October 2015

Comparing the cost of electricity generation from Hinkley Point C with solar and flexibility mechanisms

An STA Analytics short report

Introduction and background

Whilst technically solar and nuclear can complement each other's output, we believe strongly that all technologies should be able to compete with each other on a level playing field. It would therefore be interesting to compare how much subsidy solar power would require to match the electricity output from Hinkley Point C (HPC) over the latter's 35 year subsidy period. Recognising that solar is a variable but predictable energy source, we made allowance for significant additional investment to match solar's output with electricity demand through the use of storage and other balancing mechanisms. Since Hinkley Point C was first considered in 2010[1], the costs of solar power have since plummeted by roughly 70%[2]. This cost drop is projected to continue[3], albeit at a reduced rate, while the cost of storage is set to reduce at a similar rate over the coming years.

Hinkley Point C has been offered a 35 year Contract for Difference (CfD) at a strike price of £92.50/MWh (2012 prices). Large-scale solar power, on the other hand, is required to bid into CfD auctions in competition with other renewable energy technologies, receiving only a 15 year CfD contract, despite the asset life being at least 35 years. The first CfD auction took place in 2014 and three solar projects were awarded a strike price of £79.23/MWh (2012 prices). In both cases the subsidy value is the difference between the strike price and the wholesale price of electricity calculated on a half hourly basis. Solar panels are expected to generate for at least 35 years, so the outputs are compared on a like-for-like basis.

Recent government changes to solar support have cited affordability concerns as the main reason for cutting support. This includes cuts in support to the Renewables Obligation (first >5MW, then <5MW) and cuts to the Feed-in Tariff (in 2011, 2012 and now proposed in 2016). Therefore it is useful to consider the affordability of Hinkley Point C compared to solar.

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[1] https://www.gov.uk/government/news/written-ministerial-statement-on-energy-policy-the-rt-hon-chris-huhne-mp-18-october-2010

[2] https://www.iea.org/publications/freepublications/publication/technology-roadmap-solar-photovoltaic-energy---2014-edition.html

[3] http://www.solar-trade.org.uk/cost-reduction-potential-of-large-scale-solar-pv/

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In summary, this analysis considers the subsidy cost of Hinkley Point C, and compares that to the subsidy cost for solar generating the same amount of electricity, with storage and balancing mechanisms.

Methodology

A detailed methodology, including the assumptions made, is contained in a technical annex. A short explanation is given below.

The subsidy costs of the Hinkley Point C nuclear plant were calculated based on the guaranteed strike price, DECC's wholesale price projections and its electricity generation projections over the 35 years of its guaranteed CfD power contract.

Based on the Hinkley Point C generation, the solar power deployment required to deliver the same amount of electricity over the same 35 years was calculated. Deployment was spread over the years 2017 to 2024. Strike prices for large-scale solar under CfDs were estimated based on industry and market analysis, and a premium added to permit the inclusion of storage and balancing to enable the solar generation to more closely match electricity demand[4]. The strike prices and wholesale prices then allow the cost of subsidy for the solar and storage deployment to be calculated.

In this initial analysis, only large-scale solar under CfDs was considered. However, a future analysis could consider commercial rooftop and domestic solar as a package of solar. Our analysis did not take into account the recent £2 billion loan guarantee from the UK government to Hinkley Point C or the other benefits provided by the Government in 2013[5].

Solar plus other renewables

To match inter-seasonal loads, the most complementary technology to add to solar would be onshore wind. This has a similar cost profile to large scale solar, and could utilise and share the storage costs. We have not undertaken an analysis to include wind, but our expectation would be to swap out solar capacity for wind with some of the storage being shared over a 24 hour basis. Other renewable resources could also be considered.

[4] Our analysis does not include inter-seasonal storage to match Hinkley's winter output. The storage and balancing aims to both smooth and shift the solar output to more closely match electricity demand. From a broader renewable energy perspective, solar generation can be complemented by wind power whose output peaks in the winter months.

[5] https://www.gov.uk/government/news/initial-agreement-reached-on-new-nuclear-power-station-at-hinkley

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Results

The table of comparative costs is shown below:	Overall subsidy cost (£bn)	Cost Ratio
Hinkley Point C	29.7	1
Solar + Storage and Flexibility	14.7	0.496
Of which, solar	3.8	
Of which, storage and flexibility	10.9	

The results show that solar together with storage and flexibility would cost roughly half that of HPC over the 35 year lifetime. In other words, choosing the solar together with storage and flexibility option would save consumers around £15bn. On this basis we would suggest that if the Government is seeking to get the best value for money for electricity consumers (generating low-carbon electricity at the lowest cost) the solar option is considerably more cost-effective.

This option would require an ambitious programme of solar deployment, outstripping historical deployment rates. However, it would provide multiple benefits to the UK in terms of jobs, energy security and environmental protection. The land requirement equating to this solar deployment would be less than 0.5% of the UK, much less than the 2% devoted to golf courses, for example.

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Technical Annex: Detailed Methodology

Subsidy cost of Hinkley Point C

The total subsidy cost of Hinkley Point C (HPC) is calculated as the sum of the subsidy cost from each year for the lifetime of the subsidy. The cost in any particular year for the subsidy is the electricity generation multiplied by the subsidy cost per MWh of electricity. The subsidy cost per MWh is the strike price subtracted from the wholesale electricity price, and the generation is calculated as the capacity of HPC (3.2GW) multiplied by the load factor, multiplied by the number of hours in a year (8760).

In the case of HPC, the lifetime of the subsidy is 35 years. We assume generation starting in 2024 and a 91% load factor. The negotiated strike price for HPC is £92.50/MWh, and wholesale price is based on DECC's 2014 projections. As wholesale prices are only projected by DECC until 2035, after this date we have assumed a wholesale price of £60/MWh (2014 prices).

Using the above assumptions, and totalling the subsidy cost over the 35 year lifetime of the power station in real terms, we obtain a total subsidy cost of **£29.7bn**.

Equivalent solar generation

In order to compare the subsidy cost of HPC to solar + storage and flexibility, we first need to calculate the equivalent deployment required to generate the same amount of energy as HPC. This is simply obtained by dividing the total generation from HPC over 35 years by the large scale solar yield, which is assumed to be 930MWh/MWp. This yield does not impact the overall cost, but simply changes the amount of solar capacity (MW) that is required to generate the same amount of electricity (MWh) as HPC. Using that figure, the total solar deployment required is around 30GW. We have assumed that deployment starts in 2017 with 3.2GW and increases at 4% per year to reach 4.3GW in 2024, the year that HPC is projected to start generating electricity.

Cost of Solar

Strike prices were calculated using industry analysis, experience from existing CfD round results and future cost estimates. Added onto the strike price for solar, we have considered an additional strike price component for storage and flexibility. This document contains interim results of ongoing analysis that the STA intends to continue and refine further. The STA hopes to for example add wind into the model as the generation profiles of wind and solar across the year balance each other particularly well.

The subsidy cost for the solar deployment is then calculated in the same way as for the HPC cost. The lifetime of the subsidy is 15 years, but we consider that the solar installations continue operating for 35 years, as expected by many in the industry. We include annual degradation of electricity production of 0.5% based on an analytical review by NREL[6]. Calculation of cost of this deployment over the period (in real terms) gives a total cost of solar of **£3.8bn** and **£10.1bn** for flexibility, giving a total of **£14.7bn**, less than the half the subsidy cost for HPC.

[6] http://www.nrel.gov/docs/fy12osti/51664.pdf

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Table of Assumptions

The following table summarises and gives references for the assumptions that are used in this analysis.

Assumption	Value	Source
Hinkley Starting year	2024	STA[7]
CfD lifetime (HPC)	35 years	DECC[8]
HPC load factor	91%	DECC[9]
HPC strike price (2012 £)	£92.50/MWh	DECC[8]
Wholesale price to 2035 (2014 £)	Updated Energy and Emissions Projections 2014	DECC[10]
Wholesale price from 2035 (2014 £)	£60/MWh	STA
Solar Yield	930 kWh/kWp	STA
Solar deployment window	2017-2024	STA
Solar deployment annual growth rate (2017-2024)	4%	STA
Solar + flexibility strike prices	See below table	STA
CfD lifetime (Solar)	15 years	DECC[11]
Solar generation time period	35 years	STA
Solar panel degradation	0.5% per year	NREL[12]
2014-2012 deflator	0.947	ONS[13]

[7] http://www.telegraph.co.uk/finance/newsbysector/energy/11841733/Nuclear-delay-EDF-admits-Hinkley-Point-wont-be-ready-by-2023.html
[8] https://www.gov.uk/government/news/initial-agreement-reached-on-new-nuclear-power-station-at-hinkley
[9] https://www.gov.uk/government/publications/electricity-generation-costs-december-2013
[10] https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2014
[11] https://www.gov.uk/government/collections/electricity-market-reform-contracts-for-difference
[12] http://www.nrel.gov/docs/fy12osti/51664.pdf
[13] http://www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?cdid=D7BT&dataset=mm23&table-id=1.1

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