence of inorganic constituents on coal combustion

(in small-to-medium sized boilers)

24/25 September 1987 at Imperial College, London

The conference will interest:

- ☐ All engineers and managers in industries using, or considering using coal as an energy source, ie —
- ☐ Process industrialists
- ☐ Designers, suppliers and users of coal-fired industrial boilers
- ☐ Coal suppliers
- ☐ Members of academic institutions interested in, or involved in coal combustion

(Energy Efficiency Year achievements continued)

circulation of detailed useful guidance on different measures provided by the Energy Efficiency Office.

8 *Architects and building professionals* are a key component in any strategy for improving energy efficiency in buildings. We need in particular to eliminate the inclusion of out-dated heating and lighting systems in new buildings and ensure that clients are aware of the long-term value of front-end energy efficiency expenditure on new buildings.

9 *Home energy audits.* I have asked my Energy Efficiency Office to create a system in which the home energy audit will be available at a price that the home owner can afford.

10 *House purchase* should include assurances to buyers that they are getting homes which include good standards of energy efficiency.

11 *Insulation of houses for those on low incomes* will be expanded. So far over 300 000 such homes have been draught-proofed, 100 000 during 1986, by the local community groups involved. We are aiming to encourage the number of community projects to increase from 336 now to 460 by the end of 1987.

12 *Buildings projects to demonstrate energy efficien* are to be doubled in 1987.

13 *Energy efficiency RD and D* will be supported. T UK spend for RD&D is the third highest of the member-states of the International Energy Agency

14 *Building Societies and banks* will be encouraged recognise in their financing of house purchase the vit importance of energy efficiency.

In addition I have recently announced the launch the biggest-ever international energy efficiency exhibitic and conference next year.*

The energy efficiency scene in Britain can transformed by these means. But they will not succe unless I have full-hearted support from every consum whether in the office, the factory, or the home. It is everyone's interest to use energy efficiently — it is mon in everyone's pocket. And for our industry and commer it is the key to increased productivity, profitability ar international competitiveness.

*Energy Efficiency International 1988 will be held in June 1988 the National Exhibition Centre in Birmingham.

orth Sea
)evelopment gap' nerging

ving evidence at a House of Commons ect Committee on Energy, the Scottish velopment Agency (SDA) put forward ase for part of the costs of new field velopments being offset against the troleum Revenue Tax (PRT) paid on sting fields.

The SDA stated that the long term ure of the North Sea was secure but pressed concern over a possible evelopment gap' emerging as the drop the oil price took its toll on new ojects being postponed and perhaps ncelled.

The SDA, in their written submission the committee, suggested this gap uld result in orders associated with new lds in the late 1980's falling to around % of the levels of the first half of the cade.

The submission continued, 'This will ve a severe effect on the capability of itish service and supply companies to ce advantage of the opportunities that ll exist in the future development of the orth Sea and the much larger markets at will result from oil developments erseas'. These overseas markets could worth up to $2000M pa by the 1990's.

To illustrate the effects of any tax ange, the SDA's submission used a net owance of 25% of pre-production velopment costs (gross 40%). The SDA ntended that this should be available to ojects started within the next four ars.

If such a tax incentive were made, the)A predicted that 19 fields could be onomically developed over the next ur years compared to nine without the ange.

They estimated that the effect of these tra developments would lead to penditure of £3200 M over the next ur years — an overall increase in ending of 21% and development orders to nearly 40%, resulting from the ggested change in taxation. It was edicted that this in turn could push up nployment by an average of 6000 pa er the next four years. These benefits would only flow from a change in the tax regime which would reduce revenue from PRT.

Stressing the importance of a change in taxation, the agency pointed out how such a move would assist British companies. They stated it would allow UK firms to maintain a capability built up over the last 10 years. It would allow them to realise their full long term potential in domestic and international oil markets.

Finally, the agency stated that it should be understood that the type of change in the tax regime proposed did not involve a subsidy from one sector of the economy to another, it was a short term adjustment to the special North Sea tax regime which did not apply to other industries.

Source: Scottish Development Agency

Offshore oil supply
Cooperation is vital

The UK and Norwegian offshore supply industries must be prepared to cooperate as well as to compete if both are to survive and to succeed in offshore markets worldwide, Mr Alick Buchanan-Smith, Minister of State for Energy, told the Energy Industries Council/Statoil conference in London. But he stressed that cooperation had to be fair, mutually beneficial, and even handed.

He said: 'The relationship between the UK and Norwegian supply industries does not have to be based exclusively on competition — cooperation can bring mutual benefits. Before the fall in oil prices both industries were too prone to be inward looking, concentrating their energies on winning work in, and meeting the demands of, their respective domestic markets. But we must both now take a fresh look at the long-term future. The North Sea alone cannot support the totality of both of our operations — we must look to opportunities overseas and not depend too heavily on one geographic area'.

Mr Buchanan-Smith pointed to the five joint UK/Norwegian projects as evidence that UK and Norwegian companies could work together on high technology research developments.

'These projects should provide the cornerstone for further useful cooperation not only in the North Sea but, even more important in export markets.

'The next step is commercial exploitation, but if the full potential and benefits of cooperation are to be realised, exploitation must involve fair, even handed collaboration between the partners.

'The opportunities provided by third markets beckon those UK and Norwegian companies prepared to work together constructively'.

Source: Department of Energy

Energy management
A new attitude needed

The need for new attitudes and standards, by building control systems manufacturers and their customers, has been urged by Charles Askwith, managing director of a Newbury-based systems manufacturers, reports *Energy Management*.

Until that happened he said there would be no change in the present situation where most occupants of buildings in Britain were denied the best comfort conditions and were paying too high a price for privilege. High on his list of priorities was the requirement to put the role of the computer in perspective.

Control systems manufacturers had to take their responsibilities to their customers far more seriously and customers must be prepared to learn more about how to manage buildings and to operate control equipment more effectively.

Manufacturers and users should stop convincing themselves that computerised building management systems provide instant efficiency, better comfort conditions and a well managed building.

Mr Askwith said: 'Why is it that the building control industry is the only one where computers are claimed to carry out management functions?

'Having been slow to recognise the value of computers, our industry now refers to them grandly — and totally wrongly — as systems for building management, energy management, and maintenance management. Computers are simply aids to better management, but they cannot take over or replace people.

'Slowly but surely managers are recognising that the use of computers in buildings requires a great deal of planning input, communication of information and simple straightforward man management expertise.

'When these simple disciplines are applied the resulting efficiency of fuel, maintenance and building comfort provide a return on investment more attractive than many other computer applications'.

Source: Energy Management

All at sea

The MOD has embarked on a programme of energy efficiency activities including on-site surveys, investment in energy saving measures, monitoring and targeting, the appointment of energy managers, and motivation and training of staff. The newly appointed energy managers were invited to specially formulated two-day seminars conducted by members of the University of Surrey's Energy Engineering Group.

The first seminar, at HMS Nelson, Portsmouth, was opened by the director of Quartering, Captain R Wright who outlined the Royal Navy's programme. Further seminars were at the RN Engineering College, Manadon and HMS Cochrane, Rosyth, the importance of the subject being emphasised at the latter by the presence of the Flag Officer Scotland and Northern Ireland. Each seminar was attended by 20 to 30 Royal Navy and Royal Marine officers and senior ratings and civilian staff from MOD(N) establishments. The programme included presentations on aspects of energy management supported by slides and video tapes, syndicate group activity and on-the-spot surveys of typical buildings.

Participants from a wide range of backgrounds, many without engineering backgrounds, entered enthusiastically into the programme and, before returning to their establishments, each produced an action plan for tackling this new responsibility.

Source: University of Surrey

Education and training
Two new Open Tech projects

The Watt Committee on Energy was pleased to announce the successful conclusion to its participation in the Open Tech Programme, sponsored by the Manpower Services Commission.

Two Open Tech Energy projects have been established, namely at Sheffield City Polytechnic and Gwent College of Higher Education. Not only do these schemes expand the range of adult training opportunities available in the energy field, but they also combine the latest techniques in open and distance learning. Teaching aids include the use of audio and video equipment, slides, microfiches and television, as well as more traditional methods, to provide a varied and stimulating learning approach for the student. The pace of learning can be chosen by the individual, and study can be undertaken where most convenient be it at home, work, or training centre.

For the employer, the demands of modern business and industry can be met by providing training in new skills, conveniently and cost effectively.

Further details of the course at Sheffield City Polytechnic, entitled *'Energy Control for Supervisors'* may be obatined from: Dr Malcolm Sunderland, Open Tech Project, Open Learning Resources Centre, Sheffield City Polytechnic, 33 Collegiate Crescent, Sheffield S10 2BJ. Tel: (0742) 665274 ext 3421.

The course produced by Gwent College of Higher Education is a modular one in plant engineering and energy management, aimed at senior technicians. Details of this are available from: Mr Les Tuckwell, Open Learning Unit, Faculty of Engineering and Science, Gwent College of Higher Education, Allt-yr-yn Avenue, Newport, Gwent NPT 5XA.

The Watt Committee is committed to the advancement of energy education and training in both further education and schools, and hopes that the new training opportunities provided through these projects will become widely known.

Source: Watt Committee on Energy

British Coal
Continuing to improve productivity

In a recent speech to the Coal Industry Society Sir Robert Haslam stressed that lower costs were the key to expanding coal sales. He reviewed the continuing action to improve productivity:

- ☐ Manpower productivity at the pits is running at an unprecedented level of over 3.5 t a manshift. Over 4 t are needed to break-even and the target must be 5 t as a sustained performance in the early 1990s.
- ☐ The productivity increase of about 23% in the past year is probably unmatched by any other industry. Half this improvement came from the increasing use of highly mechanised heavy duty faces, and it is the intention to use this equipment on nearly all coal faces five years from now. Only five percentage points of the 23% improvement arose from colliery closures.
- ☐ Although it is clearly not possible to maintain the recent staggering improvement in performance, a productivity target of a 10% yearly increase should be within our reach. It is vital not to slip back to the unacceptable yearly level of about 1% which characterised the decade before the strike.
- ☐ By April, the average age o mineworkers will be down to its lowe level of 34, which implies we will b increasingly working with a ne generation of miners. It is hoped soo to resume limited recruitment o young miners.
- ☐ British Coal are now the lowest-co producers in Western Europe, wi operating costs this year expected to b 20% lower in real terms than befo the strike. Faced with the challen from formidable competitors Australia, South Africa, the USA an Columbia — who share the enormou benefits of thick opencast coal depos and favourable exchange rates whic transport costs only partly offset British Coal need to reduce costs b another 20%.

Sir Robert said that most of th industry's hopelessly uneconom coalmining capacity had now close Closures and mergers had reduced th number of collieries by 60 in the two yea since the strike, with a reduction o 78 000 employees (including 60 00 mineworkers).

He believed no other industry ha experienced such a severe retrenchmen over such a short space of time. Althoug all redundancies were voluntary, and wi exceptionally generous terms under th Government's Redundant Mineworker Payments Scheme, he fully recognise that it had been very painful in huma terms, but he emphasised that great ca had been taken in handling these ve difficult situations. The protracte colliery review procedure ensured that a the facts and figures were fully expose to all the trade unions and employe concerned.

Source: British Coal

South Wales
Support for drift mine project

Management have completed the examination of the £90 M Margam dri mine project in South Wales and th Board of British Coal decided to suppo the project with two major provisos: tha the mining unions accept the need for si day working; that satisfactor arrangements are made for financing, i discussion with Government and th European Coal and Steel Community.

Mr Ken Moses, British Coal boar member and technical director said, 'Th achievements of South Wales miners hav removed a number of the performanc risks associated with a new minin project. Management have taken steps t minimise the geological risks which ar inherent in mining operations. Howeve there remain substantial commercial risk ahead.

'These commercial risks primaril concern the likely prevailing world price of coking coal and the exchange ra

*Information Transmission

tween the pound and the dollar in the xt decade.

'It would take four and a half years to nstruct the Margam mine and the main stomer for coking coal, which is sold in llars on world markets, would be itish Steel.

'It is quite clear from all the lculations that mining operations over : days will be necessary to ensure a tisfactory financial basis for this highly pitalised project'.

South Wales area management will ld discussions as soon as possible with e mining unions on the working rangements which will be needed for e proposed mine, which will provide 0 jobs.

On the satisfactory completion of scussions on extended working, British oal propose to submit the project to the cretary of State for Energy for his view the public interest.

ource: British Coal

'uel cells
call to Government

he Government should play a more ositive role in encouraging fuel cell chnology in the UK, Dr Gary Acres* id when making a presentation on fuel lls to a meeting of the Parliamentary roup for Alternative Energy Strategies 'ARLIGAES) in the House of ommons.

Fuel cells, while similar in concept to battery, generate electricity by feeding el and air to appropriate electrodes here a catalyst (normally platinum-ased) converts them into electrical ower. The by-products are heat, carbon ioxide and water so that the technology environmentally friendly as well as eing suitable for combined heat and ower (CHP) applications.

Compared with conventional forms of ectricity generation, fuel cells are also ubstantially more efficient, irrespective f power output. Although invented in e UK, their commercial development as occurred mainly in America and apan. Dr Acres pointed out that these ountries had made considerable advances in recent years and were looking closely at the potential of fuel cells to generate electricity at a local level.

Dr Acres said that the UK Government should help to fund, jointly with industry, a demonstration CHP fuel cell plant and provide an institutional framework which would bring together all the companies and organisations with an interest in this technology.

Source: Johnson Matthey

Nuclear waste disposal
Major contract awarded

A major design and construction contract valued at over £40M for a new radioactive waste storage facility at the Sellafield Reprocessing Plant in Cumbria had been awarded.†

The purpose built beta-gamma store will house dry intermediate level waste, including filters and equipment used in the reprocessing of spent nuclear fuel, and is due to be ready for operation in 1989.

The project has included the original design of stacking, lidded metal storage boxes for the waste, a semi-automatic remote handling system for the store and the safety assessement of the complete design.

The storage facility will comprise two linked buildings, one receiving the waste and packaging for storage and the second building, the vault, to serve as the storage area. Waste will arrive at the plant in shielded flasks, either by road or rail, passing first into a receipt area where the flasks will be emptied and the contents streamed or sorted before being placed into the specially designed metal storage boxes.

The boxes will be transferred to the storage vault in three high stacks and a rail mounted, remote controlled trolley system will transport each stack to its storage position. The boxes will be stored in rows and will be able to be retrieved. The store will have a design life of 50 years.

The structure will have reinforced concrete raft foundations, and is designed to withstand seismic events. The storage vault will be single storey, measuring 83 m by 42 m, and will have full height perimeter shielding and a central partition wall in reinforced concrete. A shielding reinforced concrete roof will be supported on internal steel work and will be covered by lightweight metal decking.

The receipt building will measure 72 m by 32 m, divided into two separate structures. The services structure, containing the mechanical, electrical and ventilation services together with changing rooms, will be three storeys with a steel frame, a metal deck roof and reinforced concrete upper floors.

The remainder of the receipt building, will house the flask handling and waste transfer systems behind concrete shield walls. The building will be reinforced concrete with a two-span steel frame and metal deck roof. External cladding will be insulated aluminium sheeting above a brick plinth wall.

Source: Taylor Woodrow Group

Aid to India
100 M for minerals sector

British aid agreements totalling over £100 M for the Indian coal and zinc industries were signed in New Delhi in March.

Up to £73.65 M is being provided to Hindustan Zinc, a state sector company, over a period of five years and a £31 M grant is being made to India's coal sector.

The grant to the Indian coal sector will be disbursed over the next three to four years on projects to be determined by the Indian authorities and the Overseas Development Association (ODA). Most of the funds will be used to continue the introduction into India of British-designed mechanised longwall mining equipment, to help India achieve its plans for a major expansion of indigenous coal production up to the end of the century.

Source: Overseas Development Association

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*Director of Corporate Development, Johnson Matthey

†Taylor Woodrow Management and Engineering

The Engineering Council
Five years of progress

We publish below a report on the first five years of the Engineering Council by Prof J C Levy, director — Engineering Profession at the Engineering Council

The birth of the Engineering Council took place some five years ago at the initiative of the government and with the active cooperation of the professional engineering institutions.

The intention was to create a body with a wider remit than that of the old Council of Engineering Institutions (CEI) and the continued commitment of the institutions has been a vital factor in the progress made towards fulfilling the Engineering Council's objectives which, stated broadly, are:

- ☐ *to promote and develop the science and practice of enginering in the United Kingdom*
- ☐ *to ensure the supply and best use of engineers*
- ☐ *to coordinate the activities of the engineering profession.*

Because it is a chartered body, rather than the statutory authority which the Finniston Report recommended, the Engineering Council has to work by persuasion rather than by edict.

But persuasion works, as our record will show, although anyone who expects a sudden change in national attitudes towards industry, towards the profession and towards the individual engineer, is likely to be disappointed because of deeply ingrained social and cultural attitudes. The fundamental change of attitude for which the Engineering Council is pressing does not come easily. It is a long hard, unremitting task for all concerned. And the arguments and action have to be sustained with determination, patience, reasoning and good humour.

The Engineering Council has many audiences which it seeks to influence and this report describes the four principal directions in which the Council looks out at the world: the profession; government; the education system; and industry. However, in its public affairs activities there is a further direction, the nation itself.

Public affairs

The Council has set itself the task of bringing about a significant improvement in public awareness of the profession and of the role of qualified engineers. An unremitting campaign has been conducted under the leadership of the director — Public Affairs, Ron Kirby to cure such persistent problems as the public confusion of engineer with mechanic, of engineer with scientist and of the many misconceptions relating to the importance of manufacture and commerce in relation to the economy as a whole.

In a sample period of eight months there were found to be 1208 newscuttings and media mentions of engineering including TV, radio and press. Of these, 534 referred specifically to the Engineering Council. While many of these efforts are simply like trying to hurry-up a glacier, there are occasionally tangible results. For example, after repeated requests to the Home Office, the notes accompanying passport application forms giving examples of 'persons of standing' fit to countersign applications now include engineers in the phrase ...doctors, engineers, lawyers..., a fortunate alphabetical chance putting us between our companion professions.

The wider public is reached several times a year via the Council's responsibility for the *Prince of Wales Award for industrial innovation and production* and via its *Young Engineers for Britain* contest. Media coverage of such events can be very extensive indeed. Just one example must suffice, though many could be given. The 1986 *Young Engineers for Britain* awards were made by the HRH Princess of Wales at the Wembley Conference Centre and not only did the quality papers carry the story but there was also coverage in the *Daily Express* and the *Daily Mail* and a front page picture of the Princess with the winner and mention of the competition in the *Today* newspaper. The competition was also mentioned in the *Sun*, *Mirror* and *Star*. In addition it featured on the influential BBC Radio 4 'Today' programme and there were excellent stories on mainline BBC TV programmes; a feature solely on the competition itself on BBC TV Breakfast Time and other features on BBC TV Superstore and BBC TV Blue Peter. The latter two programmes alone went out to more than 7 000 000 youngsters. The subsequent enquiries fully occupied the full attention of four members of staff for several days.

Behind this public affairs frontage a vast amount of solid work and pressure is maintained resulting in the issue of Council policy statements or discussion documents or sometimes in changes in which the Council has played a leading part but which cannot be attributed. The Engineering Council employs less than 60 people of whom about a dozen are exclusively engaged in maintaining the Register and in running the Engineering Council examinations which cater for more than 5000 students a year in 50 centres worldwide. The other staff run the qualifications function of the Council together with its engineering education and training activities, maintain contact with the Engineering institutions and 170 industrial affiliate organisations, service the Annual Engineering Assembly a[nd] encourage its role, look after the regional committees and maintain conta[ct] with a large number of nation[al] organisations each representi[ng] substantial interests in industr[y,] education, training and government.

From time to time too the chairma[n,] Sir Francis Tombs, and director gener[al,] Dr Kenneth Miller, penetrate to high[est] levels of government at ministerial lev[el.] This involvement may even include t[he] Prime Minister who, in fact opened t[he] first meeting of the elected Engineeri[ng] Assembly in Birmingham in 1985, bei[ng] followed in 1986 by the Secretary of Sta[te] for Wales at the Swansea meeting.

The Register, the Engineeri[ng] Assembly and the Regions

The Register contains the names a[nd] particulars of 280 000 Charter[ed] Engineers, Technician Engineers a[nd] Engineerng Technicians. Th[e] designations CEng, TEng and EngTe[ch] are continuing to establish themselves [as] recognised hallmarks of competence a[nd] there is some evidence that this is no[w] showing on the salaries front. Ea[ch] registrant receives the Engineeri[ng] Council's newsletter twice a year and ca[n] vote in elections to the Engineeri[ng] Assembly, giving all the opportunity [to] influence policy.

The country has been divided into [.] regions, each of which elects fo[ur] Chartered Engineers and two Technicia[n] Engineers or Engineering Technicians [to] the Assembly. The 114 Assemb[ly] members may discuss any matter with[in] the responsibility of the Engineeri[ng] Council and may pass resolutions whi[ch] the Council is required to consider.

The Council aims to expan[d] considerably its activities in the regio[ns] through the Engineering Counc[il] Regional Organisation (ECRO) committees on which local institutio[n] branches are represented. Activity centr[es] on contacts with the schools, loc[al] industry, local government, local pre[ss] and local radio. In particular th[e] immediate plan is to expand the *Openi[ng] windows on engineering* scheme fro[m] about 5% of schools to 80% in the ne[xt] five years.

Already the Council's initiatives o[n] correcting the shortage of maths a[nd] physics teachers is having an effect at th[e] highest levels; we are working with th[e] Manpower Services Commission o[n] 'career breaks' to enable women to retu[rn] to the profession; we are encouragi[ng] more registrants to become scho[ol] governors; and we are pressing f[or] problem-solving methods to b[e] introduced at primary school level.

One task with which the Engineeri[ng] Council and its ECROs will *not* [be] concerned is that of duplicating th[e] learned society function of th[e] engineering institutions. Technic[al] activities by means of papers, meeting[s]

ʼhe president-elect:)r E G Masdin FEng

ıy Masdin is the head of Research anning for Shell International troleum Company and is a director of ell Research Limited. He joined the stitute as a Student Member and came a Fellow in 1974. He is also a llow of the Institution of Chemical ıgineers, and in 1985 was elected a llow of the Fellowship of Engineering. ıy obtained his BSc(Tech) and PhD at effield University. He is married with ur children and lives in Wokingham, rkshire.

Guy was born in 1936 and brought up the Yorkshire village of Oughtibridge. om 1947-54 he was a pupil at clesfield Grammar School where his terest in mathematics and science was imulated by several good and perienced teachers, and he was couraged to participate in a wide range sporting activities. He became terested in the possibility of a career her in the local steel industry, or — on s father's recommendation — in the st-growing oil industry. His headmaster ggested the Sheffield course on Fuel chnology and Chemical Engineering hich Guy found was fully endorsed by ıell and United Steels (now the Special eels of BSC).

He started the undergraduate course in 54 and was awarded a first class onours degree in 1957. During these ree years he also benefited from dustrial training at Shell's Heysham finery, and in United Steel's boratories and steelworks. The latter perience convinced him that he would t most satisfaction from applying his ademic training to applied R&D for dustrial processes. He also learnt the portance of close cooperation with perienced plant operators in achieving ogress.

He was invited by Med Thring to turn to university for a PhD study on l-droplet combustion sponsored by ıell Research. He found this post-aduate experience rewarding both in the pportunity to research a specific area in epth, but more importantly to work in n excellent atmosphere of scientific and cial cooperation. These contacts tablished almost 30 years ago formed e nucleus of a worldwide network of ofessionals in the Energy business with hom he still retains close links today.

His career in the oil industry started in 960 when he began work as a research ıgineer in the Combustion Division at ıell's Thornton Research Centre near Chester. He participated in a range of activities in the laboratory and in field trials aimed at developing new uses for fuel oil; these included the first commercial fuel oil injection trials in a blast furnace arranged by Shell-Mex and BP and the Steel Company of Wales. After three years at Thornton, Guy moved to another Shell Research site - Egham. He was based there for the next 10 years and was promoted to head of Combustion Division in 1966. The main aim of the division was to develop the technology required to promote the use worldwide of Shell's products including fuel oil, distillates, LPG and natural gas. Areas of research included the development of industrial and domestic oil and gas fired equipment — usually in close cooperation with potential users and manufacturers —, pollution and noise control, fuel quality studies and basic research into combustion aerodynamics and heat transfer. The programme involved close links with Thornton and also with Shell Laboratories in Holland, France, Germany, Japan and North America, who also cooperated in the proving trials in the field. During this period he also became involved with the British Flame Research Committee.

In 1973 Guy moved to Shell Centre in London to join the New Enterprises Division which organised the company's entry into the international coal business. He became technical marketing manager of the newly formed Shell International Coal organisation. This job involved the promotion of the coal market in Europe, N America and the Far East. This also required the development/demonstration of new and improved coal technology and presentations on the technical and economic viability of thermal and metallurgical coal in potential customers' plant.

He had close links with major plant manufacturers, coal research laboratories and coal users worldwide in promoting these activities. Advocating coal-fired power generation and the conversion of cement and other industrial works to coal was a particular involvement. Technologically, Guy devoted considerable time to the coal/oil slurry work of Shell Research, the capabilities of which were demonstrated at BSC blast furnaces in the UK and at EPDC power plant in Japan. He also supported fluidised bed technology developed by other companies.

In 1982 Guy became a member of Shell Research's international management team as head of Research Planning and Co-ordination, part of Shell International Petroleum Company in London. In his patch is research on oil products, such as fuels, lubricants and bitumen; natural gas; marine; and new business activities, for example forestry. The essential task is to marry up business needs and opportunities with the advances achievable by the Group's research resources. Included here is the generation of new ideas. Close interaction is demanded with Shell managers in both the business sectors and the laboratories located in seven countries around the world. Guy is also involved in the organisation of extra-mural research at universities, research institutes and other companies. A longer-term role is identifying — by way of strategic studies — technological trends and developments that could have a significant impact in the future for Shell businesses.

Dr E G Masdin FEng

Responsibilities outside work include the chairmanship of the Society of Chemical Industry Academic Relations Committee and membership of the Institution of Chemical Engineer's Research Committee, the Watt Committee, and the advisory committee of his old university department.

As a Yorkshireman, Guy is very keen on cricket, the mysteries of which he endeavours to explain to his Dutch, American and Japanese colleagues at Shell. Although he claims his own playing days are now over, he is a qualified coach and enjoys helping to bring on young cricketers in his adopted county of Berkshire. □

ʼhe Engineering Council *continued)*

ımposia, conferences and distance arning programmes are the recognised sponsibility of each of the institutions their own fields of engineering. The ngineering Council at national and local vels will concentrate on a coordinating nd public relations role.

Industry — the engine for change

If the views of the Engineering Assembly provide one essential input in forming the policy of the Engineering Council, the views of industry provide another equally important channel. There are now some 170 employers of engineers who have become Industrial Affiliates of the Engineering Council. They each pay an annual sum depending on their number of employees, the largest organisations paying £10 000. Regular meetings are held with the members of this industrial forum, each meeting having a set theme

(continued on p 18)

such as continuing education and training, school education, registration of engineers.

To assist industry the Engineering Council is encouraging managements to take a critical and positive look at various engineering activities. This is accomplished by means of easily assimilated but authoritative texts including *Technical reviews for manufacturing, process and construction companies* and *Appraising the technical and commercial aspects of a manufacturing company,* both of which have been distributed widely and have been well received. They have been followed recently by a joint venture with the Design Council *Managing design for competitive advantage.*

Involvement with industry in these ways and emphasising the desirability of industrial support for the registration system will form a continuing theme in the policy of the Engineering Council.

The engineering institutions

So what of the institution front itself? The professional institutions stand in a very special relationship to the Engineering Council in their role of Nominated Bodies able to certify the attainment of individuals for registration and, in some cases, as Authorised Bodies for the accreditation of academic courses and training programmes. They alone may appoint representatives to the Council's five Executive Group Committees which in turn nominate to the Board for Engineers' Registration. Their involvement has been wholehearted and characterised by tremendous collaboration with the Council and with each other in overhauling standards of engineering education and training for Chartered Engineers, Technician Engineers and Engineering Technicians. The effort culminated in 1984 with the publication of *Standards and routes to registration* familiarly known in the education and training world as SARTOR.

This policy statement has had a profound effect upon the development of engineering degree and BTEC courses for the 1990s and, with its companion statement *Resources for engineering education,* has been instrumental in convincing the government of the need to provide extra finance to the tune of £43 M for more student places in subjects linked to information technology and, more recently, an additional £54 M for the polytechnics to restore their unit of resource and to support new initiatives in areas of advanced technology.

To aid the continuing collaboration with the engineering institutions, Engineering Council senior staff hold regular meetings with the secretaries of the institutions who are consulted about a wide range of administrative and policy matters before decisions are taken. The smooth working of the registration system is a tribute to their goodwill and helpful attitude.

The Engineering Council would like to promote even more joint working between the engineering instututions and has not been slow to encourage mergers amongst them. At present negotiations are at an advanced state for mergers or federations involving nine institutions.

The international dimension

A further area of common interest and joint efforts between the engineering institutions and the Engineering Council lies in the area of international relations for the profession.

The most important and active overseas link is through the European Federation of Engineering Institutions (FEANI), which consists of 20 European countries including all those in the European Economic Community. Each country has a National Committee which is responsible for its participation, the British National Committee consisting of representatives of the chartered engineering institutions, the Fellowship of Engineering and of the Engineering Council which also provides the administrative back-up. There is in addition a Technician Engineer representative.

The importance of FEANI deliberations lies in the mutual recognition of engineering qualifications within the countries of Europe and lately there has been a breakthrough which could be of the utmost importance for United Kingdom engineers. For many years the continental countries have refused to acknowledge Chartered Engineers on an equal basis to their own professionals because the length of continental degree courses is generally longer than those in the United Kingdom. Now, due to a new initiative taken by the British National Committee, this deadlock has been broken and all 20 National Committees of FEANI have agreed to recognise a seven-year package of education, training and experience which strongly resembles that of the Chartered Engineer requirement in the United Kingdom. In 1987 this agreement will be used to launch the new title Euro-Engineer which may perhaps be used as a pan-European prefix such as Euro Ing Jack Levy. All Chartered Engineers would then be able to use the new title on personal application and would receive a FEANI 'passport'. A similar provision for Technician Engineers would follow.

The future

So what else is on the stocks for the future? While it is not the policy of the Engineering Council to press for widespread licensing of engineers, it intends to examine the areas where licensing exists and to consider whether any extensions to those areas should be sought. To lift the veil slightly on this kind of issue, work is beginning to examine the practicability of defining the type and level of responsibility which, it may be recommended, should be reserved for registered engineers. This would fall short of a full licensing arrangement but would indicate to employers and government the views of the Engineering Council on this important matter.

On the education and training front, emphasis will swing to continui[ng] education and training following t[he] Council's publication a few months a[go] of its statement *A call to action,* whi[ch] showed the need for an urgent approa[ch] to up-dating and for improved faciliti[es] to be made available. Providers inclu[de] colleges, polytechnics, universities and t[he] engineering institutions as well as indust[ry] itself which provides a large amount of i[n-]house re-education and training. T[he] institutions will also be responsib[le] through the Council's Board f[or] Engineers' Registration, for establishi[ng] a truly national system of monitori[ng] which will include a personal reco[rd] compiled by each registrant and whi[ch] will act as evidence of their effort [to] maintain awareness and keep up-to-da[te] in their chosen field.

Although the initial government gra[nt-]in-aid terminated after the first thr[ee] years of the Council's existenc[e] government support is still forthcomi[ng] for various individually planned proje[cts] particularly in the education and traini[ng] field. In 1987 this includes support fro[m] the Manpower Services Commission, t[he] Department of Education and Scien[ce] and the Department of Trade a[nd] Industry.

Because there is no further automa[tic] government grant-in-aid, the Engineeri[ng] Council can now claim to be ful[ly] independent. It derives about 50% of i[ts] income from registration fees, the oth[er] 50% coming from the specific support[ed] projects (10%), examination fees(20%) and fees from the Industrial Affiliat[es] (20%).

By the end of its first five years [of] existence it can fairly be stated that t[he] Engineering Council has established [a] place in the national scene by acting in [an] independent, forthright manner whi[ch] nevertheless takes account of the ma[ny] and varied interests and opinions amo[ng] its external contacts.

The next five years will probably [be] even more challenging than the last. T[he] priorities will be to continue to establi[sh] the Council permanently and prominent[ly] as the core of national strategic thinki[ng] for industry, for the profession and for t[he] role and importance of qualifie[d] engineers. Great care has been taken, in [a] proper engineering approach, to bui[ld] sound foundations which will serve t[he] profession well in the long run.

Institute of Energy
1987 May meetings

North-Eastern

19 May (Tu). AGM. BSC, Steel Hous[e] Redcar, Cleveland. Details will be sent [to] branch members.

National

28 May (Th). AGM. Institute of Energ[y] 18 Devonshire Street, London W1N 2A[...] at 1030 h.

Institute news continu[ed] on p [...]

SPECIAL ANNOUNCEMENTS

stitute of Energy AGM

annual general meeting will be held at the Institute of rgy, 18 Devonshire Street, London W1N 2AU on *rsday 28 May 1987 at 1030 h.*

uth Wales and West of England: nchtime lecture

South Wales and West of England branch have organised annual lunchtime lecture at the NCB Coal Research ablishment, Stoke Orchard, Cheltenham, Glos for 12 noon Thursday 18 June 1987. The speaker will be Dr R J Cohen odrell Bank, University of Manchester.

ickets and further information from A A Randell, NCB, E (tel 024 267 3361).

nergy cost control by targeting and onitoring: Conference, ockton-on-Tees, 13 May 1987

: Department of Civil and Structural Engineering and lding, Teesside Polytechnic are holding their sixth annual -day energy conference at the Swallow Hotel, Stockton-Tees on *Wednesday 13 May 1987.* The cost is £30.00 luding VAT and one set of papers), which covers lunch, rning coffee and afternoon tea. *(Second notice).*

visional timetable

)-0930	Reception desk opens for delegates.	
)-0935	Welcome to hotel by assistant director (resources), D G Leyland.	
5-0945	Opening remarks by chairman for the morning session, *Prof J Swithenbank*, (president, Institute of Energy.	
5-1030	Paper 1 —	R Anthony (Department of Energy). *Government help in energy cost control.*
)-1045	*Coffee.*	
5-1115	Paper 2 —	Dr J Barr (NIFES, Glasgow). *The basis for setting realistic energy targets.*
5-1145	Paper 3 —	B C Oliver (superintendent engineer, — Works Group, DHSS). *Targeting and monitoring in NHS buildings.*
5-1215	Paper 4 —	Mr Bell-Berry (Industrial Efficiency Systems). *Targeting and monitoring in heavy industry.*
5-1300	Discussion.	
)-1400	*Lunch.*	
)-1405	Introduction by chairman for afternoon session, *J Barton* (chairman, Teesside Energy Managers Group).	
5-1435	Paper 5 —	Dr S D Fawkes (energy manager, London Borough of Tower Hamlets). *Targeting and monitoring in local authority buildings including housing.*
1435-1505	Paper 6 —	R Tinson (managing director, Emstar). *Contract energy management.*
1505-1550	Discussion.	
1550-1600	Closing remarks.	
1600	*Tea.*	

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

MIDEST 87: British group granted joint-venture terms

The British Overseas Trade Board has granted joint-venture terms, with the Engineering Industries Association as co-sponsor, for a British group at MIDEST 87, in Paris, 16-20 November 1987. MIDEST, the international market of sub-contracting, covers five industry sectors: mechanical engineering, electrical/electronic equipment, plastics and rubber, special machines and semi-finished products.

For first-time exhibitors participating in a BOTB joint-venture at MIDEST, the participation fee, including shell stand and display aids, is £52/m^2, representing a subsidy of 60% of actual costs. The fee for second-time exhibitors is £72/m^2 and third-timers or more, £98/m^2. Applications for the joint-venture at MIDEST 87 must be received by EIA before *15 May 1987.*

Further information from Mrs Anna Small, export director, Engineering Industries Association, 16 Dartmouth Street, Westminster, London SW1H 9BL (tel 01-222 2367).

Second World Basque Congress: change of date for energy conference

The second World Basque Congress will be held from August to December 1987. As reported on p 24 of *Energy World* (Nov 1986), a conference on *Energy* will be one of the four technological conferences to be held in Bilbao within the framework of the Congress. *Please note that the dates for this energy conference are now 14-18 December 1987.*

The conference will cover the following topics:

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

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

stitute news (continued)

lew members

Aember

eresa Jane Butler, W S Atkins & artners, Epsom, Surrey

tanley William Ellis, Gravatom rojects, Fareham, Hampshire, *(transfer)*

avid Brook Fortune, Shell Coal nternational, London

onald Hugh Garrett, Scott Houghton & artners, Qatar *(transfer)*

harles Alexander Hamilton, C V arpets, Co Down, N Ireland

Vincent Richard Harris, CEGB, West Burton Power Station, Notts

Gordon Robert Hill, GHS, Bury St Edmunds, Suffolk

Andrew Ibbotson, Stockbridge Engineering Steels, Sheffield *(transfer)*

Alexander Smith, University of Ulster, Newtownabbey

Wing Kwok Szeto, Environmental Protection Dept, Hong Kong

Kin Sang Peter Tam, Caltex Oil, Hong Kong

Peter Tarren, CEGB, Hinkley Point Power Station, Somerset

Technician Engineer

Andrew McHugh, British Gas North West, Gtr Manchester

Graduate

Andrew William Cox, University of Newcastle upon Tyne

Student

Amir Said, University of Sheffield

May 1987

Oil prices and the outlook for investment

Conference, City of London, 11-12 May 1987.
Details from Jennifer Codling, South Conferences, New Zealand House, 80 Haymarket, London SW1Y 4TS (tel 01-930 8411).

Computer-aided process design and modelling of natural gas processes

Course, London Press Centre, 13-15 May 1987.
Details from Miss Suzanne Goodall, IBC Technical Services, Bath House (3rd floor), 56 Holborn Viaduct, London EC1A 2EX (tel 01-236 4080; tlx 888870).

June 1987

Energy recovery

Conference, Essen (FRG), 1 and 2 June 1987.
Details from Haus der Technik eV, Hollestraße 1, Postfach 10 15 43, 4300 Essen 1, FRG (tel 0201/1803-1; tlx 857 669 hdt).

Chemistry of acidic dry deposition

Symposium, Sainte-Foy (Quebec, Canada), 7-9 June 1987.
Details from Ghislain Jacques, Direction de la meteorologie, Ministere de l'Environment, 2360 chemin Sainte-Foy, Sainte-Foy, Quebec, G1V 4H2, Canada.

Direct combustion of coal

Seminar, Denver (CO,USA), 8-10 June 1987.
Details from DELTA-H Institute, PO Box 1053, Springfield, NJ 07081, USA (tel (201) 654-9633; tlx 238667 ATT DELTA).

New and renewable sources of energy

ECE symposium, France, 8-12 June 1987.
Details from Klaus Brendow, director, Energy Division, UN Economic Commission for Europe, Palais des Nations, CH-1211 Geneve 10, Switzerland (tel (022) 346011; tlx 289696).

District heating: energy conservation and environmental benefits

Congress, Berlin (FRG), 17-19 June 1987.
Details from the UNICHAL General Secretariat, Bahnhofplatz 3, CH-8023 Zurich (tel 01/211 51 91).

Engineering aspects of MHD

25th symposium, Bethesda (MD, USA), 24-26 June 1987.
Details from Dr Robert Kessler, 25th SEAM, Avco Research Laboratory Inc, 2385 Revere Beach Parkway, Everett, MA 02149, USA (tel (617) 381-4772).

June 1987 (continued)

Condition monitoring for safety

Seminar and exhibition, London, 25 June 1987.
Details from Miss Laura Christie, ERA Technology, Cleeve Road, Leatherhead, Surrey KT22 7SA (tel 0372 374151 ext 2290).

September 1987

1987 ASME Cogen-turbo

International symposium and exhibition on *Turbomachinery, combined-cycle technologies and cogeneration.* Montreux (Switzerland), 2-4 September 1987.
Details from International Gas Turbine Institute (formerly ASME Gas Turbine Division), 4250 Perimeter Park South, No 108, Atlanta, Georgia 30341, USA (tel (404) 451-1905; tlx 707340 IGTC ATL).

Distillation and absorption

International symposium, Brighton, 7-9 September 1987.
Details from Conference Section, Institution of Chemical Engineers, 165-171 Railway Terrace, Rugby CV21 3HQ, (tel (0788) 78214; tlx 311780).

INPOWER 87

Independent power generation conference and exhibition, Heathrow, 8 and 9 September 1987.
Details from *INPOWER 87,* Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS (tel 0737 68611; tlx 948669 TOPJNL G).

Advances in solar energy technology

ISES solar world congress, Hamburg (FRG), 13-18 September 1987.
Details from ISES Solar Weltkongress 1987 eV, c/o Hanseatic Congress Management GmbH, Am Weiher 23, D-2000 Hamburg 20 (FRG) (tel (040) 407623).

International projects

Conference, London (ICE), 16-18 September 1987.
Details from Conference Office, Institution of Civil Engineers, 1-7 Great George Street, London SW1P 3AA (tel 01-222 7722 ext 279).

Fire safety and the community

Conference, workshops and exhibition, Bristol, 21-25 September 1987 *(exhibition 22-24 September).*
Details from Mrs C E Mackwood, general secretary, Institution of Fire Engineers, 148 New Walk, Leicester LE1 7QB (tel 0533 553654).

October 1987

Refractories in the chemical industry and in waste incineration

30th international colloquium on *Refractories,* Aachen (FRG), 8 and 9 October 1987.

October 1987 (continued)

Details from Institut fi
Gesteinshüttenkunde der RWT
Aachen, Mauerstrasse 5, D-5100 Aache
FRG.

Windfarms

International conference, Leeuward
(Netherlands), 13-16 October 198
Parallel to conference *Windpower Euro*
87 (international exhibition).
Details from: *(conference)* Hollar
Organising Centre, 16 Lange Voorhou
2514 EE The Hague, the Netherlands (t
(+31-70) 65.78.50; tlx 33111 hoc nl
(exhibition) Expoconsult, PO Box 20
3600 Ae Maarssen, the Netherlands (t
(+31-3465) 73.777; tlx 47945 expo nl)

Industrial power

1987 conference, Atlanta (GA, USA
25-28 October 1987.
Details from Gemma Tansey, America
Society of Mechanical Engineers, 3
East 47th Street, New York, NY 1001
USA (tel (212) 705-7795).

Electrostatic precipitation

Third international conference, Veni
(Italy), 25-29 October 1987.
Details from Prof Massimo Rea, Institu
di Elettrotecnica e di Elettronic
Universita di Padova, via Gradenig
6/A, 35131 Padova, Italy.

Coal science 1987

International conference, Maastric
(Netherlands), 26-30 October 1987.
Details from Dr H A G Chermin, Dut
Centre for Coal Specimens-SBN, PO B
151, 6470 ED Eygelshoven, Th
Netherlands.

Coal power 87

Conference and exhibition, Düsseldo
(FRG), 27-29 October 1987.
Details from conference secretary, C
Publications, McMillan House, 5
Cheam Common Road, Worcester Par
Surrey KT4 8RJ (tel 01-330 3911; t
8953141 Carsys G).

Electricity and electronics

Exhibition, Jeddah (Saudi Arabia), 15-1
November 1987.
Details from ITF International Agencie
Radcliffe House, Blenheim Cour
Solihull, West Midlands B91 2BG.

January 1988

BEST 88

British engineering supplies and tec
nology exhibition, London (Olympia 2
18-21 January 1988.
Details from Mack-Brooks Exhibition
Forum Place, Hatfield, Herts, AL10 0R
(tel 07072 75641).
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