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Determining and delivering Scotland's energy future: Feedback to the Economy, Energy and Tourism Committee

Institute of Physics response

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15 August 2008

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Economy, Energy and Tourism Committee
Scottish Parliament
Holyrood
Edinburgh
EH99 1SP

energyinquiry@scottish.parliament.uk

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Dear Sir/Madam

Feedback on Determining and delivering Scotland's energy future
Economy, Energy and Tourism Committee of the Scottish Parliament
Energy Inquiry – Call for Evidence

The Institute of Physics is a scientific membership organisation devoted to increasing the understanding and application of physics. It has an extensive worldwide membership (currently over 34,000, 2,500 in Scotland) and is a leading communicator of physics with all audiences from specialists through government to the general public. The Institute of Physics represents its members in Scotland through an active volunteer network and two members of staff based in Scotland

The Institute welcomes the opportunity to respond to the Scottish Parliament's Economy, Energy and Tourism Committee's Inquiry into 'Determining and delivering Scotland's energy future'.

This response was prepared with input from the Institute's Energy Sub-group, which includes a range of leading physicists working across the energy sector. The Sub-group reports to the Science Board of the Council.

If you need any further information on the points raised, please do not hesitate to contact me.

Alison McLure
National Officer (Scotland)
Institute of Physics
22-26 George Street
Edinburgh
EH2 2PQ
T: 0791 785 5940
E: alison.mclure@iop.org
W: www.iop.org

What type of future is needed in Scotland in terms of the production, distribution and more efficient use of energy, given the issues of price, security of supply and sustainable development?

- Energy from a diverse set of sources is essential to maintain the national economy and to promote security of supply and sustainable development.
- Scotland is fortunate in having a large range of potential energy supplies, so a choice from these can be made. There has been experience at international levels in coal, oil, natural-gas, nuclear power and many forms of renewables.
- Promotion and development of energy efficiency in production, delivery and usage should be a key priority.
- Within Scotland, the combustion of fossil fuels will be a major component of national energy for the foreseeable future since alternatives cannot immediately provide the quantities at an economic level. However, advances in technology need to be made to increase the efficiency of coal and gas fired power stations and steps need to be made to progress and implement carbon sequestration technologies.
- Of heat, transport and electricity, transport provides the greatest challenge. For road and rail, strategies for improved vehicles, public transport and alternative provisions are possible. However, shipping and aviation will be the most difficult.

How can this future be delivered in Scotland and how will we meet all the various targets and obligations?

- Energy efficiency must play a role in Scotland's energy future, if the problem of waste in energy usage could be tackled with changes in the style and use of energy in the home and elsewhere. However, it is understood that such changes in energy usage will require a significant cultural change.
- Scottish energy is now dominated by fossil fuels, nuclear power and hydro electric. Therefore, changes and improvements are needed in fossil fuel generation, and in increasing Scotland's nuclear and renewables capacity.
- There is a need for increased research and innovation in the relevant RD&D sectors, such as wave, tidal, third-generation photovoltaic technologies and strategies for deployment, in order for Scotland to be in a position to meet the challenges of the medium to long-term future.

What decisions need to be taken, by when and by whom to deliver on Scotland's energy future?

- The Scottish Government should develop an energy strategy within the bounds of devolved powers and in partnership with the UK Government.
- The National Indicator for electricity should be expanded to include all types of energy use.
- There should also be a National Indicator for energy efficiency to support the commitment to reduce emissions.

Which energy sectors offer the best prospects for economic growth and reduced carbon emissions, and how should these be secured?

- Given the need to reduce fossil-carbon footprints and to provide secure and diversified energy supplies, Scotland's opportunities from renewables and nuclear power are outstanding. Most renewables options are experienced commercially, with further known, namely electricity from hydro, wind and

biomass; heat from biomass, combined heat and power, passive solar, heat recovery and ground sourced heat pumps; transport from electric vehicles (train and road) and biofuels. Other Scottish renewable supplies are in their infancy with attractive potential for wave power, tidal power (range and flow), biomass heating and solar photovoltaics.

- The Institute has particular knowledge and expertise to stress the importance of harnessing solar energy via photovoltaics. Photovoltaic solar electricity is already commercially viable, but far greater efficiency at much less capital cost is likely from sustained and well-financed research. These solid-state components have no moving parts and no operational emissions, making the technology eminently sustainable.
- Within the electricity generation sector immediately, increase of wind power with the associated grid connectivity is vital, but may still need to be augmented by nuclear power and fossil fuels with carbon sequestration and greater efficiency.
- A potent non-renewable mechanism in meeting the EC 2020 renewables targets[1] would be to reduce the consumption of electricity.

What are the hindrances to determining and developing Scotland's energy future?

- The UK's competitive energy markets and Renewables Obligation Certificate method have not induced significant new renewables capacity as compared with other major countries in the EU with feed-in tarrifs, perhaps because the UK's approach is extremely complicated and expensive to administer.
- At present there appears to be no coherent, structured, plan of implementation of renewable technologies, either for simple and sustained market incentives, or for nationally (UK and Scottish) supported RD&D.
- Realising the large potential of renewables and nuclear power in a low carbon economy requires a number of technical, economic, institutional and social constraints to be overcome.
- For the long term development of the enormous renewables potential of Scotland, it is vital to monitor closely and encourage progress without closing off options for introducing other low carbon technologies.
- The large proportion of energy used by the transport sector will be hard to reduce without significant social change.

What is needed in the short and medium-term, particularly from the Scottish Parliament and the Scottish, UK and other governments (such as the EU), to deliver Scotland's energy future?

- Within an approximate 10 year time frame there are likely to be significant reductions in Scotland's existing coal-fired and nuclear power capacity. As a consequence, despite likely planned levels of reductions in energy demand resulting from increased energy efficiency and an increase in renewables capacity, there is likely to be a shortfall in electricity generating capacity.
- Over this timescale, the shortfall can be addressed by the construction of additional capacity from existing technologies. Such capacity must, however, be consistent with the commitment for reduction in carbon dioxide emissions. Policy and regulatory regimes must also ensure that both sustainability and diversity of

[1] http://ec.europa.eu/energy/climate_actions/doc/2008_res_directive_en.pdf

supply are assured and that Scotland does not become overly dependent on imported fossil fuel sources, i.e. natural gas, from a small number of gas producing nations.

- The present Scottish Government has decided not to favour nuclear power. However, this technology cannot be dismissed lightly, as has been found elsewhere in the UK, Europe and around the world to ensure low carbon emissions and security of supply.
- Given the important role that renewable energy technologies will play in meeting future demands for energy, it is imperative that the Scottish Government (i) removes remaining barriers to the realisation of the technology, and (ii) establishes the best financial mechanisms for rapidly increasing renewables markets.
- Therefore, Scotland would greatly benefit by adopting a straightforward feed-in tariff system for electricity, which is clearly the most successful method in the EU for increasing renewables generation and associated manufacture.
- Technical issues will need to be solved. For instance, where major renewable sources are remote from areas of major consumption, new or increased grid infrastructure will be necessary to transport the power to the load centres.
- Several UK studies which examined the renewables supply chain have reported that technology and project developers have found a lack of suitably qualified people at all levels in the implementation chain – both general technical skills and also more specialist skills[2, 3]. Hence, encouraging physicists, and indeed other scientists and engineers, to consider a career in renewables, could help to plug the skills gap.

How can demand for energy be reduced in Scotland?

- A strategy should be developed which considers the principles of planning for energy saving from the point of view of product use, whether at home or in the work place. The main benefit should be that users participate intelligently in energy saving measures. Not only should products be intrinsically energy efficient, but users should be able to use them in an energy-efficient manner. The information about energy consumption which accompanies products should be attractive, informative and fulfilling. It also should be easy to assimilate and invite a meaningful response.
- The following measures could also be considered:
    - Improved building design by imposing higher building standards
    - Improved electrical appliances, including better insulated fridges
    - The development and use of more efficient lighting
    - The development of more efficient vehicles, such as hybrid vehicles, and a greater emphasis on the use of public transport
    - The introduction of a general carbon tax, based on the quantity of carbon dioxide emitted per unit of energy supplied, and
    - Improvement of energy efficiency of old building stock, taking into account the long time frame for only concentrating on new buildings.
- Within Scotland, every opportunity should be taken to encourage the best efficiency for production, delivery and usage of energy within the limits of Scottish

[2] Mott MacDonald 2004 “Renewable energy supply chain analysis”, DTI
[3] ICCEPT & E4Tech Consulting 2004 “The UK innovation systems for new and renewable energy technologies”. A report for the DTI

legislation. In particular, there are opportunities to influence the energy efficiency of social housing with measures such as:

- Building regulations for best insulation, passive solar design, incorporation of microgeneration, use of smart meters, control of heating and electricity
- Local regulations to (i) decrease energy use in unoccupied space, (ii) increase local production of energy to meet local demand
- Utility bills to display energy performance in an attractive and usable way for the general public
- Technical trades to require qualifications in energy efficiency and microgeneration.

How can the energy sector deliver the kind of reductions in greenhouse gas emissions that the Scottish Government wants to see?

- This is dependent on the fiscal environment in which the companies work.
- A roadmap towards emissions reductions, sector-by-sector, should be designed. Government and industry will then be able to judge whether they are on track and respond accordingly if not.

How can energy supplies be secured at a price which is affordable?

- Investment is required in the development of whole-lifecycle financial models, including full acquisition, operating, distribution, disposal/recycling and environmental costs for all renewable technologies. Models are also required to predict how significant power levels generated from renewables might change the characteristics of the transmission network planning and operation.
- A DTI/Carbon Trust review[4] found that there appears to be a funding gap in moving renewables to the pre-commercial stage, and from the pre-commercial to the supported commercial stage. The review also considered that the current landscape for renewables funding is complex, which suggests that a clearer overall strategy for UK and Scottish RD&D in both renewable and other technologies, together with a clearer map of RD&D funding and clearer demarcation of the roles of different funding bodies could be useful.

How can economic benefits from Scotland's energy industries and the development of clean technologies be maximised?

Support needs to be provided to Scotland's significant research capability in wave and tidal RD&D and its potential lead in third-generation photovoltaic devices with adequate funding and a sufficient supply of qualified personnel.

What are examples of best practice in Scotland and elsewhere, particularly focussing on low-carbon solutions and covering electricity, heat and transport?

There are many areas in which Scotland lead the world, including hydro energy (e.g. Glendoe hydro scheme), wave energy development (e.g. AWS Ocean Energy Ltd and Pelamis Wave Power), wave and tidal work carried out by the European Marine Energy Centre based in Orkney, the biomass facilities in Fife and Lockerbie for heat and the PURE hydrogen project in Shetland for transport.

[4] Renewables Innovation Review, DTI/Carbon Trust, 2004