

**The Royal Society of Edinburgh**  
**Inquiry into Energy Issues for Scotland**  
*British Energy Submission*

**(I) Background information about British Energy**

- a) British Energy welcomes the opportunity to contribute to the Royal Society of Edinburgh Inquiry into Energy Issues for Scotland. We believe this is timely initiative and hope the deliberations of this body, and the subsequent debate stimulated, will help inform on the major challenges facing Scotland over the next few decades.
- b) British Energy is the operator of two nuclear power stations in Scotland (Hunterston B and Torness), which together account for about half of Scotland's electricity demand; this quantity of electricity is sufficient to meet the electricity needs of over a million homes.
- c) The electricity generated by these two stations does not only contribute to the nation's security-of-supply, it is also emissions free, making a major contribution to air pollution targets in general and climate change in particular.
- d) The Company employs around 1,200 permanent staff in Scotland, a figure that is nearly doubled when contractors and suppliers are taken into account, making a major financial contribution to local communities in which we operate.
- e) Lewis Wind Power, a joint venture between British Energy Renewables and Amec, is seeking to develop a major wind farm on the Isle of Lewis. If planning permission is given, this project would play a vital role in establishing the Western Isles as Europe's leading centre for renewable energy and make a major contribution to the UK's renewable energy targets (project equivalent to ~5% of the UK target, ~35% of Scotland target). It would also provide significant socio-economic benefits to the Western Isles. The Company is also developing a second wind project at Knowehead in Perth and Kinross.

**(II) Response to Questions**

**General**

**1. How should Scotland provide for its energy needs over the next 5, 15, 30, 45 years, in the context of the likely UK, European and global energy environment?**

- a) A critical factor to take into account when considering how future energy needs can be met is the 'inertia' in the existing systems. Scotland's energy systems involve extensive supply and distribution networks that have been developed over long periods of time, involving major investment. Society has come to rely on these systems and the way in which they deliver energy and it makes sense to continue using these assets for as long as possible. Any major change would not only considerable new investment but also changes to the way energy is used. These changes would also require major penetration of emerging technologies, most probably requiring significant political intervention. The capacity and speed with which this could be achieved should not be overestimated.

- b) It is clear that Scotland's future energy needs will need to be met against a background of growing environmental concern. The Scottish Executive has, and will continue to implement policies to protect the environment (such as the Renewables Obligation, energy efficiency measures, the EU Emissions Trading Scheme, all aimed at cutting CO<sub>2</sub> emissions). It is therefore important that Scotland adopts its own emissions reduction targets, within the UK Kyoto target, in order to determine the success of the measures being adopted, and to identify the need for any further measures. In particular, it should adopt a CO<sub>2</sub> emissions reduction target to determine Scotland's progress towards making an equitable contribution to tackling climate change.

### **Short term (0-15)**

- c) In the short term Scotland is likely to be able to meet its electricity needs, primarily because the current plant delivers more than is required. The key concerns are that Hunterston B is due to close in 2011 while Cockenzie and Longannet, having both currently opted out of the Large Combustion Plant Directive (LCPD), may have limited operation post 2008 (although this would change if they opted back in); in any event these stations may also close by 2015. Closure of any of these stations would likely offset the current export of electricity to the South.
- d) Closure of large thermal plant will reduce capacity margins in the absence of equivalent new build, therefore there would be a potential reliance on the rest of the UK to satisfy demand in peak periods or during periods of significantly reduced supply. This is a major change for Scotland i.e. a move from being a significant net exporter of electricity to a major net importer with all the ramifications this brings.
- e) Scotland's 40% renewables target by 2020 is a major challenge based on recent experience and on the fact that the resources, be they wind or marine, are often a long way from where the electricity is needed. For these technologies to contribute to the desired level will require a major investment not only in delivering the actual technology but, crucially, the transmission and distribution infrastructure.
- f) Efforts to improve energy efficiency will continue but ultimately this too may be limited because of progressively increasing costs associated with further improvements. Such action must also be set against the backdrop of the increasing electricity demands of a growing economy and prosperity.
- g) It is likely that there will be some progress with transport efficiency, although the car manufacturers appear not to be making the progress expected under the existing voluntary agreements. Also there needs to be a major shift in consumer behaviour towards more efficient options, made more difficult in a climate of relatively low energy prices.

### **Medium term (15-30)**

- h) In the medium term Torness is expected to close and in the absence of new nuclear build, the baseload electricity needed will have to be provided by imported gas will grow.
- i) With the loss of existing large thermal plant there will be a reverse flow of electricity at the Scotland-England inter-connector with increased reliance from the South, which in turn will rely on energy supply from outside the UK.

- j) There will be an increased contribution from biomass and minor contributions from marine technologies as these develop. It is possible that Carbon Capture and Sequestration technologies will develop from niche applications to more widespread application on this timescale but there is considerable uncertainty associated with this option.
- k) In the transport sector there will be an opportunity for increased penetration by hybrid cars extending the use of liquid fossil fuels beyond their peak production.

### **Medium to long term (30-45)**

- l) Looking towards the longer term, there will have to be a transition to a low carbon economy because of the inevitable decline in oil supply, increased pressure on gas supplies, and the contribution from renewables will stabilise, probably at much less than the 40% target due to a number of well-chronicled practical constraints. Nuclear can make a valuable contribution to this low carbon future.

### **Long term (>45)**

- m) In the longer-term new carbon free technologies will be needed to meet environmental objectives whilst delivering energy needs. These will include use of fossil fuels with carbon capture and storage and hydrogen production via electrolysis from nuclear or, less effectively, from renewables.

## **2. Should Scotland aim to be self-sufficient in energy in general, and in electricity in particular, despite trends towards interdependence within Europe?**

- a) Scotland and the UK has enjoyed energy self-sufficiency for much of the 20<sup>th</sup> century, brought about by indigenous coal mines, nuclear generation and North Sea oil and gas. Unfortunately this will situation will not continue as demand increases and indigenous supply declines. Even with a high penetration of renewables, then Scotland like the rest of the UK will have to rely on imports of energy for its needs. New nuclear would provide a measure of 'indigenous' supply, and help the country to meet its environmental aspirations.
- b) Even if Scotland were self sufficient in terms of capacity, it must maintain strong links to the rest of the UK to meet demand in periods of low supply when the 'variable' renewables' ability to deliver electricity is not what is needed. Further, it is not clear whether the 'market' would deliver the investment needed to ensure adequate connections to the rest of the UK to meet these exceptional periods of low supply, in a timely fashion.

## **3. What are the possible implications and consequences for Scotland, and the UK, of becoming increasingly reliant on imported oil and gas for their energy needs?**

- a) There is an increased potential for interruptions in supply from imported sources. Scotland, and the UK, should ensure sufficient *diversity* of sources and adequate *fuel storage* capability to mitigate these risks. It is not clear whether the market will deliver these in a timely way, since the signals for a potential shortfall may not be evident sufficiently early, given the long timescales for infrastructure development.

- b) An increased reliance on imported oil and gas would make Scotland more vulnerable to price volatility in both these markets. This includes long term trends due to changes in demand as well as short-term shocks due to international events.

### Energy Supply

4. What are the feasibility, availability, reliability, sustainability, efficiency, capacity and risks of the different energy [*electricity*] generation technologies?

	Availability Capacity		Feasibility Sustainability		Reliability Efficiency		Risks (1)
Coal	H	H	H	L(2)	H	L	H
Oil	H	H	H	L(2)	H	L	H
Gas	H	H	H	L(2)	H	H	M
Nuclear	H	H	H	H	H	H	M(3)
Hydro	L	L	H	H	H	H	L
Wind	H	L	H	H	L	L	L
Biomass	M	L	H	H	H	L	L
Solar	M	L	M	H	M	L	L
Marine	H	L	L	M	M	L	L

*Notes: H, High; M, Medium; L, low; (1) environmental risks; (2) H with carbon capture and sequestration; (3) so long as a permanent repository is available*

5. What are the likely trends, and uncertainties, in the availability and cost of energy sources over the next 20/45 years?

- The domestic coal supply will decline but supplies will remain available globally. Costs are likely to rise, brought about by a significant increase in demand globally but particularly from emerging nations such as China.
- Oil resources will decline and in the absence of new technologies based on alternative energy sources, costs will rise.
- Gas resources will be relatively plentiful for several decades but once again costs will rise as supplies decline.
- There will be an increasing trend for environmental costs to be factored into fossil fuel prices, creating upward pressure on the latter.
- The next generation of nuclear power stations will be cheaper and produce less overall waste than current designs. Uranium stocks will remain available. With fuel costs a relatively low contribution to generating costs, nuclear electricity prices will tend to be less volatile than alternative fossil generation.

f) The costs of renewable projects will decline through the 'learning curve', although scale may ultimately limit the gains possible.

**6. What are the economic issues of capital investment in the supply and distribution of energy that need to be considered?**

a) Significant investment will be required to maintain the supply and distribution networks and to develop the systems for new sources of supply, such as remote renewable electricity generation. There remains uncertainty over who will pay for these investments, and what market incentives are needed to ensure adequate and timely investment. The industry will need to go through a major transition over the next two decades but it is not clear how the 'market' will deliver the investment needed.

**7. What are the key issues surrounding the development of Scotland's bulk electricity transmission and local distribution systems**

a) Stronger links to the rest of the UK may be required if baseload plant in Scotland is to be displaced in part by renewables. This will be necessary to ensure adequate supply for a diverse market, and during periods of low renewable generation.

b) A key issue for the renewables industry is that there is a serious mismatch between the locations of supply and the population centres that need the electricity. Significant investment will therefore be required to provide access to these relatively remote supply sources although the mechanism to do this is still not clear.

**Energy Demand**

**8. What will the impact of energy availability and price be on the demand for energy by commerce and industry in Scotland?**

a) The increasing demand for more limited resources will further increase energy prices.

b) In the short term the cost of products will rise although the full cost of energy may not be passed onto the consumer. Higher energy prices may encourage energy efficiency measures, although there appears to be a relatively inelastic response to this indicator. It will become progressively harder to achieve energy efficiency gains once the easier options have been exploited.

c) Scottish industry will become less competitive due to higher energy costs. Uncertainties in future oil and gas prices may deter new investment.

d) In the longer term there will be a shift from high to low energy intensive goods, although this may be a 'crowded' and highly competitive arena as other countries follow the same path. Self evidently, in order to succeed in this new market Scotland must offer something that distinguishes it from its competitors; some have suggested that it is Scotland's major academic institutions that could provide this distinctiveness.

**9. What are the likely trends in the domestic demand for energy for space heating and other purposes? What would need to be done to achieve major savings? What are the investment costs?**

- a) Investment costs for energy efficiency measures may be prohibitive for poorer households. However, this should not prevent the Scottish Executive introducing higher standards for energy efficiency, but the Executive would need to complement these with support measures for those unable to comply.
- b) There will continue to be increases in appliance standards with respect to energy efficiency. However, these gains will be offset in part by a continued trend for greater use of appliances.
- c) The potential for emerging technologies, such as in building energy management, should be exploited.

**10. What are the likely trends in the demand for energy for transportation in Scotland? What is the likely time-scale and scope for substituting other power sources for fossil fuels? What are the likely investment costs?**

- a) The reliance on 'individual mobility' has increased in recent decades with the trend for out-of-town offices and commercial zones, and relatively isolated residential areas. Many of these trends are very difficult to reverse, and in any event will take a several decades. It is clear that a high degree of 'individual mobility' will be a feature of future transport.
- b) Whilst fuel prices remain relatively cheap (to the extent that they are not a high percentage of consumer disposable income and as such are not a strong driver in consumer transportation choices) the trend will be for continued increases in energy use for transport.
- c) The inertia in the transportation system means it would be difficult to reduce energy use through infrastructure or cultural changes (further public transport links or better consideration of transport needs in town planning would only have limited impact). Instead in the medium term it will be necessary to pursue technology solutions to deliver 'mobility' more efficiently and with reduced environmental impact.
- d) Future options will include hybrid vehicles, which offer the potential to provide a transition to a lower carbon transport system. However, in the absence of significant incentives, the penetration by these vehicles will be hampered by a falling price (in real terms) of the existing vehicle designs.

**Environmental and Social Issues**

**11. What are the environmental concerns that need to be taken into account, in terms of the impact on ecological and other natural resources, as well as waste management and impacts on the landscape?**

- a) Climate change is a key concern the energy industry must address. In particular, CO<sub>2</sub> emissions must be reduced in line with clearly defined long-term targets supported by measures to incentivise low carbon technologies.

- b) Local pollution must be kept to acceptable levels and significant regulation in the form of, for example, the Large Combustion Plant Directive and Water Framework Directive will come into force over the next few years.
- c) Radioactive waste management is an important issue for the nuclear industry. It is vital that the CoRWM process identifies a long-term waste solution and that the UK Government signals a clear policy framework and implementation plan to deliver a solution for the long-term storage of this waste.
- d) Conventional waste management must also be considered, in particular waste treatment routes, disposal and local impacts.
- e) The implications for future generations of resource depletion, loss of biodiversity and habitats, water resources management, and other issues, must be considered under the sustainability banner.
- f) Resource use should also consider the full life cycle impacts. For example, resources are required in the construction, operation and decommissioning of a power station as well as in associated fuel chain activities. Also, when considering the construction and operation of energy installations it is necessary to take into account the visual impact and sound pollution.

**12. Can the objectives of environmental improvement and economic growth both be met without a major increase in energy costs? What should be taken to enable an informed debate on the issue?**

- a) These objectives cannot be met together, at least in the short to medium term. There will be costs associated with pursuing cleaner energy use, either through more expensive 'cleaner' technologies or due to investment required to improve energy efficiency. Costs to consumers will rise (and there will be costs to ensure the fuel poor are not disadvantaged) and the profitability of industry will decline. There is then a conflict between environmental improvement and economic growth.
- b) With regard to industry, Scotland can minimise the conflict between economic need and environmental protection by evolving its economy to lower carbon, lower energy intensity industries. However this would necessitate an increased reliance on imported goods and would have social impacts as local industries close. From an environmental perspective it must also be remembered that climate change is a global problem and simply importing goods from other countries (many of which will be less developed and consequently use higher carbon intensity energy sources) will only shift the source of greenhouse gas emissions, not deliver reductions.

**13. What are the social values and consequences of energy generation and distribution on employment opportunities, health, and energy affordability?**

- a) As the energy industry evolves there is the potential for significant impacts on society, primarily through the loss of jobs that could occur should large established industries decline. It is possible that the emerging technologies will spawn new employment opportunities, although their character will be different.

- b) The nuclear industry is a large provider of high quality technical jobs, often in remote areas where there are few alternative large employers. Each power station alone directly employs about 500 staff, and many others are involved in contracting support and other aspects of the fuel cycle. Closure of the existing stations without replacement nuclear build would ultimately mean the loss of these jobs as well as a wealth of valuable nuclear experience. Chapelcross closed in 2004 and on the basis of current lifetimes Hunterston B would close in 2011 and Torness in 2023.
- c) The coal industry has already seen a significant decline in recent years, with closure of several mines (such as Castlebridge in 2000 and Longannet, the last deep mine, in 2002). These closures impact local communities. Likewise, closure of coal stations will cause loss of jobs. Cockerzie and Longannet have both currently opted out of the LCPD and may therefore have limited operation post 2008, equivalent to about 2½ years continuous running; this situation would change if they opted back into the scheme, although this would only delay closure by a few years.
- d) Similarly, a run-down of the domestic oil and gas supply industry would affect jobs in this sector. Again, these jobs are concentrated in local communities and therefore would have a significant impact when lost.