

# **PERFORMANCE AND INNOVATION UNIT ENERGY REVIEW**

## **MEMORANDUM BY PROSPECT SUPPORTED BY THE ELECTRICITY SUPPLY TRADE UNION COUNCIL**

### **EXECUTIVE SUMMARY**

#### **Introduction** (Paragraphs 1-6)

We reaffirm our support for a balanced energy policy and we welcome the Government's decision to review energy policy over a 50-year period.

#### **Energy and Environmental Policy** (Paragraphs 7-8)

Proper long-term planning is needed to manage the future fuel mix, taking account both of environmental concerns and the need to maintain security of supply.

#### **Security of Supply**

##### *Network Risks* (Paragraphs 10-13)

Gas and electricity transmission networks have become highly integrated in a wholly unplanned way. Significant failure of one system will immediately impact on the other.

The networks are now under considerable risk. This must not be ignored by government.

##### *Capacity Risks* (paragraphs 14-20)

In five years time the UK is likely to be importing oil and gas from Russia, Iran and Algeria. Worldwide the major short-term constraint will not be finite resources but the effort, investment and underlying political conditions needed to exploit the reserves.

Although the UK has a healthy margin of generating capacity at present, portentously the position is very similar to that in California five years ago, where the market is controlled by the same generating companies.

By summer 2000 fragmentation of electricity supply and market competition resulted in California suffering major problems of electricity supply and pricing. Lessons for the UK to learn from this experience include:

- There is no clear relationship between price signals and investment in capacity in a private market.
- To fulfil security of supply and social considerations, government must retain control and access over data needed to assess wholesale market pricing and supply scheduling behaviour.
- Competitive market structures may not lead to price reductions for electricity consumers.

- An effective and authoritative regulatory regime is essential.

#### ***Commercial Risks*** (Paragraphs 21-22)

The New Electricity Trading Arrangements (NETA) must be reconsidered. NETA does not give the right price signals for investment, instead rewarding marginal capacity at high prices. This takes priority both over fuel balance and environmental objectives.

#### ***Economic Risks*** (Paragraphs 23-24)

We agree with Dr Dieter Helm's assessment that there is no evidence that economic growth can be met by reducing energy demand. The only solution to the long-term problem of climate change has to be via a switch from carbon intensive fuels to carbon non-intensive ones. This requires a substantial increase in the price of carbon.

#### ***Political Risks*** (Paragraph 25)

The biggest political risk of all is for the Government to take no action now.

Both immediate action and longer-term vision are needed to ensure that the UK can continue to benefit from a range of energy sources.

Independent and effective regulation is essential and there must be central direction and leverage over investment and supply decisions.

#### ***Environmental Risks*** (Paragraphs 26-28)

The Climate Change Levy (CCL) is a tax on energy not a tax on carbon. It needs to be rethought as a matter of priority.

We support the use of flexible mechanisms agreed under the Kyoto Protocol providing that they are implemented in a controlled and equitable manner and as part of a wider package of measures.

Emissions trading is an attractive idea though there are dangers of trading "hot air", particularly between Eastern Europe and the USA. Proposals to exclude hydro and nuclear power from the EU emissions trading scheme make no sense.

#### ***Regulatory Risks*** (Paragraph 29)

The Office of Gas and Electricity Markets (OFGEM) must be strengthened and its scope extended to ensure that social and economic needs receive as much attention as commercial regulation.

#### **Research and Development** (Paragraph 30-35)

There is an urgent need for increased research and development across all energy sectors:

##### ***Coal***

There are several avenues to explore:

- Improved plant design to reduce emissions levels.
- Integration of CO<sub>2</sub> capture into pulverised fuel coal-fired steam cycles.
- CO<sub>2</sub> storage through the enhanced coal bed methane production method (ECBM).

### ***CO<sub>2</sub> Storage and Capture***

This has been identified by the DTI as an immediate priority for research, development and demonstration but is currently being led by the USA, Japan, Netherlands and Norway.

### ***CHP***

Targets, similar in magnitude to those for renewables, must be underpinned by financial support.

### ***Nuclear***

Continuing R&D is necessary to maintain and develop:

- Methods for dealing with waste;
- The UK's position in the world market for decommissioning.
- Capability for fusion research within UKAEA.

### ***Renewables***

A particular focus is needed on renewable sources that have not been tackled adequately by the private sector.

### **Renewables (Paragraphs 36-38)**

We support the current UK target of supplying 10% of electricity from renewable sources by 2010, but believe that it will be very difficult to meet on current policies.

Action is needed to establish a clear economic value for environmental benefits and to resolve planning difficulties.

There are economic benefits to be gained for the UK from developing new technologies and industries, but this is a competitive market and developmental support is needed to secure prime-mover advantage.

Promising technologies include:

- Marine wind farms
- Waste biofuels
- Coastal wave power
- Photovoltaic cells.

### **Energy Efficiency (Paragraphs 39-40)**

Considerable scope exists for improved energy conservation and for stimulating markets for energy efficiency products.

The Carbon Trust must ensure increased resources and a higher profile for work in this area.

### **Nuclear (Paragraphs 41-44)**

Unlike carbon based competitors the nuclear industry has to capture, handle and store all its waste.

It has a disproportionate level of regulatory costs, including the essential and wholly supported costs of safety regulation.

There are a number of promising emerging technologies, but the energy market is not structured to support them.

**Coal** (Paragraphs 45-47)

Reserves of coal in the UK are large and could contribute significantly to security of supply.

There is a strong case on economic and strategic grounds for investment in clean coal technologies and power stations.

## RECOMMENDATIONS

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

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

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

3. There is little point in exhorting the benefits of liberalisation and fuel competition across the EU if companies in other Member States are the only ones strong enough to secure gas supplies at reasonable prices. 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 the Government reaches a view about the likelihood of an energy shortage, higher prices, and a European rather than UK market. In our view these trends are inevitable and demand a wholly different market and regulatory response.

4. It is essential that the 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 are capable of such a large-scale contribution.

5. The need for action to combat global warming is much greater than required in commitments to the Kyoto protocol. The UK should play a full role, with the USA and developing nations as well as Europe, in achieving a more sustainable agreement.

6. Broad based tax penalties on energy consumption combined with short run price inelasticity are likely to lead to an inefficient economic response and a counter-productive political reaction. Tax penalties must be focused on areas of relative short run price elasticity, such as road congestion pricing.

7. The Government must ensure 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 market place. However, the Government should not succumb to the temptation to pick winners nor make unsupported assumptions about the scale of renewable contributions.

8. It is entirely with 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 market distortions created by the exclusion of the nuclear industry from carbon tax initiatives or emissions trading proposals must be removed.

9. Emerging technologies, whether based on renewable sources or passive safety systems in nuclear reactors, involve too great a commercial risk for the markets as currently structured. These technologies need to be supported without government in any way attempting to select winners. All such technologies depend on an infrastructure of knowledge, skills and people that must be nurtured.

10. Sustainable and secure energy sources will only be maintained in the long term if appropriate technologies are discovered, tested and developed. Due to the long lead times involved, there is now an urgent need for sustained and increasing government funded research and development.

## **INTRODUCTION**

1. This Memorandum is submitted by Prospect with the support of the Electricity Supply Trade Union Council (ESTUC). Prospect is a new trade union, formed by merger of the Institution of Professionals, Managers and Specialists (IPMS) and the Engineers' and Managers' Association (EMA). It will be formally vested on 1 November. IPMS represents 75,000 scientific, technical and specialist staff in the Civil Service and related bodies and major companies. In the energy sector, IPMS represents scientists, engineers and other professional specialist staff in the nuclear industry. Our members are engaged in operational management, research and development and the establishment and monitoring of safety standards, environmentally and in the workplace. Organisations in which IPMS members work include AEA Technology, British Nuclear Fuels, Environment Agency, HSE (Nuclear Installations Inspectorate), National Nuclear Corporation, National Radiological Protection Board, Nukem Nuclear, Amersham, Nirex, Serco Assurance and the UKAEA. IPMS members are also directly involved in a range of sectors and functions for which environmental issues are of significant professional concern. Within the Civil Service, IPMS has a wide and diverse membership across policy, research and executive functions in the Department for Environment, Food and Rural Affairs (DEFRA) and the bodies linked to it. We also have a wide-ranging membership in conservation bodies, including English Nature and the Countryside Commission, and in the Natural Environment Research Council.

2. EMA represents, Professional/Technical and Management staff throughout the electricity supply industry and a growing number of similar staff in the gas industry.

3. Both IPMS and EMA are actively involved in the work of the Trade Union Sustainable Development Advisory Committee (TUSDAC), which works in parallel to the Advisory Committee on Business and the Environment. TUSDAC is jointly chaired by the Environment Minister and General Secretary of the GMB Union on behalf of the TUC.

4. In 1994 IPMS and EMA submitted evidence to the Government's Nuclear Review<sup>1</sup> on a joint basis with other unions representing members in the nuclear industry. The Electricity Supply Trade Union Council (ESTUC), of which EMA is a leading constituent, and IPMS also submitted evidence to the 1995/6 House of Commons Trade and Industry Select Committee Inquiry into Nuclear Privatisation. We have not sought to repeat earlier evidence in this Memorandum, but we reaffirm our support for a balanced and co-ordinated energy policy. This is essential because:

- Significant elements of the delivery systems 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 suppliers and customers.
- The public is apparently even more risk averse to the disruption of energy supplies than the economic disbenefit implies and, as recent experience has shown, will respond robustly.

- There appears to be real limits to the prices that the public seems prepared to pay and the price volatility that will be tolerated.
- Energy use is probably more pervasive and less flexible than any other commodity throughout all spheres of commercial and personal activity.
- Fuel poverty is viewed as a distinct and particularly pernicious aspect of general poverty.
- Governments have long been concerned with employment levels in the energy industries.
- The Government cannot be indifferent to the implications for international competitiveness if energy costs are significantly out of line with those of other countries.

5. In important respects, however, the current context is different from that in the mid-1990s. First, notwithstanding the recent difficulties surrounding implementation of the Kyoto agreement, environmental concerns are higher on the political agenda. This raises issues both about the UK achieving its CO<sub>2</sub> emission targets specified under that agreement, but also about achieving the much larger reductions of up to 60% by 2050 identified as necessary by the Royal Commission on Environmental Pollution (RCEP). Second, maintaining security of supply has become a much sharper concern especially, but not exclusively, in the light of recent experience in California.

6. We therefore welcome the Government's decision to review energy policy. The 50 year time horizon of the PIU review is a sensible one in energy policy terms, though it must be recognised that immediate action is necessary to meet medium and long term policy objectives. In contrast to the pattern of spasmodic, short term intervention in recent years, it would be sensible to progressively roll this review period forward in order to ensure planning consistency and effective future implementation of policy objectives.

## **ENERGY AND ENVIRONMENTAL POLICY**

7. We believe that a balanced energy policy should be developed on a level playing field. All energy processes should be held accountable for their environmental and socio-economic impact. Risks should be fully identified and the practicability of the necessary risk management taken into account. However, this is not the experience in the UK which in recent years has conspicuously lacked a coherent, long-term energy policy. Coal fired power stations have been closed in preference for the quicker returns offered by gas, apparently without regard for the consequences for long-term security of supply, and the reality is that there is no real industrial commitment to the continued existence of the coal industry. Insufficient support has been given to development of renewable energy sources, which, although unlikely to make a major contribution to total energy needs over the next twenty years, have an important role to play in ensuring balance and diversity. The lead times for research, development and implementation of alternative energy production are such that action is needed immediately in pursuit of those plans. The reality is that any further investment in building nuclear power stations is, even on optimistic assumptions, unlikely to come to fruition by 2010. Yet most of the scenarios posed by the RCEP involve a nuclear element and the one most clearly founded on proven current technology rests to a very large degree on nuclear energy. This is in stark contrast to the short-term and "cheapest is best" mentality that has driven the UK to its current position. Proper long term planning is needed to manage the future fuel mix.

8. We believe there are four areas in which Government energy policies can have significant beneficial impact in terms of sustainability:

- Demand reduction
- Renewable energy development
- Nuclear generation
- CO<sub>2</sub> sequestration in conjunction with clean coal generation.

Each of these areas is addressed briefly in this Memorandum following consideration of the key issues of security of supply and the underpinning role of research and development. A more detailed analysis of the contribution of nuclear energy is contained in a separate submission from the relevant trade unions.

### **SECURITY OF SUPPLY**

9. There are both international and domestic dimensions to this issue.

#### **Network Risks**

10. Gas and electricity transmission and distribution networks are regulated monopoly businesses. They are freestanding networks that 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 suppliers 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.

11. Most supply disruption stems from some form of network failure, yet the risk of such failure has always been the Cinderella of security of supply concerns because:

- Network design and maintenance was regarded in the nationalised industries as low status compared with generation and / or extraction.
- Interruption can be fairly reasonably be blamed on “acts of God”.
- There has been no high profile competition or debate about allocation as there has been between alternative fuels and fuel sources.

12. Consequently, these fundamental networks have become increasingly vulnerable:

- The network interdependencies are poorly understood.
- 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 restore the network in the South East following the storms of 1987.
- Global warming increases the probability of severe weather patterns.
- Companies have chosen different mixes of investment and maintenance. These may have similar commercial consequences but very different risk profiles. For instance high investment, low maintenance systems (with lower staffing levels) may create a less

vulnerable system but one which can be less readily restored when it does collapse. We simply don't know.

- We understand that gas storage capacity is similarly based on a margin above average winter demand, which has been falling per capita due to warmer winters. The underlying assumption that this trend will continue is wholly unsupported.

13. We have consistently made the case that regulatory reviews should start with a competent system of risk assessment. Our members are now adamant that the networks are under considerable risks that must not be ignored by government.

### **Capacity Risks**

14. 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. This is best understood not simply as a reaction to a deregulated market, but to a market highly distorted by partial deregulation:

- 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. This helped coal in the short-run, whilst over-incentivising investment in its new competitor.
- The “pool” ensured both specific capacity payments and an ability to ensure production at a price 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.

15. On a global scale however, there is a real danger that fuel supplies will become increasingly insecure. On most projections of present policies, the world will become increasingly dependent on oil and gas supplies from a limited number of producers. By 2006, the UK is likely to be importing up to 15% of gas compared with 2% currently, and by 2006/7, the UK is also likely to be a net importer of oil. These imports will be from Russia, Iran and Algeria - hardly the most reliable of trade partners. The issue is not so much one of finite resource, at least in the short term: For example the International Energy Agency estimates that natural gas reserves are more than sufficient to meet a projected 86% rise in demand up to 2020. The real challenge is the effort, investment and underlying political conditions needed to exploit the reserves. 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 will therefore increase exponentially.

16. Portentously the position in the UK is very similar to the position in California five years ago, where the market is controlled by the same generating companies. In California the shares of coal, nuclear and other renewables in electricity generation declined during the 1990s, whilst the shares of gas, hydropower and petroleum rose. Over the same period, employment at investor-owned utilities, which have traditionally produced and sold most of the electricity in the USA, fell by one-third - a reduction of nearly 180,000 employees. In

1996 California passed landmark legislation to restructure its electric power industries and give consumers the right to choose the supplier of their electricity. This resulted in fragmentation of an integrated electricity system, previously dominated by state-regulated utilities into isolated components, and opened electricity generation to market competition.

17. By summer 2000, these policies had resulted in major problems in electricity supply and pricing. Crisis point was reached in June due to a combination of hot weather, voltage instability relating to gaming the previous day, import limitations and power plants out of service. Prices were driven up dramatically: During one week purchasers of California power spent \$1.2 billion on electricity, 300% more than they had paid during the same period in 1999 and 1/8<sup>th</sup> of their cost of power for all of 1999. Even so, there were inadequate supplies of power and over 100,000 customers in the Bay Area of San Diego suffered electricity cuts. The State of California had no influence on this decision.

18. Key points to learn from the Californian experience include:

- There is no clear relationship between price signals and investment in capacity in a private market. Californian energy prices are expected to remain high due to market structure and the tight supply of electricity. However, there is no obligation on the generators to fund new investment in electricity supply or delivery reliability. As private operators, they can take advantage of higher retail prices to increase profit margins.
- The State of California lost control and access over data needed to assess wholesale market pricing and supply scheduling behaviour. Thus it is heavily dependent on electricity suppliers that behave according to market signals not security of supply or social considerations.
- Competitive market structures have not reduced prices for electricity consumers. Californians pay substantially more on average for electricity than customers in other States that have not shifted to competitive market structures.
- The regulatory system is not working effectively. State authority has been ceded to the federal government and the bodies with a supervisory remit have no duty to protect the public or to consider the retail consumer. In addition, there are serious conflicts of interest because some members of the supervisory boards are in positions to benefit either individually or at corporate level from higher prices in electricity markets.

19. However, it is noteworthy that some of our European partners are taking the threat to gas security far more seriously than the UK:

- In Germany, Italy and Spain, liberalisation is being accompanied by State-factored concentration rather than regulator-factored fragmentation.
- Companies in these countries, together with EdF in France, are large enough to counter to some extent attempts at supplier cartelisation.
- EdF is clearly keen in this context to influence the North African gas market and there are close links between Germany and GazProm.

20. 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. The other is the continued existence of a hedge against abuse provided by alternative fuels. Unfortunately, for differing reasons no other fuel source is capable of competing economically for new investment against gas in the present electricity generation market.

### **Commercial Risks**

21. The New Electricity Trading Arrangements (NETA) need to be reconsidered. These do not give the right price signals for investment, instead rewarding marginal capacity at high prices. This takes priority both over fuel balance and environmental objectives. For example, there is evidence that Combined Heat and Power projects are losing out under NETA to larger generators with more flexible plant that can easily be turned on or off. More profit needs to be reinvested into research and development in order to improve efficiency and protect the environment, and alternative energy provision systems should not be neglected simply because they cannot compete for the fuel price. The current OFGEM review must address this issue.

22. Some renewable sources are near to achieving economic competitiveness, and the adoption by some regional electricity companies to introduce “green” tariffs should assist in this regard. Even so business commitment to renewable sources will hinge on economic factors and this may mean that in the short term a financial incentive is required.

### **Economic Risks**

23. We strongly agree with Dr Dieter Helm, in his contribution to British Energy's recent seminar on "The Consequences of UK Energy Policy" that:

*"There is, of course, no evidence that economic growth, can be met by reducing energy demand. We can move from inefficient use of energy to efficient use of energy but energy demand will march ever upwards. The only solution to the long-term problem of climate change has to be via a switch from carbon intensive fuels to carbon non-intensive ones. There has to be a substantial increase in the price of carbon if you're going to get a supply side shift".*

24. Energy projections for the UK in the DTI's Energy Paper 68 forecast an 8% increase in overall final energy demand for the industrial sector by 2020 and an increase of up to 39% for transport.

### **Political Risks**

25. Developing energy policy, particularly after a prolonged period in which a clear policy framework has been conspicuously lacking, requires both political sensitivity and a balanced practical approach. All energy sources have vocal protagonists but there is no perfect or risk-free solution. In reality, what is required from government is both immediate action and long-term vision to ensure that the UK can continue to benefit from a range of energy sources. The Californian experience shows that leaving supply decisions to private sector market disciplines is not the way forward. This is not to argue that all energy industries should be publicly owned, but they must be subject to independent and effective regulation and there must be central direction and leverage over investment and supply decisions. The biggest political risk of all is for the Government to take no action now: The certain consequence of failure to take this opportunity to plan ahead is that it will be forced into crisis management in a few years time.

### **Environmental Risks**

26. To capture environmental externalities effectively, it is essential to build the costs of carbon pollution back into the system. We support an approach to reducing business energy use that combined regulation with use of voluntary agreements and economic instruments. The problem with the Climate Change Levy that emerged from Lord Marshall's consultation on "Economic Instruments and the Business Use of Energy" is that it is a tax on energy, not a tax on carbon. This needs to be rethought as a matter of priority.

27. We also support the use of flexible mechanisms agreed under the Kyoto Protocol provided that they are implemented in a controlled and equitable manner and as part of a wider package of measures. The Clean Development Mechanism has much to offer in terms of encouraging good practice through technology transfer. To give just one example, just before privatisation British Coal had developed clean burn technology to the point of commercial exploitation. As countries like China depend to a significant degree on coal for energy generation the UK could use its technology to assist China in reducing greenhouse gases. The UK needs to increase its share of the worldwide market for environmental technologies.

28. Emissions trading is an attractive idea and may be an effective way of focusing the minds of plant managers. However, it has parallels with the CAP milk quota scheme, which is by no means ideal, so practical difficulties may arise. From the UK perspective, one of the biggest dangers is that trading in "hot air", in particular between Eastern Europe and the USA, will allow climate change targets to be met without substantively addressing the issue of domestic emissions. This could have adverse competitive consequences for UK traded goods. Proposals to exclude hydro and nuclear power from the EU emissions trading scheme make no sense.

### **Regulatory Risks**

29. The dangers of ineffective energy regulation have been illustrated in relation to the Californian experience. There are no grounds for complacency in the UK, which has followed the same path of privatisation and fragmentation. The powers of OFGEM must be strengthened and its scope extended to ensure that social and economic needs receive as much attention as commercial regulation.

### **RESEARCH AND DEVELOPMENT**

30. There is an urgent need for increased research and development across all energy sectors. For example:

#### ***Coal***

31. At present fugitive methane emissions from burning fossil fuel can only be reduced by increasing the efficiency of the "burn" or by "scrubbing out" the methane for disposal. Modern plants are more efficient and have lower emission levels than older plants and more research and development into plant design could yield further reductions in emission levels. CO<sub>2</sub> capture could be integrated into pulverised fuel coal-fired steam cycles. The enhanced coal bed methane production (ECBM) method being tested in the Netherlands and the San

Juan basin in New Mexico could lead to CO<sub>2</sub> storage, by absorbing CO<sub>2</sub> in deep coal layers that are not suitable for mining, as well as production of methane. In Australia there is a GEODISC programme to assess the feasibility of geological sequestration. The First US National Conference on Carbon Sequestration, in May 2001, considered several papers on amine absorption. This is a commercially available technique for CO<sub>2</sub> post-combustion capture, which can be applied to both to gas and coal fired power stations. It is analogous to flue gas desulphurisation, which is used widely on oil and coal fired power stations to reduce emissions of SO<sub>2</sub>. It is notable that the UK is not leading progress in this area despite, for example, the world-class coal research facilities that existed prior to privatisation of the electricity supply industry, which was swiftly followed by stark cuts in funding for research and development.

### *CO<sub>2</sub> Storage and Capture*

32. The Department for Trade and Industry (DTI) has identified CO<sub>2</sub> storage and capture as an immediate priority for research, development and demonstration. We are aware of useful work in progress in the USA, Japan and some parts of Europe. For example:

- The Japanese Central Research Institute of the Electric Power Industry and the Electric Power Development Company both have substantial R&D programmes, and the Research Institute of Innovative Technology has an annual budget of around 7 billion Yen and 430 employees.
- The US Department of Energy has a growing budget for research on carbon sequestration and eight national laboratories have been selected to head research efforts, managed by the National Energy Technology Laboratory.
- The Norwegian Klimatek programme supports development of novel technologies for reducing emissions from fossil fuels and an annual programme of NK 100 million has recently been announced.
- Canada has recently established an International CO<sub>2</sub> Capture Test Centre at the University of Regina in Saskatchewan. A National CO<sub>2</sub> Capture and Storage Initiative, involving the federal and provincial governments, industry and research organisations, was established in 1999 and two workshops were held to identify capture and storage options for Canada. In 2000 Canadian coal producers, utilities and Federal governments formed a consortium with similar American stakeholders to develop a novel coal to electricity power process with no atmospheric emissions.
- There are a number of leading research groups in capture and storage in the Netherlands and major engineering consultancies have also been working on these technologies for some years. As mentioned above, there is a national programme on CO<sub>2</sub> ECBM, which includes preparation of an inventory of coalbeds and measurement of gas sorption capacities of coals.

The Natural Environment Research Council is involved in a number of European and international programmes on CO<sub>2</sub> capture and sequestration, mainly funded by the European Union.

### ***CHP***

33. Combined Heat and Power (CHP) plants have a large potential but this will only be realised by investment programmes that will not yield short-term profits. It is worthwhile setting targets, which should probably be similar in magnitude to those for renewables, but these must be underpinned by financial support and recognition that returns will accrue over a longer period. We hope that the current review of CHP will result in an appropriate level of support.

### ***Nuclear***

34. Leaving aside the potential demands of new build, continuing R&D is needed to maintain the UK's position in the world market for decommissioning and clean up. This is not being maintained at present, not least because of skill shortages in a sector often no longer perceived as an attractive career prospect. New R&D is needed to specify and, if necessary, develop the next generation of nuclear power plants. Nuclear fusion poses distinct challenges for research. We strongly believe that this capability must be maintained intact within the UKAEA.

### ***Renewables***

35. There is certainly a need for increased research and development in this area, particularly on renewable sources that have not been tackled adequately by the private sector. For example, production of hydrogen from fossil fuels with CO<sub>2</sub> storage could be an attractive transitional strategy to aid the introduction of hydrogen as an energy carrier. In the longer term, a hydrogen economy offers the potential for zero emissions at the point of use. However, if hydrogen is to make a significant contribution as a fuel then large-scale generation of hydrogen in addition to significant infrastructure development will be required. The use of hydrogen will only deliver the maximum potential environmental benefits if it is generated using non-fossil fuel sources of energy.

### **RENEWABLES**

36. The European Commission's Green Paper on "Security of Energy Supply" recognises that alternative and renewable energy sources have an important contribution to make to achieving environmental objectives. However, although we support it, the current UK target of supplying 10% of electricity from renewable sources by 2010 is very challenging on current policies. We note the concerns expressed by the Chair of the Sustainable Development Commission that steps so far taken to develop renewable energy sources in Britain will miss, by a substantial margin, the targets for reducing greenhouse gas emissions. Even with consistent support, the lead-time for large-scale renewable technologies, such as tidal schemes and wave power, is probably at least ten years.

37. Supporting renewables is unlikely to be the lowest cost way of saving carbon so, in terms of promoting use of renewable sources, it will be important to establish a clear economic value for environmental benefits and to resolve some of the planning difficulties that currently exist. Consideration should be given to a new consensual planning-led approach involving all stakeholder groups, either at regional or sub-regional level, in identifying renewable energy opportunities. Such planning groups could be charged with contributing to the government's target for renewables, taking account of all appropriate

opportunities and constraints. Investment needs to be assessed both against the positive contribution to achievement of the climate change targets adopted by the Government and a wider range of sustainability principles. There should be benefits in further developing relatively new technologies and stimulating new British industries, though this is a competitive market. For example, wind farm technology has been primarily developed by Denmark, with the result that the Danish firms now control more than half a global market worth £2.5 billion. Unless support is quickly secured, there may well be a similar loss of tidal power technology to overseas competitors.

38. As far as specific renewable sources are concerned:

- Further expansion of large-scale hydro generation is limited by the availability of suitable sites and also by environmental concerns about the flooding of valleys in mountainous areas and the effect on the environment in the lower course of the dammed rivers. Small-scale hydro generation can be of local importance but can only make a small contribution to meeting total energy demand.
- Wind farms have led to complaints about noise and unsightliness and wind generation also suffers from the problem of low energy density; even a sizeable wind farm would have a generation capacity of only a few tens of megawatts. At present most planning applications for wind energy schemes are not receiving approval, but the process of application itself often results in much tension amongst the communities affected by the proposals.
- However, marine windfarms could be encouraged. The Irish Sea has the potential to replace the equivalent of all the present UK generating capacity. The Germans and the Swedes are pushing ahead. We will eventually have to buy their technology, or even their power from our seas, if the government does not allow UK developments to go ahead.
- The generation of energy from waste biofuels may merit further expansion. However, this will require investment in waste incinerators with high standards of emission control and in facilities to collect the decomposition gases from landfill sites and sewage installations.
- There is potential for electricity generation from tidal barrages and wave energy, though barrages are very expensive. Harnessing coastal wave power may be a more promising route though, as shown by the sinking of the Osprey off the north of Scotland, the technology is demanding and equipment will need to be very robust. An additional consideration is the level of risk associated with installation and maintenance work at sea.
- Further possible technologies include the use of photovoltaic cells to produce energy from sunlight or fuel cells to produce electricity from chemical reactions. The prospect of being able to produce cheaper and more highly efficient solar cells is quite high. Households could be encouraged to make use of solar cells for at least part of their energy requirements at suitable times of the year.

## **ENERGY EFFICIENCY**

39. There is, in addition, still much scope in the UK for energy conservation and combined heat and power schemes. For example, work by the Building Research Establishment (BRE) shows that non-industrial buildings can account for as much as 50% of national energy consumption but that significant energy savings could be achieved by taking relatively cheap and simple measures. Similarly the EU Green Paper on Security of Supply notes that

more could be done to stimulate markets for energy efficient products. The Carbon Trust must ensure both increased resources and a higher profile for work in this area.

40. It is also important for government to continue to support and encourage reduction in demand for energy, though there are limitations as to what may be achieved in practice:

- Energy demand is price inelastic in the short term, but in the long run high prices stimulate technological responses.
- Reductions in demand through the introduction of building and energy consumption standards can be slow to take effect due to the varying timescales of investment.
- Reductions in demand tend to mimic price falls and can lead to a “rebound” effect in which energy savings are spent on other products. For example, 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 1.5 litres.

## **NUCLEAR**

41. The nuclear industry currently generates one third of UK electricity, without CO<sub>2</sub> emissions. The earlier Magnox stations have plant closure dates that can now only come forward. The AGR stations are less likely to enjoy significant design life extension, and will therefore start to close shortly thereafter. This alone will negate any the Kyoto improvements made by the UK to date.

42. There are a number of “level playing field” issues that currently disadvantage the nuclear industry:

- Unlike its carbon-based competitors, the industry has to capture, handle and store all its waste. It is totally inappropriate therefore, that attempts to “internalise” the carbon-based “externalities using taxation and emissions trading should exclude the only large non-CO<sub>2</sub> producing technology currently available. This means that the industry will pay for part of the CO<sub>2</sub> waste management costs as well as its own.
- The industry has a highly disproportionate level of regulatory costs, including the essential and wholly supported costs of safety regulation:
  - National licensing systems mean that good and properly licensed designs have to be re-licensed at considerable extra cost before they can be re-used.
  - Planning inquiries are structured so that opponents can string them out for years, regardless of the merits of their case, sometimes inhibiting rational consideration of key issues.
  - The impact of economic regulation on the price of capital is particularly problematic in so highly capital intensive an industry.

43. There are a number of emerging technologies that the energy market is not structured to support:

- New generating technologies are emerging that 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 use of thorium may replace a uranium-based cycle.
- Also in the longer term, it is technologically feasible to convert long-lived intermediate level waste to short-lived high-level waste thus avoiding the need for very long-term storage.

44. A more detailed analysis of the contribution of nuclear energy is contained in the submission from Prospect supported by Trade Unions for Safe Nuclear Energy.

## **COAL**

45. Reserves of coal in the UK are large and could contribute significantly to security of supply:

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

46. Loads in coal-fired power stations can be varied relatively easily, so coal fired generation is particularly useful in meeting peak demand or covering for supply difficulties in other fuels. This may become even more important as the share of renewables in electricity generation increases. Coal fired stations are also currently more resilient and easily repairable than higher precision CCGT stations.

47. The downside of reliance on coal is that emissions of CO<sub>2</sub> are higher per unit of electricity than from burning gas in stations of similar thermal efficiency. Increased investment in clean coal technologies and power stations should help to resolve this problem, and it is disappointing that there has as yet been no positive signal from the Government in this regard. As indicated in paragraph 32, increased Government support for emerging CO<sub>2</sub> sequestration technologies is also needed.

Submitted by \_\_\_\_\_

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### **Note:**

1. "Joint Trade Unions Submission to the Government's Nuclear Review" (1994)