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The cost of finance and the cost of carbon: a case study of Britain's only PWR

EPRG Working Paper 2013

Cambridge Working Paper in Economics 2047

David Newbery

The paper 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 compares 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.

The advantage of studying Sizewell B 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 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. This paper looks at a particularly expensive example and argue 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.

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. 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.

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}$36/tonne CO_2 abated and $£_{2019}$43/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 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.

Contact dmgn@cam.ac.uk
Publication April 2021 (updated from May 2020)