Department for Business, Energy & Industrial Strategy

TLP Tidal Lagoon Programme: Summary value for money assessment

Summary

This note sets out the assessment of the value for money (VfM) of Tidal Lagoon Power's (TLP) proposed programme of tidal lagoons. The assessment has considered the value for money benefits from an electricity system perspective as well as the wider economic benefits such as the value of jobs and export potential. An assessment of whether any proposed lagoon offers a fair return without over-compensation has not been assessed as no contract or agreement has been negotiated.

Overall, the value for money assessment demonstrates that the costs to consumers of reducing the emissions associated with the electricity system would be higher under scenarios where the programme of tidal lagoons is delivered compared to one where other low carbon alternatives are deployed.

This analysis has considered the impact on the UK Exchequer as a whole, as required under HM Treasury guidance. Consequently, consideration of any direct contribution from UK public funds would not fundamentally change the overall value for money conclusion.

Programme

TLP has proposed a programme of six tidal lagoons which, taken together, would generate c.30 TWh annually and cost in excess of £50 billion to build, with the final lagoon assumed to begin generating in 2052. A pathfinder project, Swansea Bay Tidal Lagoon, has estimated construction costs of c.£1.3 billion and would generate 0.52 TWh annually, c.0.15 percent of today's demand. By way of context, the construction of Hinkley Point C is estimated to cost c.£20 billion to generate 26 TWh annually, c.7 percent of today's demand.

Value for money assessment

TLP's proposed programme of tidal lagoons has been subjected to a VfM assessment consistent with that conducted for Hinkley Point C. The VfM assessment comprises of four separate tests, which are summarised below:

Test 1 considers whether a Contract for Difference strike price for a single or programme of lagoons offered a fair return to investors without overcompensation, given the true costs and risks associated with a programme of tidal lagoons. This test has not been conducted as no contract or agreement has been negotiated.

Test 2a considers whether a programme of tidal lagoons is cost-competitive against the likely alternative options for delivering low carbon power. Here the levelised costs per unit of electricity generation for the lagoon projects in TLP's proposals are compared with the levelised cost per MWh of a range of alternative low carbon generation technologies.

Each proposed lagoon has been compared against nuclear, onshore wind, gas with carbon capture and storage, and a number of different offshore wind cost assumptions. All six lagoons, even using optimistic capital and financing cost assumptions, were significantly more expensive per MWh over their asset life than other low carbon alternatives

Test 2b considers the impact of the programme of tidal lagoons on the costs of the GB power system to 2050 and assesses whether there are net social benefits. This test uses BEIS' Dynamic Dispatch Model (DDM) to assess the total electricity system costs of scenarios where TLP's proposed programme of tidal lagoons is deployed.

This compares a scenario where long-term power system decarbonisation is achieved according to the mix of technologies underpinning the government's latest published Energy and Emissions Projections, to another where the programme of tidal lagoons displaces other low carbon technologies while achieving the same level of decarbonisation. This test differs to Test 2a in that it considers additional impacts to society such as the limits of alternative technologies, security of supply, balancing & network costs. Sensitivity analysis is undertaken to draw out to test the robustness of the assessment to key uncertainties.

Taking into account the wider impacts on the electricity system, such as security of supply, balancing and network costs, TLP's lagoon programme has been compared against using nuclear or offshore wind to achieve the same level of generation to 2050. TLP's proposals are estimated to increase the cost of the electricity system by between £2 billion and £20 billion in net present value terms (2012 prices) over the period to 2050. This encompasses scenarios using more optimistic financing and capital cost assumptions for lagoons and less favourable assumptions for offshore wind and nuclear.

The lower end of this range – a net cost of £2 billion – results from comparing a scenario where all six lagoons have 'low' construction costs and 'low' financing costs, against a baseline reference case where the costs of the offshore wind are above the levels observed in the most recent contracts for difference auction. The higher end of this range – a net cost of £20 billion – results from comparing a scenario where the six lagoons have 'high' construction and financing costs, against a baseline reference case where offshore wind costs fall slightly from levels in the last auction and central costs are assumed for nuclear, with only a small reduction from the cost of Hinkley for later plants. All the scenarios that have been undertaken show that a full programme of tidal lagoons is more expensive than either offshore wind or nuclear when analysed using the 2016 or 2017 Updated Energy and Emissions Projections reference cases.

Test 3 considers the impact on GB electricity consumers. Using the same 'with and without tidal lagoons' scenarios outlined for Test 2b, this test considers the estimated change in the typical household electricity bill to 2050 if the programme of lagoons were deployed.

The impact of the support through Contract for Difference (CfD) costs for TLP's lagoon programme on household electricity bills has been estimated and compared to deploying nuclear or offshore wind in its place. All the scenarios considered assume a 35-year CfD, and do not test TLP's alternative financing proposals – for example for a 90-year CfD. Compared to nuclear and offshore wind, TLP's lagoon programme would add between £6 and £35 on average per year to the bill of each of the over 30 million households in the country between 2031 and 2050 (2012 prices). That could cost the average household consumer up to an additional £700 between 2031 and 2050. The lower bound of this estimate is based on a scenario in which all six lagoons have 'low' construction costs and 'low' financing costs, with offshore wind costs above the levels observed in the most recent contracts for difference auction.

The limitations in the modelling used to conduct the analysis are set out in Annex A. The modelling assumptions are set out in Annex B.

Further considerations

Cost reduction potential

Future cost reductions for tidal lagoons overall depend heavily on site-specific factors, such as the tidal range, which are largely unrelated to the scale of deployment. In terms of the scope for substantial future capital cost reductions, the opportunity for tidal lagoons has been assessed as being limited. While there is some potential for cost reductions in engineering works, these may be offset by challenging weather conditions and limited supply chain capacity to deliver a programme of lagoons. Independent technical advice suggests that 5 percent would be a realistic figure, lower than the circa 10 percent savings suggested in the Hendry Review.

Export potential

Independent consultancy advice to government suggests that UK export potential is limited to design, development and consultancy. This view was also taken in the Hendry Review, which stated that there are substantial uncertainties regarding the likelihood of other countries developing their own lagoon programmes, and even so it would be a 'leap of faith' to assume the UK would be the main beneficiary. The Review concluded that international opportunities would be 'good to have' but they are not sufficiently concrete that they can be relied upon.

Wider benefits

The analysis undertaken for tests 2a, 2b and 3 suggests that Tidal Lagoons from an electricity market perspective are relatively high cost compared to the alternatives. However, there are other perspectives, not least regarding wider benefits.

Using evidence provided by TLP, the net impact (compared to an assumption of displacing offshore wind) of the development of a programme of lagoons on employment benefits and innovation benefits to the UK and areas local to the proposed tidal lagoon sites has been monetised.

As with any such programme, a number of jobs would be associated with the lagoons' construction. The Hendry Review noted, however, that only 28 long term jobs would be associated with the operation and maintenance of Swansea Bay Tidal Lagoon.

Employment benefits were evaluated based on a wage premium approach, calculated as the difference in wages in the tidal lagoon project against regional wages. This represents increases in economic productivity from the same units of labour used, which is assumed to be measured by the relative premium in wages. Innovation benefits are likely to arise from the development of the six sites, the design of the turbines, and the post-project monitoring. The R&D element is treated in a similar way to a capital investment, which depreciates over time, as the new information gained from building the tidal lagoons gradually diminishes and becomes obsolete. Spillover effects are also incorporated to capture the likely benefits to the non-tidal sector. Environmental impacts, tourism impacts and up-skilling are not monetised.

The estimated wider benefits of deploying a full programme of 6 tidal lagoons range between c.£0.4 billion and £1.2 billion in the central scenario using site-specific wages (2012 prices), and inclusive of the innovation benefits. The range in wider benefits demonstrates the high degree of uncertainty in the estimates but even in the high case is less than the increase in electricity system costs presented in test 2b (including the very optimistic case).

The wider benefits of developing a programme of tidal lagoons such as the long-term jobs and global export opportunities do not fundamentally alter the conclusion that a programme of tidal lagoons is unlikely to be value for money for the UK energy consumer/taxpayer.

Annex A: Limitations

1. The **main limitations** of the modelling are:

   (i) Modelling is undertaken in light of uncertainties, including but not limited to the cost of construction, financing costs and the cost of capital, wholesale energy prices.

   (ii) DDM simulates until 2050. Modelling is inherently uncertain beyond 2050.

      a. The net present value figures produced by the DDM assumes capital expenditure (capex) costs are spread over the lifetime of the asset. Therefore, only the capex share up to 2050 is included. This is the same for the other technologies such as nuclear (asset life of around 60 years).

      b. It is assumed that each tidal lagoon has an asset life of 120 years. However, this may involve additional costs beyond the reserve funds that are not currently factored into the developer's financial model. Additional pre-development costs are not included. Final contracts and pricing has not yet been achieved.

   (iii) The timing of generation will shift for lagoons as tide time shifts day-to-day. The Hendry Review was not conclusive on the impact of a portfolio of lagoon on the peak demand. The contribution of tidal lagoon at peak demand (de-rating) is set to the average tidal load factor and a simple de-rating assumption is applied for illustrative purposes[1].

   (iv) Decommissioning costs are uncertain and not modelled. If decommissioning costs were high, they could put upward pressure on levelised costs (test 2a) and downward pressure on the net present value (test 2b).

[1] The engineering issue is that tidal lagoons are predictable, but not fully dispatchable. By sacrificing output tidal lagoon could become partially dispatchable. The water could be stored in the lagoon until it is required at low tide. This would mean lower CfD payments and would not be economically advantageous to an operator. Hence each lagoon is assumed not to be dispatchable. The tides vary around the coast, a portfolio of projects would look more like base load power than a single project. However, as tides around the UK are correlated, there would still be periods of several hours each day when they could not dispatch. These would be at random periods with respect to peak load on the grid. As a result the programme of tidal lagoons is treated as being completely non-dispatchable.

Annex B: Modelling assumptions

The value for money assessment follows an established set of tests that are applied to energy projects of this nature. The tests have been applied using established methods, objective analytical tools, and the Department has sought independent technical expert advice on the key inputs and assumptions.

An independent technical adviser has provided: assumptions used to calculate levelised cost of electricity for each lagoon. Costs are based on current data at the time of collection and have been reviewed throughout. The key levelised cost information are: net power output, availability profile, load factor profile, pre-licensing costs, technical and design, regulator and licensing and public enquiry, Capital cost (excluding interest during construction), infrastructure costs, operations and maintenance (O&M) fixed fee, O&M variable fee, insurance, connection and Use of System charges, and decommissioning costs.

The assessment assumes inflation to be 2 per cent per year and a CfD length of 35 years is assumed. Wholesale prices were taken from the 2017 Energy and Emissions Projection.

A range of scenarios have been tested in order to capture the uncertainty around the assumptions made. For example, sensitivity analysis has been undertaken using different assumptions for cost of capital, capital expenditure costs, and assumptions on costs of other technologies and different wholesale price projections.

Some additional assumptions are listed below:

a. It is assumed that that De-rating[2] for tidal lagoons are set equal to estimated load factor to account for their intermittent but regular and predictable electricity generation. Other intermittent technologies that are not predictable generally have a de-rating lower than their load factor.

b. Tidal lagoons will not take part in the balancing mechanism.

c. Generation timings for lagoons. In real life, the timing of generation will shift for lagoons as tide time shifts day-to-day. However, it is assumed output will be flat across the day at the average load factors for each lagoon in the programme.

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[2] De-rating is the probability that a technology will be available at peak demand.