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Swansea Bay Tidal Contracts for Difference analysis

An analysis of the Contracts for Difference payments to / from Swansea bay tidal project if it had been operational from 2021, and had a 2012 Contracts for Difference strike price of £92.50 per MWh.

<https://zenodo.org/record/6793432>



Summary

In June 2022, an interesting question arose in relation of the value of Contracts for Difference that the Swansea bay tidal project may have attracted or paid back to the Low-carbon contracts company in 2021 and 2022 if it had been awarded a strike price of £92.50 (in 2012 prices).

The method presented here attempts to answer this with some caveats around uncertainties.

In summary: from January to June 2022 the average value that the Swansea bay tidal project would have paid to the Low-carbon contracts company (rather than paid from) was just over £17 million.



Method

The approach taken was to use three different sets of hourly time-series data to calculate a range of total annual values of funds paid from or to the Low-carbon contracts company. These were:

1. a time-series of the Intermittent Market Reference Price (high certainty)
2. a time-series of the strike price (medium-high certainty)
3. a time-series of the generation of the Swansea bay project if it was operational (medium certainty)

The Intermittent Market Reference Price (IMRP) was available at an hourly granularity, therefore the other timeseries were constructed to also have an hourly granularity. To provide a context to the analysis over a longer timeframe, even though the operation of the tidal project would not have happened at full output prior to 2021, the analysis considered time-series values from 2016 (when the IMRP values were available).

1. The Intermittent Market Reference Price (IMRP) values are from:
2016-06-29T23:00:00+00:00 to 2022-06-22T22:00:00+00:00 for each hour.
From: <https://www.lowcarboncontracts.uk/data-portal/dataset/imrp-actuals>
The certainty of the values in this timeseries is high.
2. The strike price is needed to calculate the difference between the IMRP and the strike price for each hour. The analysis used a 2012 price of £92.50 that was increased over a number of years. The increase was calculated as the average % increase in values from the different technologies from the Strike_Price_GBP_Per_MWh column in the Low-carbon contracts company dataset <https://www.lowcarboncontracts.uk/data-portal/dataset/actual-cfd-generation-and-avoided-ghg-emissions>.
Certainty: medium-high.

Table 1 - Strike price increases and dates of increases:

Settlement Date	average % increase	cumulative % increase
01/04/2012	0	1
01/04/2016	0.75	1.0075
01/04/2017	1.97	1.0274
01/04/2018	3.003	1.0582
01/04/2019	2.022	1.0796
01/04/2020	2.172	1.1035
01/04/2021	1.318	1.1176
01/04/2022	6.128	1.1861



3. The generation profile was from a 2-way flow dataset from 720 hours of synthesised 6-minute power output data from personal correspondence with Professor Reza Ahmadian from Cardiff University (<https://www.cardiff.ac.uk/people/view/364315-ahmadian-reza>) based on a paper 'Numerical model simulations for optimisation of tidal lagoon schemes' (<https://www.sciencedirect.com/science/article/pii/S0306261915016529>). The operation of the 2-way flow was not necessarily representative of the operation of the tidal lagoon, as there would be an expectation that in order to maximise revenues, that output would be controlled e.g., delayed until times of higher prices. The 2-way flow is representative of a tidal generator that has its power output without the benefit of a lagoon to be able to delay and better optimise its output. Certainty: Medium.
- The 720 hours of 6-minute synthesised data was time locked to start on the 2016-01-01 and repeated to create 100 months' worth of 6-minute power data. This was then resampled to hourly output data, normalised by dividing by the peak value and then multiplied by 320 MW (the capacity assumed for this analysis of the Swansea bay project). The initial generation output of this synthesised and resampled 2-way flow power output was 617 GWh for 2018, therefore this initial timeseries of hourly data was simply multiplied by 530/617 to rescale the output to the 530 GWh output mentioned on the Swansea Bay website ([Key Statistics - Tidal Lagoon](#) tidallagoonpower.com). This provided a scaled hourly generation output of 530 GWh for 2018.

Time shifting of generation output

The synthesised generation values are not time locked to the actual dates and times of tides at Swansea, so it was not known when the generation output happened in relation to the IMRP and strike prices. A solution was therefore to run through every possible combination to match the generation output to the prices. As the hourly generation timeseries repeated itself every 720 hours and had a granularity of values for every hour, the start time of the synthesised generation output was shifted by one hour until all 720 hours were covered, i.e. it was shifted 720 times.

For each of the 720 runs, the generation output for each hour is multiplied by the difference between the IMRP price and the index linked strike price for every hour. This provides an hourly time-series with a value in £ that is the price paid from the Low-Carbon Contracts Company to the generator (if positive) or paid from the generator to the Low-Carbon Contracts Company (if negative). These hourly values are summed over a calendar year to provide the annual value for each of the 720 runs and these are plotted on the box plot to show the spread of annual values.

The method therefore creates a range of annual values for the amount paid to and from the Swansea bay project to the Low-carbon contracts company.



2021 and 2022 values

Overall – Swansea Bay would indeed look to be paying funds to the LCC company from 2021 if it had secured a strike price of £92.50.

The overall certainty of paying funds back (rather than receiving funds) is pretty high for 2022, as the 2022 sums are not close to zero – they are around £17 million for only the first six months of the year as shown in Figure 2 and Table 2.

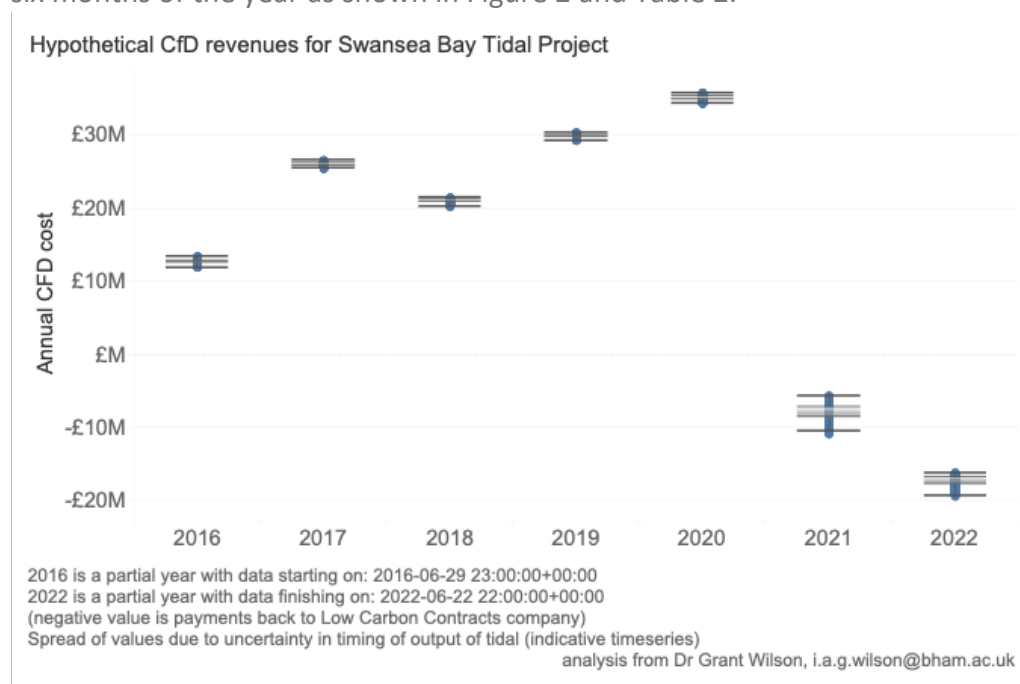


Figure 1 Hypothetical CfD revenues for Swansea bay tidal project

Table 2 Average Annual amount from LCC to Swansea Bay project in millions of pounds

Year	Average Annual amount from LCC to Swansea Bay project Million pounds
2016	12.7
2017	26.0
2018	21.0
2019	29.8
2020	35.1
2021	-7.9
2022	-17.3

(negative values are payment back to LCC) 2016 and 2022 are partial years.

The analysis was carried out by Dr Grant Wilson of the Energy Informatics Group at the University of Birmingham. Any queries or questions on the analysis can be emailed: i.a.g.wilson@bham.ac.uk

