DTI Energy Review

Response from Professor Emeritus M J O'Carroll 14.4.06

<u>1. Background</u>

I am an applied mathematician and retired academic, with experience in energy industries and environmental issues. For the last fourteen years I have been chairman of REVOLT, a group campaigning for a more rational energy policy and against unnecessary and excessive power lines. This is a personal response as some of the issues raised lie outside the interest of REVOLT, although REVOLT would concur on those more directly related to electricity matters. A Position Statement can be seen on <www.revolt.co.uk>. Other responses and more detailed papers have been submitted to the DTI and Ministers over the years.

<u>2. Population issues</u>

Some years ago I enjoyed a talk at the University of Sunderland by Jonathan Porritt in which he discussed three underlying issues of global sustainability: population, per capita consumption and technological advances. He argued that the crucial issue to tackle was per capita consumption, bearing in mind the positions of the developed and developing world. Last year the G8 discussions have pointed more to the third issue, to seek technological solutions to global warming.

Population concerns are of course politically sensitive. The UN forecasts an eventual levelling of world population later this century, perhaps around double the present level, based on historical western trends. That must be very uncertain, and even so a doubling of world population risks serious strains on resources and serious effects of pollution including climate change.

A first question is: can population be considered in the context of energy review? And if it were to be considered, can anything be done? The concept of population management is fraught with problems, but must they be worse than lack of management?

A more objective question might be: what is a sustainable human population for the world, and for the UK? Is energy to be reviewed regardless of this question? Is energy policy simply to be reactive, that is to cater for whatever population is forecast? Should there be population targets? What about aiming to get population to 1990 levels? One could go on to think of incentive schemes and parallels to carbon trading!

I have no answers and make no recommendations except to ask that arrangements be made to open debate and thought on the subject of sustainable population levels. Energy is one important context but only one, though it may be a good starting point.

<u>3. Wind power</u>

In response to a DTI energy consultation in 2002 I wrote:

"The PIU target is unrealistic. The popular assumption that wind will provide the bulk of the solution is unreasonable, in view of the unreliability of that source and the implications for grid adequacy and stability. Wind would be better served making a storable form of energy, such as hydrogen by electrolysis of water. Major renewables projects other than wind, e.g. Severn barrage, would probably have a long lead time but could provide significant reliable electricity. The government's frenetic pursuit of wind energy is misplaced."

It is pleasing to see the more mature summary in the present consultation document with reference to a range of government and other reports, e.g. in Appendix A. I felt the SDC report on wind power was unashamed and uncritical advocacy which misrepresented objections to it, but at least that is balanced by the other reports cited.

Wind generation of electricity has so many problems, subsidies and secondary costs and impacts, that I recommend its re-classification as non-renewable, particularly since it depends on a larger amount of non-renewable back-up generation. This is not just a question of system management but of actual generation used and consequent emissions. This argument is developed in APPENDIX 1 below.

4. Nuclear power

Notwithstanding the risks of nuclear power and its long-term waste, and mindful of the risks (and uncertainties) of carbon emissions and climate change, my feeling is that the UK should re-join world development of nuclear power. At the least, existing nuclear sites could be kept open and generation continued and renewed, thereby securing the containment of low level site waste, and with the prospect of consuming high level waste.

There should also be a feasibility study into smaller scale nuclear generation, such as is elsewhere based on submarine engines or else using newer technologies (pebble bed reactors have been mentioned though the principle may be older), some with the prospect of reducing high level waste. Small units could be distributed at electricity substations, thereby reducing the need for transmission. I am not an expert in nuclear generation, nor its waste or security, but the UK seems to be left behind when at the least we might keep up with feasibility studies.

5. Fuel poverty

In answer to your question 5 I would recommend shifting subsidy from the production of energy to the reduction of consumption and the increase energy efficiency. In particular, subsidise insulation in all homes without means testing.

6. Electricity transmission

As the demands of renewable energy generation upon the electricity grid increase, it is not enough to leave the planning to disjointed companies with limited separate interests. A UK-wide review and planning approach is needed, including fuller consideration of submarine cables.

APPENDIX 1 **Call to re-classify wind power as non-renewable.**
(From Revolt news 184, amended 16.5.05.)

Reason: wind power needs a high level of back-up generation which is usually fossil-fuel based, because of wind power's intermittence and high variability (power output varies as the cube of wind speed). It's a tip-of-the-iceberg problem: UK data for 2004 show that only 24.1% of capacity was delivered by UK wind farms, because of intermittence and variability. Most (but not all) of the remaining 75.9% has to come from back-up generators. This 25-75 mix is implicit in UK wind power on any large scale, rendering it in effect as a non-renewable energy source.

In news178.4 I gave a summary equation for effective wind power, generously allowing that only 50% out of the 75% would be needed as back-up. Here it is, tidied up a bit:

1 unit wind + 2 units back-up + X = 3 units in-feed to grid + X waste

= (3 - Y) usable units from grid + (X + Y) waste.

Greenhouse gas emissions come from the 2 units of back-up as well as from the waste. The X is needed for volatility, rapid start-up and related off-design inefficiencies, and can be highly polluting from fossil-fuel back-up systems. The Y represents additional waste in the system, for example in excessive long-distance transmission, which can be considerable (e.g. 20%).

The net effect of the mix can even be to cause increased greenhouse gas emissions, as indicated in experience in Denmark (news171.7 and 176.2). It depends on what the mix displaces and how it is used (news174.5 and Bass and Wilmot, UK Power, issue 2, 2004). In addition large-scale wind power needs excessive infra-structural development (roads, foundations, etc.; plus billions of pounds' worth of powerline developments) which all add further to greenhouse gas emissions.

While re-classification would be right and proper, it would be reasonable to define and except Good Quality Wind Power (GQWP). That would reflect the way Good Quality CHP (Combined Heat and Power) has been defined in association with government CHP targets. Examples are small-scale wind projects which are used locally, or projects including renewable back-up. Another example, in the Shetlands, uses wind power to produce hydrogen, itself a clean fuel, which is then used for back-up.

Qualification for GQWP should depend centrally on the provision for clean back-up, not the sort of virtual generation used in green trading but actual physical clean back-up available locally to respond to the variations of the particular wind farm's output. Wind generators small enough to be absorbed within a local demand point, or embedded wind power not exporting large variable output to the grid, should qualify. Examples might include wind turbines serving a school or factory. A general maximum size for such systems might be set, say at 1 MW. Any multi-megawatt wind farm should be excluded unless it has its own on-site clean back-up generators.

Additional (not alternative) criteria for GQWP might include the location not requiring long-distance transmission nor extensive infrastructure such as foundations and service roads. Further conditions of landscape and residential impact might be added. But most wind farms, especially large scale wind power stations in remote areas, should not count as GQWP. They should not receive the (large) government subsidies and should not be tradable as carbon-free generation.