

RESPONSE FROM THE NATURAL ENVIRONMENT RESEARCH COUNCIL TO THE RSE'S INQUIRY INTO ENERGY ISSUES FOR SCOTLAND

The Natural Environment Research Council (NERC) welcomes the opportunity to comment.

NERC is one of the UK's eight Research Councils. It funds and carries out impartial scientific research in the sciences of the environment. NERC trains the next generation of independent environmental scientists. Its priority research areas are: Earth's life-support systems, climate change, and sustainable economies.

NERC's research centres are: the British Antarctic Survey (BAS), the British Geological Survey (BGS), the Centre for Ecology and Hydrology (CEH) and the Proudman Oceanographic Laboratory (POL). Details of these and of NERC's collaborative centres are available at www.nerc.ac.uk.

NERC's comments draw on inputs from CEH and Swindon Office staff.

Answers to Consultation 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?

Consideration should be given to the forms of energy that will be required: not just electricity, but heat and vectors such as liquid biofuel and hydrogen. Scotland is in a good position to capitalise on a mix of generating sources and vectors, some already developed (e.g. wind), others requiring development (e.g. wave and tidal). The existing supply infrastructure will also need modification and/or new forms will have to be put in place.

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

It should be Scotland's goal (as it should be for all nations), but that does not mean living in isolation. Interdependence with Europe should offer a market for surplus and a source of supply in times of need. Self-sufficiency will not be achieved simply by increasing Scottish generation; demand reduction will be equally important.

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?

Energy availability could not be guaranteed, and Scotland could become an economic hostage to fortune.

Energy Supply

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

The barriers to deployment of different technologies require consideration; these range from the need for basic R&D to cultural acceptability and financial backing. NERC and CEH are concerned principally with environmental capacity and impact. Ideally, generating capacity will match demand both in terms of location and magnitude.

Considering the main generating technologies in turn:

Wind (onshore) capacity is increasing, but is meeting resistance in the form of public resentment and planning restrictions. Arguments against it describe wind strikes on birds (limited evidence), radar interference and intermittency of wind (not a serious problem), but NIMBYism is the main barrier as people don't feel ownership of wind power. Bird impacts in Scotland are being mitigated in one instance by the use of radar! Turbine sizes (blade diameter) have grown over the past few years, but micro-turbines are now being offered to individual households; these could take off in a big way.

Wind (offshore): the RSPB has raised concern about effects on bird migration routes, but they have not expressed outright objection. Offshore wind generators are usually linked to other offshore utilities (oil or gas platforms).

Biomass (landfill gas, sewage gas, agricultural waste, forestry waste, industrial waste, energy crops including short rotation coppice and forestry): These have enormous potential and the UK Government sees them as becoming increasingly important. Barriers again include NIMBYism (e.g. Winkleigh power station in England), but the goal should be more community energy (including heat – CHP), where the local populace can experience ownership and are encouraged to give support, as happens in Sweden. Energy generation from biomass offers improved waste management.

Small-scale hydro: This is an under-considered option, given that Scotland has great potential. CEH Wallingford can model the exploitable resource.

Large scale hydro: This is established and Scotland is well served.

Wave: This is a new development and still requires substantial R&D, but as with tidal, Scotland has one of the best resources in the world.

Tidal: This is in a demonstration phase so may still be a decade or so off serious deployment.

Photovoltaic and other direct solar (passive and water heating): These need to be considered for new and replacement buildings. Some PV utilise cadmium and so they need careful disposal; new R&D is making systems more efficient and cleaner.

Combined Heat and Power (CHP): This is currently based on gas (predominantly fossil). It improves efficiency (from ~25% to about 75%) so shouldn't be overlooked, but there is a need to identify the appropriate scale of deployment (household, terrace, community or larger). Biomass (as solid fuel or via pyrolysis/gasification) must also be brought into the equation

Nuclear: Fission can be said to be clean when working properly, and we are better at handling waste than we used to be, but it carries the legacy of the past in terms of mis-

managed waste and accidents, and this presents perhaps more of a psychological barrier than a technological one. Fission will likely have to be part of the short- to medium-term solution (with a question-mark over limited new build); but in the longer term there is hope that fusion (much cleaner) will come on line.

Coal: This still has a role, and the re-opening of mines should be contemplated, although it is debatable. Carbon sequestration and storage are key.

Oil: This still fuels most transport and looks set to continue doing so in the immediate future. Liquid biofuels, electricity and hydrogen may replace petrol/diesel in cars, but boats, planes and (some) trains still need to be catered for. Shipping uses sulphur-rich oil, whose sulphur dioxide emissions Scotland is affected by, and aircraft use high-octane fuel at high altitude which is highly damaging; both are seen as being outside national jurisdiction.

Gas: This is the growing source of electricity. It is cleaner than coal or oil (in terms of traditional generation), but still a fossil fuel.

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

No comment.

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

No comment.

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

Increased local electricity generation could have implications, especially if domestic consumers/producers are to be rewarded for supplying electricity to the network.

Energy Demand

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

No comment.

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?*

No comment.

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?*

Transport's need for fuel is increasing despite increased efficiency. Some strategies targeted at reducing travel, e.g. the encouragement of home working, have been demonstrated to have the opposite effect, as people then travel more in their leisure time. Liquid biofuels (bio-diesel and bio-ethanol) are already available and are being mixed with fossil fuels; they could be used as total replacements, but wheat and rapeseed production would have to expand beyond Scotland's capability.

Replacement is already underway (e.g. as a result of the EC Renewables Directive, electric/dual fuel cars, etc.). Longer-term shifts will be the introduction of hydrogen and fuel cells; this will need both new vehicles and a supply infrastructure; the rate of change will depend upon political will and perspectives of economic opportunity.

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?

The environment is dynamic. It will change whatever we do or don't do and is still catching up in its response to drivers from the previous centuries. However, we need to try to understand how it will change in response to our extraction and use of energy in the future. The environment is capable of providing energy sustainably (renewables), but its capacity to do this and the impacts of exploiting renewable sources need to be monitored. A transition to 'clean' energy promises enormous benefits, especially where climate change and atmospheric deposition are concerned. CEH is investigating energy issues down two broad routes, quantifying the capacity of the environment to provide power and forecasting/monitoring impacts (using both expertise and datasets such as the Countryside Surveys).

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

To be sustainable, economic growth and increased standards of living must go hand-in-hand with environmental improvement – at a global level. There is a need to continue the uncoupling of economic growth from resource use. The cost of producing energy sustainably will have to be met, because the alternative is unthinkable. However, there are different options with different cost implications (and costs not always expressible in financial terms); these include demand reduction. Informed debate requires not only information; popular, high-profile champions who are good at communicating and use a range of styles and techniques are essential.

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

We are not in a position to comment on employment and affordability, but NERC is beginning to invest in research into "Environment and Health" issues. There are undoubtedly links between mortality and health, and energy availability, environmental pollution, and climate change. "Health" must be measured not only in terms of years of life gained, but also in terms of people's quality of life. Decisions about energy supply should be made in the context of people's perceptions of their quality of life as well as information supplied by the scientific community about actual environmental impacts, effects of pollutants on biota etc.