Value for Money assessment critique - Hinkley Point C and first-tranche new-build nuclear programme

The Hinkley Point C nuclear project was subject to a BEIS Value for Money (VfM) assessment in the summer of 2016. VfM assessments compare the consumer affordability and wider considerations of providing an equivalent amount of low-carbon electricity from non-nuclear sources ('counterfactual' scenarios) for due diligence reasons.

HPC VfM ('detailed') document : https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/621400/Detailed_value_for_money_assessment.pdf

This paper is a critique of the HPC VfM document. It aims to show that the selection of counterfactuals appears to be a rather dark art, as is the analysis and supporting rationale, for the £ 92.50 / MWh Contract for Difference (CfD) price proposed for the HPC contract. The VfM comprises three tests (1, 2a, 2b and 3) This paper focuses on Test 2a, 2b and 3.

Test 2a

In the HPC VfM document in Test 2a opens with £ /MWh Strike Price cost estimates, based on March 2016 auction price caps, for a range of potentially plausible counterfactual technologies to HPC (at £ 92.50 / MWh) namely : onshore wind (£ 71 / MWh), solar PV (£ 77 /MWh), offshore wind (£ 91 / MWh) and CCGT with CCS (£ 155 / MWh). However there was no indication or discussion of the contract length likely to apply to different technologies eg 15 years for on and offshore wind, compared to 35 years for HPC.

There is then some discussion in paras 27 and 28 to the effect that both onshore wind alone (9 GW installed) or PV alone (27 GW installed) could potentially be delivered by 2025 given various constraints to supply the annual average output of HPC. If or when operational HPC would generate 25.5 TWh/y (at 90% capacity factor). In 2015 47.9 TWh/y was being generated by windfarms (mostly onshore) and just a few TWh/y from solar PV. In contrast, Germany had achieved annual solar PV installation rates of up to 7 GW (6 TWh/y) before 2015.

There was no VfM discussion about selecting a mix of renewables, to minimise any such constraints, to identify the most deliverable low-cost counterfactual scenarios for testing. It may well have been the case that in practical terms an 'additional' (to policy at that time) mix of mostly offshore wind, with some onshore wind and some solar PV, would have been the lowest cost and most deliverable counterfactual.

In 2015 energy secretary Amber Rudd was reigning back deployment support for onshore wind farms and PV deployment. So it would have required a reversal in policy to then deploy 25 TWh/y of onshore wind and or PV by or around 2025. However, there is a very large scale of UKCS (UK Continental Shelf) offshore wind resources, estimated at well in excess of 1,000 TWh/y, and clear public and political support for offshore wind energy. So an offshore wind counterfactual was a very reasonable counterfactual, as would have been one mixed with some additional onshore wind and PV.

Then, in para 29, it states : '*On the basis of the preceding analysis, it can be said that the costs of HPC are competitive with those costs of alternative low-carbon large-scale technologies in the mid-2020s'*. What analysis is not clear. What is clear is that a mix of onshore wind, PV and offshore wind could have a combined Strike Price cost which was significantly lower than HPC. Had such a mix been run through the DDM it would have presumably shown significant cost savings.

For example, an additional 33% mix of onshore wind and PV (8.5 TWh/y by 2025) with 66% offshore wind (17 TWh/y by 2025) could have a combined Strike Price of about £ 85 / MWh ([[71 + 77] /2 + 91 + 91] /3). In the first 15 years of operation (to 2040) such a mix would have delivered cost savings of **£ 2.87 billion** ([92.5 - 85] x 1 m x 25.5 x 15). The wind schemes (and PV ?) would then be out of contract an competing at lower cost with other Grid generators so the annual savings would have increased.

It would have been reasonable to assume after the service lifetime (20-25 years) of the onshore and offshore windfarms their HPC counterfactual replacements would have had much lower technology costs, and possibly system costs too. So a lower 2045 Strike Price (than £ 85 / MWh) would have been likely. Even if the 2025 Strike Price comparator was run across the whole 35 years of the HPC contract then there would have been cost savings of **£ 6.7 billion** (2.87 b x 35/15) ie excluding 2040s technology cost reductions and post contract operation. Onshore wind alone (at £ 71 / MWh for 35 years) would have resulted in a **£ 19.2 billion** saving (excluding 2040s technology cost reductions and post-contract operation), and similarly **£ 13.8 billion savings** for PV.

Counterfactual savings calculated by the DDM to 2050 would presumably have shown something more than **+£ 13.7 billion** for onshore wind, **+£ 9.9 billion** for PV, **+£ 0.95 billion** for offshore wind, and **+£ 4.8 billion** for £ 85 /MWh 'mix' ([Strike Price HPC - SP wind/PV] x 1m x 25.5 x 25). Over 25 years the cost of electricity from HPC would have amounted to £ 59 billion (£ 92.50 x 1m x 25.5 x 25). No such counterfactual savings from the DDM model runs appeared in the VfM.

Para 29 then goes on to make a carefully crafted statement : '*As explained in Test 2a, technology or location specific network costs beyond those included in averaged static network charges also need to be taken into account. If such impacts were included, HPC is expected to become more competitive particularly against onshore and offshore wind*.'

Yet, additional network cost (and 'capacity') impacts are not estimated or monetised (higher 'network' access due to geographical spread and 'capacity' presumably means additional 'back-up capacity' eg gas-fired or other). Even if such cost estimates were included it still does not mean that any resulting cost reduction significantly reduces the counterfactual cost savings relative to HPC.

Even if un-assessed impacts amounted to £ 1 or £ 1 billion over 25 years then HPC would become 'more competitive' (compared to before) but still not near actual or as 'cost-competitive' (ie about the same or within 5 %) even compared to the £ 85 / MWh counterfactual mix. The omission of the figures and crafting of the text suggest the author is downplaying the findings.

Test 2b

This test examines the costs of HPC not going ahead in terms of the knock-on effect on the Government's planned first-tranche 16-18 GW (five or six project) nuclear programme (generating around 140 TWh/y electricity when completed). The counterfactuals selected include offshore wind, and onshore wind and PV, and CCS from 2035 (VfM Note 15).

Given that the VfM Test 1 Strike Price costs of onshore wind and solar PV are much lower than the HPC Strike Price (£ 92.50 / MWh), and offshore wind is marginally cheaper (by £ 1 / MWh for 2025 delivery), it is difficult to understand how any, let alone huge, counterfactual dis-benefits accrue to 2040 and 2050 as set out in Table 2. Consideration of un-monetised costs (eg network, back-up, balancing) are discussed below.

It appears that some CCS is included in the three-year delay offshore wind counterfactual which would have pushed up that counterfactual's dis-benefits. On the basis that even an 18 GW programme would generate 140 TWh/y there is no reason why a counterfactual mix of mostly offshore wind and PV (without any CCS) could not be built in the required 'emissions' policy timescale (even assuming little further onshore wind deployment due to public acceptance limits).

The counterfactual for a ten year delay is a mix of offshore wind (at £ 91/ MWh) + CCS (at £ 155 / MWh). No reasons are given why this counterfactual is selected considering that CCS is very high cost compared with offshore wind (and onshore wind and PV). Presumably a ten year delay (ie to 2035) would enable CCS technology to be included at scale for assessment (to obviously rule it out at £ 52 billion dis-benefit).

Test 2b Wider electricity sector considerations

Test 2b states it considers '*limits of alternative technologies, security of supply and balancing and network costs*'. There is no obvious or expressed reason why an offshore wind+ PV counterfactual would not address such considerations as well as, or better than, the planned nuclear programme. Such issues have been discussed at numerous DECC / BEIS-NGO nuclear Forums and no robust rebuttals by BEIS to renewable energy counterfactuals have been forthcoming.

As regards limits, the DECC 2050 energy model a few years previously had estimated the UK's practical offshore wind resource at 400 TWh/y and solar PV at 150 TWh/y (resource estimates which will presumably have increased significantly).

As regards security of supply, offshore wind and solar PV are indigenous UK resources, hardly susceptible to hostile threat. These intermittent renewables can produce hydrogen, storable at scale, for 'P2G' power generation in back-up gas-fired schemes (CCGTs, CHP, fuel cells, gas engines) when wind and PV supply is below consumer demand or zero (eg calm winter evening peak demand hours, month long low winter winds).

The additional considerable GWs of back-up (eg 16 GW) in the counterfactual scenarios would greatly increase Grid resilience because that back-up would operate at low annual capacity factor (ie high redundancy back-up = greater Grid resilience). The back-up would also be geographically dispersed not concentrated in five or six coastal locations. Large, critical nuclear infrastructures are a much more tempting target for malicious action then geographically dispersed, decentralised, renewable infrastructures and their high redundancy gas-fired back-up.

Additional back-up capacity (eg new gas-fired plant) and additional balancing costs in the counterfactuals should have been clearly assessed if they were not in the DDM (which surely should capture such costs). Para 36 makes the point that the assessment does not include replacement gas-fired plant (eg in 2060) which could have been monetised. Had the VfM tests and DDM model assessed beyond 2050 then such costs could have been monetised and included. This shows up the limits of the BEIS DDM and its assessment tests, as distinct to any limits of the counterfactuals.

Similarly, any additional network costs should have been estimated not just left to the VfM readers technical understanding, imagination and interpretation. Indeed, offshore wind Strike Prices and or CfDs may include transmission line costs and it is not clear if HPC / new-build nuclear Strike Prices includes costs for the new transmission links required.

If Grid 'rotational inertia' (a benefit of CCGT and nuclear plant) was considered a significant limitation of the offshore wind and PV counterfactuals (hence a selection of CCGT+CCS available form 2035) then the costs for the provision of sufficient synthetic inertia and or actual inertia (flywheel schemes, other) should have been assessed and included in the counterfactual assessment.

There is discussion of nuclear supply-chain benefits. However, in a renewables counterfactual there would be offshore wind and PV supply chain benefits. These counterfactual benefits could presumably be just as relevant, if not more so, not least because all the nuclear projects are based on foreign reactor designs.

Note also that possibly much cheaper CCS technology could have been added to industrial plant with 'low-hanging-fruit' carbon dioxide emissions rather than CCGT plants (operating at decreasing capacity factor and hence sub-optimal emissions capture year on year to 2050 and beyond). The job and supply-chain benefits of the UK being a first-mover in such CCS application could have been, and remain, potentially considerable.

VfM Test 3

This test appears to summarise the dismissed counterfactual benefits in Test 2a with the nebulous considerations and questionable scenarios of Test 2b, then throws in mention of Capacity Payments for HPC too, to arrive at a spurious final assessment. The three poor counterfactual scenarios selected in this Test (Table 3) all focus on a three-year delay to HPC and show either consumer benefits for HPC or 'gas' with decarbonisation policy consequences.

The HPC CfD contract was signed on the 26th September 2016 by energy Secretary Greg Clark MP

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