A response to the Royal Society of Edinburgh's inquiry concerning issues for Scotland's energy supply

Members of the Aberdeen, Highlands and Islands, and Southern Scotland branches of the Energy Institute are pleased to submit this response to the Royal Society of Edinburgh's independent inquiry into issues for Scotland's energy supply.

In summary:

- Scotland is rich in opportunities to develop a variety of energy technologies;
- The costs between different technologies are not dissimilar;
- Considering the open market of electricity – a public policy framework will influence choices taken;
- Diversity of supply is essential to security of supply;
- Members of the Energy Institute urge HM Government and the Scottish Executive to take action and stimulate public debate to move energy policy forward;
- The Energy Institute encourages Scottish policy makers in their decision making to facilitate the positive expansion of Scotland's energy knowledge and skills base;
- Major infrastructure changes today will influence the 'carbon footprint' for the coming decades yet equally policy must stimulate action within that time if short to medium term targets and aspirations are to met; and
- Scottish policy makers must determine the context for Scottish energy policy (relative to other values or benefits that energy policy can influence e.g. economic wellbeing, employment etc.) and its relationship to global challenges and targets.

Over the last 30 years Scotland has seen the emergence and growth of its participation in the international arena of oil and gas exploration. The development of the human and technical resources related to this sector is such that Scottish trained engineering professionals and scientists and innovative technical solutions are being applied worldwide.

Over this period internationally-recognised centres of research and education excellence have also been established. This oil and gas exploration and production community has provided a considerable resource to contribute to the solutions necessary in the next 50 years of energy supply.

Meanwhile, global climate change has been recognised to be the major environmental challenge facing mankind today. Reductions of around 70% in emissions of greenhouse gases, principally carbon dioxide arising from fossil fuel combustion, will be needed to stabilise emissions at levels that will not cause harm to human health. A global temperature rise of 2°C by the end of the century is widely predicted.

Developed countries represent the largest share of global emissions and if developing countries are to make progress towards a higher standard of living, then greater reductions in the developed countries emissions will be needed. Developed countries have access to a broader range of technologies and a greater scope for emission reductions based on more efficient resource use.

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Emissions arising from the use of energy in industry, commerce, in residential properties and in transport represent a major proportion of carbon dioxide emissions. The UK Government has set an aspirational target of a 20% reduction in domestic emissions of CO2 by 2020, setting the country, and so its' four nations, on a path to 60% reductions by 2050.

There are some interesting aspects to UK Energy Policy, as set out in the Energy White Paper, which specifically affect Scotland. In particular, the nature of the Scottish electricity system, and some anomalies arising from environmental issues being devolved to the Scottish Parliament, whereas energy is not.

Energy needs appear to fall into two primary applications: fuels for transport and electricity. Current attentions seems to be on clean generation of electricity for which Scotland is well suited - but not enough focus is being given to forward developments for fuelling transport even though the technology can be applied today. Scotland does not seem to be publicly involved in demonstration projects evident in other countries, such as experimental water vapour emitting transport running on fuel cells. There is also no evidence of work towards biofuels like ethanol or interim technologies like clean coal or GTL (gas to liquids) in the public domain.

Scotland is rich in renewable energy potential (wind, marine technologies and biomass), has a considerable supply of nuclear power, is rich in coal, has direct access to both undeveloped and exhausted North Sea oil and gas reservoirs, and has more potential for energy saving due to the condition of the housing stock and the climate. However, the electricity network is not well developed in the more remote areas and interconnection to the UK and Irish markets is not strong.

It is anticipated that the coal fired stations at Longannet and Cockenzie will close in the next 5-10 years as acid rain legislation tightens and the nuclear plants at Hunterston and Torness will reach the end of their lives by 2012 and around 2018 respectively. The gas-fired plant at Peterhead can be assumed to continue as it undergoes an engineering re-design to improve flexibility and efficiency, and generate 'carbon-free' electricity from hydrogen. This planned project would convert natural gas to hydrogen and carbon dioxide gases, and then use the hydrogen gas as fuel for a 350MW power station, and export the carbon dioxide to a North Sea oil reservoir for increased oil recovery and ultimate storage.

The Scottish Executive has set a target of 18% from renewable energy by 2010 (this is actually the same as the UK's 10% target because 8% already comes from large scale hydro plants). However the Executive has also set an aspirational 40% target by 2020 and indicated that they would wish to see the marine resource, particularly wave and tide, develop rapidly in order to advance technologies in which Scotland has a lead (as Denmark has done with wind). There has been a very strong response to renewable energy policy in Scotland – with some 6,000 wind turbines currently proposed – however this has led to substantial (and growing) public opposition.

Similarly, proposals (agreed as needed by OFGEM) to develop the Scottish transmission system to accommodate new renewable energy is attracting considerable opposition (the line from Beauly to Denny). Without such investment, renewable energy development – both wind and marine, will be severely restricted. It should be noted that changes to infrastructure today will be likely to determine the 'carbon footprint' of a nation for the next two to three decades. Significant input from appropriate engineering expertise to design flexible yet robust infrastructure systems is essential.

The issue of intermittency of generation is significant. Whilst there are few wind free days, the output of wind farms will vary and will require some level of back up as it represents an increasing percentage of supply (Northern Germany are having problems at 20%, but that is a much stronger grid than that of Scotland).

Marine resources – wave and tide - are more predictable, but cannot be dispatched over time to match the changing demand patterns over day/night and summer/winter. Plant power by burning biomass (coppiced wood, forestry waste etc.) could be used in that role, but would have to be running only when wind did not blow – making it less economic.

Probably the most significant challenge for Scotland, however, is the closure of nuclear power. These plants are very large and are planned to close at specific dates rather than be 'run down', producing 'step changes' in the supply profile. Development of new resources in advance of need would assist, as would stronger grid links to allow import from England and Wales. But above all, it should be noted that nuclear is CO2 free – so unless Scotland's CO2 emissions are to rise sharply, nuclear will have to be replaced with new nuclear, renewables, gas or coal with carbon capture.

In addition to these challenges, it is important that the efficient and clean exploration and development of UK oil and gas reserves is encouraged through the application of state of the art reservoir characterisation methods, and innovative drilling and production methods to ensure that increasingly high proportions of recovery are achieved. An issue of concern in this area is likely to be the supply of professional engineers and scientists to meet this need as other sectors compete for the reducing number of engineering graduates.

There are many facets of the energy and environment policy debate. No one solution will provide the answer to today's challenges. Firstly there is the public perception of risk to safety surrounding nuclear power and CO2 capture and storage. Issues of intergenerational equity are an obvious topic. Policy makers need to assess whether in their decision making they opt to support solutions which allow us to develop today, in the belief that technology advances will make solving those problems simpler and more cost effective later. These are large scale 'impersonal technologies', but are likely to be rather less expensive than renewables. This leads to the interesting topic of costs and how we relate that to 'value for society'. For example, opting for small local technology can bring with it local benefits such as employment, landscape protection etc., but this becomes difficult to evaluate in economic terms.

The management of carbon dioxide is one of the major issues related to energy generation. Carbon dioxide storage is likely to be one of a number of approaches to reducing CO2 emissions. The storage of carbon dioxide in subsurface formations is one of a number of ways of managing this global warming gas. Storing carbon dioxide in saline aquifers, oil and gas reservoirs to improve recovery, in redundant oil and gas reservoirs, are some ways of emission management, and the upstream oil and gas exploration community are uniquely placed to contribute effectively to this challenge and the application of this technology. The tools and human resources being developed and used in the broad areas of exploration, development and production of oil and gas will be those involved in long term storage of carbon dioxide in subsurface formations. The engineering challenges are not small as the timescales of storage are far greater than those for oil field lifetimes.

The coastal locations of Scotland's populations and the related power generation infrastructure provides a good base for integration of clean power generation, carbon dioxide capture and offshore oil and gas reservoir storage than other countries where the more distributed capture and collection sites reduces the economic efficiency of this integrated process. However the benefits of this technology if applied today are only likely to be felt in 20 years time, so other measures such as energy efficiency are also an essential part of a package of solutions.

Energy efficiency is a cost effective means of tackling climate change – but the poor cannot afford the measures and the better off are frequently indifferent. Policy makers must decide whether it is acceptable to use energy policy to add costs to the better off to pay for measures for the fuel poor – or whether this is a matter for general taxation. Fuel poverty remains part of UK energy policy, and to date, many energy efficiency schemes have had limited success, primarily due to the low value placed on energy.

Therefore, the best way to maximise energy efficiency amongst consumers may be to inform debate by placing a higher value on energy and incentivising consumers to be energy efficient.

This push towards efficient use of energy could also include the adoption of local CHP, encouragement of micro-generation on a domestic scale and discouragement of commuting by car to work through better transport planning.

The time taken to design, manufacture, construct, install and commission power stations varies between 2-10 years, depending upon the technology. Of which some of this time is taken up by obtaining planning consent, before which no significant planning and design work can proceed, orders placed for bulk items of material, and suitable staff mustered and trained, and the financial, industrial, educational and political organisations established. Some reduction in this period might be obtained by adopting standard designs, and having the necessary transmission lines and switchgear already in position. Reduction in the time taken over the planning regulations must be obtained. Considering the timescale for the demise of nuclear power, these timescales must be taken into account i.e. if nuclear is to be replaced by nuclear, this could take up to 10 years to replace, whereas the lead time for wind farms and gas power stations is much shorter.

In the meantime, the provision of the trained manpower and equipment necessary for this undertaking and the subsequent operation, maintenance and replacement of the equipment and installations will require a large re-organisation in the financial, industrial, educational and environmental establishments, together with a realisation by the public on the importance of a safe, secure and sustainable energy supply.

There is currently an increasing reliance on imported oil and gas in the UK and this may result in increases in energy costs as well as placing the security and reliability of supply at possible risk, as it does when any single fuel becomes dominant. Diversity of supply is of prime importance to the security of supply.

However, the considerable infrastructure in Scotland in developing the offshore oil and gas sector provides a valuable resource to progress to recovering remaining reserves on the UK Continental Shelf. The human and technical resources of this sector also provide an established resource in carbon dioxide subsurface storage management. The 30 year success story of UK and Scottish oil and gas should provide a confident base to integrate this sector into the overall energy and carbon management strategy. An important perspective will be the maintenance of high quality research and education in this sector to provide the skill base to meet the considerable engineering challenges.

Without urgent and decisive action being taken, Scotland's supplies of electric power and petroleum based fuels may be put at risk within the next twenty years. The implication of which may well be that the costs of petroleum products will have escalated to such an extent that the manufacturing and transport industries will be reduced to a non-competitive fraction of their present position.

We currently live in a world of markets. Given the market nature of electricity, public policy must be driven by market signals such as the Energy Efficiency Commitment, Renewables Obligations and national allocation under the Emissions Trading Scheme. There are plenty of technological choices available. The challenge in developing policy is to determine which technologies will be most feasible and therefore likely to be invested in by industry given the policy decisions made.

One fundamental aim for any country, particularly island countries, should be to have self sufficiency as part of its strategic defence plans - separate from technical and commercial aims. Such strategy has to include energy storage to cover interruptions of the supplies, wherever they come from: Scotland currently does not seem to have sufficient storage of fuel to maintain electricity during any interruptions.

A difficult question to address is how do we value the broader costs of different technologies? Nuclear power leaves waste for future generations; renewables, deployed in meaningful quantities, will change our landscape as surely as the agricultural revolution did, and coal or gas with carbon capture and storage could result in major problems should the CO2 subsequently leak. But of course doing nothing is not an option as it means that Scotland will not play its part in addressing climate change.

The arguments at present are very entrenched, focusing on single issues and site specific activities. The Scottish Executive needs to look at the whole of Scotland's environmental burden that is sustainable over the next 50 years in order for Scotland to deliver a sound energy policy. The policy needs to be flexible to enable any unforeseen changes to be incorporated and will have to manage negative environmental impacts with offset positive environmental impacts.

This response has been collated from views of members from the Aberdeen, Highlands and Islands branch, and the Southern Scotland branch of the Energy Institute. The Energy Institute is a professional membership body for the energy industry, providing a home for energy professionals and an intellectual reservoir for the industry, with some 12,000 individual members and 350 companies participating in the furtherance of knowledge and dissemination of good practice in the energy industry. Members, through this response have highlighted the complexity of the subject and the wide range of issues for consideration. As a Royal Charter professional body and learned society, the EI would be happy to assist further in analysis and work required to inform future Scottish policy development in this subject if desired.