UK ENERGY POLICY

INTRODUCTION

1. Liberalisation and privatisation have not exempted Government from a quest for a comprehensive energy policy because:

   - Significant elements of the delivery systems remain and will remain effective monopolies
   - All energy systems carry substantial and unique health and safety risks to staff and public
   - Where markets do exist, and function well, there remain considerable externalities (such as environmental impacts) which the markets cannot capture
   - Failure to deliver normally has disproportionate impact on the suppliers and customers. The loss of income due to 30 minutes' electricity disruption, for instance, may be insignificant to the supplier but fundamental to the customer
   - The public is apparently even more risk averse when it comes to disruption of energy supplies than the economic disbenefit implies. This implies a powerful political reaction regardless of whether the problem is preponderantly a market problem.
   - There appear to be real limits to the prices the public seems prepared to pay (the recent fuel protests are indicative) and the price volatility they will tolerate. Again, the response is a political one rather than a market one.
   - Energy use is probably more pervasive and less flexible than any other commodity throughout all spheres of commercial and personal activity.
   - Because energy use is so pervasive and so much part of a comfortable life, fuel poverty is seen as a distinct and particularly corrosive aspect of general poverty.
   - Governments have long been concerned with employment levels in the energy industries
   - Finally, Government cannot be indifferent to the implications for international competitiveness if energy costs are significantly out of line with those of other countries.

2. These varied reasons may be categorised as issues of sustainability, security and social impact. Even a cursory analysis will reveal, however, both the conflicting objectives and competing priorities which make any coherent energy policy so complex. Without some common analytical framework, it may be impossible even to fully understand all the possible or necessary trade offs any policy requires.

3. In fact, almost all of the issues raised can be analysed in terms of risk:

commercial risk; political risk; individual risk; environmental risk; etc. We propose to do just that, with the exclusion of that individual risk represented by fuel poverty about which we feel strongly but believe that others will provide a more comprehensive analysis than we feel able to.

NETWORK RISKS

4. Gas and electricity transmission and distribution networks are regulated monopoly businesses. They are free-standing networks which have become highly integrated in a wholly unplanned way. Gas generates one third of all electricity. Whatever the nature of the contracts, gas supplies to electricity generators will be interrupted if necessary rather than risk disruption of the domestic gas network. Electrically driven pumps circulate the gas, maintain pressure in the system and so impact on the amount of gas "stored" within the network. Significant failure of one system will immediately impact on the other. The results may not be predictable.

5. Most supply disruption stems from network failure in some form or other, yet the risk of such failure has always been the Cinderella of security of supply concerns. This appears to be because:
   - Network design and maintenance was regarded in the Nationalised Industries as low status in comparison to generation and/or extraction.
   - Interruption can be fairly reasonably blamed on "Acts of God" (serious weather).
   - There has been no high profile competition or debate about allocation as there has been between alternative fuels and fuel sources.

6. Whatever the reason, these fundamental networks are more vulnerable now than they have ever been.

   a) The network interdependences are poorly understood;

   b) The total number of linesmen and engineers employed throughout the electricity distribution network is now not much greater than the number who could be released to help restore the network in the south-east in 1987;

   c) Yet global warming may well be increasing the likelihood of such a storm;

   d) Companies have chosen different mixes of investment and maintenance. These may have similar commercial consequences but very differing risk profiles. For instance, high investment, low maintenance (with lower staffing levels) may create a less vulnerable system which can, however, be less readily restored when it does collapse. We simply don't know.

e) We understand that the gas storage capacity is similarly based on a margin above average winter demand which in turn has been falling per capita due to warmer winters. The underlying analysis here is that winter demand will remain distributed around the mean n the way it always has, as winters warm up, a wholly unsupported hypothesis.

7. We have consistently argued that regulatory reviews should start with a competent system risk assessment and have been as consistently rebuffed by Ofgem. We do not seek to defend past over-provision but our members are adamant that the networks are now under considerable risks which it is not commercially wise for governments to ignore yet which the regulator chooses to ignore.

RECOMMENDATION 1

Companies are responsible directly to their shareholders and responsive to customers' needs only insofar as that is consistent to making decent returns for shareholders. Even this does not apply in a monopoly. Effective regulation thus is all that protects the customers' interests and effective regulation in this instance requires:

a) That Government determines the level of risk/vulnerability which the community is prepared to tolerate;
b) That Government then instructs the regulator to ensure that economic regulation does not increase risk by excessively driving down operating costs and investment incentives.

CAPACITY RISKS (Generation and Storage)

8. There is currently a very healthy margin of generating capacity in the UK. Indeed, since privatisation there has been a surge of investment in new generating capacity which has to be understood not simply as a reaction to a de-regulated market but to a market highly distorted by partial de-regulation.

- It coincided with the availability for the first time of huge quantities of gas kept artificially cheap by the lack of outlet to the more expensive European market.
- At the same time, electricity prices were held artificially high, first to facilitate privatisation and later to help the coal industry. Artificially high prices helped that industry in the short run while over-incentivising investment in its new competitor.
- The "Pool" ensured both specific capacity payments and an ability to bid to ensure production at a price totally unrelated to the bidder's contract price,

with a fairly predictable fallback system price.

- All the companies were privatised without debt making it extremely easy to raise capital for investment.

9. None of these factors now applies. Gas prices have risen and are likely to stay higher (and more variable?). The UK will have to import up to 15% of its gas by 2006. The new trading system has abolished both specific capacity payments and the fallback systems price. The companies have been fragmented and subjected to “good behaviour” regulation which has depressed share prices and had a highly detrimental effect on the real cost of capital. We believe that there will now be a long investment pause while demand and capacity come into better balance. Unfortunately, there is also reason to believe that, given the long time lags in this industry, this balance is likely to tip in the other direction.

10. Less than 10 years' ago, California had a huge capacity surplus and, because of the contraction in the defence industry, this was predicted to grow. Now there is a substantial capacity deficit with catastrophic economic and above all political consequences. Whatever the specific idiocies of free wholesale and capped retail prices, the underlying cause of California's problem is that it makes absolute commercial sense to cut back on investment in new capacity until all existing capacity is heavily utilised and then exploit the inevitable volatility of the market when demand is unusually high. The UK now has a market perfectly designed to deliver a similar result in 5 to 10 years' time exacerbated by the closure of the Magnox stations.

11. We have already pointed out that gas storage capacity is predicted on continuing warm winters and that if the system is in any difficulty in meeting demand, the generation market will be sacrificed to maintain the integrity of the domestic network. Thus dependence on gas for 30% of electricity generation could mimic the effect of inadequate electricity generation capacity well before that actually comes to pass.

RECOMMENDATION 2

It is not sufficient for Government, stimulated by evidence of company manipulation in California, to endorse ever more tough "good behaviour" regulation if this helps to depress necessary investment. Government needs to develop as part of its policy a view on the necessary generation and storage margins; ensure that these are monitored; and that incentives to invest in new capacity are not serious compromised by over-aggressive and backward looking regulation.

FUEL SOURCE RISKS (DIVERSITY)

12. We have long championed the cause of diversity and a balanced energy policy, not because these are ends in their own right but because they are essential to the management of risk, especially when history teaches us that the most damaging risks are always those we don't recognise until too late. In this context the UK is in fact entirely fuel rich. We have significant reserves of oil, gas and especially coal; a well developed nuclear industry and considerable potential for renewable energy development, particularly in the areas of wind and tidal or wave energy.

13. There is always however one crucial swing source. Currently this is gas. Ten years' ago, gas was used to generate virtually no electricity. Today it is used for one-third of all generation and that proportion is growing. This rapid growth and its displacement of other fuels encapsulates the main fuel supply risks facing the UK today. In the 80's, we were a significant gas importer. In the 90's, we were self-sufficient. We began this decade as an exporter but will again import 150%k of our needs by 2006. This would not matter a damn if it were not for the fact that:

- We are only slightly ahead of a similar explosion of demand for gas in the rest of Europe and North America. The competition for gas reserves is therefore increasing exponentially. These reserves are highly concentrated, to all extents and purposes for our use in the North Sea; North Africa; Russia and the Caspian Sea nations.
- This means that supplies are vulnerable to either politically inspired disruptions or to the activities of a potential price cartel like OPEC.
- The last two world-wide depressions and arguably the current incipient depression were caused by OPEC induced price risks.

14. It is noteworthy that some of our European partners are taking this threat far more seriously than we appear to be doing. The EU Green Paper on security of energy supplies was stimulated by such consideration. More intriguingly, we note that:

- In Germany, Italy and Spain, liberalisation is being accompanied by State factored concentration rather than the UK Regulator factored fragmentation.
- These companies, together with EdF in France, are large enough to counteract to some extent attempts at supplier cartelisation.
- EdF is clearly keen in this context to influence the North African gas market heavily while there is now a close tie up between Germany and Gasprom.

15. There are two potentially effective responses to the concentration of gas supplier power. One, clearly espoused by the rest of the EU, is an equivalent concentration of purchaser power, and the other is the continued existence of a hedge against abuse provided by alternative fuels. Unfortunately, no other fuel source is capable for differing reasons of competing economically against gas in the present electricity generation market when it comes to new investment

- Renewable energy suffers from high capital costs, large risks of interruptability and low power density
- Nuclear and coal generation suffer from high capital costs and significant waste production problems

It will be convenient to return to these problems in the next section of the paper which deals with sustainability and in a parallel paper on nuclear power the unions are preparing.

RECOM MENDATION 3

It will avail us little to go on exhorting our EU partners about the benefits of liberalisation and fuel competition if EU oligarchies are the only companies strong enough to secure gas supplies at reasonable prices in the tighter gas market to come. UK energy markets have been highly successful in a period of energy glut and operating largely within the confines of the UK. It is essential that Government reach a view about the likelihood of an energy shortage, higher prices and a European rather than UK market. In our view, these will be inevitable and demand a wholly different market and regulatory response than that we currently "enjoy".

RECOMMENDATION 4

It is essential that Government ensures the continued health of alternatives to gas for electricity generation as a hedge against cartel price fixing and/or politically inspired disruption. For the foreseeable future, only coal and nuclear generation are capable of such a large-scale contribution.

SUSTAINABILITY RISKS

16. There are two major faces of sustainability relating to reserve depletion and waste creation. We do not believe there is any question of energy scarcity. The earth is full of untapped or only marginally tapped energy reserves. The question therefore is one of price at which it becomes worth tapping. More specifically, there is clearly a possibility of carbon based fuel depletion (though it must be said that reserves expressed as years at current consumption have continued to grow) and it is clear that use of carbon based fuel has

returned a very substantial amount of CO_2 to the atmosphere. We think it is important, however, to put this in context.

- Without carbon based fuels, there would have been no industrial revolution
- "Fuel poverty" would be universal at a very low level
- There would not have been the wealth generation which makes it possible to contemplate cleaning up the pollution caused **or** developing alternative energy sources because all these need high levels of capital only available in highly developed economies.

17. Having said that, however, we need also to be honest about the magnitude of the task.

- Human populations will double before stabilising in about 50 years' time
- The developed world will wish to continue growing and the underdeveloped world to catch up. There will therefore be a substantial increase in per capita growth. Even if we succeed in reducing the energy intensity of this growth every year, demand per capital for energy will grow.
- We do not want to get into the scenario game but it is clear without doing so that a quadrupling of demand for energy over 50 years is perfectly feasible and a doubling almost certain.

18. At the same time, the Royal Commission on Environmental Pollution states that we need to reduce CO_2 emissions by 60^0/o from the 1990 figure by 2050 and by 80% of the 1990 figure by 2100 if we are to stabilise atmospheric carbon dioxide at **twice** the pre-Industrial Revolutionary level. Given the continued rise in carbon dioxide emissions since 1990 this means that we need to reduce emissions to only 15% of current levels.

19. The Kyoto "agreement" levels of emission reduction were capable at best of putting off a 2°C rise in mean temperature by 6-8 years. Yet consider the problems around that agreement.

- It didn't include the fast growing developing countries
- The largest CO_2 emitter will not sign because, given the increased emissions in the United States of America since 1990, it could not deliver.
- No country could cope with a 30% plus carbon dioxide emission cut over a short ten-year period!
- Europe will only meet its targets accidentally because of the United Kingdom dash for gas and the East German industrial collapse.

RECOMMENDATION 6

Government policy should not get hung up over the details of Kyoto, however symbolic the first attempt at climatic change agreement appears. The need is far greater and there may well be far more cost effective methods of achieving it. It is essential therefore to play a full role with the United States of America and the developing nations as well as Europe in achieving a more sustainable agreement.

20. We believe there are four areas where Government energy policies can have significant beneficial impact in terms of sustainability.

- Demand reduction
- Renewable energy development
- Nuclear generation
- CO_2 separate sequestration in conjunction with clean coal generation

Fortunately all four of these areas are also capable of helping deliver on security of supply targets as well as sustainability targets.

21. It is clearly important for Government to continue to support and encourage reduction in demand for energy as part of its policy. However, enthusiasts for demand management are inclined to overlook its real limitations.

- It is generally believed that energy demand is relatively price inelastic. However, that only applies in the short run. In the long run, high prices stimulate technological responses and demand is no more inelastic than other commodities. This is most clearly demonstrated by the move towards more efficient internal combustion engines and we remain totally supportive of Government initiatives to continue this trend. Unfortunately, as the fuel demonstration showed, short run inelasticity leads to public reaction and political repercussions if prices are perceived as too high. The key therefore is a better balance between short run price and long run benefit.
- Reductions in demand sought through the introduction of building and energy consumption standards are relatively slow to take effect due to the varying timescales of investment turnover.
- In any case such reductions tend to mimic price falls and will therefore often lead to a "rebound" in which the savings are spent on other energy products (for instance, the average family car had a 1 litre engine 25 years' ago; today in response to greater fuel efficiency and therefore lower costs, the average is about 1.5 litres).
- For all these reasons we do not believe that demand management and fuel economy, however otherwise desirable, can offer the scope for CO_2

reduction that enthusiasts believe.

RECOMMENDATION 7

Government needs to recognise that broad based tax penalties on energy consumption combined with short run inelasticity is likely to lead to an inefficient economic response and a counter-productive political reaction. It is essential therefore to discover areas where tax penalties can be focussed on specific areas of relative short run elasticity, such as road congestion pricing.

22. We are extremely supportive of Government's attempts to support renewable energy and, like the Government, concerned that the new electricity trading system has difficulty in accommodating the Government's 10% renewables target. There have been quite outstanding improvements in both economic and technological performance of most of the main alternatives over the last few years and it is essential that support is maintained and, if necessary, funded for further innovation. However, there remain intrinsic difficulties for the widespread deployment of all existing renewable energy sources.

- Many technologically viable sources are inherently and unpredictably variable (sun and wind). Consumers are not prepared to have their supply cut. Therefore a system with a significant amount of such energy will have to maintain either (or both) a high level of efficient storage capacity, not yet feasible, or a high level of reserve power of a more traditional kind. This is expensive. Furthermore, such power source volatility increases the vulnerability of the system to network failure and all that implies. It is not surprising therefore that the market demands high premium to cover such risk.
- The intrinsic power density of most renewable sources is low. It has been estimated that a 1gW power station would require 20Km^2 of solar cells; 50Km^2 of wind farms; or 4,000Km^2 of afforestation. This is on the assumption of high levels of availability which can certainly not be expected of the first two examples. On the basis of this analysis, for instance, the whole of the United Kingdom would have to be afforested to supply less than the totality of the current electricity demand.

RECOMMENDATION 8

It is essential that Government ensures sufficient support for all renewable energy sources so that economic and technological progress can continue up to the point where they can be wholly self-supporting in the marketplace. However, Government *should not succumb to the temptation to pick winners, nor make unsupported assumptions about the scale of renewable contributions until the very real intrinsic difficulties are overcome.*

23. The nuclear industry currently generates one-third of United Kingdom electricity, without CO_2 emissions. The earlier Magnox stations have plant closure dates which can now only come forward. The AGR stations are less likely to enjoy significant design life extension and will therefore begin to close slightly thereafter. This alone will more than negate any improvements the United Kingdom has made to date in the context of Kyoto.

    A separate paper is being prepared for submission to the Review by the Trade Unions for Safe Nuclear Energy. We refer the PIU to that paper and will confine ourselves here to a few specific issues.

24. There are a significant number of "level playing field" issues which currently disadvantage the nuclear industry:

    - Unlike its carbon based competitors, the industry has to capture, handle and store all its waste. It is wholly absurd, therefore, that attempts to "internalise" the carbon based "externalities" using taxation and emission trading should exclude the only large non-CO_2 producing technology currently available. This means that the nuclear industry will pay for a part of the CO_2 waste management costs as well as all its own.
    - The industry has highly disproportionate level of regulatory costs, excluding the essential and wholly supported safety regulatory costs:

        a) National licensing systems mean that perfectly good and properly licensed designs have to be re-licensed at considerably extra costs before they can be used.

        b) Planning enquiries are structured so that opponents may be able to string them out for years, regardless of merits of their case and so paradoxically prevent any rational consideration of the real issues. There is therefore a pressing need for reform to ensure that legitimate concerns and objectives can be voiced and acted upon, without the danger of high jack by vested interests of any sort.

        c) The perceived regulatory risk introduced by the economic regulator has already been discussed but its impact on the cost of capital is particularly problematic in so highly capital intensive an industry.

25. There are a considerable number of emerging technologies which the energy market is not structured to support.

- New generating technologies are emerging which are "intrinsically safe". This means that safety systems depend passively on the physics of the reactor not actively on the human designers or operators.
- In the longer term, the production of the dreaded plutonium (which incidentally is not the most deadly substance known to man) may be avoided altogether by use of Thorium rather than a uranium based cycle. This has the further merit of tapping vast resources of Thorium.
- Also in the long term, it is technologically feasible to solve the long lived intermediate level waste problem by conversion to short lived high level waste which we will not have to store for huge periods and, incidentally, produce electricity as a by-product.

RECOMMENDATION 9

It is entirely within Government's power to create a level playing field in the energy markets so that they can fulfil their function of selecting the most cost effective technologies. Licensing and planning laws need to be overhauled and the market distortions created by the exclusion of the nuclear industry from carbon tax initiatives or emission trading proposals should cease forthwith.

RECOMMENDATION 10

Government needs to recognise, as it does in the case of renewables, that emerging technologies, such as passive safety systems, involve too great a commercial risk for the markets as currently structured and that these technologies therefore need to be supported without Government in any way attempting to select winners.

26. The United Kingdom benefited throughout the industrial revolution from its large reserves of coal. This is one of those difficult areas of competing priorities for Government. Reserves of coal remain large and could contribute enormously to security of supply concerns as an alternative to gas.

- On a day to day basis given the inter-dependence of the gas and electricity networks
- In the medium term, as a hedge against cartel or politically created shortages or price spikes
- In the longer term, as a reserve in case of unforeseen shortages.

Unfortunately, these worthy objectives are in danger of being lost because coal produces far more Carbon Dioxide per unit of electricity than gas from stations of similar thermal efficiency. Efficient, clean coal stations may be desirable in themselves, but unfortunately cannot in themselves address this problem.

27. There are, however, again emerging technologies which, as in the case of the nuclear industry and renewables, will need support before they can be tested and possibly brought to market.

- CO_2 is naturally taken up in the growth of both vegetation and animal livestock. It may be possible to stimulate this by planting species such as trees which keep carbon dioxide out of circulation for a considerable period of time, or by encouraging the growth of marine animals which subsequently leave CO_2 captured in marine deposits such as chalk.
- Natural gas which is replacing coal has remained securely in the earth for millennia. Carbon dioxide injected into such strata may facilitate gas extraction and remain stored in its place.
- Carbon dioxide will, in any case, adsorb on coal itself (as does methane). There are many coal seams which are unlikely to be exploited which could serve as carbon dioxide depositaries in this way.
- There are other stable geological strata which could also safely house carbon dioxide.
- It may even be possible to store carbon dioxide safely at great ocean depths where huge quantities of methane (a far more efficient and therefore dangerous greenhouse gas than carbon dioxide) have been quite naturally stored for millennia.

RECOMMENDATION 11

It is essential that Government energy policy recognises, as it must with both renewables and nuclear energy sources, that there are emerging technologies which the market cannot at this stage support. These technologies need support from Government if they are ever to reach the stage where they can effectively come to market. Governments themselves are extremely inefficient at picking winners and should leave the selection of those technologies which come to market to the market.

It is also important to recognise that all these technologies build on existing technologies which currently support a highly developed, professional and technologically infrastructure. That infrastructure of knowledge, skills and people cannot be allowed to wither.

RESEARCH AND DEVELOPMENT

28. Much of the previous section has dealt with the need to support the development of new and sustainable technologies. However, before technologies can reach the development stage, they require an adequate research base which simply does not exist.

29. Government energy related research and development fell from US$708 equivalent in 1985 to US$83 equivalent in real terms at 1995 prices in 1995. This fall exactly coincided with the period of privatisation and has continued apace. Private sector energy research and development is to all extents and purposes insignificant. Huge capital costs, low margins and high levels of regulator-induced risk, together with the high intrinsic costs and risks of most energy research, will ensure that it stays at this level.

RECOMMENDATION 12

Sustainable and secure energy sources will only be possible in the medium to long term if appropriate technologies are discovered and tested. Because of the long lead time involved, there is now an urgent need for a sustained and increasing Government funded research and development programme.

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