The Cost of Finance and the Cost of Carbon: A Case Study of Britain's only PWR

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The article argues for the critical importance of the cost of finance for decarbonising the economy, and demonstrates this by calculating the cost of CO_2 abatement from Britain's only operational PWR nuclear station, Sizewell B. It computes this cost using a Regulatory Asset Based model, whose efficacy in reducing the weighted average cost of capital (WACC) has been demonstrated in the financing of long-lived regulated utility assets like transmission and distribution networks. The resulting cost of decarbonisation is then compared with commercial financing (assuming, as is doubtful, that would be possible for nuclear power) and with keeping the station in public ownership at the social discount rate. Moving from a WACC of 3% real to the UK Government's typical WACC of 8% more than doubles the cost of carbon saved.

The advantage of studying Sizewell B, commissioned in 1995, is that we know its build and operating costs. A second objective is to show that its cost of abating CO_2 compares favourably with the social cost of carbon and the alternative ways of decarbonising electricity available. This incidentally sheds some light on the logic of the Central Electricity Generating Board's then proposed nuclear power programme, derailed by privatization, and the consequential lost economies of replication – issues that are germane to the UK's current plans for future nuclear power stations.

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. By examining the particularly expensive example of a first-of-a-kind nuclear power plant, it argues against that view, based on a tried and tested method of lowering the WACC used to set prices for regulated utilities. The evidence also allows us to speculate on a counterfactual in which decarbonisation had been taken more seriously in the early 1990s, when Britain's embryonic nuclear programme was abandoned under free market pressures. Successor stations could then have been built at lower cost.

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. Almost without exception, where these reports give costs, they do not draw attention to the cost of financing the investments (the 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 liberalised electricity markets. Thus the National Infrastructure Commission assumes almost all WACCs at around 9% real. However, one characteristic shared by all zero and low-carbon energy technologies is that they are very capital intensive and many are very long-lived, so the cost of capital is a main determinant of their life-time costs. This can matter when choosing the best portfolio of techniques to deliver the target, favouring shorter-lived technologies such as wind over longer-lived technologies such as nuclear power and carbon capture and storage. This article argues 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 tried and tested method of reducing the WACC is to apply the Regulated Asset Base (RAB) model adopted for privatized network utilities and with a successful 30-year record of delivering low WACCs in the UK. This article 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 decar-

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This article calculates the cost per tonne of CO_2 abated to displace fossil generation. The assumption on which this calculation is based is that in the absence of an adequate carbon price, new nuclear power was not commercially viable. Just as zero-carbon renewables required (and obtained) 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 RAB model of the privatised utilities, using the WACCs then applied to network utilities. At low values of the WACC the cost is $£_{2019}$36/tonne CO_2 abated and $£_{2019}$43/t. CO_2 at the high WACCs, compared to the roughly £40/t. CO_2 paid by GB generators in 2019 (of which £18/t was the additional Carbon Price Support tax). By April 2021 the EU Emissions Allowance price alone was just over £40/t. (US $57/t.)

The other striking observation is that the full cost of SZB (including First of a Kind costs) at $£_{2019}$4,290/kW is less than the $£_{2019}$5,340/kW estimated for the proposed second EPR planned for Sizewell C. If 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 $£_{2019}$9-18 billion.