Renewables and the Grid: Access and Management

Institute of Physics response to a PRASEG inquiry

A full list of the Institute’s submissions to consultations and inquiries can be viewed at www.iop.org

8 January 2010
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Rose Dickinson
Coordinator
PRASEG – Parliamentary Renewable and Sustainable Energy Group
4th Floor
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Dear Rose

Renewables and the Grid: Access and Management

The Institute of Physics is a scientific charity devoted to increasing the practice, understanding and application of physics. It has a worldwide membership of over 36,000 and is a leading communicator of physics-related science to all audiences, from specialists through to government and the general public. Its publishing company, IOP Publishing, is a world leader in scientific publishing and the electronic dissemination of physics.

The Institute welcomes the opportunity to submit its views to PRASEG’s inquiry into ‘Renewables and the Grid: Access and Management’.

The attached annex details our comments on two of the main questions listed in the call for evidence.

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

Yours sincerely

Tajinder Panesor MInstP
Manager, Science Policy
**Variability: How can variability of input to the grid be best managed?**

Because of the natural variability of the environmental sources of most renewable supplies (e.g. wind power), strategies are needed for their significant integration with present supplies. This particularly applies to electricity supply, where all forms of generation require national ‘back-up’ because of power plant and grid failures. Presently, the Grid has sufficient overcapacity for large central fossil fuel and nuclear plant outages and this same overcapacity is sufficient for UK renewables plant for the next 5-10 years.

However, the present system will not be able to support the 35-45% of variable renewable generation that is generally considered necessary to meet the EU 2020 renewables target. The location of the most productive projects – wind, tidal and wave – will require extensive new transmission lines or undersea cables; for example, significant investment will be needed to connect wind farms in Scotland or the Thames Gateway into the Grid. Because the connection has to be capable of taking the full output, but the load factor of the best wind farms is only around 35%, it follows that the cost of connection to them per unit of electricity produced is about 2.5 times that of a conventional generator of the same maximum output and a typical load factor of 90% or more. Undersea cables will be more expensive than overhead lines of the same capacity.

As the penetration of variable generation rises to the levels anticipated for 2020 and beyond, it will be necessary to maintain and possibly increase the capacity of conventional generating plant to serve the concomitant increased requirement for system balancing and reserve.

A detailed study is required to assess the impact of potential additional renewables capacity in the 2020 time frame. The study will need to address cost alternative scenarios for the mix of technologies providing the additional capacity and, in particular, the issues associated with distributed resources and the potential ‘grid connected market’. This concept requires a radically different approach to manage the transmission network and current trading arrangements. Such information, along with any additional network associated maintenance and security costs, is a prerequisite for calculating the cost of electricity produced.

**Energy storage**

One fundamental, but little mentioned approach to easing the problems of variable generation is the provision of energy storage, whether electrochemically as electricity (i.e. batteries and supercapacitors) or in other forms from which it can readily be converted, for example, stored water in barrages, pumped water and compressed air. An additional approach might be termed ‘pseudo-storage’ in which amenable loads such as heating, refrigeration and possibly air-conditioning are time-shifted to accommodate short-term variations, possibly assisted by the addition of thermal capacity to the installation. This last approach could be applied at various scales – from commercial and industrial to domestic and could include a contribution from...
time-shifting the recharging of electric vehicles. We believe that all these approaches are amenable to considerable development, many without major technological breakthroughs. All should be part of an integrated long-term strategy for Grid access and management.

**What other issues regarding access to and management of the transmission and distribution networks do you think will need to be addressed to ensure the UK meets or exceeds its renewable energy & climate change targets?**

Existing Grid technology and operating practices have proved themselves well capable of supporting large-scale, low-carbon generation. It follows that a substantial acceleration of the installation of new and replacement nuclear capacity on a conventionally reinforced Grid will minimise the technical risks, speed-up the reduction in carbon dioxide and will be essential to meet longer-term carbon dioxide targets. This too should be part of an integrated long-term strategy for Grid access and management.
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