THE ROYAL SOCIETY

Royal Society Response to PIU Energy Project scoping note

This response has been prepared by Sir Eric Ash FRS, Chairman of the Royal Society's Energy Policy Advisory Group, in consultation with other members of the group (please see below for membership).

We highlight the following points:

- European and international policy drivers must be addressed, as well as strictly UK considerations.
- The correct economic instruments are the key to a sustainable energy policy and we believe that there is a strong case for a carbon tax.
- We are concerned that the closure of the Magnox nuclear power stations over the next decade will lead to a rise in CO2 emissions. We therefore welcome the debate on the future role of nuclear energy in the UK.
- We recommend that adequate funding is allocated for research and development of energy technologies and that collaboration with other countries is increased, for example by creating an international fund for energy research and development.

The nature of the PIU study

We have some concerns about the speed at which this review is being undertaken. Imposing such a short timescale on a study of this complexity could be counter-productive. The scoping paper asks whether this should be a report 'of the Government' or 'to the Government'. We would urge that PIU opt for the latter. The former will be heavily constrained by immediate political issues. The latter cannot be wholly free from such considerations but can present the possibilities with fewer constraints. In addition, the short timescale makes a report to government even more appropriate.

Climate change

The main focus of our recent work has been the role of energy policy in reducing emissions of greenhouse gases. The recent report from the Intergovernmental Panel on Climate Change suggests that global surface temperatures could rise by up to 5.8^{o}C by 2100 and finds increasing evidence for a human influence on global climate. There will always be some uncertainty surrounding the prediction of changes in such a complex system as the world's climate. However we would agree with the statement posed by Gordon MacKerron in his paper for the PIU stakeholder workshop that climate change science is unlikely to reverse itself and that the case for internationally co-ordinated action on emission reductions will become stronger. The ratification of the Kyoto Protocol will be a small but essential first step towards stabilising atmospheric concentrations of greenhouse gases, but much more substantial reductions will certainly be necessary by the middle of the century. We must consider exploiting all possible approaches, including using less energy, using technologies based on renewable sources, finding ways to prevent CO_2 from reaching the atmosphere and the nuclear option. It is not appropriate to dismiss an energy source on the grounds that it could supply 'only' a small percentage of the need.

The European and International dimension

It is crucial that a strategic assessment of UK energy policy accommodates international policy drivers, particularly in the context of a move towards a European energy market. The original scoping note barely deals with this aspect. The European Commission is currently considering in its Green paper the question of security of energy supply and how this might affect policies for emission reduction. It is expected that it will use the results of its consultation to propose new energy related legislation. We hope that the results

of the UK study will be brought to the attention of the EC. The post-Kyoto challenge is enormous and international influences are likely to be at least as compelling as strictly UK considerations.

Employing the correct economic instrument

The introduction of the correct economic instruments is the single most important factor in achieving reductions in greenhouse gas emissions from the energy sector. There is widespread concern that the economic instruments that are currently proposed in the UK will prevent the renewables industry from developing at the rate necessary to reach even the Government's 10% target[1]. Under the proposed Renewables Obligation (now at the statutory consultation stage), electricity suppliers will have to supply a proportion of their electricity from renewable sources or purchase the equivalent number of 'green certificates' from others who have supplied power from renewable sources. However, suppliers who are unable or do not wish to provide the required proportion of electricity from renewables can 'buy-out' their obligation – essentially pay a fine. The level of this buy-out price is critical, as it will set the maximum market price for renewables at the pool price plus the buy-out price. The latest consultation from the DTI suggests that the buy-out price will be set at 3 pence per kilowatt hour (p/kWh). This is too low to encourage the more expensive technologies such as offshore wind that will almost certainly be necessary to meet the UK's 10% target. In contrast, the non-fossil fuel obligation (NFFO) previously employed in the UK operated a banded pricing scheme to reflect the different costs of the various technologies. NFFO also provided contracts of up to 15 years, a factor that offered a level of security to potential investors. In this respect therefore recent government reforms appear to have reduced the incentive for embarking on the more expensive technologies. The situation for the renewable industry in the UK is further complicated by the New Electricity Trading Arrangements. It would appear to discourage some renewable energy schemes (wind tide, solar) as a consequence of their variability of supply and thus their inability to guarantee to supply a contracted amount of electricity within the specified period.

The primary aim of any economic measures should be the reduction of greenhouse gas emissions. The most direct economic approach is to introduce a cost for such emissions, namely a tax on the quantity of carbon emitted – a fiscally neutral upstream carbon tax on primary fuels. It is the approach that has been recommended by almost every group that has studied these issues including the Royal Commission on Environmental Pollution. The level of carbon tax needed to encourage a number of renewable technologies is not enormous. We are of course conscious of the fact that the impact of a tax can never be confined to its "target". Nevertheless we believe that the case for the carbon tax is so strong that government should seek to counter undesirable consequences of introducing such a tax in other ways. As one example, an up-stream carbon tax would increase domestic fuel costs. Fuel poverty would then have to be addressed by other means – as indeed, to some extent, it is already. The key problem with economic instruments – and the carbon tax is no exception – is that it is exceedingly difficult to implement in a single country. We have seen how differences in the price of diesel between ourselves and France can cause enormous social stresses. We regard convergence to international agreements on economic instruments designed to reduce carbon emission as absolutely essential.

Setting targets

We have been concerned about the use of percentage targets to achieve the UK's Kyoto targets. For example, the reduction of CO_2 emitted by generating a percentage of electricity from renewable sources will depend on the total demand for electricity and on the origin of the electricity. So, a requirement for 10% electricity from renewable sources in a scenario of increasing electricity supply would leave 90% of the increase being supplied from other sources and thus the potential for an increase in emissions to the environment. In the UK, at least, electricity demand is still rising. Similarly, a reduction in the electricity supplied from non-CO_2 emitting sources, such as nuclear power, and its replacement with electricity supplied from renewable sources would result in no net change in emissions. With respect to reducing concentrations of CO_2 in the atmosphere, the policy should always focus on the actual mass of CO_2 emitted.

Fossil fuels

The PIU scoping note mentions the world becoming increasingly dependent on oil and gas supplies from a limited number of producers. With the UK increasingly importing gas from Europe. Russia is already supplying some 20% of the EU gas consumption. There is also the growing EU and USA dependence on Middle East sources for oil. Geological assessments suggest that with oil discoveries at about 7 billion barrels / year on a falling trend and consumption at 23 billion barrels / 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 and also, with gas - oil price indexation, gas price stability.

The output of North Sea gas fields is now starting to decline and is expected to drop sharply over the next decade. The present import capacity of the Bacton – Zeebrugge pipeline with the new compressors in Zeebrugge is of the order of only 20 % of present UK demand. According to the PIU scoping note the UK is expected to be importing up to 15% of its gas by 2006 compared with 2% currently and, from previous analysis and reports to the DTI, the import requirement will be between 55% and 90% by 2020. Several new pipelines will therefore need to be constructed to connect the UK to the main European gas grid in order to maintain supplies even at present levels. Perhaps five or six more of the same capacity as the existing interconnector will be needed eventually, a not inconsiderable undertaking. The Government should address the problem of ensuring sufficient investment is made to provide reliable supplies in the event of plant or pipeline outages. The question has to be put as to whether it is wise to allow so much of the UK primary fuel supply, which will include much of the energy used in the electrical supply industry, to depend on such an arrangement.

Given the resources of fossil fuels available and the need to reduce CO_2 reaching the atmosphere, the potential for carbon sequestration should be seriously explored. Statoil is already undertaking carbon sequestration on a large scale off the coast of Norway where the Norwegian carbon tax makes it economically viable to pump the gas into deep submarine saline aquifers. We have previously highlighted the need for further research and development to establish the feasibility, cost and safety for such mechanisms of reducing atmospheric CO_2[2].

Renewable energy

Renewable energy sources have the advantage of either not emitting greenhouse gases or being essentially greenhouse gas neutral. In our recent report on the role of land carbon sinks in mitigating global climate change[3] we highlighted the role that biomass crops such as perennial grasses (e.g. Miscanthus) or short rotation coppice of willow can play both in providing long-term savings of GHG emissions through their replacement of fossil fuels and in contributing to the finite increase of the soil carbon sink. In addition, renewable energy can have a role in increasing security of supply and can provide an important contribution to sustainable development as reserves of fossil fuels decrease. As mentioned above, our recent report on renewable energy[1] concluded that the introduction of the correct economic instruments is the single most important factor controlling the sustainable growth of renewable technology, but there are other barriers to implementation. Wind generation is probably the most promising of the renewables in the immediate future but planning regulations are a major barrier to new wind energy generators. Initiatives that promote a better understanding of all the issues pertaining to renewable energy generation among the wider community may improve this. The sheer scale of build required, even to meet the government's 10% target, will place a significant strain on the engineering and manufacturing industry and should not be underestimated.

A modern electrical power system cannot operate with more than a limited amount of randomly intermittent power from wind, wave or solar. Since there is not, as yet, a mature technology for storing electricity, there is a clear need for energy buffers. According to the International Energy Agency, this becomes necessary as the contributions of these sources approaches 12% of power supplied. At a 20% level a buffer is absolutely necessary. This is a power constraint not an energy constraint, so would have

particular effect under light electrical system load conditions. There is, therefore, a technical limit, which may not be appreciated, to the development of renewable energy supplies if their output is geared solely to direct connection to the electricity supply system. 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 could 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. Given that the review covers 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.

Nuclear energy

Nuclear power accounts for approximately 23% of the total electricity consumed in the UK. This figure will fall with the closure of the Magnox stations over the next decade. To prevent an associated rise in CO_2 emissions this capacity must be replaced by other non-emitting sources, or electricity demand must be reduced. In the UK, at least, electricity demand is still rising and it is improbable that the renewables industry is developing to the extent that it can replace this carbon-free source of power. We therefore welcome this debate on the future role of nuclear energy in the UK. Given the long lead-in time for new build, any decision to build new nuclear power plants in UK must be taken in the very near future. There is the opportunity to build such stations on sites where existing Magnox stations have been or are in the process of being decommissioned. To win public confidence for new build the government must express confidence in the ability of the industry to erect safe installations and to deal with the waste problem.

We recognise the important issue of the long-term management of nuclear waste has to be addressed. The key need is to identify a safe system for waste disposal –one which, with careful, detailed and transparent explanation will be acceptable to the public. A key conclusion reached by the 1999 House of Lords Select Committee enquiry on 'The management of nuclear waste' is that 'phased disposal in deep repository is feasible and desirable' [4]. Evidence submitted to that enquiry recognised the need for developing the relevant sciences, at a fundamental level, including the understanding of fracturing and fluid flow at depth, before carrying out detailed assessments of deep repository sites. The government should commit itself to finding an acceptable deep depository storage site as soon as possible.

Research and Development

There is a need for sufficient levels of funding of research and development to ensure sustained growth of energy technologies, particularly those associated with renewable energy and carbon sequestration. The correct balance will depend on the technology in question. Wind turbines, for example, no longer require core research funding but do require investment in development to reduce manufacturing, production and installation costs. They also need funding for demonstrators for large off-shore installations.

Much of the necessary research and development must be done in collaboration with other countries. It is not feasible for the UK to work in isolation in areas such as the development of designs of new nuclear power stations or large-scale carbon sequestration. We have previously advocated the establishment of an international body funded by contributions from individual nations[2,5]. We do not envisage the establishment of a new research institution, rather an international fund for energy research and development where industry and academia could obtain funding to carry out a co-ordinated research programme.

Public concern and acceptance

Utilisation of technology and sometimes research itself is, quite rightly, dependent on public acceptance. It is clearly best to debate new technologies and establish their acceptability before there is substantial investment, or delay in seeking alternative solutions. This is particularly true for the nuclear industry but also extends to other areas of the energy debate such as onshore wind turbines and large-scale terrestrial sequestration of carbon dioxide.

References

[1] Royal Society and The Royal Academy of Engineering (2000) *The role of the Renewables Directive in meeting Kyoto targets*. Document 11/00. Available from the Royal Society and http://www.royalsoc.ac.uk/templates/statements/StatementDetails.cfm?statementid=124

[2] Royal Society and The Royal Academy of Engineering (1999) *Nuclear energy – the future climate*. Available from the Royal Society and http://www.royalsoc.ac.uk/templates/statements/StatementDetails.cfm?statementid=146

[3] Royal Society (2001) *The role of land carbon sinks in mitigating global climate change*. Available from the Royal Society and http://www.royalsoc.ac.uk/templates/statements/StatementDetails.cfm?statementid=150

[4] *Management of nuclear waste* (Select Committee of Science and Technology, House of Lords, 10 March 1999)

[5] *The science of climate change*. Joint statement by 16 of the world's scientific academies (2001) Available from the Royal Society and http://www.royalsoc.ac.uk/templates/statements/StatementDetails.cfm?statementid=138

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