Technical annex: Tidal power

July 2018

Tidal Power

The Commission has considered the case for tidal lagoons alongside the full range of other options for meeting the UK's energy needs.

Recent history

In October 2010, the government concluded it did not see a strategic case for public investment in a tidal energy scheme in the Severn Estuary. It did not rule out a privately financed scheme. [1] Since then, private sector groups have been continuing to investigate the UK's tidal lagoon potential.

In February 2016, government revisited this decision following proposals for tidal lagoon projects by Tidal Lagoon Power.[2] Government appointed Charles Hendry to assess the strategic case for tidal lagoons and the role they could play in the UK's energy mix. Charles Hendry published his final report and recommendations in January 2017 (the Hendry Review).[3] His report recommended a small scale pathfinder project, supported by a 60-year 'contract for difference',[4] and concluded that a programme of seven tidal lagoons would be optimal for the UK.

Following the Hendry Review, government responded to Tidal Lagoon Power's proposals in June 2018, issuing a statement which said "the project and proposed programme of lagoons do not meet the requirements for value for money, and so it would not be appropriate to lead the company to believe that public funds can be justified".[5]

This note explores both the conclusions of the Hendry Review and the analysis of tidal power's potential role in the UK's energy system that was undertaken as part of the National Infrastructure Assessment. This analysis was conducted separately from the government's work underpinning its decision on Tidal Lagoon Power's proposal in June 2018.

The Hendry Review

The Hendry Review estimated that a programme of seven tidal lagoons would provide around 30 TWh of low carbon electricity per year.[6] This is approximately 10 per cent of current electricity demand. The Commission's analysis suggests that this is equivalent to meeting between 5 and 6 per cent of total electricity demand in 2050.[7]

The Commission's assessment of the Hendry Review highlights some major limitations:

1. Hendry suggests that illustrative subsidy requirements for tidal lagoons provided by Tidal Lagoon Power are competitive with targets for new offshore wind and nuclear

projects commissioned in the mid 2020s.[8] Recent falls in the costs of deploying renewables such as offshore wind mean that the cost projections for these technologies in the review are already outdated.

2. Strike price parameters used in the review to compare tidal lagoon costs with other renewables and nuclear have been changed to make tidal lagoon strike prices look more attractive. For example, the Hendry Review and Tidal Lagoon Power make use of average strike price estimates and different indexing rates (this is explained in further detail in the next section). [9]
3. Hendry argues tidal power could also provide additional benefits such as economic regeneration, recreational facilities or flood protection. However, he does not recognise the lost opportunity cost of supporting other forms of infrastructure, which would also create jobs.
4. The review argues that tidal power will make a strong contribution to the UK's energy security. While tidal power is a predictable form of supply, it is not continuous as it is subject to daily tidal patterns. The interim National Infrastructure Assessment looked at the potential contribution of tidal range projects.[10] It concluded that tidal lagoons will never provide a large scale solution to meet future electricity demand, which limits their potential contribution to energy security.

Tidal Lagoon Power's offer

The latest offer tabled by the Tidal Lagoon Power company (June 2016) for building Swansea Bay quoted an average strike price of £89.90/MWh, just under the figure for the fixed strike price agreed for Hinkley Point C of £92.50/MWh.[11] All contracts for difference to date have been awarded with a fixed strike price, lasting 15 years or, in the case of Hinkley Point C, 35 years.[12] The Swansea Bay average strike price was calculated over a period of 90 years, beginning at £123/MWh and not dropping below Hinkley Point C's price until roughly 2044, and the most recently awarded offshore wind strike price until 2077. The Cardiff proposal similarly did not drop below the latest offshore wind strike price until roughly 2065.[13]

In more recent discussions, Tidal Lagoon Power suggested targeting a strike price of £50-£70/MWh, assuming a policy commitment to six tidal lagoons.[14] However, this headline figure was referred to as 'contracts for difference equivalent'. 'Contracts for difference equivalent' is a new metric, created by Tidal Lagoon Power. It calculates the value that a fully indexed strike price (all technologies that have previously received contracts for difference) would need to be to generate the same net present value of contracts for difference payments as a partially indexed strike price (i.e. tidal lagoons). This is not commonly used across the industry. It is not clear how this figure would translate into a strike price and what the other terms and conditions would be.

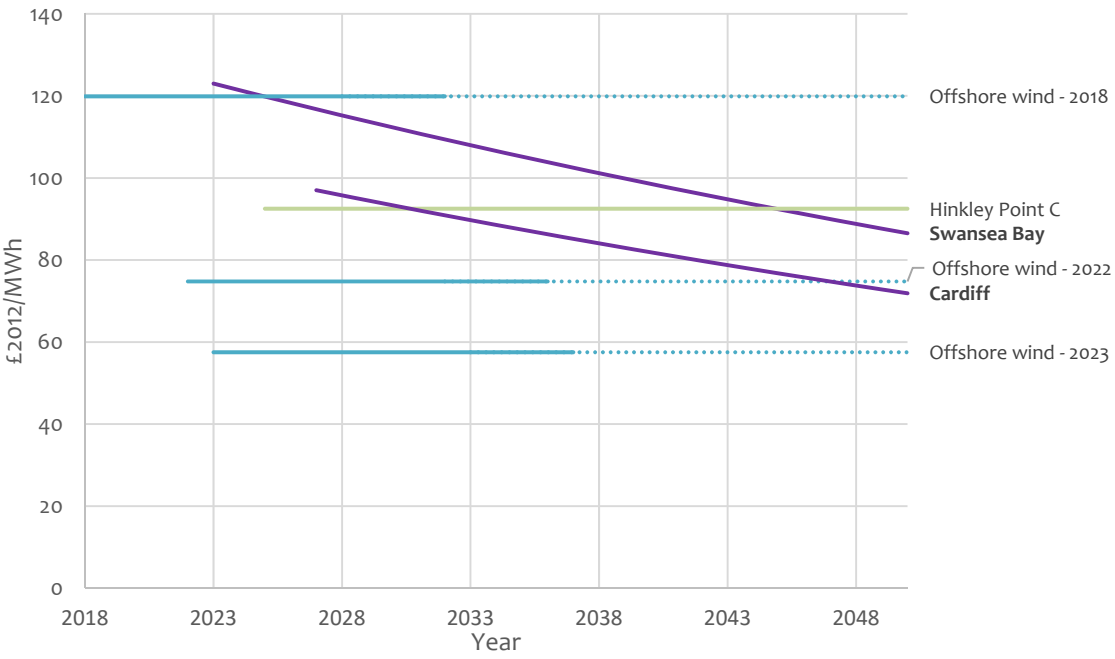

Figure 1: Estimated strike prices for Swansea Bay and Cardiff tidal lagoon projects, compared to offshore wind and Hinkley Point C [15]

Tidal Lagoon Power claim cost reductions similar to offshore wind through scaling up, innovation of design for manufacturing and construction and supply chain development.[16] However the Hendry Review's technical advisers ITP estimate moderate cost reductions, including potential capex reductions in the order of 8-10% as a result of learning by doing.[17]

The results of the Commission's analysis

Commission analysis, carried out by Aurora Energy Research, modelled decarbonisation pathways for the UK power system, on a whole system cost basis. The modelling did not bring forward any tidal capacity as part of a cost-effective generation mix, as other renewable technologies are cheaper.

An extra sensitivity was then carried out to look at the cost impact of building a fleet of tidal lagoons in line with the recommendations of the Hendry Review. Figure 2 shows that replacing cheaper renewables with tidal power drives up total system costs due to additional required subsidy support. Tidal lagoon projects are unlikely to ever be economic without government support, unlike other renewables. The benefits from the predictability of electricity generation from tidal power are not sufficient to offset the higher costs imposed on consumers over the period.[18]

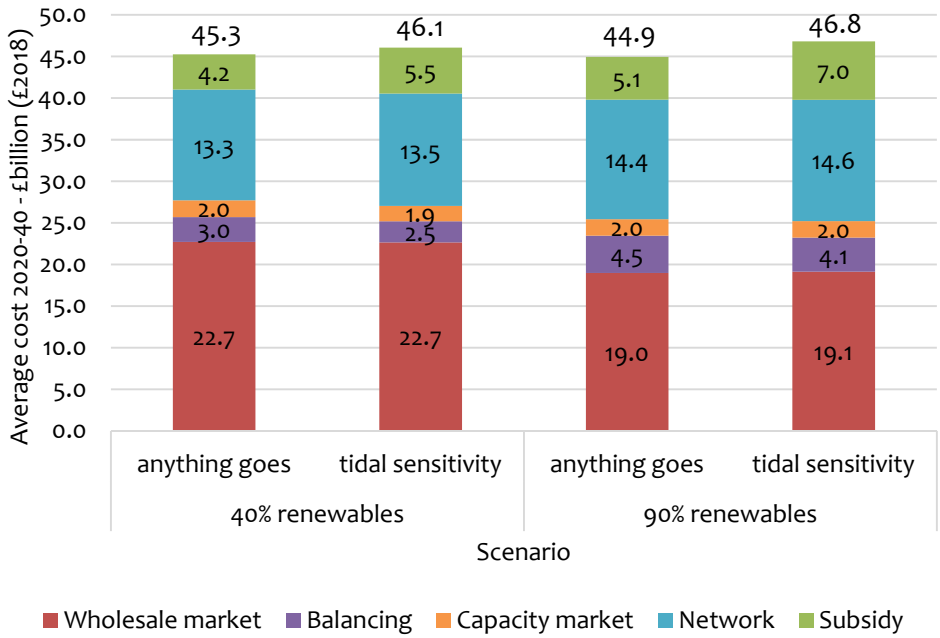

Figure 2: Average power system cost with and without a programme of tidal lagoons, 2020-2040 (£2018 billion/year). 'Anything goes' represents scenarios in which cheaper renewables are deployed. 'Tidal sensitivity' shows the results for scenarios where a programme of tidal lagoons is constructed.[19]

Tidal range projects cannot currently participate in auctions

A lack of cost data, required to set strike prices for a given technology, and the site specific nature of tidal lagoon projects meant that tidal projects were not originally included in the design of the contracts for difference auctions.[20] Unlike other low carbon technologies, the potential benefits of tidal lagoons are not being recognised through access to competitive contracts for difference.

Conclusion

Without government support, tidal lagoons are unlikely to develop in the UK, or elsewhere.[21] [22] The projected costs for Swansea Bay are currently higher than large nuclear reactors and other generation technologies. Building a fleet of tidal lagoons may bring down costs, however it is questionable whether costs will drop below other renewable technologies, given recent cost reductions and the characteristics of tidal projects. The opportunities for export are also limited; not many countries have significant tidal lagoon potential, and even where they do the UK's contribution is likely to be limited to design and consultancy.[23]

Tidal Lagoon Power's estimated strike price requirements are presented to look more attractive than they are in comparison to other technologies. Making a policy commitment to a pipeline of specific projects, as proposed for tidal lagoons in the Hendry Review, could

similarly bring down the costs of many other technologies. It is also clear that tidal lagoons will not provide a large scale solution to meet future electricity demand in the UK. The Commission's analysis concludes that the predictability of tidal lagoons is not enough to offset the higher costs that energy consumers would face.

End notes

[1] BEIS (2013), Wave and tidal energy: part of the UK's energy mix
[2] Tidal Lagoon Power is the proposed project developer for Swansea and the other six tidal schemes.
[3] Charles Hendry (2017), The role of tidal lagoons
[4] Contracts for Difference are designed to support new investment in a wide range of low carbon generation by reducing their need to rely on wholesale electricity prices, which can be volatile. Contracts for Difference are usually awarded through competitive auctions (an exception is Hinkley Point C, which received a bilaterally agreed Contract for Difference).
[5] BEIS (2018), Oral statement to Parliament: Proposed Swansea Bay tidal lagoon
[6] Charles Hendry (2017), The Role of Tidal Lagoons
[7] Calculated based on the Commission's future electricity demand assumptions, available on page 21 of Aurora Energy Research's report: Aurora Energy Research (2018), Power sector modelling: System cost impact of renewables, Report for the National Infrastructure Commission.
[8] Charles Hendry (2017), The Role of Tidal Lagoons
[9] The Hendry Review and Tidal Lagoon Power use partially indexed CfD values. Partial indexation of a Strike Price reduces the "real" value of the Strike Price during the contract term – this means the value of the strike price will reduce over time. All previous CfD contracts have been fully indexed to a measure of inflation.
[10] National Infrastructure Commission (2017), Congestion, Capacity, Carbon: Priorities for National Infrastructure
[11] The Department for Business, Energy and Industrial Strategy (2016), Hinkley Point C Collection. Accessed at: https://www.gov.uk/government/collections/hinkley-point-c
[12] Ibid
[13] Tidal Lagoon Power (2018), Cost of energy review submission
[14] Tidal Lagoon Power (2018) Tidal Lagoon Power response to Congestion, Capacity, Carbon: Priorities for National Infrastructure
[15] Offshore wind and nuclear strike prices: BEIS (2015), Contracts for Difference Allocation Round One Outcome; BEIS (2017), Contracts for Difference Second Allocation Round Results; BEIS (2016), Hinkley Point C Collection. Estimated tidal strike prices based on Tidal Lagoon Power (2018), Cost of energy review submission and Commission calculations. This assumes partial indexation of tidal strike prices at a rate of the consumer price index - 0.987.
[16] Ibid
[17] Charles Hendry (2017), The Role of Tidal Lagoons
[18] Charles Hendry (2017), The Role of Tidal Lagoons
[19] Aurora Energy Research (2018), Power sector modelling: System cost impact of renewables, Report for the National Infrastructure Commission. Costs converted to 2018 prices.
[20] DECC (2014) Consultation on directions to offer Contracts for Difference: government response
[21] Aurora Energy Research (2018), Power sector modelling: System cost impact of renewables, Report for the National Infrastructure Commission.
[22] Charles Hendry (2017), The Role of Tidal Lagoons
[23] DECC (2014) Consultation on directions to offer Contracts for Difference: government response