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The cost of CO2 abatement from Britain's only PWR: Sizewell B

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The UK has now committed itself to Net Zero by 2050, and various bodies, such as the Commission on Climate Change and the National Infrastructure Commission are publishing pathways for the energy sector to meet that target. Considerable uncertainties are highlighted with important differences in possible pathways to net zero. Heating is recognised to be one, where the two extreme options are to decarbonise natural gas to hydrogen by Steam Methane Reforming with Carbon Capture and Storage (CCS), or to electrify using heat pumps. The hydrogen pathway could use the existing gas pipeline system and (slightly modified) existing equipment in buildings, while electrification requires massive investment in heat pumps as well as a considerable expansion of the electricity system. The other major choice, or rather, the optimal balance, is between renewable electricity, nuclear power and/or CCS.

Almost without exception, where these reports give costs, they do not draw attention to the cost of financing the investments (the Weighted Average Cost of Capital, WACC), and where they do the default assumption appears to be that these will be financed at the kinds of hurdle rates used by private companies investing in a liberalised electricity market. However, one characteristic shared by all zero and low-carbon energy technologies is that they are very capital intensive, so the cost of capital is a main determinant of their life-time costs. With the exception of CCS and SMR hydrogen, operating costs are low, further amplifying the role of the WACC in determining cost. This can matter when choosing the best portfolio of techniques to deliver the target. This paper will argue that the tendency to assume high hurdle rates is both damaging (in exaggerating the costs of decarbonisation), potentially dangerous (in the choice of techniques) and unnecessary, in that there are better methods of financing such investments that dramatically reduce the WACC.

One practical method of reducing the WACC is to follow the Regulated Asset Base model adopted for privatized network utilities and with a successful 30-year record of delivering low WACCs. This paper applies that model to the last nuclear power station commissioned in the UK (Sizewell B, SZB, on the east coast of Britain) to ask whether it was a cost-effective way of decarbonising. This is particularly important as the standard argument against nuclear power (other than dread of massive accidents, and its association with the bomb) is that it is too expensive compared to the now rapidly falling costs of renewables. This paper will look at a particularly expensive example — the first and only one of its kind in the UK — and argue against that view, based on a tried and tested method of lowering the WACC.

Britain originally planned a nuclear power programme, partly in response to Prime Minister Margaret Thatcher's concern over the environment and global warming. On November 8, 1989 she told the UN: "What we are now doing to the world, by degrading the land surfaces, by polluting the waters and by adding greenhouse gases to the air at an unprecedented rate - all this is new in the experience of the earth. It is mankind and his activities that are changing the environment of our planet in damaging and dangerous ways." That same year the Thatcher Government announced a programme of ten new PWR reactors, of which Sizewell B is to date the only one commissioned, a programme certainly brought to an end with the privatization of the CEGB and the realisation that the nuclear power plants were at that time unsaleable to the private sector (at least without the kind of long-term contract examined here).

This paper asks what it cost per tonne of CO_2 abated by displacing fossil generation. The assumption on which this calculation is based is that without an adequate carbon price, new nuclear power was not commercially viable. Just as other zero-carbon renewables required contractual support, SZB would have required a long-term contract at above market prices. The simplest such contract would be a long-term Contract-for-Difference (CfD) with the terms periodically revisited in quinquennial price controls under the Regulatory Asset Base model of the privatised utilities. At a low value of the WACC the cost is £$_{2019}$34.1/tonne CO_2 abated and £$_{2019}$49.2/t. CO_2 at the high WACC, compared to the roughly £40/t. CO_2 paid by GB generators in 2019, now thought to be a not excessive carbon price.

The other striking observation is that the full cost of SZB (including FOAK costs) at £$_{2019}$4,290/kW is less than the £5,000/kW estimated for the proposed second EPR planned for Sizewell C (SZC, itself 20% less than the budget for Hinkley Point C). As SZC has not yet been built, the £5,000/kW remains an estimate, and indeed one that the National Infrastructure Commission considered with some scepticism. If (and it is a big if, given the difficulty of retaining the construction and engineering expertise until needed) instead Britain had built both Hinkley Point C and SZC at the cost of a Nth-of-a-kind PWR, the saving would have been £$_{2016}$9-18 billion.

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