



Lord Oxburgh  
Chairman – Science and Technology Sub-Committee II  
House of Lords  
London SW1A 0PW

17 February 2004

Dear Lord Oxburgh

I would like to thank the Committee for providing the opportunity to discuss our research and submission in person. This letter summarises the evidence submitted to the enquiry, and clarifies or expands on some of the responses given to the Committee on 11 February 2004.

### **A PORTFOLIO OF INTERMITTENT ELECTRICITY GENERATION**

A strategic approach to the evolution of the intermittent generating infrastructure in the UK will result in a robust, reliable, low-intermittency solution to renewable energy development. This research can identify the “next best” development option for intermittent technologies, whether that be identifying the next best offshore wind site that will deliver the most reliable wind electricity supply, or the next best intermittent technology that will provide system benefits including lower backup and load following requirements (see below), lower grid capacity requirements, etc. Furthermore:

- This research considers only intermittent generators - our scenarios do not include electricity generated from waste, landfill gas, hydro-electricity or bio-mass, as these are essentially dispatchable power supplies;
- Marine resources (wave and tidal current) have yet to be included. Preliminary work on a geographically diverse tidal power system suggests that the combined output of a diversified tidal generating system would not drop below 50% of peak system output, resulting in a renewable electricity supply capable of supplying baseload demand, with output above the 50% level being intermittent but predictable;
- The installation of domestic combined heat and power (dCHP) contributes substantially to the stability of the system during the crucial winter peak – dCHP should be considered integral to a successful low-intermittency electricity supply, irrespective of whether dCHP itself is considered a renewable source of electricity or not, and
- The initial policy should be to install around 175 dCHP units (8kW heat output) and 225 solar roofs (32m<sup>2</sup> @ 15% efficiency) per MW of installed wind capacity.

### **BACKUP AND LOAD FOLLOWING REQUIREMENTS**

Using a portfolio of wind power, solar power and domestic combined heat and power systems would result in the lowest requirement for conventional backup capacity and the lowest need for additional load following. Backup and load following requirements under this scenario are given below – it should be noted that further geographic expansion of offshore wind power (ie to Scotland) and additional intermittent generating technologies (eg tidal stream power) will further reduce the need for additional backup capacity.

#### **Backup Requirement for 10% Intermittent Supply**

- The amount of additional backup generating capacity required when 10% of annual electricity demand is met by intermittent sources is 400MW;
- This figure does *not* include the contribution that the existing backup capacity operating on the transmission network would make to balance intermittency (typically around 20% of operating generating capacity), and
- Backup would be required on average one hour in every five years – for four out of every 5 years no additional backup would be required.

### **Backup Requirement for 20% Intermittent Supply**

- The amount of additional backup generating capacity required when 20% of annual electricity demand is met by intermittent sources around 2,000MW;
- Again, this figure does *not* include the contribution that the existing backup capacity operating on the transmission network would make to balancing intermittency, which would be expected to significantly reduce this figure, and
- Backup would be required on average one hour each year.

### **Load Following**

- With a diversified intermittent generating portfolio meeting 10% of annual electricity demand, there is very little change in the load following requirement for the conventional generating capacity on the network;
- The average hourly load following requirement is virtually unchanged from that currently experienced due to variation in hourly demand, and
- The peak load following requirement increases from 7,600MW currently to 8,700MW, however load following in excess of the existing peak will occur on average only one hour in each year.

### **INTERMITTENCY AND COST**

A focus solely on the cost of providing the electricity to the grid as cheaply as possible will not provide the lowest cost solution for the whole supply system. Through a strategic approach to the location, type and amount of intermittent generation:

1. The costs of back-up capacity, its running time and the amount of cycling (and thus wear and tear) will all be reduced, and
2. Lower carbon emissions will be achieved, as less backup plant and less load following (from existing conventional plant) will be required for the same overall contribution of intermittent electricity.

### **EMBODIED ENERGY**

Lord Winston asked a question regarding the energy payback times, or embodied energy component, of renewable energy systems. This is not dealt with directly by our research, however previous work has shown that:

- Wind turbines have an energy payback time of around 3 months (ie they generate the same amount of energy in their first three months of operation as was used in their manufacture and construction), and
- Solar photovoltaic panel have an energy payback time of around 3-5 years, depending on manufacturing process and roof mounting system.

### **GOVERNMENT POLICY AND SUPPORT**

A question was raised regarding Government support for renewable energy targets. In this context is important to note that:

- If given an informed choice and no price differential, 80% of householders and small and medium-sized enterprises (in Europe and in the UK) would choose electricity with a 'low impact on climate change and no nuclear waste' (Boardman and Palmer 2003, p21 – copy attached);
- This choice will be available under the EU Directive 2003/54/EC on liberalisation of the European electricity market to be implemented by the British Government after July 2004, and
- As a result, it is important that the Directive is implemented in the most effective way possible, providing consumers with the information and choice they are seeking.

Should you have any further questions regarding our original submission or evidence provided to the Committee, please do not hesitate to contact Graham Sinden (01865 281 208 or [graham.sinden@eci.ox.ac.uk](mailto:graham.sinden@eci.ox.ac.uk)).

Sincerely

Dr Brenda Boardman MBE

Graham Sinden