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A Nuclear Future? UK Government Policy and the Role of the Market

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The target of reducing Greenhouse Gas (GHG) emissions to 80% below 1990 levels by 2050 is best achieved by decarbonising electricity. If fossil generation paid the full social cost of carbon, zero-carbon nuclear power and much on-shore wind power would already be competitive in favoured locations, but carbon capture and storage (CCS) and many renewables (biomass, tidal stream, wave power, photovoltaics, and even concentrated solar thermal power) remain commercially uncompetitive.

Renewable electricity supply (RES) may be more suitable for many developing countries than other zero-C options, particularly nuclear power. If RES is to be widely adopted, costs must be driven down through research, development, and deployment (RD&D). Supporting RES is justified by the induced innovation and learning-by-doing that deployment might deliver. The case for EU-wide RES targets is as an equitable burden-sharing arrangement to finance this RD&D.

The UK options for delivering zero-C electricity appear limited with the exception of nuclear power: hydro-electricity is limited, wave/tidal energy is too costly, biomass for electricity generation is an inefficient use compared with heat raising and requires a huge land-take, CCS is expensive as are photovoltaics, leaving onshore wind which is almost competitive at present prices but faces challenges in visual acceptability and transmission connection. Offshore wind is costly, and so the concentrated power in North Africa appears a long way off. Nuclear power has a proven track record of delivering rapid reductions in carbon intensity. Between 1975 and 1990 France installed 50 GW of nuclear capacity at rate reaching nearly 5 GW/year, comparable to the best achieved by the United States. The carbon intensity of electricity fell from about 500g CO2/kWh in 1977 to about 100 g CO2/kWh in 1987. In contrast the UK constructed only 7 GW between 1975 and 1990 and now has a carbon intensity of 550 g

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CO2/kWhr. Unfortunately, over the next decade instead of increasing its share of generation and helping reduce carbon intensity, British nuclear power will gradually fade away and unless new build is commissioned soon, we shall be left with just one station in the 2020s.

Contrast this with wind power where the leaders, Germany and Spain, have added effective capacity (allowing for the relatively load factor of 25%) at rates less than 400 MW effective per year, or about 10% of the rate at which France installed nuclear capacity. By 2008, Germany had the equivalent of three nuclear power stations in installed wind capacity, with Spain somewhat behind and the UK with the equivalent of just over one-half a nuclear power station. Nonetheless, if the UK matched the German build rate she could meet the Committee on Climate Change's (CCC) 2020 targets of 27 GW installed (not effective) wind capacity.

Nuclear power can thus deliver zero-C electricity in bulk, reliably and without intermittency, it has a very small land take in contrast to RES, and the first set of sites are now available. It still appears to be the least costly of large-scale zero-C alternatives, particularly at low discount rates. The White Paper on Nuclear Power (2008) now accepts "that nuclear power is low carbon, affordable, dependable, safe and capable of increasing diversity of energy supply." Given build times, however, the CCC expects no stations commissioned before 2018, even if the market would build them.

In liberalised markets, nuclear power faces risks that are avoided by state-owned or regulated companies with the power to pass costs through to consumers. The forward price of electricity moves very closely with the forward fuel costs of generating plus the cost of CO2 required, so fossil plant is hedged while low-C plant is exposed to the full and considerable electricity price risk. In addition the CCC argues that the EUA (i.e. CO2) price is too low to support low-C investment and should be raised. The more successful the EU is at meeting CO2 and RES targets, the lower the EUA price and the worse the market prospects for unsubsidised low-C generation.

A well-designed market should provide incentives for timely, efficient (by location and technology) and adequate investment in generation and transmission, reflecting the correct social cost of carbon. It should support RD&D without distortions, ensure that the existing plant is efficiently despatched and that the final price is affordable to consumers. However, wind is intermittent, increasing within-year price

volatility and requiring more flexible reserve margins and lower load factors for flexible plant, both raising costs and/or risking security of supply. Volatility raises the cost of delivering RES targets under the current Renewable Obligation Certificate (ROC) scheme, would be cheaper if replaced by a feed-in tariff (FIT) such as those in Germany and Spain, both successful investors in wind. Unfortunately, attractive low-C support schemes tend to bypass the market. Acquiring reserves more cheaply will likely require longer-term (4+ year) contracts. If a large fraction of generation is intermittent, or inflexible (like nuclear), or operating with long-term contracts, the market will fail to deliver its intended advantages and will need redesign.

Given that the carbon price is both too low and too unpredictable, and that the UK's RES support through ROCs is costly and inefficient, the country faces essentially two alternatives. One is to abandon the liberalised market and move to a single buyer model with competitive tendering for contracts for new plant. That could overcome the risks and costs facing nuclear and other low-C power. The alternative is to reform the market to meet some of the drawbacks of the current design by a shift to nodal pricing with central despatch and the System Operator given a longer time horizon (4 plus years) to contract for balancing and reserve services. ROCs for future RES. would be replaced by a FIT paying a capacity payment for availability and an energy payment if despatched. That should avoid wind bidding negative prices and disrupting the spot market and should provide greater investment assurance for new RES.

Supporting the carbon price should ideally be done at the EU level, and as between the alternatives for the UK of offering contracts for differences on the carbon price or imposing an additional carbon tax on fossil generation, the latter is fiscally preferable to the former. Provided the future carbon price is underwritten at a sufficiently high level, nuclear power would seem viable in a liberalised market without long term off-take contracts, particularly if nuclear generating companies issued electricity-indexed bonds to consumers to reduce the cost of capital.

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