Submission to the Environmental Audit Committee Inquiry
The role of carbon markets in preventing dangerous climate change

David Newbery
Research Director, Electric Policy Research Group[1]
University of Cambridge
26 February 2009

The EU Emissions Trading Scheme

Summary

- **Whether, and under what circumstances, emissions trading ought to be supplemented or replaced by tax or regulation**

1. The EU ETS has many virtues, most obviously that it was probably the simplest means of securing support from EU member states (MS), as it allocated entitlements rather than imposing obligations to set taxes, a hotly defended prerogative of individual MS's. Its main limitation is that, as presently operated, it cannot deliver the predictable and stable carbon price needed for long-term low-C investment decisions. There are sound economic reasons for setting a carbon price rather than a carbon quota, and the system of feed-in tariffs is a good example of one such approach. HMG should consider issuing options on the carbon price for low-C technologies in the covered sector, and encourage the EC to withhold enough EUAs to trade to stabilise their price.

- **Extent to which the EU ETS carbon price will be sufficient to drive low carbon investment, in particular decarbonisation of energy**

2. Whether or not the EU ETS price will be sufficient to drive low-C investment will depend on its predicted level and investors' confidence that the price will not fall below the point at which the low-C investments cease to be profitable; and additionally whether the planning and licensing regimes and, critically for electricity, grid access and charging regime, are adequately supportive of the investments.

---

[1] The Electric Policy Research Group (EPRG) is the culmination of a continuous series of projects starting in 1990 and at various times supported by the UK Economic and Social Research Council, The Cambridge MIT Institute, and the European Commission. The larger part of current funding comes from a 5-year £2.4 million ESRC research group grant. EPRG's membership within the University is drawn from economics, management, engineering and law and also includes associates from business, regulatory agencies and government. EPRG engages in research, publication and informed debate on the economics and public policy issues concerning the efficiency, regulation, security and sustainability of electricity in the wider context of European and global energy supplies and environmental constraints, as reflected in the European Emissions Trading System. Members of EPRG have published a number of reports on carbon pricing, carbon markets, and emissions trading, of which the most useful is probably the book *Delivering a Low Carbon Electricity System: Technologies, Economics and Policy* (Grubb, Jamasb and Pollitt, 2008). This submission draws heavily on Grubb and Newbery (2007), but reflects the views of author alone.

- **Allocation or auctioning of EU ETS credits, and the use of auctioning revenues**

3. HMG should press for the maximum extent of auctioning, and should endeavour to find better ways of protecting export-exposed carbon-intensive sectors from unfair competition from countries lacking an adequate carbon price, preferably by border tax adjustments, and only as a last resort via allocations of EUAs. There is a strong case for hypothecating the auction revenues for low-C RD&D, most immediately in providing the subsidies required above the carbon price for renewable energy, and not passing those subsidies through as charges for end-users. HMG has already accepted the principle of hypothecation for its earlier (and mis-named) Climate Change Levy (that was really an energy tax), and it would be in line with the intent of the Renewables Directive as a burden sharing agreement to finance such subsidised deployment of immature but promising low-C technologies.

The EU Emissions Trading Scheme

- **Whether, and under what circumstances, emissions trading ought to be supplemented or replaced by tax or regulation**

4. A price for carbon can be established directly either using a carbon tax or charge, or by setting a quantity limit and letting companies trade the resulting emission allowances, which is the approach adopted by the EU Emissions Trading System (EU ETS). In the past various countries, notably Scandinavia in the early 1990s, have imposed carbon taxes on fuels (with exemptions for internationally exposed industries). With complete information and no uncertainty, the efficient level of emissions can be achieved either by issuing the correct number of quotas or setting the pollution tax at the marginal damage cost (measured at the efficient emissions level). This equality of outcome breaks down under uncertainty or with asymmetric information. Weitzman (1974) started a lengthy debate by observing that in the presence of uncertainty, quotas are only superior to taxes if the marginal benefit from abatement schedule (i.e. the marginal damage of emissions) is steeper than the marginal cost of abatement schedule. In the case of CO_2 emissions the marginal benefit from abatement should be almost perfectly flat, as greenhouse gas (GHG) emissions contribute to an atmospheric stock with a very slow rate of decay. The damage contributed by emissions today is thus effectively the same as those tomorrow, and so the marginal benefit of abatement is essentially flat at each moment, while the marginal cost of abatement rises rapidly beyond a certain point.
5. Figure 1 (at the end) shows that if the taxes and allowances are set on the basis of the expected marginal costs and benefits, but the correct marginal costs are higher than expected, then the deadweight or efficiency loss from incorrectly setting a permit at level Q rather than Q^* is considerably higher than incorrectly setting the tax or charge at t rather than t^*.
6. The scale of the hazard of global warming is very uncertain, as are the future costs of reducing carbon intensity. All these are arguments for a stable global carbon price. As more information about the damage of global warming arrives, so the optimal price can be adjusted (just as the allowed level of emissions would have to be adjusted). The desirable stability of the carbon price is not absolute, but only applies over (possibly quite long) periods of time in which no significant new information arrives, and should be adjusted as better information about future climate change damage arrives. In contrast, tradable quotas can give rise to volatile prices over quite short periods of time, as illustrated by the experience of both phases of the EU ETS.
7. Thus the *Stern Review* accepts the force of the Weitzman argument for the short term, but argues that we should collectively aim at an equilibrium GHG concentration below 550ppm (CO_2 equivalent). This is equivalent to specifying a stock of GHGs, or a quantity limit on the amount of fossil fuel that can be burned over the next 100-200 years. Thus while the carbon price should be moderately stable over reasonable time periods (1-15 years if no new information about the costs of climate change arrives),

8. There are thus good economic arguments for fixing the price of carbon rather than fixing the total level of emissions in each period and allowing the market to determine the price. There are good political economy arguments for launching climate change policies through issuing tradable permits, as in the ETS. Pizer (2002) argues for an initial allocation of permits, followed by selling additional permits at a fixed price (and being prepared to buy back when the traded price fell below a floor). This can be made cash positive or neutral to the EC by suitable reductions in the allocations of EUAs each year to ensure that on balance the EU were selling rather than buying.

9. A similar proposal termed the "safety valve" is discussed by Jacoby and Ellerman (2004), while Hepburn (2006) surveys the range of hybrid instruments, including price ceilings and floors, and penalties for failing to deliver permits (which effectively cap the price at the penalty level – the method used in Britain for Renewable Obligation Certificates). These alternative approaches to reducing or eliminating price volatility differ in the financial risks they place on the agency entrusted to stabilise the price. While there is little risk in capping the price (and penalties would generate extra income), the main problem is in providing a floor, as buying permits to support the price could be costly. Of course, if sufficiently few permits are issued in the first place, with the balance sold at a fixed price, this risk can be made arbitrarily small, but that is not the present design of the ETS, and any change to the ETS would require the agreement of the member states. Such design issues should be put on the agenda as soon as possible.

10. Price stability (or at least a price floor) should be pursued at EU level, but it may also be necessary to provide investor assurance in the UK in pursuit of the next objective.

- **Extent to which the EU ETS carbon price will be sufficient to drive low carbon**

11. Whether or not the EU ETS price will be sufficient to drive low-C investment will depend on its predicted level and investors' confidence that the price will not fall below the point at which the low-C investments cease to be profitable; and additionally whether the planning and licensing regimes and, critically for electricity, grid access and charging regime, are adequately supportive of the investments.

12. Uncertainty is not new: investors face it all the time. There are, however, three things that make the low carbon investment fundamentally different:

    a. The risk associated with carbon price is largely *policy and political* – risks that private investors find particularly hard to judge and manage, and where alternate strategies include investing in lobbying, or just waiting for policy uncertainty to be resolved. That waiting is costly if it undermines the UK's claimed leadership role in dealing with climate change.

b. The timescales of investment are very long, and there is a marked disjuncture between the time horizons of most corporate or equity investors (seeking typically 10-15% rate of return for more speculative projects, though considerably lower for low-risk mainstream utility investments), and those professed by the government (discount rates that reflect ethical bases for consistent intergenerational decision-making, as in the Stern report (of about 1.4%), and the UK Government *Green Book* rate of 3.5%). In itself this would not necessarily matter (other investments are also long-lived but do not need special treatment), but it is the combination of long timescales *and* policy risk that is damaging.

c. While fossil-fuel generation is at the margin and setting the electricity price, conventional generators will be largely hedged against both fuel and carbon price risk, as these will determine the price of electricity. Investors take comfort from the link between the marginal (fuel plus carbon) cost of generation and the electricity price, and are thus able to shift much of the input cost risk through to consumers, at least if they have a balanced portfolio of plant. Companies that specialise in renewables or nuclear power are exposed to an electricity price driven by the volatile marginal fuel cost and a possibly volatile carbon price, and so face more risk (Roques et al., 2006). Thus *even with a fixed and guaranteed carbon price, the structure of electricity markets places the risk associated with uncertainties in the electricity price on low carbon investors.* Again such risks are not necessarily indicative of market failure, but they may amplify the underlying problem of policy risk.

13. It therefore follows that any measure to reduce these risks should have a beneficial effect on low-C investment, and should lower the cost of delivery, as the cost of risk is reflected in higher discount rates or required rates of return. At present, renewables are supported by a mechanism (Renewable Obligation Certificates) that maximises the risk, as the received revenue will depend on the price of electricity (driven by gas prices and hence risky to renewables), the carbon price (also volatile) and the ROC price that depends on supply and demand for ROCs, and hence on the efficacy of the planning system and the fragility of the financial system, as well as on changing legislation about the number of ROCs offered for differing technologies.

14. There are a number of ways of reducing risk and encouraging investment, of which in electricity the two most important are to remove barriers to investment created by planning delays and the queue to connect to the national grid. The latter is not a problem for base-load stations such as nuclear power, but is a real problem for intermittent and low-load factor renewables, as they must be offered firm transmission rights under the current Grid Code, and have to secure expensive balancing services under the poorly designed Balancing Mechanism. Both (and arguably also the entire market design of the wholesale market) need reform, reaching beyond the very limited Transmission Access Review of Ofgem and DECC.

15. If we return to reducing risk and ensuring that low-C investments are profitable, the most direct way is to ensure that the price of carbon is kept at a high enough level to support socially profitable low-C investments. Within the UK, HMG could issue a contract-for-difference (CfD) with investors on the future carbon price. [2] This could be a simple CfD in which the contract states a strike price of e.g. 25 €/tonne CO_2 (or 92 €/tC), and these are either sold or issued in proportion to declared net capacity of new zero-carbon generation (or in proportion to generation each year). The holder would then be entitled to receive the strike price *less* the actual carbon price implicit in any UK-wide carbon instrument that applies to fossil generation (and if this price were above the strike price then the holder would be obligated to pay the amount by which the price were above the strike price).[3]

16. An alternative would be to issue or sell a one-sided CfD with a floor price, say 20 €/tonne CO_2, with the issuer obligated to pay any shortfall below this floor price, but the holder would benefit from any upside. Another variant on this is to issue put options on the carbon price(Ismer and Neuhoff, 2006). Such instruments would provide a powerful commitment signal by the Government (or the European Commission) to the continuation of the ETS or its successor, and would also help stabilise the future (and hence, with banking, the present) carbon price.

17. A more direct method that would avoid the need to underwrite the carbon price would be to offer long-term electricity off-take contracts to low-C investments, following the format of e.g. German Feed-in Tarrifs, (which specify a constant real or nominal price per kWh for a set period for a particular place and technology, or one that declines after a number of years). Alternatively, HMG could hold a tender auction for the fixed and per MWh amount that would be acceptable for the offered investment opportunities, with penalties for failure to deliver (except where these could be demonstrated to be a failure of an otherwise acceptable planning application).

- **Allocation or auctioning of EU ETS credits, and the use of auctioning revenues**

18. As is now widely recognised, the price of EUAs was passed through fully in the final price of electricity (the industry for which we have the best data) and hence the free allocation was cashed in at the EUA price by the fossil generators, resulting in a massive windfall gain. There is no case for repeating such a wilful misuse of the value of a common property resource that should be owned by the country. The only sectors with any case for free allocations are those for which the carbon cost is material and which are exposed to vigorous international competition from countries that have no carbon price. Aluminium, some kinds of steel and cement may come in this category.

---

[2] See for example House of Commons (2006) at paras 179 et seq.

[3] This would require the Government to be quite explicit about the equivalent carbon value of any instrument that might replace the ETS, particularly if this took the form of a carbon tax (*not* an energy tax like the Climate Change Levy). If there were no such instrument that specifically charged electricity generators in proportion to the CO_2 emitted, then the price would be deemed to be zero.

There are, however, better means of addressing the unfair competition from sources that do not pay the social cost of the emissions they release.

19. The most direct way would be to ensure that any imports are taxed on the deemed carbon content of the commodity (based on moderately poor performance unless certified to come from an efficient supplier), with rebates in proportion to any carbon tax or quota price paid by the import; with an export rebate of the EUA or carbon tax embodied in the export. Only until such a system is in place might exposed industries be granted EUAs in proportion to their output at some deemed (and high) efficiency level.

20. There is a good case for providing *additional* support for renewables (additional to the support received for avoiding CO_2 emissions through the EU ETS). If the renewables technologies are not yet mature, then their costs should fall as money is poured into their development and deployment. Just as in the past huge sums were spent developing nuclear power (see figure 2), and, through defence contracts, high efficiency gas turbines that have revolutionised electricity generation, so we should now spend large sums developing renewables to the point that they are commercially attractive in developing countries. If that happens, climate-damaging emissions will not just be reduced in the EU but in the world as a whole, helping to mitigate damaging climate change.

21. Wind generation costs have fallen dramatically as more wind generation has been deployed, to the point that they are already competitive (on-shore) with coal and gas generation, providing the latter pay an EU carbon price of €30/tonne (its projected level). Photovoltaic (PV) panels have also seen dramatic falls in cost as chip technology driven by the IT revolution has spurred development (although they are still far too costly for most purposes). Figure 3 shows the results of increasing the production of various technologies, where the suggestion is that increased production from the technologies (proxying for the increased deployment of these technologies) results in learning by doing and with that a fall in costs. The numbers on the graph show the costs as a percentage of the previous cost level after the scale has been doubled. Thus PV falls to 65% of its earlier cost for each doubling of output, while wind falls to 82%, or by 18% for each doubling of scale.

22. The auction revenues should therefore be hypothecated to deliver as yet uncommercial (at the EUA price) but promising low-C technologies. HMG has already accepted the principle of hypothecation for its earlier (and mis-named) Climate Change Levy (that was really an energy tax), and it would be in line with the intent of the Renewables Directive as a burden sharing agreement to finance such subsidised deployment of immature but promising low-C technologies. At present the (unnecessarily high) cost of supporting renewables is passed through to final electricity consumers. The SKM report commissioned by the Government estimates that to meet the UK renewables target agreed with the UK, some 120 TWh of electricity will have to come from renewables by 2010. Although BERR estimates

that the extra cost of the renewables support per household might only be £32-£53 per year, a more realistic estimate might be £82/household/year.[4]

23. Between 2004 and 2005 the cost of electricity rose by £20/ household/year and the number in fuel poverty rose by 500,000, partly wiping out the reduction in number of fuel-poor of 4 million over the years in which the cost of electricity fell by £100/ household/year. On a simple extrapolation, a further rise of £80 might return all those 4 million into fuel poverty. These and other electricity consumers are paying for the RD&D that is the justification of renewables support and which will largely benefit people in the rest of the world (assuming that it meets its objectives of making commercially attractive other low-C renewables for deployment in the rest of the world). It is hard to see why the poor in the UK should be charged for this support.

[4] This is based on the observation that the 14.6 TWh of renewables were estimated to cost each household £10/year in 2006/7, so that 120 TWh might cost 120/14.6 times £10 = £82.

References

Grubb**,** M. and D. Newbery (2007) "Pricing Carbon For Electricity Generation: National And International Dimensions " (EPRG 07/22); Ch 11 in *Delivering a Low Carbon Electricity System: Technologies, Economics and Policy* Editors: Michael Grubb, Tooraj Jamasb and Michael G. Pollitt (*University of Cambridge)* Cambridge University Press

Hepburn, C. (2006) 'Regulating by prices, quantities or both: an update and an overview', **22**:2 *Oxford Review of Economic Policy*, 226-247.

Hepburn, C., Grubb, M., Neuhoff, K., Matthes, F. and Tse, M. (2006) Auctioning of EU ETS phase II allowances: how and why?, *Climate Policy*, vol.6, no.1, pp.137-160.

House of Commons (2006) *New Nuclear? Examining the Issues* House of Commons Trade and Industry Committee available at http://www.parliament.uk/parliamentary_committees/trade_and_industry/tisc_nuclearnewbuildreport.cfm

IEA (2000) *World Energy Outlook*, Paris: International Energy Agency

Ismer, R. and K. Neuhoff (2006) "Commitments through Financial Options: A Way to Facilitate Compliance with Climate Change Obligations" EPRG06/25

Jacoby, H. D. and A. D. Ellerman, The safety valve and climate policy, Energy Policy, 32 (4) 2004, 481-491

Pizer, W. (2002). "Combining price and quantity controls to mitigate global climate change." *Journal of Public Economics* **85**(3): 409-434(26).

Roques, F. A., W. J. Nuttall, D. M. Newbery, R. de Neufville, S. Connors (2006) "Nuclear Power: a Hedge against Uncertain Gas and Carbon Prices?" *The Energy Journal*, **27**, (4) 1-24

Stern, N.H. (2006) *The economics of climate change*¸Cambridge: CUP

Weitzman, M.L. (1974) "Prices vs. Quantities", *Rev. Econ. Stud.* **41** (4), 477-91

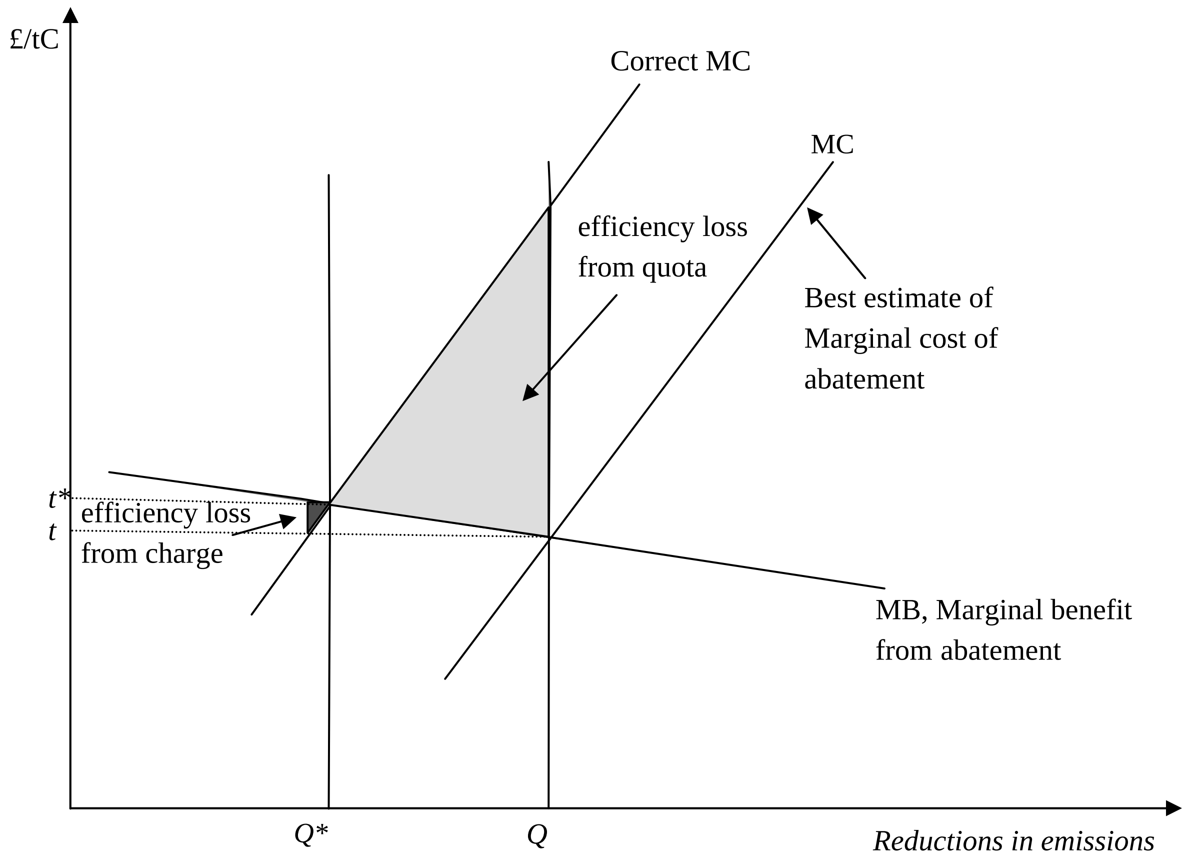

Figure 1 Relative efficiency of prices vs. quantities

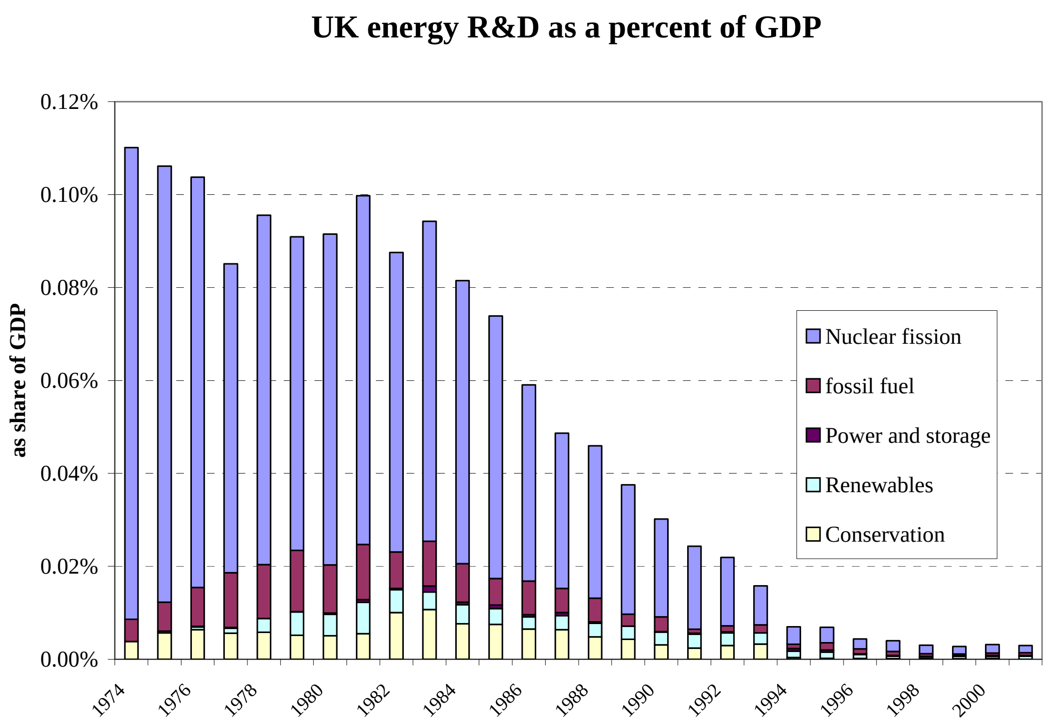

Figure 2 UK energy R&D

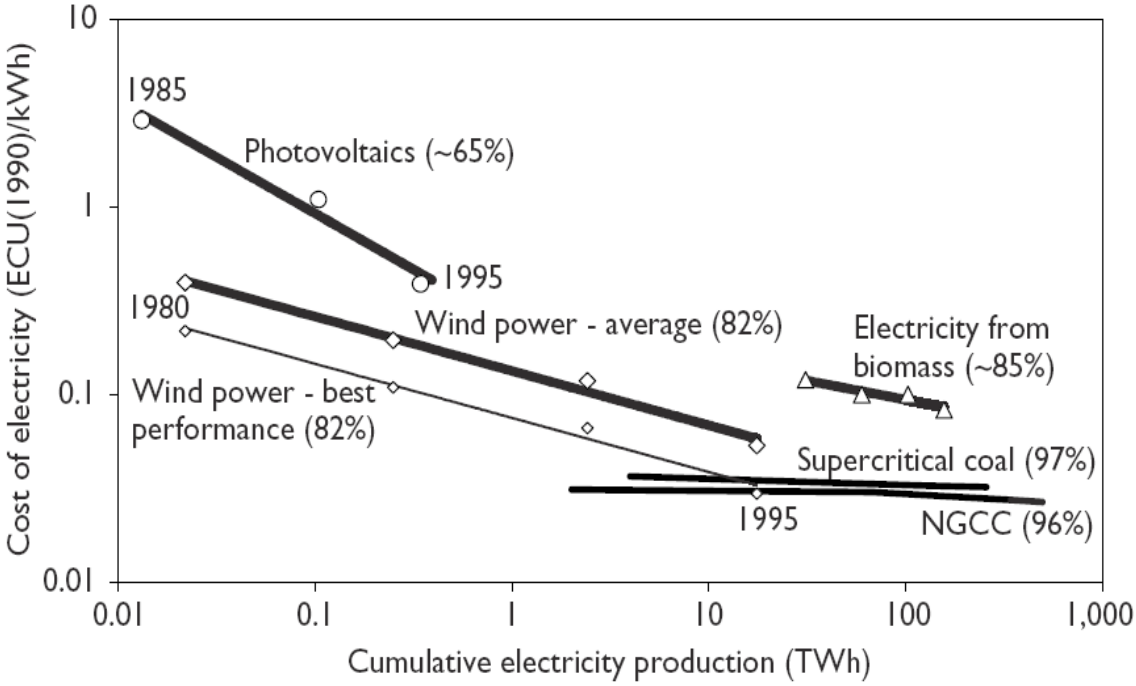

Figure 3 Experience curves showing cost reductions in response to learning
Source: IEA (2000)