The Economics of Wind Power

Costs of Renewables Obligation Subsidy Support to Wind Power to Date

1. REF publishes generation data based on Ofgem's Renewables Obligation Certificate (ROC) Register. By taking into account the variable numbers of ROC/MWh, and using the ROC value quoted by Ofgem prior to 31 March 2011 and assuming a cost to the consumer of £50/ROC since that date, we can estimate the subsidy costs (excluding VAT) as follows.
2. The total RO subsidy cost from April 2002 to February 2012 amounts to over £8.2 billion, of which wind power received £3.3 billion, with onshore wind power taking £2.4 billion of that sum.
3. The total RO-supported renewable electricity subsidy cost in the calendar year 2011was £1.5 billion, of which wind power received £818 million, with onshore wind taking £509 million.
4. Domestic households account for about 36% of UK electricity consumption, and it might therefore be assumed that 36% of the RO costs will have a direct effect on household electricity bills. However, industrial and commercial consumers are able to buy closer to the wholesale price, and it is therefore likely that domestic households bear more than their proportional share of the costs of levies such as the RO. The scale of this effect is unknown, but DECC data discussed in our study *Shortfall, Rebound, Backfire*,[1] suggests that households pay for as much as 40% of the costs.
5. The Committee should be aware that a large part, perhaps all, of the 60% of the RO cost that is recovered directly from the bills of industrial, commercial and public sector consumers is ultimately imposed on households through the increased cost of goods and services (and taxes).

Future Costs of Renewables Obligation (EMR) Subsidy Support to Wind Power

6. Wind's subsidy share is expected to grow, and on the basis of the plant mix projected in DECC's 2011 *Renewable Energy Roadmap,* REF has calculated, in our study *Energy Policy & Consumer Hardship* (2011), that the total subsidy cost of the RO (or successor mechanisms) in 2020 would amount to approximately £8 billion a year, with onshore wind accounting for about £1.5 billion, and offshore wind £4.5 billion, with biomass taking most of the remainder.[2]

The Need for Studies of Total Cost to Consumer

7. However, the Committee cannot afford to neglect the fact that subsidy is not the only cost imposed on the consumer by wind power. This point is poorly accounted for by the conventional levelised cost studies to which the Committee is likely to be directed in other evidence. Such levelised cost studies have certain limitations, namely:
    - Conventional levelised cost studies generally assume that power station load factors are limited only by plant availability and access to the prime source of energy, not by the system demand. This is unrealistic.

[1] REF, *Shortfall, Rebound, Backfire* (2012), 19-20. See http://www.ref.org.uk.
[2] REF, *Energy Policy & Consumer Hardship* (2011), 27. See http://www.ref.org.uk.

- The fuel consumption and emissions of the overall system as a whole are not considered. This is clearly undesirable given decarbonisation goals.
- Most studies only calculate the levelised cost as seen by the generator (or an investor in that generator), and other costs imposed by the generator on the system and ultimately passed on to the consumer are not considered. For the purpose of long-term planning in relation to various technology options it is essential to calculate the total economic costs borne by the consumer, and thus by the wider economy.

8. Total system studies will overcome these limitations. However, it will be necessary to use a time series daily load curve (rather than a load duration curve) to capture all of the costs, and to describe the fuel consumption and emissions resulting from the uncontrolled variability and unpredictability of most renewables, not least wind generation.
9. By using daily load curves, the degree to which a station operates will be determined by its running costs (including part-load operation, start-up costs, etc.), its stand-by condition (hot, warm, or cold), and the degree to which it is flexible and thus able to meet variations in intermittent generation.
10. The output of such a study will not only describe the amount of fuel used, including that required during part-load generation and on stand-by, but also the consequent emissions, and the costs carried by the consumer, including the following, which are excluded from current levelised cost studies:
    - The cost of extra operational generation to control frequency and voltage (i.e. flexible plant to compensate for errors both positive and negative in the wind forecast).
    - The capital costs of new generating plant required to contain the security of supply risk within a specified limit, for example at 17.30 on a windless winter day.
    - The capital costs of new grid infrastructure required to operate the interconnected system within the specified standard of security.
    - Costs of constraint payments.
    - Transmission revenue costs, and costs of losses.
11. Writing for The Institute of Engineers and Shipbuilders in Scotland (IESIS) one of us (Gibson) has recently (01.06.12) submitted a sketch of such a total system cost analysis to Professor David Mackay, Chief Scientific Advisor to the Department of Energy and Climate Change, and we refer the Committee to that document.
12. The Committee should be aware that in the absence of such an analysis the subsidy cost should be regarded as the lower bound of consumer cost, but also that the additional costs imposed at the system level are difficult to estimate, except to indicate likely order of magnitude. Employing the methodology described in work by one of us (Gibson) REF has estimated that the additional system burden in 2020, assuming the 2011 *Roadmap* plant mix, would amount to around £5 billion a year.[3]
13. On this view, even if the capital costs of wind power fall to zero the additional system integration costs caused would result in wind electricity being 50% more expensive than that generated by CCGT or nuclear.

[3] REF, *Energy Policy & Consumer Hardship* (2011), 30. See http://www.ref.org.uk.