



WHO'S THE PATSY?

Offshore wind's high-stakes poker game

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About the author

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If you've been in the game for 30 minutes and you don't know who the patsy is...you're the patsy.

Warren Buffett on poker

1 Introduction

There is an aphorism, which applies to both business and economic policy, that when a deal is too good (or bad) to be sustained, the only question is when and how it breaks down. This applies to the auctions to supply renewable energy under the UK's Contract for Difference (CfD) contracts.* The headlines following the announcement of the results of the allocation round in 2017 highlighted dramatic reductions in the strike prices for three projects due to come on-stream in 2021 and 2022 relative to the strike prices for the previous round of offshore wind contracts.

Shortly after the CfD strike prices were first announced, Capell Aris, John Constable and I wrote a paper *Offshore Wind Strike Prices: Behind the headlines*¹ questioning the assumption that the capital costs of offshore wind were falling rapidly and suggesting that offshore wind would be unviable at these low strike prices. More recent data on the capital costs of the Triton Knoll, Hornsea 2 and Moray East projects appear to support our conclusion on costs, yet project managers seem undeterred. How can investors justify going ahead with projects that appear to have no prospect of covering their cost of capital?

The Moray East project is the primary focus of this Note. It has received a lot of publicity in recent months as Moray Offshore Windfarm (East) Ltd has announced financial closure and the award of multiple contracts for construction and the establishment of bases for managing construction and, later, operation. Almost no attention has been paid to whether the CfD contract is sustainable and what will happen if it is not. It seems that officials and politicians are making the somewhat naïve assumption that because a project is being built, the developers are planning to operate it on the terms stated.

In fact, this is a very high-stakes game of poker. As in any game of poker, the first question that a participant or observer should ask is: who is the patsy? Who is most likely to pay for the winnings of the successful gamblers? For Moray East the range of possible outcomes is quite stark. Either, a consortium made up of large overseas energy companies and financial institutions is deliberately planning to lose money, or UK electricity customers will find themselves having to pay much higher prices, so as to permit lenders to recover their loans and the developers to earn some kind of return on their equity.

Arguably there is even more at stake. The UK Government is being pressed by lobbyists to adopt low-carbon policies, justified by reference to CfD auction prices that are patently unsustainable on the terms presented, but which are really a one-way option on higher market prices in future. In other words, low CfD prices are a way of creating positive public relations, and are offered in the expectation that developers can get out of the contracts, because the Government is committed to the future of offshore wind and will therefore have to bail out the industry with a high carbon price in order to save face.

While the precise details of the Moray East project are commercially confidential, it is not difficult to carry out a broad-brush evaluation using information that is publicly available, together with financial and technical assumptions that reflect standard financial and indus-

* Contracts for Difference are legal agreements between a company owned by the UK Government – the Low Carbon Contracts Company (LCCC) – and low-carbon generators. Each contract guarantees that the generator will receive a specific price (the strike price), adjusted annually by CPI inflation, for electricity that it delivers to the grid. If the market price is below the adjusted strike price, the generator receives a top-up payment from the LCCC equal to the difference between the market price and the adjusted strike price. On the other hand, if the market prices is above the adjusted strike price, the generator must pay the excess to the LCCC. The net cost of the price guarantees is recovered through a levy on all electricity consumers. While the intent of CfD contracts is clear, they are lengthy and full of confusing legal verbiage.

trial practices. The figures outlined below are clear and robust enough to give a picture of a project that cannot possibly break even using reasonable assumptions about revenues, costs and financing.

2 Project revenues

There is no magic fairy dust to sprinkle over the performance of the project. Shortly after the CfD auction in 2017, many assumed that the low strike prices would be achieved by relying on a new generation of much larger (15-MW) offshore turbines with enhanced performance. However, the Moray East project will use the MHI Vestas V164-9.5 turbine, which is a development of a model range that has already been deployed in Germany and the UK. Its performance characteristics are well-documented and the model does not offer the prospect of a large improvement in load factor relative to other offshore turbines. This is critical to any assessment of the prospective revenues of the project.

Under the CfD arrangement, Moray East will receive a guaranteed strike price of £57.50 per MWh. That is not as low as naïve reports imply, because the strike price is set at 2012 prices and is already worth £67/MWh in 2019. Using the Bank of England target for CPI inflation, that figure will increase to £71.20/MWh in 2022.

The actual amount of electricity generated can be expected to vary substantially from year to year because of changing wind conditions. Over the three years from 2016Q2 to 2019Q1, the average load factor for all UK offshore wind farms was 38.4%. It is within the margin of error of such an average to assume a load factor for Moray East of 40% over the first 10 years of operation. However, it is very likely that the projectors expect – or claim to expect – an average load factor of 45%. All of the evidence points against sustaining such a high load factor over the life of an offshore wind farm operating in the severe conditions of the northern North Sea.

Such evidence does not stop project developers and turbine manufacturers making optimistic and, ultimately, mistaken assumptions about performance. Notoriously, Siemens is believed to have lost a lot of money on performance guarantees for offshore turbines off the English coast whose performance was severely compromised by blade erosion. So, one potential patsy is the turbine supplier MHI Vestas – or, rather, their shareholders – if they have given extended performance guarantees.

To summarise Moray East's income over the first 10 years, the expected gross revenue would be an average of:

- £267 million per year at 2022 prices with an optimistic load factor of 45%
- £237 million per year with a more realistic load factor of 40%.

3 Operating costs

Recurrent operating and maintenance expenditures (opex) for offshore wind farms tend to be high. In addition to direct costs for the wind turbines, it includes grid connection and operating costs, insurance, licence fees, management and base costs, and an allowance for decommissioning. The review of renewable energy costs prepared for DECC by Arup in 2016 used a mid-range estimate for opex of £114/MW/year at 2014 prices, with a high-range estimate of £148/MW/year.² The low-range figure of £81/MW/year applies to wind farms in shallow waters close to shore, and is thus irrelevant to Moray East, which is in deeper waters

and at a greater distance. The most recent estimates published by the US National Renewable Energy Laboratory are reasonably similar, with a mid-range figure of \$131/MW/year at 2016 prices.³

Translated to 2022 prices, the Arup estimates imply total operating expenditures of £127 million per year for their mid-range figure and £173 million per year for their high-range figure. Neither Arup nor NREL expect major reductions in operating expenditures up to 2030 – no more than 2–3%. There is a great deal of optimistic chatter in the industry about ways of reducing offshore opex costs by better collection and analysis of data, but up to now the problems of maintaining offshore turbines have tended to be worse rather than better than expected. There is a strong optimism bias in the industry that tends to discount past problems as one-offs rather than as a basis for making estimates of future costs. The northern North Sea is a much more hostile marine environment than the Dutch or German coasts. The likelihood is that the operator of and suppliers to Moray East will experience unpleasant shocks in the actual costs of running the wind farm. There is a strong possibility that actual operating expenses will be closer to the high-range than to the mid-range estimate.

4 Financing costs

The developers of Moray East have announced that a financing package consisting of £2.1 billion of project finance loans and £0.5 billion of ancillary loans had been agreed with a consortium of lenders, including the export guarantee agencies of Denmark and Japan. For such financing to be viable, the debt leverage will be no more than 60% for the project finance loans, implying a total project cost of about £3.5 billion. The £0.5 billion ancillary facility will be junior high-yield debt, reducing the equity requirement to about £0.9 billion. The project finance debt will match the price guaranteed under the CfD contract, while the ancillary debt is likely to have a shorter term – 8 to 10 years – and the operator will plan to refinance thereafter.

With such a financing structure, the project finance debt will have an average spread of 300 basis points above 15-year base swap rates, while the junior debt will have an average spread of 500 basis points above the equivalent swap rates. In mid-2019 terms, these spreads translate to nominal interest rates of about 4% on project debt and about 6% on ancillary debt. Since the project revenues are indexed, these figures can be expressed as real interest rates of 2% on project debt and 4% on ancillary debt. These estimates are quite low since they make no allowance for any increase in real interest rates between 2019 and 2022 when the project is expected to commence operation. It can be assumed that interest during construction is rolled into either ancillary debt or equity.

On these terms, the debt service for the project will be equivalent to £225 million per year at 2022 prices from 2022 to 2032, falling to £163 million per year from 2032 to 2037. Under the most optimistic scenario, the real interest rates might be 1 percentage point lower. This would reduce debt service in the first 5 to 10 years to £210 million per year at 2022 prices.

5 Net earnings

Table 1 summarises the annual cash flows for the Moray East project at 2022 prices for the first five years in two scenarios. The Best Scenario relies upon the most optimistic assumptions about the average load factor and operating costs plus real interest rates that are 1% lower than the more plausible rates discussed above. The Realistic Scenario is based on more

realistic assumptions about the various parameters. Even under the Best Scenario there is

Table 1: Moray East: projected financial performance

	Scenario	
	Best £m	Realistic £m
Gross revenues	267	237
Operating expenditures	127	173
Gross profit	140	64
Debt service	210	225
Net cash flow	-70	-161

a negative cash flow for the first five years, and there is little prospect of the equity partners ever earning a return on their investment. Indeed it is likely that the lenders will sooner or later have to accept a restructuring of the debt, and therefore a significant loss. Just for reference, even if the average load factor is expected to be 50% (without any reasonable justification), there would still be a negative cash flow of £39 million per year. The load factor would have to exceed 57% simply to generate positive cash flow and it would have to exceed 65% to make even a modest return of 5% on equity.

In the Realistic Scenario, the negative cash flow would exceed £160 million per year. The project would certainly go into default. All of the equity and junior debt would have to be written off and the providers of senior debt would lose up to 50% of their money. The result would hardly be a good advertisement for the merits of investing in the UK offshore wind sector.

These figures are likely to overstate the long-run net earnings from the project. A portion of the losses may be disguised initially by building the costs of service contracts into the purchase price of the turbines and other equipment, (in effect) capitalising a proportion of opex costs. The full opex costs tend only to become clear after wind farms have been operating for 4–5 years; manufacturers hope to shift responsibility for service before major costs arise.

In addition, the cash flow from a project will be affected by tax arrangements, up-front fees and a variety of other factors. These tend to mean that the return to equity partners is lower in the early years. However, investors may expect that they will receive free cash flow from continued operation of the wind farm after the expiry of the CfD contract.

6 Comparison with the Beatrice offshore wind farm

Is this financial assessment too pessimistic? As it happens, there is a convenient comparator. The Beatrice offshore wind farm received a CfD contract in the previous bidding round and started full operation in the summer of 2019 – three years before the Moray East project. It has a strike price of £140/MWh at 2012 prices, a figure which will probably reach about £168/MWh in 2022 – 2.36 times the price for Moray East. At 2012 prices, the reported project capital cost was £3.92 million per megawatt, about 27% higher than the estimate of £3.08 million per MW for Moray East. The two sites are adjacent and for practical purposes the wind

conditions at the two sites are identical. Beatrice is in deeper water – 55 m, versus 48 m for Moray East – and the export cable to the southern shore of the Moray Firth is longer, which explains a substantial part of the higher cost of development.

The Beatrice wind farm uses Siemens SWT-7.0-154 turbines while the Moray East project will use an MHI Vestas V164-9.5 turbine with a hub height that is 4 m higher. Both the cut-in and rated power wind speeds for the Moray East turbine are slightly higher than for the Beatrice turbine. This means that with an identical distribution of wind speeds, Beatrice should achieve a slightly higher load factor than Moray East. The minor difference in hub height is not sufficient to alter that conclusion for an offshore wind farm.

An analysis by Oxera of the strike prices for the CfD contracts awarded in 2015, which included Beatrice, concluded that they were consistent with an assumed load factor of 40%.⁴ Combining that assumption with public information on the costs of the Beatrice project and the strike price of £140/MWh at 2012 prices, a financial analysis similar to the one carried out for Moray East indicates that the Beatrice project will generate a return for its equity investors with a simple payback period of about 10 years. That is in line with expected returns for the wind industry at the time. On the other hand, with an expected load factor of 45%, Beatrice would be extremely profitable, with a simple payback period of 5–6 years, while an average load factor of 50% would reduce the simple payback period to about 4 years.

There is no escape from the conclusion that, on all of the evidence available, the data for Beatrice and Moray East imply wildly different figures for the ‘true’ costs of generating electricity from offshore wind. They are located on neighbouring sites and their wind turbine characteristics imply a very similar load factor for the two projects, while we have a reasonably good basis for adjusting for differences in capital and operating costs. If the Moray East project is a reliable basis for assessing the cost of electricity from offshore wind, then the Beatrice project is absurdly profitable – to the extent that the UK Government is guilty of a very serious dereliction of duty in managing public funds. If, on the other hand, the Beatrice costs are accepted as the starting point with allowance for known cost reductions, the Moray East project is financially unsustainable on the terms implied by the original strike price. As noted at the outset, the only question is when and how those terms are rewritten to rescue lenders and equity investors.

It is, of course, quite possible that the ‘true’ costs and other parameters lie somewhere in the large gap between the Beatrice and Moray East assumptions, but there is no Goldilocks combination – just warm enough but not too hot. Any assumptions that allow the Moray East project just to repay its debt will yield huge profits for the Beatrice project.

7 Who is the patsy?

The immediate conclusion would seem to be that the main investors in the project – EDP, a consortium led by Mitsubishi and Engie – are likely to be the losers. This might be a classic case of the ‘Winner’s Curse’, where an investor overbids for the right to develop a project or resource – a pattern that is far from unusual in the energy sector. On reflection, however, this story is not convincing. CfD contracts are not signed until the project financing package has been put together. The Moray East consortium has had ample time to pull out of the deal if they had thought that the project was bound to fail.

So what might be the get-out-of-jail card(s)? We have seen that even a very high load factor does not make a sufficient difference to turn net cash flow positive under the Best Scenario. Reducing the interest on project finance debt to 0% in real terms will only save

£12 million per year in debt service. In any case, such terms would clearly indicate that one of the parties is the debt finance consortium, since a real interest rate of 0% would be absurd for a 15-year project that clearly faces a significant probability of a debt default.

The project investors may hope that future operating expenditures have been overestimated. This requires a high level of optimism. Transmission and other grid charges account for more than half of operating expenditures; these are more likely to increase than fall over time. The fact that NREL has similar estimates of and trends in offshore operating expenditures should give pause to any thought of a large reduction, especially as NREL itself has been notoriously prone to over-optimism about future costs for renewable technologies.

Ultimately, there is only one plausible get-out-of-jail card. It is the expectation that the actual price received for electricity generated by the project will be substantially higher than the headline CfD strike price. The original auction price of £57.50/MWh (at 2012 prices) was much lower than the strike price of £74.75/MWh for Triton Knoll, a wind farm that is due for completion just one year earlier. With the Best Scenario assumptions plus the Triton Knoll strike price, the Moray East project would have a small positive cash flow of £10 million per year. This would increase to £49 million per year if the average load factor were 50%. The return to investors would not be especially high, but it is better than a huge loss.

On the reasonable assumption that the project investors are not intent on making large losses, their private estimate of revenue from the project must be based on an offtake price in 2022 or shortly thereafter of at least £95/MWh, and probably more than £100/MWh. That is just over twice the level of the day-ahead market price of power in the UK in the first half of 2019. This could happen if the Government chose to bail out projects that have bid too low, but that would involve a humiliating public climb-down and seems very unlikely. Rather investors may expect – and lobby for – a general increase in wholesale electricity prices in the near future, promoted and underpinned by public intervention in the electricity market. Not by chance, such a policy would have the merit of saving face with respect to the costs of the CfD contract for the Hinckley Point nuclear plant. The obvious mechanism to achieve such an increase would be a sharp and sustained rise in carbon taxes.

Such an increase would be a huge shock to householders and non-residential consumers. The average price in 2018 was about 20% higher in real terms than the average price in 2017. This caused a major political upset, with Ofgem being forced to put caps on standard variable tariffs and a series of bankruptcies of energy suppliers whose business models relied upon falling or stable market prices. What would be the political and social consequences of electricity prices increasing by 25–30% per year every year from 2019 to 2022, especially when this is the consequence of deliberate public policy? The reaction of *gilets jaunes* in France may appear mild in retrospect.

And how is this compatible with the Moray East CfD contract with its expected price of £71.20/MWh in 2022? If the market price were, say, £100/MWh in 2022, Moray East should, under the contract, pay the difference of £28.80 back to the CfD Counterparty – currently the Low Carbon Contracts Company. However, careful reading of the CfD contract shows that there is little to prevent a CfD supplier from giving notice to terminate the contract on payment of a relatively small penalty. So, if the market price for electricity in 2022 was £100/MWh and is expected to stay above, say, £72/MWh for the foreseeable future, the Moray East operator will simply abrogate the contract and rely on selling power at market prices.

While CfDs are presented as a fixed guaranteed price, what the contracts actually create is a one-way option. The contractor is guaranteed a minimum price but has every incentive to exercise the option if the market price rises and stays above the guaranteed price. It must be

assumed that civil servants, even politicians, understand this but they have not been willing to acknowledge it and to publicise the implications. Part of the reason is that most of the original CfD contracts had strike prices that were much higher than the prevailing market price, so officials seem to have assumed that abrogation was unlikely.

The Moray East project changes this assessment. There are two possibilities:

- the project developers have miscalculated and thus committed themselves to making large losses when the project starts to operate
- they are confident, for whatever reasons, that they will be able to obtain an offtake price that is far higher than the adjusted strike price.

The higher offtake price may not materialise by the time that the project starts operations but any significant delay will lead to heavy losses, which will require even higher prices in future to make up.

8 Conclusion

The Moray East project is a very high-stakes game of poker. The project developers have about £900 million of equity at risk and the providers of junior debt could lose a significant part of their loans. A part of the risk is linked to the long-term yield from the wind farm. To have any chance of obtaining a reasonable return, the wind farm will have to achieve a load factor between 45% and 50% for 15 years, well above the long-term average load factor of 38–39% for offshore wind farms in the UK. Statistically, that is a bad bet, but the developers may have been given a turbine performance guarantee that transfers the risk from them to the turbine manufacturer MHI Vestas.

Even if the turbines deliver an average load factor above 45%, the project will still only earn a reasonable return on equity if the actual revenue per megawatt hour is about 50% higher than the CfD strike price. That, in turn, will require a market price for electricity that is slightly more than double the market price in the first half of 2019. Readers can reach their own conclusion. One view is that a group of large and sophisticated overseas investors have convinced themselves to tear up large numbers of bank notes in the cold maritime conditions of the northern North Sea. An alternative view is that investors are prepared to bet that the UK Government will force through a large increase in the wholesale price of electricity, perhaps through a large increase in carbon taxes, thus allowing the investors to make a reasonable return. In that case, the ultimate patsy at the poker table is the British public.

Given the past record of UK ministers and officials in the energy field, this seems to be the more likely outcome. The only real doubt is how the capitulation will be dressed up and what the implications will be for the UK's economy.

Notes

1. Hughes G, Aris C and Constable J, *Offshore Wind Strike Prices: Behind the headlines*. GWPF Briefing 26, 2017. <https://www.thegwpf.org/forget-the-spin-offshore-wind-costs-are-not-falling/>.
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