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Nuclear Power in the UK: is it necessary? is it viable?

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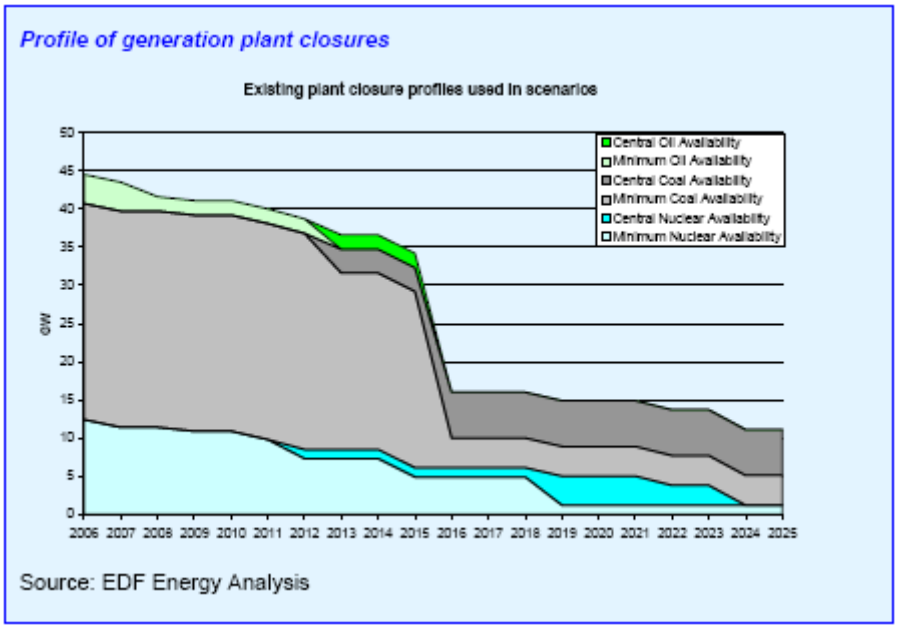
Introduction

Politics is said to be the art of making the necessary possible. If so, it is likely to be what determines the viability of new nuclear power in this country. New nuclear is arguably necessary – to deliver energy security and diversity and to enable carbon emissions targets to be met. However, significant investment in new nuclear is unlikely to be viable, unless the government gives it more support as an outcome of the current nuclear review. It will therefore be for the government to decide whether to make the necessary possible.

Security and diversity

Energy security is usually discussed in terms of the reliability of imports of primary fuels. But in practice interruptions to energy supply are usually a result of problems with infrastructure, whether due to accident, breakdown, industrial action or under-provision, leading to a lack of capacity to deliver energy as and when consumers require it. The UK is currently facing a major capacity challenge in the area of electricity generation due to the planned retirement of nuclear and coal plant – most of the UK nuclear fleet is due to retire by around 2020 while a large proportion of existing coal capacity is expected either to retire or to be restricted to a limited number of running hours as a result of the tightening of the requirements under the Large Combustion Plants Directive. The picture is shown in the chart below.



In practice, matters might not be quite as stark as the chart implies. Some plants will receive lifetime extensions and some may operate for longer than currently expected. Nonetheless, the overall picture is accepted by all parties, including the government: around 25 to 30 GW of coal and nuclear plant, one third of the UK's capacity, is due to be taken out of service by around 2020 or shortly thereafter. This may seem a fair way off, but it is in fact a tough deadline when it comes to new nuclear. Even if a decision to build new plant is made in the wake of the current review, it is only on fairly optimistic assumptions that it could be brought into service by 2020.

The problem is compounded by what might at first sight seem to be a partial solution. The government has a target of 20% of electricity from renewables by 2020, which will require the construction of large amounts of renewable capacity. (This target is not formally binding and may well be unrealistic, but the EU has this year agreed, with the support of the UK, a "binding" target that 20% of all energy should come from renewables by 2020. The uncertainty about the status of the target only adds to the unpredictability of the investment climate.).

What the target means in terms of capacity will depend on the renewable sources involved, but the Sustainable Development Commission (SDC) has suggested that about 26 GW of new renewable capacity might need to be built, on the assumption that the main source would be wind. While this might seem to fit well with the loss of 25 to 30 GW of coal and nuclear plant, in fact it makes life more difficult:

- First, because it adds to uncertainty. Every government renewables target to date has been missed and many will expect the same to happen with the 20% target. However, they can also expect the government to keep ratcheting up support for renewables in a desperate attempt to get closer to the target, creating an increasingly distorted and unpredictable power market.
- Second, because the SDC's 26 GW of renewables is only equivalent to around 6 GW of firm capacity, due to the intermittent nature of wind power. So around 20 GW of capacity would still need to be built, essentially as back-up for the wind. The wind and other renewable capacity would run when available, limiting in an unpredictable way the market available for non-renewable sources.

So the intervention in favour of renewables makes the electricity market much less attractive for other sorts of capacity, yet they would still be needed in nearly the same quantities. The likely market response will be to limit the risks by building low capital cost, low lead-time, gas plant at the latest possible moment. This might prove a security problem and would undoubtedly reduce diversity.

In short, the UK is facing a significant security challenge, and government interventions in the electricity market are so far increasing, not reducing, the security risk. The UK is very likely to face a loss of diversity and reliability in its electricity system, and possibly even capacity shortages, unless steps are taken to ensure reliable replacements for the nuclear and coal plants which are due to retire.

Climate change

The problem with climate change is similar – the government is facing a major challenge and has not (yet) developed the means to deliver an effective response. This challenge is to a large extent self-imposed – in its new Climate Bill the governments has set a goal of reducing CO_2 emissions by 60% by 2050, with an interim target of a 26-32% reduction by 2020. Both targets would be legally binding.

The government's willingness to make such commitments flies in the face of its own poor performance. Under the present administration, CO_2 emissions have in fact increased, not declined. (The UK's relatively good performance on greenhouse gas emissions overall is due to two main factors – the dash to gas of the early 1990s, and a significant reduction in non CO_2 gases, which now provide only limited opportunities for further savings). In other words, all the climate change policies introduced over the last ten years have done nothing to reduce CO_2 emissions, yet the government seems to believe that it can meet future targets, despite having nothing new to offer in policy terms.

It is relying on measures (like energy efficiency, combined heat and power and new renewables) which have not been proven to have a significant impact, and neglecting those measures for which there is evidence of effectiveness. Apart from cases of war or industrial collapse, the two most striking examples of rapid reductions in emissions over a short period which can be identified from the historical record are:

- France – where emissions fell by around 100 million tonnes (mt) between 1979 and 1987 (20% of total French emissions); and
- Sweden – where emissions went down by 20mt between 1979 and 1983, or 25% of the Swedish total.

These reductions have been sustainable as the following table, showing emissions across the economy and in particular sectors, indicates:

CO_2 emissions (tonnes per capita)

Country	Total	Electricity	Transport
France	6.2	0.6	2.3
Denmark	8.8	4.3	2.3
Germany	9.9	3.7	2.0
Netherlands	11.2	3.1	2.1
Sweden	5.6	0.8	2.5
UK	8.8	2.7	2.2

Source: IEA

The countries with low emissions are not those, such as Denmark, Germany and the Netherlands, which have adopted the sort of policy the government is advocating, but countries such as France and Sweden with high nuclear (and hydro) capacity. They have emissions per head some 40 to 50% below that of other northern European countries, due almost entirely to the low level of emissions from electricity – in other sectors, such as transport, the differences are minor. Since significant expansion of hydro power is probably not an option for the UK, that leaves nuclear as the only alternative with the proven capacity to deliver emissions reductions on the scale required. There may in future be others (for instance, tidal power or carbon capture and storage) but they are at present uncertain. To meet a binding target of the sort the government has imposed on itself, it will need all the tools available (and will need to be confident that they can deliver) so it would be ill-advised to neglect nuclear.

Is nuclear viable?

Furthermore, nuclear appears to be a cost-effective form of carbon reduction – considerably cheaper than renewables according to the government's consultation paper. While such calculations inevitably depend on the assumptions chosen, the figures suggest that nuclear can deliver carbon reductions at a cost of around €25per tonne while for renewables the cost is around 10 times as much, €250 per tonne. The policy conclusion seems obvious – to meet tight carbon targets at minimum cost, the government should give nuclear support of the same sort as it gives to renewables, but at a much lower level.

But this is not the government's position. Admittedly, it has to be careful in what it says during the consultation period on the nuclear review to avoid appearing to pre-empt a decision (though it never faced similar concerns over renewables); nonetheless, it has committed itself firmly to the proposition that it will be for investors to decide whether to build nuclear plant. The government might have a facilitating role, for example in simplifying planning procedures and setting up a nuclear waste and decommissioning regime, but it has made it clear that it does not intend to subsidise nuclear in the same way as renewables, apart from recognising the carbon benefit via the European Emissions Trading Scheme.

It is not clear that nuclear would be viable on this basis, given the dynamics of investment in a liberalised market. The government appears to base its position on calculations of the cost of generation from nuclear, which appears more or less economic. (On the government's central gas price scenario, and with no carbon price, in fact nuclear has a small cost penalty. However, the government is now making the assumption that a carbon price of at least €25 needs to be factored into the calculations, making nuclear appear economic on some scenarios, and especially if gas prices are high.)

However, it is assessments of risk which drive liberalised markets, not ex ante calculations of "levelised costs" and simple pence per kWh comparisons. Risk depends not just on scenarios of possible price movements but on the dynamics of competitive markets – that is, on what other generators are doing – and on minimising and managing risk. In economic terms it is a question of game theory. It is easy to

demonstrate that in conditions of uncertainty, this will tend to lead to the postponement of investment; to investors choosing plant which offer flexibility and "optionality"; and to a preference for "running with the herd" to ensure that even if an investment choice is not (with hindsight) optimal, it will at least remain competitive with the rest of the system – in practice, to a preference for gas. We have seen all these phenomena in liberalised power markets.

Such markets are therefore problematic, at the best of times, for nuclear. Nuclear is high capital cost, takes longer to build than fossil plant and entails not just a higher level of risk but a wider range of risks. These include:

- **market** risk arising from electricity price volatility, which affects all generators, but particularly nuclear, because of its high fixed costs (as was shown in the UK in the earlier years of this decade).
- **nuclear specific** risks, such as planning, decommissioning and waste management (which are being discussed with the government at present but have not yet been resolved).
- **political risk.** Government support for nuclear can easily change over time, as many European countries have shown (Germany, Sweden, Spain, Italy, Netherlands etc) raising the risk that plant may not be allowed to operate for their full life times (or at all). There is no real consensus on nuclear in the UK at present – for instance, the Scottish National Party remains opposed and Scotland is an important player, with a much higher proportion of nuclear generation than the rest of the UK. Furthermore, political risk may be completely outside an investor's control. A nuclear accident anywhere in the world could change political attitudes overnight (as happened in the wake of the Chernobyl accident).
- **environmental risk.** Despite nuclear's low emissions, the environmental risk is real. Whatever the government may argue, it is difficult to rely on any particular level of carbon price, especially when the successor regime to Kyoto remains to be agreed; the short experience with emissions trading so far only underlines the risk of carbon price volatility. The government has actually increased the uncertainties, because the timescales in its Climate Bill are not nuclear friendly. As noted, the 2020 deadline would be quite a stretch for nuclear (while the 2050 target is too far away for it to be clear whether nuclear would be needed). It would be easy for an NGO to argue that nuclear would not be of obvious help in meeting these (binding) targets, and that the government is therefore obliged to do something else instead, adding to the already high risk of legal challenge to any nuclear construction programme.
- **construction risk**. It is not clear whether nuclear has overcome the major problems of the past – construction delays and cost overruns – given that so few nuclear plants have been built in the OECD recently. Experience with the Olkiluoto plant in Finland, the only one currently under active construction, suggests that there may still be problems in this area. The plant is behind schedule and over budget.

In short, nuclear remains a high cost, high risk option, ill-suited to a liberalised market. Renewables face similar barriers, but the government has taken steps to overcome them, knowing that that is the only way to get renewables built in

significant quantities. So far it has shown no disposition to do so in the case of nuclear, despite the fact that it is a lower cost and larger scale source of carbon reductions and that, as with renewables, it is unlikely that significant quantities will be built without clear government support.

Nuclear therefore remains on the horns of an uncomfortable dilemma. It seems to be necessary, but not possible. The government will have to show political will if it is to resolve this dilemma and produce a credible long term energy and climate change strategy.