

Cabinet Office, Performance and Innovation Unit

**Energy Policy Review – Project Scope**

Response from The Royal Academy of Engineering

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*The evidence which follows represents a collation of personal views from Fellows of The Royal Academy of Engineering. It cannot reflect the views of all contributing Fellows nor those of The Academy as a whole.*

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## **Introduction**

The Royal Academy of Engineering welcomes the opportunity to comment on the scope of the PIU project on UK Energy Policy. The response which follows is a collation of replies received from Fellows of The Academy with direct knowledge and experience of the issues under investigation. The views presented are not necessarily representative of all Fellows of The Academy.

The decision to formulate an energy policy for the UK is applauded. For too long there has been no policy other than that of “market forces”, with various initiatives started and progressing in a vacuum. To take a long term outlook, to 2050, is encouraging but it is important that the outcome is “holistic” so that the various government bodies subsequently adopt the policy and use specific aspects to direct activities in areas under their control, thereby avoiding a break down in the “joined-up” approach.

The scoping note and the subsequent Project Management Plan set out clearly the very wide-ranging and complex remit the PIU has. If anything, there are possibly too many issues identified and it will be very important to focus on the most important elements that directly align to the three key challenges set out in the scoping note. It may be appropriate for the final report to recommend the setting up of a formal mechanism for reviews at, say, five yearly intervals of the project’s outcome. It would also be helpful to have an idea of how the PIU intends to take forward any new issues that arise and whether the PIU report will ultimately be “from” or “to” Government.

The text which follows is divided into two main sections. The first deals with the Project Scoping Note and the second addresses some of the many issues which are raised.

## **Section 1**

Comments on the project.

### **Scope**

The Project Scoping Note is an excellent statement of the objectives and issues. It is reasonably comprehensive and highlights some of the conflicting requirements e.g. cheap, competitive fuel v environmental objectives. It identifies the consistency between both environmental and resource pressures in pointing to the need for a substantial reduction in the use of fossil fuels. However, the document does not spell out the critical strategy and policy questions that need to be addressed. Creative diplomacy and long-term agreements on supply and investment with reciprocal benefits for all concerned will be required to meet the concerns expressed in the Scoping Note.

All aspects of electrical power generation appear to be addressed adequately but the focus on electricity is to the detriment of the transport sector which also merits special attention in terms of emissions to the environment. The key to the Energy Policy Review is that an overall approach should be taken to consider the categorized requirements across the many related sectors e.g. to address the links between primary sources of power generation through to areas of transportation including the impact on the environment and society.

The Note wisely recognises that the UK's policy will have to evolve in step with other countries' policies. It is vital that the broad implications of this statement are not overlooked in the final report. Too often in the past governments in the UK have introduced policies which try to make the UK a ground-breaking exemplar of international good practice without having considered the serious short-term effects of these policies on the ability of our businesses to compete globally. Two examples are policies which have restricted the ECGD's ability to assist exporters and the opening up of the UK's electricity supply industry infrastructure procurement contracts long before any form of reciprocity existed even within the EU. A desire to be seen to be in the vanguard of "green" policies could have a similar effect.

With the review covering a fifty year period during which the availability of supplies of conventional oil and gas fuels will certainly change for the worse, it is recommended that serious consideration be given to the development of alternative energy-vectors.

## **Project Considerations**

This is a very large and complex exercise to be undertaken within a relatively short timescale. It is noted that the review is being undertaken by the Performance and Innovation Unit (PIU) within the Cabinet Office. The PIU is expected to be able to handle the inevitable conflicts that will arise not only between energy generation and environment targets, but also between the various Government departments, their advisers, the Regulators and the energy generators and their respective suppliers of fuel. Perhaps one of the main potential conflicts will be the assessment of the PIU in response to the statement “Competitive markets will continue to be central to energy policy”. Whilst this has certainly been the case of the past 10 years, albeit with some state involvement of late, this is not too apparent in the rest of the European Community.

It is important that the review should be as objective as possible, without being driven by current reviewed opinion, media orientation or ideological stance. There must be an awareness of and an alertness to any inbuilt bias (e.g. the reliance on a “market focus” policy for all energy supplies results in a bias which currently favours gas.) Unless countered, this ignores the value to be ascribed to the nation’s strategic needs and which could therefore warrant the adoption of lower rates of return on capital investment.

As all past projections of future demand have been wrong there is no reason to expect the current versions to be any different. Thus assessment of the sensitivity of any policy, and its implications, to variations in base case assumption is essential and should be stated explicitly.

The government’s policy of reducing emissions is very laudable but the defined arbitrary targets are questionable. They bear little relationship to what can be achieved practically by improvements in technology or changes in policy. Extrapolation of the savings achieved in the last decade by switching from coal to natural gas is not a further option.

There should be specific reference to policies and strategies adopted by other nations e.g. France, US, Japan, Sweden. A clear analysis of any divergence and the reasons for such divergence should be included. (This is different from the ‘global considerations’ referred to in the note.)

## Section 2

Comments on issues raised by the review of national energy policy.

### **Economics/ Fiscal Instruments**

Government has a difficult commitment to reduce carbon dioxide emissions by 20% but not all the actions taken have been in support of this. The reduction in VAT on domestic fuel triggered increased fuel use and a rise in carbon emissions of half a million tonnes per year. The climate change levy made no distinction between CO<sub>2</sub>-free electricity generation and that produced by burning fossil fuels. Since then, new renewable electricity has been exempted from the tax but not nuclear or, for that matter, hydro, which supplies 2% of UK electricity without emitting carbon dioxide. The nuclear industry run-down between now and 2010 will increase emissions by four million tonnes of carbon per year, just about the amount it is claimed the levy will save when applied to the industrial sector. If the government is serious about meeting its carbon dioxide commitment it should employ a carbon tax. Some Scandinavian countries have such a tax. Carbon trading is now on the agenda but will only be taken up, if at all, by an exclusive “club” of large companies. It will not be for 60 per cent of UK industry, those SMEs that do not have the skills or expertise to trade.

The Academy welcomes the recognition of the need to internalise environmental costs when evaluating available energy sources and technologies objectively on a common basis. This should include all known environmental impacts and be applied impartially to all sources. Particular attention will be needed in deciding the cost to be attributed to CO<sub>2</sub> emissions, where the consequences are still only vaguely perceived. Another problem, requiring original thinking, is how to internalise the cost of security of supply.

It is essential to make a clear distinction between cost and price. If costs are evaluated comprehensively, they would be the main driver for deciding the overriding energy policy for the nation as a whole. Allocation to energy users by price should be disentangled from this, as an internal issue to be addressed separately through parallel fiscal, business and social policies. Work should be done to establish whether increased energy efficiency is more likely to emerge from raising fuel prices by taxation or by prescriptive regulation with fuel prices remaining low.

## **Markets**

UK policy has been to liberalise the energy market so as to “create competitive markets which will ensure secure, diverse and sustainable supplies of energy at competitive prices”. However, as recent experience has shown, when left to its own devices the energy market does not deliver what is required nationally in terms of a balanced energy supply network. This is now seen to require regulation, subsidy, and legislation. It is a paradox that the “de-regulated market requires “regulation” to make it work as required. “Levelling the playing field” to let the market operate in an unfettered way will never work, particularly where social engineering to deal with the coal industry, for example, is included in any plans. The market values the environment at zero and will pour into it whatever waste it can, unless prevented by legislation, taxation or other fiscal instruments. The market will never, of its own accord, protect the environment. Thus the statement that “competitive markets will continue to be central to energy policy” could be in conflict with the need for a long-term approach to meeting the challenges identified. Energy is an essential public service and Government policy must ensure that long term security of a sustainable supply takes precedence, if necessary, over shareholder interests which are the normal priority for a market-led private sector.

It is not clear what is meant by the statement in the Project Note “Transformation of the infrastructure for producing and distributing energy...”. This may mean a strong and practical encouragement, in the current business framework, for a shift towards a secure, environment-friendly energy economy, biased strongly towards “clean” coal, nuclear, renewables and conservation, and with long term in-built investment capability. This implies serious regulatory distortion of the energy business climate and of the “competition + low cost” market. In addition, the necessary regulatory levers to achieve the end may not easily be established. The current, supposedly simple, market model has not been easy to regulate and adjustment to promote new kinds of objectives will complicate matters greatly. However, given that “competitive markets will continue to be central to energy policy”, any other form of infrastructure transformation is difficult to envisage.

The energy industry will continue to face considerable uncertainties as identified in the Project Note, revolving around questions of environmental impact, sustainability and primary fuel price. Of these, history tells us that the price of primary fuels is likely to be the most volatile. Enthusiasts for the free market will say that markets are predictive and such matters are automatically accommodated. Over a forty year period the cheapest primary fuel source has changed several

times. None were accurately forecast – even the tripling of oil prices on the formation of OPEC was not foreseen, the UK too was busy building oil-fired power stations.

The market takes no account of future primary energy costs. Gas prices need only rise by a modest percentage before renewable, coal and nuclear generation costs begin to look attractive. But the UK is already importing natural gas from Russia and Norway, as supplies from the North Sea fail to meet demand. The price of gas has doubled in the last year to the dismay of those intending to build the six new gas-fired power stations which have just been licensed. Security of energy supply requires a long-term strategy; the market operates in the short term and will not deliver security.

The Project Note quite rightly states that the energy situation in the UK differs from that in California in some respects but the essential lessons are common and support the questions about the UK market. The strategy in California, devised at a time of electricity surpluses, was to buy on the spot-market and leave others to worry about investment. Not surprisingly, in the early days, this produced cost benefits for customers but as, inevitably, the surpluses in electricity supply evaporated, costs to consumers rose. Over a ten year period this has proved to be not in the consumers interest. Now, in addition to having to pay high prices for their electricity, there are also threats of serious power shortages and the indirect costs of these to all customers is inestimable. The public reaction to this situation should concern Government (and it appears that it has.) Electricity generation is of strategic importance to industry and power cuts are guaranteed to excite public reaction. The lesson from California is that excessive reliance on short-term market forces is a mistaken policy.

### **Impact on the UK Economy**

The Project Note does not emphasise sufficiently that progress will not be made without major costs to industry, the customer and taxpayer. There is a need for greater stability if industry is to invest in new generating plant. The industry is capital intensive and thus, if it is to operate economically, plant must operate for long lifetimes. This also makes energy sense. It is wasteful of energy for plant to be constructed, consuming large amounts of energy in construction, and then for it to be faced with early closure because of small shifts in primary fuel costs. The UK regulatory regime has focused very heavily on price control and may be damaging investment (i.e. it takes a very short-term view.)

In addition, the Review should recognise the need to secure the appropriate base for British industry in all the relevant sectors. It is important that the engineering community is in a position to respond to the requirements. As identified this is a global issue and as such there are potentially many opportunities for UK research, technology and manufacturing to respond to the needs of both the UK and to exploit the global market.

Of concern is the UK imposition of constraints on emissions for political reasons, thereby having a detrimental effect on economic growth and prosperity, and damaging industry, without any significant improvement in the environment or in reducing total global emissions. (Whatever is done in the UK will be dwarfed by the emissions from other countries. For example, in China the consumption of coal per annum is expected to rise from 1,000 to 2,000 million tons in the next 10 years.) A policy of raising fuel prices to restrict usage is unlikely to work and could have disastrous

### **Electricity Transmission Networks**

An integral part of a national energy policy and a key issue for the next decade or so is the development of highly efficient energy distribution/transmission systems that are capable of handling energy produced in many ways such as large scale, embedded, base load or transient supplies from renewable sources. Furthermore, the systems should be coupled with the other European grid networks in a way that permits the transfer of significant amounts of energy as required. These systems, electricity and gas, are of course in place but the efficiency and capability should be improved and coupled with substantial energy storage capability. More R&D needs to be undertaken on large-scale storage systems. In the case of the electricity system the system should be capable of handling the present methods of generation as well as enhanced amounts of renewable supplies.

A modern electrical power system cannot operate with more than a limited amount of randomly intermittent power from wind, wave or solar. According to the International Energy Agency, as the contributions of these sources approaches 12% of power supplied and with electricity not being capable of storage, policy makers need to start thinking about creating an energy buffer. At a 20% level it is contended that a buffer is absolutely necessary. Furthermore, this is a power constraint not an energy constraint and so would be of particular concern under light electrical system load conditions. There is, therefore, a technical limit to the development of renewable energy supplies if their out-put is geared solely to direct connection to the electricity supply system.

## **Security of Supply**

Security of fuel supply and the relative mix of the various fuels are important parts of the energy policy study. A policy directed towards a diversity of energy supplies to ensure security is essential and requires a balance between gas, coal, oil, nuclear and renewables. A speculative, beyond 2050, scenario should also be considered to ensure that the policy developed is consistent with long-term projections for the exhaustion of gas, oil and coal and the development of other sources e.g. nuclear fusion.

The security of supply issue is a classic situation requiring insurance. The form this insurance takes is that of diversity of primary fuel sources – it is essential to correct some of the imbalances that have arisen. The difficulty here is in deciding how to reconfigure the market to take proper account of longer term factors and to override the short term market forces. The premium to be paid for this insurance is the difference in generation costs between fuel sources. These are relatively small especially when the generation costs represent about one third of the retail price.

On the choice of fuel sources, it is pertinent to consider the situation in France in 1973 when security of supply was a major concern. Unlike the UK, France had few indigenous fuel resources and was building oil-fired power stations as the preferred choice. The formation of OPEC and a tripling of crude oil prices overnight placed the French economy in a very vulnerable position. France chose nuclear power to provide itself with secure fuel supplies and stockpiled large energy reserves in the form of Uranium. The healthy position of diverse energy supplies available to the UK in the 1970s has eroded and we are now moving to a position much closer to that of the French in 1973.

## **Research and Development**

R&D has declined markedly in the UK since liberalisation of the energy market but much effort is required if we are to achieve the goal of reducing significantly the CO<sub>2</sub> emissions to the environment. A future energy policy statement must define focused R&D objectives as part of a coherent strategy for the UK (and Europe). Areas of future work readily identifiable include: cleaner fuels (clean coal technology) resulting in reduced emissions from power generation; next generation nuclear plant such as the high temperature gas cooled reactors (pebble bed) with inherent safety features; and a realistic optimisation of energy sources.

## **Education and Training**

The general topic of education and training needs to be addressed. This ranges from the serious decline in students studying subjects in the energy sector to the need for greater public understanding. The public has to be educated in the more efficient use of energy and must gain an improved understanding of the relative merits and disadvantages of various energy sources. Planners, architects and building services engineers must receive better training to enable them to create more energy efficient designs.

## **Coal**

Coal will play a major role in power generation for many years to come. Whilst there has been a continuing, sometimes rapid, downward trend in coal production throughout Europe, demand has not reduced as much. The market for UK coal is very strong and easily outstrips the production capability of the UK coal industry. It is inevitable that both UK coal output and demand will continue to fall without much greater levels of investment in the mines and, in particular, coal fired power stations.

The UK has extensive reserves of unworked coal which will probably never be worked by conventional deep mining methods. This potential energy resource may be accessed by other means e.g. Coal Bed Methane and Underground Coal Gasification. The Project Note makes no direct reference to examining such alternative means for exploiting this energy resource available within the UK.

Clean Coal Technology (CCT) offers opportunities to assist the UK in meeting the twin demands of energy requirements and emissions limitations whilst enabling UK manufacturers to export plant and technology. Many countries are reliant on coal-fired generation and will remain so for many years, seeking to satisfy their own security of supply and environmental demand by utilising CCT. The Project Note should emphasise much more than it presently does, the CCT initiatives, benefits and the need for a demonstrator plant.

## **Gas**

Natural gas will increasingly be required to achieve the reduction in CO<sub>2</sub> emissions however, the output of North Sea gas fields is starting to decline. The Project Note anticipates the UK importing up to 15% of its gas by 2006 but a previous report to the DTI suggests that this import requirement will increase to between 55% and 90% by 2020. Since the present import capacity of the Bacton-Zeebrugge pipeline is of the order of 20% of present UK demand, this would suggest that several new pipelines need to be constructed to enhance the UK connections to the main European gas grid. This is not an inconsiderable undertaking and raises the problem of ensuring that sufficient investment is made to ensure reliable supplies in the event of plant or pipeline unavailability. An important question which has to be addressed is whether it is wise to allow so much of the UK primary fuel supply, which will include much of the country's electricity generating capability, to depend on such an arrangement.

An alternative approach to countering a diminution in indigenous natural gas supplies is to augment the supply with hydrogen. Most gas burning equipment can probably cope with up to 20% hydrogen but, whilst reducing CO<sub>2</sub> emissions, this action would reduce the thermal capacity of the transmission system. The hydrogen could be supplied from coal gasification or other methods.

## **Oil**

The PIU Note highlights the fact that the world is becoming increasingly dependent on oil and gas supplies from a limited number of producers; for example, the EU and USA rely increasingly on Middle East sources for oil. Geological assessments of world oil suggest that with oil discoveries at about 7 billion barrels per year on a falling trend and consumption at 23 billion barrels per year on a rising trend, the oil industry is not replacing its reserves and will be reaching a production peak in this next decade. This implies that oil price spikes may be of major concern in this period as will gas price stability, with gas - oil price indexation.

This conclusion is at odds with the assumptions in the econometric models underpinning the scenario analysis in energy paper 68 and, also, is more stringent than the thirty year possibility raised in the Stakeholder Workshop - 20 July, 2001 paper, (section 4.4, question B2.) If the above conclusion is valid, it will prove to be a major constraint on energy policy choices; thus it is extremely important that this question be addressed.

## **Nuclear**

Nuclear power offers a proven means of replacing carbon-based energy supplies on a large scale yet the Project Note refers to nuclear power only in statements about its decline, appearing to ignore nuclear power as a future option and accepting its demise over the next two decades. It fails to refer positively to the undeniable and very significant CO<sub>2</sub> reduction and security/diversity opportunities offered, counterweighted if necessary by reservations concerning the severe obstacles to re-establishing the option.

It is difficult to see how generation and emissions targets will be achieved in a sustainable, balanced, diverse and secure electrical energy supply scenario without a continuing substantial nuclear component. The decline in the nuclear electricity market share, caused by the progressive closure of the existing nuclear power stations, presents the Government with a greater challenge in its attempts to meet its CO<sub>2</sub> emission targets.

A rigorous assessment of the potential and limitations of nuclear power is required. It is an established technology and build times and operating performance internationally have improved considerably over the last two decades. It is recognised that there is opposition to the expansion of nuclear power, particularly on waste management, safety and public acceptability issues. To keep the nuclear option open will require: public acceptability, an agreed solution to long-term waste management and favourable relative economics for new plant to be built. However, there are new developments involving improved reactor designs with higher efficiency that go some way to responding effectively to these concerns. Also, fuel processing and waste disposal must be operated to higher environmental standards than that at present to gain public acceptability. It is vital that these are examined as part of the review.

In anticipation of some of the objections to nuclear power the following comments have been made:

- **Safety and public acceptability**

There are clearly risks with nuclear power but these have always been addressed with the result that nuclear power in the UK has an excellent safety record. The risks have been managed but future plant designs will be even safer. The new plant options such as the AP600 PWR or the helium cooled pebble bed reactor offer standards of safety well beyond those of plant built in the past. In reviewing this area, it is important therefore to maintain a vision of the future in order that proper credit is given to the advances made in developing these systems.

Recent public opinion polls in the USA appear to show a dramatic change of heart amongst the population with regard to nuclear power. Over many years there has been apparent opposition to nuclear power and suddenly there is a healthy majority in favour. In all probability this does not represent a change of heart but a change in the perceived question that is being asked. Asked an abstract question unrelated to any consequences “Are you in favour of nuclear power?” the answer will almost certainly be no and why would one expect it to be different? But such an abstract question is not possible in the USA following the Californian debacle. Whichever way the question is posed the question being answered is “If it is a choice between power shortages and nuclear power would you be in favour?” This produces a very healthy majority in favour.

- Waste

The argument above applies also to the question of radioactive waste. Many of the current concerns in this area relate to practices of several decades ago when the industry was in its infancy. It has to be admitted that in this area, because the problems were not immediate, they were not addressed as thoroughly as was required. However, tightened regulation would forbid those practices and today’s waste and that in the future will be much better controlled.

It is perhaps worth noting too that it is unlikely that fuel for a new plant would be reprocessed. Reprocessing does not add to the radioactive content of waste but it does increase the volumes through which it is dispersed.

All generating systems have some negative impact on the environment. In the case of nuclear power it is radioactive waste, in the case of fossil fuels it is CO<sub>2</sub> and in the case of wind it is visual amenity, noise and damage to bird-life. It is important that views of these different kinds of detriment are balanced. A typical issue is emotive arguments about the long lifetimes of nuclear waste. The decay rates of fission products are known, understood and should not necessarily be regarded as a disadvantage. Conventional waste (i.e. non-radioactive) has an infinite lifetime. The nuclear industry includes environmental costs, de-commissioning, radio-active waste disposal and so on in its accounts, which increases the cost of nuclear electricity. The gas, coal and oil-fired stations are not obliged to include the cost of their environmental degradation, which gives them an unfair financial edge over nuclear.

It is arguable that a revival of nuclear generation ought to form part of the UK's energy strategy - both to reduce our dependence on imported fossil fuels and to contribute to CO<sub>2</sub> emission reduction.

Anti-nuclear propaganda has made nuclear engineering a deeply unfashionable career among young people. Universities have all but abandoned courses in nuclear power. The age distribution in most nuclear companies means that the expertise within them will disappear through natural retirement over the next twenty years. If it is decided that nuclear power has an important role, there is urgent need for enthusiasm to be regenerated and the supporting infrastructure and capability to be rebuilt. The infrastructure needs to be in place to accommodate policy changes. The paper observes that the nuclear industry in the UK will decline over the next twenty years but this should not be taken to mean that it could be picked up in twenty years time.

### **Renewable Energy**

Renewable energy sources must play an increasingly greater role, as indicated by the Government's strategy to reduce CO<sub>2</sub> emissions by satisfying 10% of the nation's electricity demand from renewable sources by 2010. However, it is feared that because of the lack of development and construction, renewable energy resources are unlikely to contribute anything near their potential in a low carbon energy supply regime.

The Government's stated policy demands an almost fivefold increase in electricity from renewable sources by 2010 but this will have to be achieved without new hydro-electric installations – the UK's most exploited renewable source of electricity. Installing one 2MW offshore wind turbine every day until 2010 would supply only 2 percent of the UK electricity demand. Replacement of Scotland's two nuclear power stations would require of the order of 10,000 wave machines of the type now installed on Islay. Consequently the prospect of achieving 10% of electricity generated from renewable sources by 2010 looks bleak.

To maintain development of renewable resources in order to mitigate carbon dioxide emissions and to improve security and sustainability of energy supplies new energy vectors linked to such sources need to be considered. Among other possibilities, hydrogen from electrolysis would provide such a buffer. In this context the development of fuel cells requiring hydrogen would be a complementary activity to the development of renewable energy sources.

The New Electricity Trading Arrangements are perverse in discouraging the exploitation of renewable energy sources by requiring guaranteed supplies of energy. The nature of many renewable energy sources is that they are variable and cannot be guaranteed to be available at any

point in time. Financing renewable energy projects in the current competitive market is also difficult. Opportunities exist for the UK but the discouraging factors have to be minimised if the nation is to benefit fully from its engineering and technological expertise.

### **Energy Conservation**

A more robust policy of energy conservation should be established since it must play a major role and cover all aspects of energy use, especially in the transport sector. The benefits of energy conservation and the timescales to achieve them should not be over-estimated. Conservation is not new; energy saving opportunities have always existed and have been exploited.

Most appliances and processes operate with efficiencies undreamt of in earlier years. However, the electricity market has continued to grow in spite of this. This implies an underlying growth rate in the utility of electricity that is over and above that in electricity sales. Thus benefits from conservation need to be appraised to assess whether they can be realistically achieved at a faster rate than in the past. In this assessment it needs to be recognised that there is a natural time constant for their exploitation. Just as in the case for generating plant, it is wasteful of energy to throw away functioning plant just because a more efficient model is now available. Replacement will and should occur at the optimum time.

As consumers, we are aware of the financial savings to be gained by improving the energy efficiency of our homes and businesses. However, recent falls in energy cost have reduced the incentive to act immediately. Low prices operate against the installation of more efficient equipment as industry requires a one, or at most, two years payable period. Low prices also discourage investment in renewables. The energy tax may improve matters for IPPC registered companies which can expect 80 percent rebates. It is, however, important to consider the effect on other companies and the domestic sector.

Large businesses can, relatively easily, justify the use of energy consultants to review their installations and recommend programmes of improvements. For SMEs the problems are more difficult. The time required to choose, brief and monitor consultants followed by implementation of their recommendations can overwhelm a small, overstretched, management team.

## **Transport**

The challenge of meeting transport needs in a sustainable way is identified. However, the Project Note places an emphasis on power generation when energy efficiency and particularly transport are equally important. In the data presented, transport stands out as the main area of energy consumption growth. This is recognised to be a more difficult area to tackle, both from the point of view of political sensitivity and the state of development of technical innovation (electrical drivers, fuel cells). The growth seems inexorable despite improvements in fuel efficiency. Moving away from a dependence on fossil fuels will probably require a considerable growth in electricity generation e.g. to produce hydrogen by electrolysis for fuel cells and/or power for charging batteries.

Without a reduction in the use of cars (not the anticipated increased of 40 per cent over the next two decades), efforts to reduce carbon dioxide levels will be negated by an increase in transport emissions. Hence transport should be included in an energy policy and not regarded as a separate problem. The level of investment necessary to reduce significantly the use of private cars and its cost effectiveness needs to be determined.

Relatively cheap fuel has encouraged many organisations to establish a single, central, distribution depot and, as a consequence, goods are transported further than necessary. The use of more sophisticated software materials management systems would reduce the distance travelled by many items with a consequent reduction in fuel consumed.

## **Global warming**

One of the foci of the project is based on the statement that 'there is scientific agreement that very substantial reductions in global CO<sub>2</sub> emissions will be required to stabilise the climate,' carrying with it the implication that humanity can bring this about. The IPCC report, whilst stating that CO<sub>2</sub> concentrations in the atmosphere have increased in recent years, also states that there is uncertainty as to how much, if at all significantly, human activity has contributed to this. Timescales in global climate change are long and hence changes in the present position could appear slow, thereby encouraging a degree of complacency with regard to the timescale for decisions and actions. Whilst it is currently fashionable to say so it needs to be acknowledged that there are a number of eminent scientists who doubt that human activity is significant in increasing CO<sub>2</sub> concentrations; these views have not been widely reported. Volcanoes are a significant source of greenhouse gases and

increased levels of solar radiation also contribute to global warming. Therefore a serious effort to understand the science, unclouded by political correctness or lobby groups, would be the most valuable contribution the government could make.

The Project note acknowledges that the UK's contribution to global emissions of greenhouse gases is 2%. Consequently there is a view that the target reduction in UK CO<sub>2</sub> emissions is trivial on a global basis. However, it will have political relevance at a later stage when Ministers want something to say, largely "pour encourager les autres".

It is a concern that the focus on global warming is distracting attention from the vital importance of having an energy supply with a secure base for decades ahead, with an armoury of options and response times capable of meeting supply shocks. It is doubtful whether this will emerge from the Review.

## **Conclusions**

- The PIU Study is long overdue but given the urgency indicated by the project timetable, it is hoped that the study will not be undertaken at such a rate as to allow key factors to be glossed over. Of particular concern is the impression that the Project Note appears to concentrate more on environmental objectives rather than security and diversity of energy supplies. It also needs a reference to the EU approach to the same subject area.
- It is very clear that as UK CO<sub>2</sub> emissions start to increase, the commitment to a twenty per cent reduction below 1999 levels by 2010 will not be achieved by the policies currently in place and that the shortfall could be considerable. The Review must recognise that there are long term requirements so that the strategy set will have to be followed by implementation in an integrated manner over a period of the next 20 years.
- Successive governments here and overseas have generally found that the whole problem of creating a national energy policy is extremely difficult. The conflicts between economic and environmental interests become contentious and the subject ceases to be a vote winner. Cutting back on new power stations appears to be a good idea until the lights go out: the environmentalist lobby in California is finding out that people's air conditioning is locally

perceived to be more important than global warming. Likewise, cheap energy is generally more important to voters than hypothetical concerns about sea level rises in remote islands.

- Government already intervenes in the energy market but pretends that its policy is market-led. The market can be very powerful, within a strategic framework, but the government should admit that a framework with legislation, regulation and incentives is necessary and then produce a coherent energy strategy, embracing the market as a powerful tool where appropriate. Large-scale changes, far in excess of those achieved by the past practice of funding of speculative minor projects, are needed and of a nature not readily achieved when the main controls are market forces. The challenge is to identify and to establish policy employing proven technical options to achieve the least unpalatable means of achieving the objectives. Realism on these points is needed if progress is to be made but the Project Note appears to be lacking in this area.
- When considering the energy "scene", it soon becomes apparent that a number of paradoxes exist. The paper appears to make a particularly difficult task more difficult by removing some of the options readily available. A reduction in the use of fossil fuels, such as oil and gas, is advocated whilst rejecting nuclear energy - the only realistic alternative for large scale electricity generation. It is then argued by some that energy prices should be increased to reduce consumption whilst the government regulators are forcing the utility companies to reduce prices. It is suggested in the Project Note that we need cleaner fuels whilst subsidies to produce coal are mentioned. Gas fired power stations produce less greenhouse gases but it is suggested that the distortions that make them more economic than coal-fired stations should be removed. Increase of fuel price creates problems of fuel poverty and competitiveness and, as the paper points out, does not work with petrol where consumption is not affected by price.
- Alternative energy sources are rightly mentioned and should be encouraged but wind and solar power alone will not make much difference in the UK. The export potential to the developing world is important and could lead to economic and social development in areas which will not see mains power for decades, and incidentally, reduce the birth rate. The UK could have a greater impact on global emissions by developing technology and plant for export to those nations which burn fossil fuel inefficiently and are or will become major emitters of CO<sub>2</sub> to the environment.

- Efforts to increase energy efficiency make sense for good economic reasons. Much has been achieved in the UK where energy consumption has risen much more slowly than GDP and we should do what we can to ensure that developing economies take advantage of our experience in this area. This will do far more to contain CO<sub>2</sub> emissions than distorting the UK economy, (which is only responsible for 2% of global emissions), in order to meet the arbitrary goals of the Kyoto Protocol.
- Whilst the Project Note highlights the initiatives on improved energy efficiency and increasing use of renewable sources, there must also be a realistic assessment of the associated risks of not being able to meet targets on greenhouse gas emissions. In the case of renewables a rigorous analysis of their future potential and associated limitations such as availability, space required and environmental impact, in terms of visual and noise effects, is required.
- The future choice of primary fuel supply for electricity generation cannot be forecast with certainty and the only responsible approach by those charged with “keeping the lights” on is to plan and pay for a high degree of diversity. Consideration of the electricity industry over the last 40 years suggests such caution is justified. The “dash for gas” was only the last of a number of dashes caused by presumptions of certainty which were eventually overturned (eg. nuclear going from cheap to expensive; oil, ditto; miners’ strike, little UK coal). There is perhaps insufficient recognition in the Project Note of the uncertainty factor and the costly investment in diversity implied in the remedy.
- In summary, the crucial issues are:
  - What will be the future demand as a function of characteristics e.g. electricity v oil?
  - What may influence demand e.g. perhaps global warming?
  - What can actually be done to influence demand?
  - What are the supply options and how secure are they to man-made events, political/religious events and natural events?

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