Cost Benefit Analysis in support of DECC's Impact Assessment of the Offtaker of Last Resort

CLIENT: Department of Energy & Climate Change

DATE: 10/02/2014

Version History

Version	Date	Description	Prepared by	Approved by
1	27 January 2014	Final	Edward Crosthwaite Eyre Chris Collins	Duncan Sinclair

Copyright

Confidentiality and Limitation Statement

This document: (a) is proprietary and confidential to Baringa Partners LLP ("Baringa") and should not be disclosed without our consent; (b) is subject to contract and shall not form part of any contract nor constitute an offer capable of acceptance or an acceptance; (c) excludes all conditions and warranties whether express or implied by statute, law or otherwise; (d) places no responsibility on Baringa for any inaccuracy or error herein as a result of following instructions and information provided by the requesting party; (e) places no responsibility for accuracy and completeness on Baringa for any comments on, or opinions regarding the functional and technical capabilities of any software or other products mentioned where based on information provided by the product vendors; and (f) may be withdrawn by Baringa upon written notice. Where specific Baringa clients are mentioned by name, please do not contact them without our prior written approval.

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

1.1. Objective and Scope

This report is intended to assess some of the **benefits** and **costs** of the offtaker of last resort ("**OLR**") policy on electricity system participants. Full details of the policy proposal can be found in the consultation document, but a brief summary of the framework assumed for the purposes of this paper is as follows:

- Concerns have been raised that low carbon generators with Contracts for Difference (**"CfDs"**) may be unable to secure long-term Power Purchase Agreements (**"PPAs"**) for their power. Without these long-term PPAs, net revenues for generators are, in principle, unfloored.

- The OLR is designed to provide a minimum level of contracted revenue for a generation project, off which low-cost finance can be secured. This is done by agreeing a "backstop PPA" (**"bPPA"**) with a fixed £/MWh discount to the market reference price (**"MRP"**) at the start of the project.

- This bPPA can be called upon by any eligible generator if its market PPA provider becomes insolvent or its existing market PPA expires, and it is unable to secure another on terms that are better than those available under its bPPA.

Note that the analysis is bounded as follows:

- It only considers the impact of the OLR in relation to deployment of onshore and offshore wind (that fall under the first EMR Delivery Plan[1]) ("**Relevant Wind Generators**"). Other eligible renewable technologies (i.e. solar PV, biomass, emerging technologies) are excluded on the basis that the Department of Energy & Climate Change ("**DECC**") either:
  - believes that they will not experience significant Route to Market ("**RtM**") issues under CfDs; or
  - does not have a sufficiently robust data set on their RtM risks to be able to quantitatively assess the costs and benefits of the OLR as it applies to those technologies.
- In relation to costs in particular, it does not consider wider administrative costs faced by market participants, DECC or Ofgem associated with the implementation and running of the policy (which we understand are being assessed separately by DECC).

1.2. Benefits

In the event that, in the absence of intervention (with the OLR or otherwise), DECC's concerns with respect to the availability of long term PPAs ("**LT PPAs**") for Relevant Wind Generators would never have materialised (hereinafter, the "**Competitive World**"), the implementation of the OLR realises negligible benefits for consumers (since it was not required in the first place). The only potential benefit would be to reduce LT PPA discounts slightly by removing tail risk for offtakers (i.e. it floors imbalance risk for the offtaker at the level of the bPPA discount). However, we conclude that this is unlikely to be material.

In the event that, in the absence of intervention (with the OLR or otherwise):

- DECC's fears of an uncompetitive and/or restricted market for long term financeable PPAs would have materialised (hereinafter, the "**Uncompetitive World**"); and

[1] https://www.gov.uk/government/publications/electricity-market-reform-delivery-plan

- the implementation of the OLR is successful in opening up a wider range of options for Relevant Wind Generators (i.e. short term PPAs ("**ST PPAs**"), direct trading, new entrant LT PPA providers),

then OLR could realise benefits for consumers by increasing levels of competition in the PPA market and eliminating scarcity rents that would otherwise have been charged to Relevant Wind Generators. This increased competition may arise directly in the LT PPA market (by lowering the barriers to entry for new entrants). Alternatively, OLR may provide alternative risk management options for Relevant Wind Generators by allowing capital providers and shorter term PPA ("**ST PPA**") providers to compete with existing incumbents in the LT PPA market.

By bringing down rents that would otherwise have been charged by PPA providers in the Uncompetitive World, the OLR increases deployment levels for wind and reduces the costs of generation relative to the counterfactual where it was not implemented. On the basis that it is difficult to assess what scarcity rents might be in a world of low competition (should one emerge), this analysis has considered the most extreme case by simulating the scarcity rent that would *theoretically* be charged assuming an entirely monopolistic market. The results, which should be viewed as an upper limit on the benefits that the OLR could bring, show that implementation of the OLR in an otherwise uncompetitive world could result in an additional 5.9 TWh and 7.0 TWh of onshore and offshore wind generation, respectively, in 2020.

Moreover, those projects that would still have gone ahead in the Uncompetitive World even in the absence of OLR would operate at a higher cost. We have quantified this as a Net Present Value (**"NPV"**) saving over the entire tenor of all 15 year PPAs signed of £476m for onshore wind and £667m for offshore wind (i.e. a saving of £5.7/MWh and £8.1/MWh for onshore and offshore wind respectively).

It is important to note that this analysis assumes allocation of CfDs at the published administrative strike prices with no budgetary constraints under the Levy Control Framework (**"LCF"**). As such, the savings generated by the OLR under this scenario (in terms of the reduced costs of generation), would accrue to *generators* (in improved returns) rather than consumers, since strike prices effectively fix the costs to consumers on a per MWh basis under both scenarios. Under competitive CfD allocation some of the cost savings for generators would be passed through to consumers in the form of lower CfD strike prices. Also excluded from this analysis are secondary effects on electricity consumers or producers that may arise from the changed generation mix.

1.3. Cost if backstop PPA is exercised

In order to provide greater flexibility to independent renewable generators as to financeable RtM market strategies under CfDs, the OLR effectively floors the RtM costs at the level in its bPPA. This analysis considers the three discounts being included by DECC as part of its consultation on the OLR – namely £20/MWh, £25/MWh and £30/MWh. While it is not expected that RtM costs should exceed any of these levels, there is a risk that if imbalance costs for wind were significantly higher than expected, the OLR could be triggered, passing costs onto consumers through levelisation payments.

In order to assess the magnitude of this risk, exercise costs have been estimated for each of the three discounts, assuming High and Extreme RtM costs (**"High RtM Cost Case"** and **"Extreme RtM Cost Case"**, respectively). Note that these cases are designed to stress test the risks relating to the implementation of the OLR and are not intended to represent a likely cost evolution pathway[2]. The results are set out in Table 1 below, giving the NPV of these costs from 2016 to 2035 discounted at 3.5% to 2014.

[2] These imbalance cost scenarios are derived from the work performed by Baringa for Ofgem in relation to the Electricity Balancing Significant Code Review (**"EBSCR"**).

Table 1: NPV of projected bPPA exercise costs between 2016 and 2035 under the High and Extreme RtM Cost Case

bPPA Discount	High RtM Cost Case	Extreme RtM Cost Case
£20/MWh	£826 million	£1,735 million
£25/MWh	£323 million	£1,000 million
£30/MWh	£65 million	£483 million

In a world without the OLR, if the High or Extreme RtM Cost Cases were to transpire, it is unlikely that consumers would in any case be fully insulated. Vertically integrated utilities (VIUs) both offering long-term PPAs and acting in the supply market might have passed through some of this cost exposure to their consumers. The extent of that pass through is sensitive to the composition of the PPA and supply markets, with and without OLR.

2. INTRODUCTION

2.1. Details of policy

This report describes analysis on certain costs and benefits of the proposed Offtaker of Last Resort ("**OLR**") policy to feed into DECC's impact assessment ("**IA**") to be published alongside the consultation document in February 2014. Full details of the policy proposal can be found in the consultation document, but a brief summary of the framework assumed for the purposes of this paper is as follows:

- Concerns have been raised that low carbon generators with Contracts for Difference (**"CfDs"**) may be unable to secure long-term PPAs for their power. Whilst the energy produced receives a guaranteed revenue stream under the CfD, the Route to Market (**"RtM"**) costs remain uncertain.

- Without these long-term PPAs (**"LT PPAs"**), therefore, net revenues for generators are, at least in principle, unfloored, which creates a risk that could jeopardise the ability for independent generators to secure low-cost finance.

- The OLR is designed to provide a minimum level of contracted revenue for a generation project, off which low-cost finance can be secured. This is done by agreeing a "backstop PPA" (**"bPPA"**) with a fixed £/MWh discount to the market reference price (**"MRP"**) at the start of the project.

- This bPPA can be called upon by any eligible generator if its market PPA provider becomes insolvent or its existing market PPA expires, and it is unable to secure another at a discount that is smaller than that available in the bPPA.

- If an eligible generator calls on the bPPA, it will receive the £/MWh price for its electricity at a fixed discount from the market reference price. Potential offtakers will bid for the right to provide this bPPA, bidding at a level that should reflect the difference between the true RtM cost and the bPPA discount. These costs are then socialised through a process of levelisation.

2.2. Report objective

This report is intended to assess the costs and benefits of the OLR policy on electricity market participants. The report is in two parts:

- First, it assesses the benefit of removing the constraint that generators are effectively required to secure LT PPAs in a currently illiquid market. This needs to be compared to any cost to central bodies or suppliers of having to administer the scheme (which we understand is being quantified by DECC as part of its IA). This analysis assumes that the bPPA is not exercised.

- The second part of the analysis focuses on the costs that would accrue to offtakers, generators and consumers in the event that bPPAs are exercised. It is assumed that this comes about because imbalance costs have escalated to such an extent that the bPPA discount is preferable to PPAs offered on the market, and because LT PPA providers can buy out generators who then opt into a bPPA.

2.3. Scope

As we understand it, the current policy intent is to make the OLR available for all renewable generators eligible for CfDs. This analysis, however, focuses solely on onshore and offshore wind (hereinafter, "**Relevant Wind Generators**"), which for the purposes of this analysis is assumed will all be developed by independents requiring access to limited recourse funding.

Other technologies are not considered as part of this analysis for different reasons:

- **Biomass** – DECC does not believe that biomass generators will need bPPAs. Their primary RtM exposure is one of liquidity risk which relates to their ability to access the baseload Market Reference Price. As a baseload generator with predictable output, imbalance costs are likely to represent a relatively low risk. Whilst liquidity may well be a risk, there are a range of regulatory protections, both in the CfD itself (in terms of adjustments to the MRP) as well as in Ofgem's liquidity reforms, which are expected to be triggered if RtM costs were to escalate significantly.

- **Solar PV -** Solar PV generation may face increasing imbalance costs in future. However, the uncertainty of this cost escalation is not expected to be as great as for wind generators for two reasons. First, overall forecasting error is less. Second, because solar is likely to remain a small part of the overall generation mix relative to wind, there is unlikely to be a strong correlation between solar PV imbalance and system imbalance (as may increasingly be the case for onshore and offshore wind generators).

- **Other technologies -** Other technologies are currently a small part of the system, and their potential RtM costs are poorly understood. The cost to the consumer of these technologies taking up the bPPA is likely to be small.

2.4. Counterfactual framework

It is assumed that where the OLR is implemented, it is successful in its policy objective. It enables greater choice for generators in terms of their RtM strategy by allowing capital to be raised both against LT PPAs with less creditworthy counterparties (i.e. PPA providers other than the Vertically Integrated Utilities (**"VIUs"**), such as smaller suppliers or aggregators with no supply base) or alternatively PPAs with shorter term tenors.

The benefits and costs of this potential impact on consumers and market participants are compared against two different worlds, or "counterfactuals":

- **Competitive World -** ***in which OLR is not a necessary intervention***. There is in fact sufficient competition in the PPA market, and potential offtakers are comfortable they are able to manage long term imbalance cost uncertainty, and to provide LT PPAs at the discount close to that assumed in the CfD strike price for Relevant Wind Generators (10% and 5% for onshore and offshore wind, respectively).

- **Uncompetitive World** – ***in which, as is expected, OLR is necessary for Relevant Wind Generators to access low-cost financing***. As such, Relevant Wind Generators continue to require a LT PPA with one of a limited pool of creditworthy counterparties. Competition is assumed to be low with oligopolistic, rather than cost reflective, pricing strategies employed that create scarcity rents for PPA providers.

3. BENEFITS

3.1. Introduction

This section addresses the immediate benefits that could arise as a result of the implementation of the OLR. In particular, it considers two effects:

- **Reducing scarcity rents -** The reduction in rents that should come by bringing more competition to an uncompetitive PPA market (i.e. looking in particular at the Uncompetitive World as PPA pricing is assumed to be cost reflective in the Competitive World); and

- **Benefit of bPPA "insurance" on PPA discounts -** The reduction in PPA costs that would be expected since the financial risk that offtakers need to price into their offerings is effectively capped by the bPPA since LT PPA providers can (it is assumed) buy out generators, who in turn exercise their right to a bPPA (i.e. looking in particular at the Competitive World whereas PPA pricing is assumed to be cost reflective).

The section then brings these two benefits together and compares them across the counterfactual framework described above.

3.2. Calculating Scarcity Rents

3.2.1. Methodology

It is not known precisely how offtakers or financiers will behave under the CfD framework, but the current view is that there is risk that 15-year PPAs might not be available in the volumes required to deliver the Government's low carbon generation deployment objectives. For the purposes of this CBA, we assume that this scarcity does not result in PPA unavailability, but does allow the limited number of offtakers to extract scarcity rents above the true cost of providing the RtM service.

We then assume that the OLR is effective in enabling Relevant Wind Generators to raise finance against either a short-term PPA strategy or a LT PPA with less credit worthy counterparties. Note that the precise level of the discount in the bPPA is not relevant here, provided it is at a level that facilitates the viable financing structures and returns. Nor is the effectiveness of the OLR under question. We simply assume that without the OLR scarcity rents are extracted, and with it they are not.

The amount of scarcity rent that can be extracted in a relatively uncompetitive LT PPA market is the key variable of interest in this analysis. The more competitive the market, the lower scarcity rents will be. Two extremes are considered:

- If the market is monopolistic, it can be assumed that the sole offtaker will charge a discount that maximises its aggregate revenue. This is constrained only by the fact that the higher the discount, the fewer projects that will accept (with those that do not simply failing to go ahead).

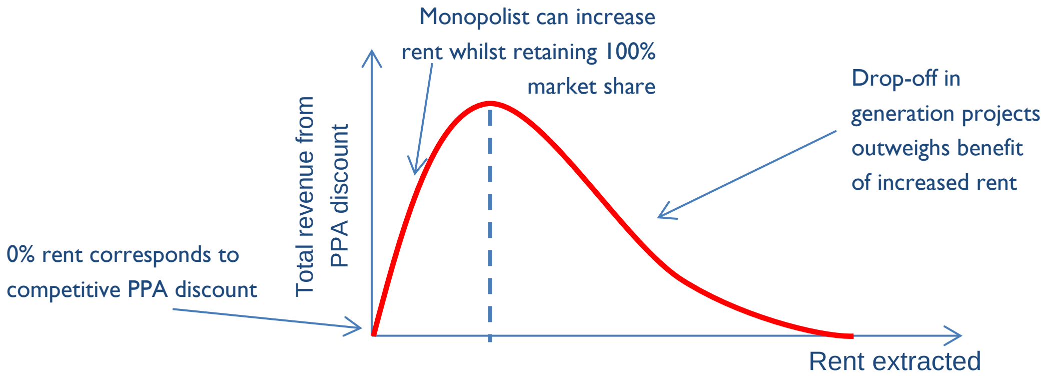
- If the market is truly competitive, there will be downward pressure on the discount until offtakers are charging the true costs of providing the RtM service, which we assume correspond to the discounts used by DECC in setting the CfD strike prices.

In reality, it is likely that the PPA markets will behave in a manner somewhere between these two extremes, but finding these levels bounds the problem.

Scarcity rents are estimated using a model of deployment under CfDs provided by DECC. This holds finance and operational data for a range of CfD-eligible generators, including supply curves by technology type. For the Competitive World, it is assumed that no rent is added to offtaker PPAs, so the project costs are consistent with DECC's own assumptions. This results in a baseline deployment rate for each technology.

As the discount is increased, the number of wind projects being commissioned decreases. Initially, the benefit for the offtaker of increased rent should outweigh this loss of wind projects, but eventually the reverse will be true. At this point, a monopolistic offtaker will be maximising its expected revenue, as illustrated in Figure 1.

Figure 1: Maximising monopolistic rents



The extent to which a monopolistic offtaker can extract rents will be a function of:

- **Gradient of the supply curve** - If projects of a given technology have a wide Capex range the levels of deployment will be relatively insensitive to increased PPA discounts. Conversely, if all projects have very similar costs and are close to the margin, the scope for extracting additional rents will be limited.

- **Proportion of revenue from the wholesale price** - Particularly for offshore wind, with a higher CfD strike price than onshore wind, the wholesale price component of revenue may be a relatively small part. Since deployment is less sensitive to PPA discounts, there may be greater opportunities to extract rents.

3.2.2. Results

This section provides the result of the analysis described above, giving, for each technology, the effect of increasing rents on the net revenue available for the monopolistic offtaker. The variables of interest are:

- The **rents charged** by the monopolistic offtaker to a project are expressed in percentage points (e.g. if the Competitive World PPA discount is 10%, adding rent of 2% results in a discount of 12%).

- The **number of projects** being built in a given year, which is a function of the number of potential projects and their distribution along the supply curve.

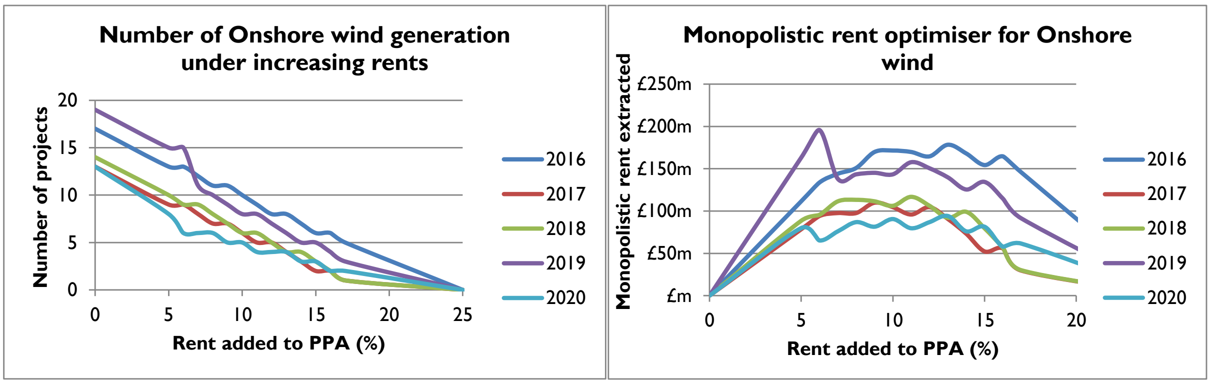
- The **total rents extracted** are a function of the number of projects going forward and the per-MWh rent that the offtaker has charged. Prices used for this analysis are annual average baseload prices provided by DECC, and are not technology specific. No adjustment has been made for price cannibalisation[3].

[3] "Cannibalisation" is the term given to the process whereby wind generators in a system with high levels of wind penetration tend to receive below-average prices. Since wind farm outputs are correlated, periods of high generation tend to occur simultaneously across the system, resulting in depressed prices captured by wind farms relative to the average.

Onshore wind

For both the Competitive World and the Uncompetitive World it is assumed that onshore wind generators will always receive the published administrative strike price[4]. In reality, strike prices for the mainland onshore wind projects will likely be set under competitive auctions before this, and possibly before OLR comes into effect. However, the details of this transition are not yet available, in particular, the available budget available under First Come First Served allocation before competitive auctions are triggered[5]. As such, it is important to note that the administrative strike price is likely to be an overstatement, with any reduction in costs to generators associated with OLR benefitting consumers through lower strike prices.

Figure 2: Onshore wind generation and monopolistic revenue as a function of % rent



As Figure 2 illustrates, for onshore wind there is scope for a monopolist PPA provider to add scarcity rent above that assumed in a competitively priced PPA. As rents are increased the return to the offtaker increases until a project that would otherwise be viable ceases to be so, resulting in a lost revenue stream for the offtaker.

This results in the ratcheting effect seen as rents are increased. The overall shape, though, has a peak which corresponds to the maximum scarcity rent that could be extracted by the monopolistic offtaker.

[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263937/Final_Document_-_Investing_in_renewable_technologies_-_CfD_contract_terms_and_strike_prices_UPDATED_6_DEC.pdf

[5] Whilst the absence of these details preclude a quantitative analysis, the impact is expected to be as follows: (a) The competitive PPA world will see cost-reflective CfD strike prices, with offtakers charging an appropriate level for the RtM costs; (b) The monopolistic PPA world would have higher strike prices since the monopolist could increase PPA discounts charged to generators. Generators would then bid up the strike price. This would be constrained either because the available auction budget that the monopolist can exploit is finite, or because the administrative strike price is met. (c) By allowing competition in the PPA market, the impact of the OLR would then be to move from a world of low deployment and high strike prices to one of higher deployment and lower strike prices.

Figure 3a: Implied Onshore wind PPA discounts under each counterfactual

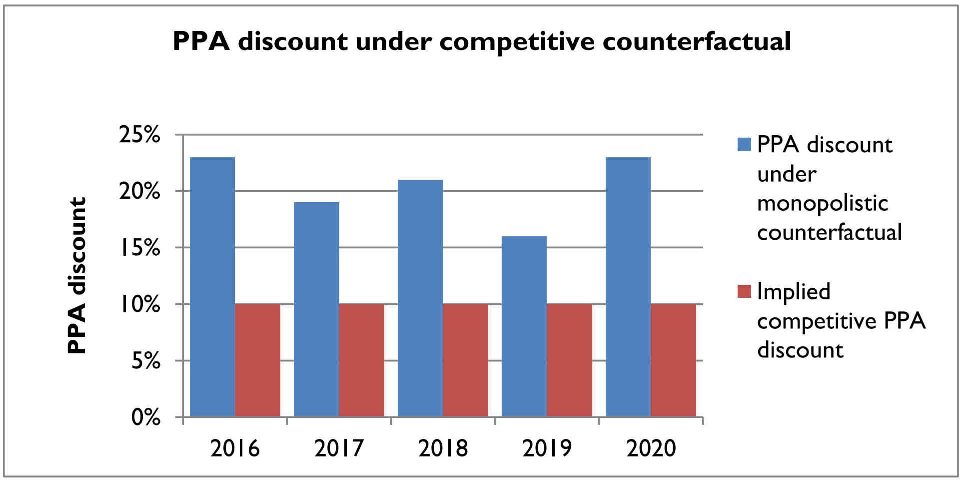


Figure 3b: Implied Onshore wind deployment under each counterfactual

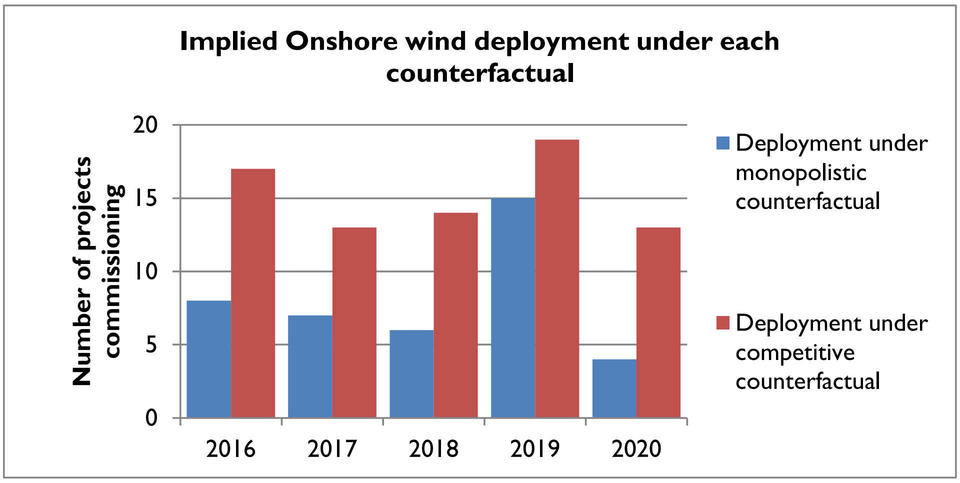
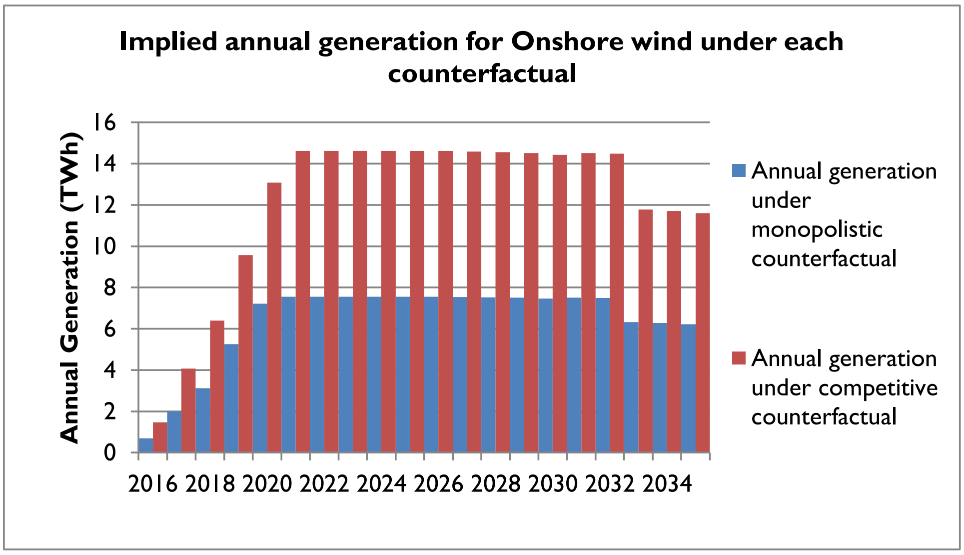


Figure 3c: Annual volume of generation from implied deployment levels



As Figure 3a shows, the rent that can be extracted varies from year to year. In 2016 the CfD strike price is higher than in the other years, which allows more projects to come forward, but also presents an opportunity for a monopolist PPA provider to increase discounts. The later years include wind projects on the Scottish Islands, which have higher underlying costs and higher strike prices.

In this case, the effect of the monopolist's scarcity rents is twofold:

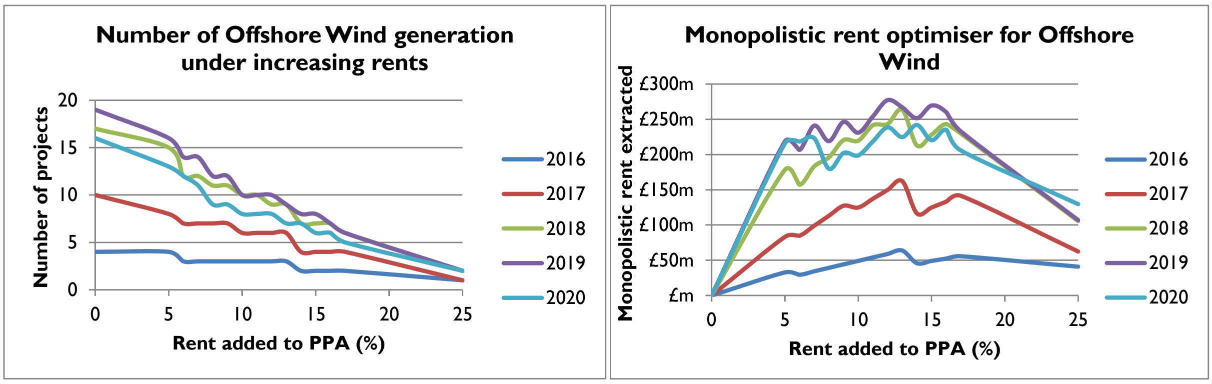
- By reducing the amount of onshore wind build between 2016 and 2020, generation is reduced by 5.9 TWh in 2020 (all other things being equal), and by 7 TWh each subsequent year until 2033.
- The onshore wind that is built is done so at a premium. In 2020 the rent charged amounts to £41m, with the total rent applied over the duration of these generators' 15-year PPAs amounting to £476m on a discounted basis[6]. This amounts to an additional £5.7/MWh for these onshore wind generators.

Given the assumption of administrative strike price setting, the benefit of the OLR in terms of reducing rents would therefore accrue entirely to the generators. If competitive strike price setting occurs, any reduction in rents charged by offtakers as a result of the OLR would accrue to consumers instead. However, the level of benefits cited here cannot be read across into a competitive CfD scenario since, as explained above, the Uncompetitive World pricing behaviour would change (given that it would be looking to maximise share of fixed budget rather than rents from an unconstrained pipeline of generation projects).

Offshore wind

Offshore wind has higher strike prices than onshore wind. Again it is assumed that the published administrative strike prices are achieved for all scenarios, and that the offtaker charges the same PPA discount to all offshore generators in a given year.

Figure 4: Offshore wind generation and monopolistic revenue as a function of % rent



As with onshore wind, there is scope for a monopolist PPA provider to add scarcity rent above that assumed in a competitively priced PPA. These optimal rents, and their impact on deployment and generation, are shown in Figure 5.

[6] Unless otherwise stated a social discount rate of 3.5% is used with a 2014 reference year. 2012 prices used throughout, consistent with published strike prices.

Figure 5a: Implied Offshore wind PPA discounts under each counterfactual

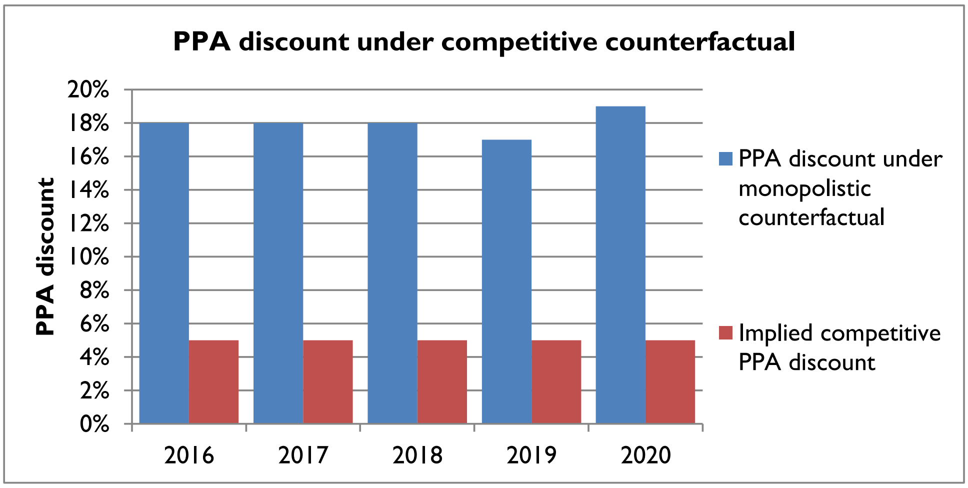


Figure 5b: Implied Offshore wind deployment under each counterfactual

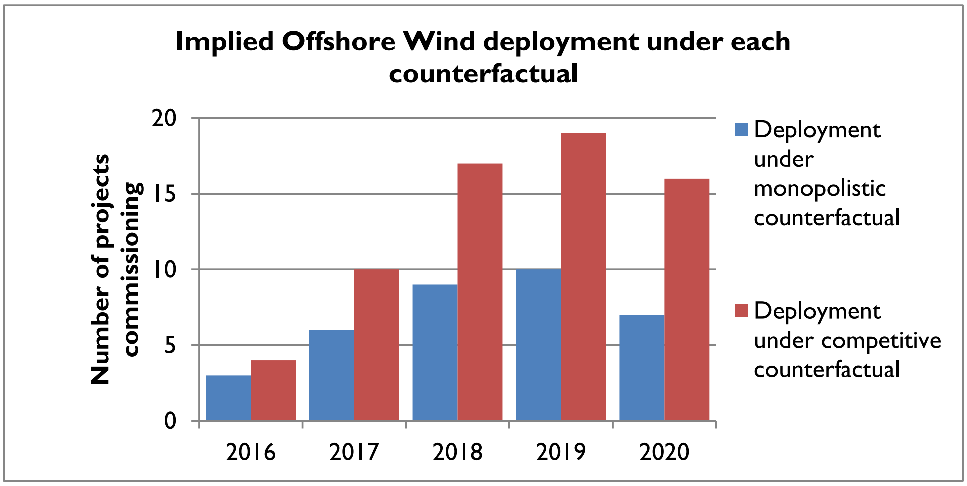
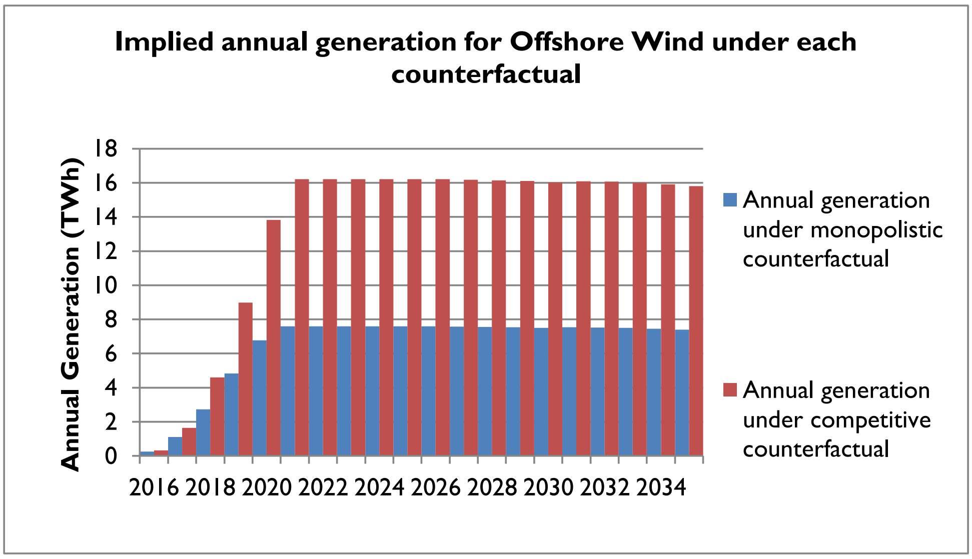


Figure 5c: Annual volume of generation from implied deployment levels



For offshore wind, the impacts are as follows:

- By reducing offshore wind build between 2016 and 2020, generation in 2020 without the OLR is 7.0 TWh lower than it would be under OLR. This reaches a peak of 8.6 TWh per year in 2021, and remains at or close to this level until the end of the modelled period.
- Projects that are built despite the scarcity rent operate at an additional cost. In 2020 alone this cost is £55m, peaking at £74m annually. Over the lifetime of the 15-yr PPAs this reaches a total NPV of £677m, amounting to £8.1/MWh for these offshore wind generators.

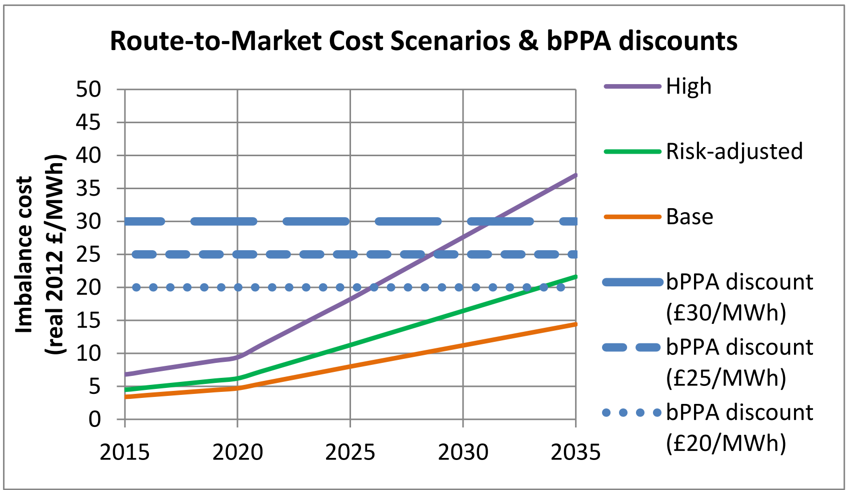
As with onshore wind, assuming no competitive CfD allocation, this cost reduction arising from OLR would benefit generators, but if CfDs were allocated competitively this could be passed through to consumers.

3.3. Benefit of bPPA availability on PPA discounts

In addition to reducing the market power that can be assumed by a relatively uncompetitive market for long-term PPAs, the existence of a bPPA should also reduce the risk premium charged by offtakers in their PPA offerings even when pricing is competitive. Without the OLR, offtakers will protect themselves against the possibility of very high RtM costs by adding in a premium to the PPA discount to price in that downside scenario. With the OLR it is assumed that offtakers will be able to buy themselves out of their LT PPAs in circumstances where the actual cost of a generator's power exceeds the level in the generators bPPA. The extent to which the OLR has an impact will depend on how high an offtaker believes RtM costs could become, and the way in which this is priced into their PPA discount.

For the purposes of this analysis, we look at the cost reduction that might occur for a 15-year PPA signed for projects commissioning between 2016 and 2020. The diffusion of cost scenarios follows the same pattern in each year in percentage terms, but the starting RtM cost increases for later years is in line with the increasing Base RtM Cost Case.[7]

Figure 6: 15-year PPA cost with and without the presence of the bPPA



PPA cost	2016	2017	2018	2019	2020
No OLR	13.81%	14.75%	15.69%	16.62%	17.56%
bPPA @ £30/MWh	13.81%	14.75%	15.69%	16.62%	17.54%
bPPA @ £25/MWh	13.81%	14.73%	15.65%	16.57%	17.48%
bPPA @ £20/MWh	13.76%	14.66%	15.56%	16.46%	17.35%

[7] These cases are derived from work performed by Baringa for Ofgem's EBSCR. Further details can be found in Annex 1.

Figure 6 shows a Base RtM Cost Case (orange) and a Risk-adjusted RtM Cost Case (green) that it is assumed an offtaker will price against for the purposes of a 15-yr PPA. The purple cost corresponds to the High RtM Cost Case against which an offtaker might choose to allocate risk capital (at an assumed 8% cost of capital) and reflect that cost in the PPA.

As can be seen, the High RtM Cost Case eventually exceeds all of the bPPA discount levels considered, so capping this risk by offering a bPPA discount should reduce the risk premium charged. However, the effect is minimal for two reasons:

- The cost of far years is discounted at an assumed commercial discount rate of 8%[8], so has less impact than the near years for the purposes of setting a PPA discount;
- Since the purple High RtM Cost Case is only costed against the cost of capital it effectively has only 8% of the impact of the Risk-adjusted RtM Cost Case. Although the latter is costed fully in the PPA it only breaches the bPPA level in the £20/MWh case, and only towards the end of the PPA horizon.

3.4. Summary of potential benefits of OLR

In Table 2 we summarise the potential benefits of OLR in terms of reduced PPA costs and potentially greater deployment of wind generation in a world of low PPA competition (as characterised by the Uncompetitive World Scenario), and its impact in a more competitive PPA world. In the next section we explore some of the potential risks and costs associated with OLR.

Table 2: Summary of potential benefits of OLR

	Competitive World	Uncompetitive World
PPA cost	Scarcity rents do not exist in this world, so there is no associated benefit. In theory there is a reduction in PPA costs by capping offtaker risk, but the effect is too small to be material.	Rents are reduced by £476m (£5.7/MWh) for onshore and £677m (£8.1/MWh) for offshore wind between 2016 and 2035 (assuming a monopolistic offtaker). Under competitive allocation of CfDs some of these cost savings for Relevant Wind Generators should be passed on to customers.
Deployment	Deployment of Relevant Wind Generators is largely unaffected since there is no rent reduction, and the PPA discount reduction is negligible.	As a result of reduced scarcity rents, generation by Relevant Wind Generators in 2020 increases (all other things being equal) by 5.9 TWh and 7.0 TWh for onshore and offshore wind, respectively.

[8] Note that this differs from the social discount rate of 3.5%. This larger rate more closely reflects a rate used for a commercial valuation, and hence the basis on which an offtaker might set PPA prices.

4. RISKS AND COSTS

4.1. Cost if backstop PPA is exercised

The OLR effectively floors RtM risk for eligible generators by guaranteeing access to the market at a fixed £/MWh discount to the market reference price in its CfD. Any costs in excess of this level are effectively passed onto consumers through levelisation payments that are levied on suppliers. As such, an important part of DECC's impact assessment is the potential magnitude of this risk transfer to consumers.

The extent of that risk transfer is a function of the level of the bPPA discount chosen. DECC are consulting on 3 potential price points: £20/MWh, £25/MWh and £30/MWh. It is important to note at the outset that, on the basis of the Base RtM Cost Case set out in Figure 6 above, the cost to Relevant Wind Generators of accessing the market is not expected to rise above the level of any of the bPPA discounts envisaged by DECC at any time prior to 2035 (when the last bPPA will expire). As such, against this Base RtM Cost Case, the OLR should not cost consumers anything over and above the administrative costs associated with implementing and administering the scheme (which are not assessed in this document) [9].

However, there remains the risk that the RtM costs could be higher than the trajectory expected (by both DECC and the market), such that the OLR is in fact used at some point prior to 2035. Indeed, it is exactly this long term uncertainty that the OLR is designed to mitigate to allow greater flexibility in financeable contracting strategies.

In order to assess the magnitude of this risk, this section looks to simulate the likely exercise costs to consumer in terms of levelisation payments for the three different bPPA discounts (i.e. £20/MWh, £25/MWh and £30/MWh) assuming a High and Extreme RtM Cost Case.

- The High RtM Cost Case is intended to reflect the downside case that an offtaker or equity provider might use to price long term imbalance risk into its PPA discount or cost of capital respectively (indeed it matches the high cost case used in Figure 6 above to simulate the pricing process of a LT PPA);
- The Extreme RtM Cost Case is intended to be an imbalance case that is likely to be higher than scenarios used by offtakers or generators alike, even for setting a risk premium[10].
- Both these cases, set out in Figure 7 below, are derived from imbalance cost projections generated from scenario analysis carried out by Baringa as part of its work with Ofgem on the EBSCR.

[9] We note that this paper assumes that generators will only use the bPPA in the event that the cost of accessing the market is greater than the fixed discount in their bPPA. This may not be the case for two reasons:

- The first is that the risk allocation in the bPPA may be better than is available in the short term market at that time (due to a shift in the terms of a market PPA from the time at which the generators bPPA was grandfathered). As such, a generator may prefer to opt for its bPPA notwithstanding that the "nameplate" discount is larger. However, our understanding from DECC is that the OLR is explicitly underwriting both risk and cost so this can be viewed as an intended outcome for the policy.
- The second scenario is on offtaker insolvency or PPA expiry where generators might opt to use the OLR as a safe haven to mitigate losses while they negotiate a replacement PPA. By doing this they could reduce the cost of their original PPA by reducing the credit cover required to be provided by offtakers to cover the replacement period. This risk can be mitigated by requiring generators to commit to a minimum period to the OLR thereby discouraging use of the OLR in this way.

[10] As with the Risk-adjusted RtM Cost Case, this was derived from the Base and High Case, from which an indicative "99th percentile" case was found.

Figure 7: RtM Cost Cases for calculating bPPA exercise costs

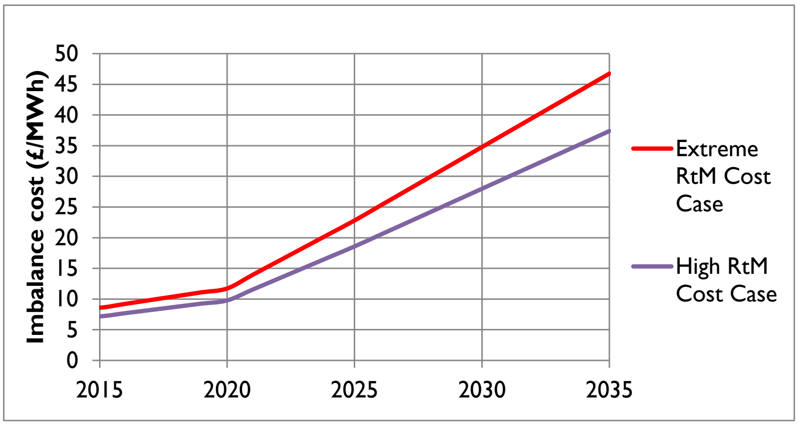


Table 3a below shows the total RtM cost arising from the Base, High and Extreme RtM Cost Cases[11]. Table 3b then sets out the High and Extreme results in terms of the exercise costs that are incurred by consumers under the different proposed bPPA discounts. In addition, the corresponding bPPA cost per MWh of electricity produced by the Relevant Wind Generators is given, as well as the proportion this represents of the total RtM cost attributable to these generators.

Table 3a: NPV of Overall RtM Costs between 2016 and 2035

	Base RtM Cost Case		High RtM Cost Case		Extreme RtM Cost Case	
	Competitive World	Uncompetitive World	Competitive World	Uncompetitive World	Competitive World	Uncompetitive World
No OLR	£3.03 billion	£1.50 billion	£6.98 billion	£3.46 billion	£8.62 billion	£4.27 billion
With OLR	£3.03 billion	£3.03 billion	£6.98 billion	£6.98 billion	£8.62 billion	£8.62 billion

Table 3b: NPV of bPPA Exercise costs accrued between 2016 and 2035

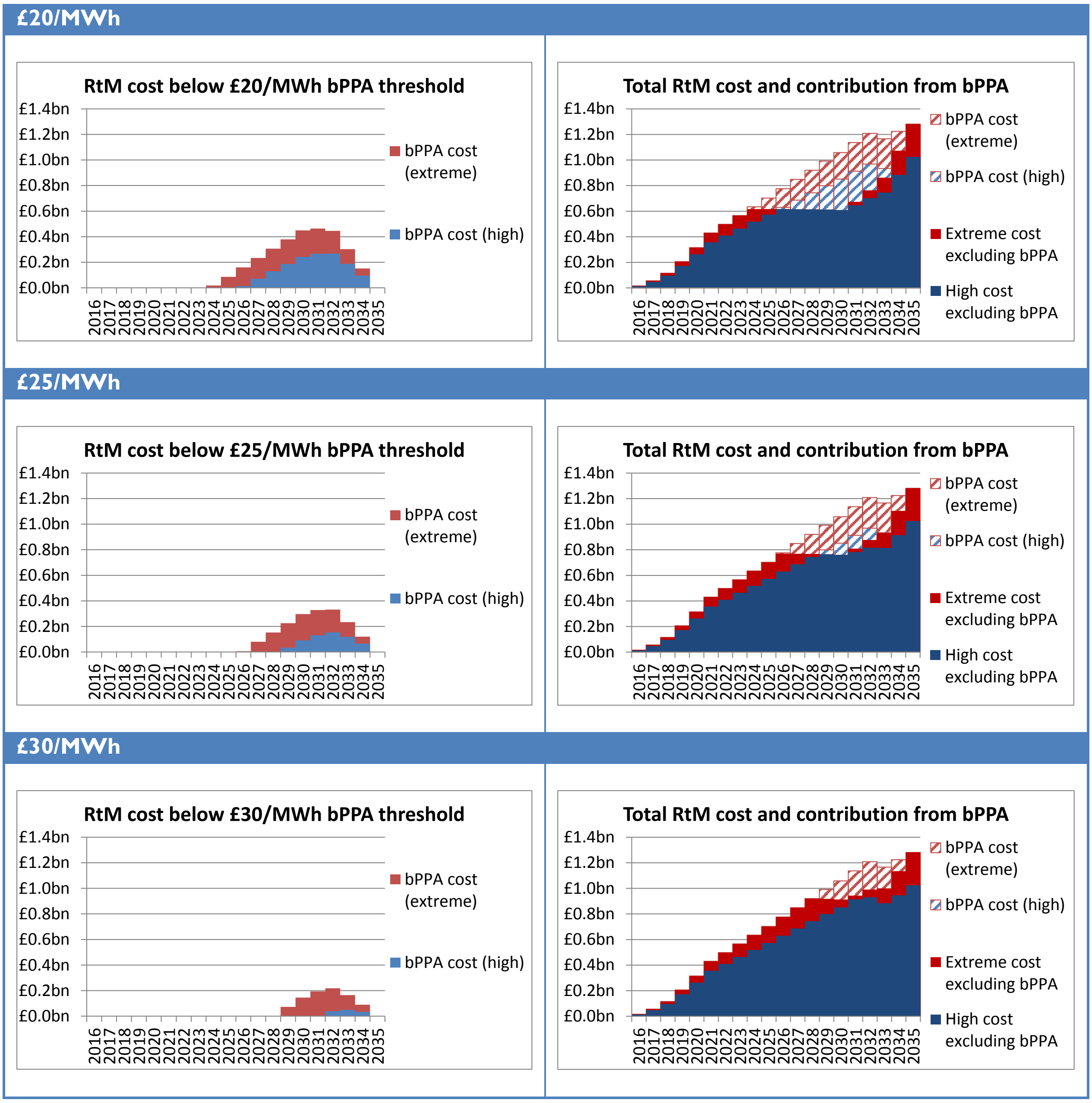
	High RtM Cost Case			Extreme RtM Cost Case		
bPPA Discount	Total bPPA exercise cost	Overall RtM cost	Consumer cost as % of total RtM costs	Total bPPA Exercise cost	Overall RtM cost	Consumer cost as % of total RtM costs
£20/MWh	£826 million	£6.98 bn	11.8%	£1,735 million	£8.62 bn	20.1%
£25/MWh	£323 million	£6.98 bn	4.6%	£1,000 million	£8.62 bn	11.6%
£30/MWh	£65m million	£6.98 bn	0.9%	£483 million	£8.62 bn	5.6%

[11] For wind generators commissioning in 2020, bPPAs will be available for 15 years. Since imbalance costs have not been modelled beyond 2030, costs beyond this point are extrapolated linearly. In reality, some regulatory or market intervention may well occur before such a situation arose, but for the purposes of establishing "high" and "extreme" case scenarios this seems reasonable.

Figure 8 below shows how these costs evolve through time.

- On the left, the bPPA exercise costs are shown on their own
- On the right the total RtM cost for the Relevant Wind Generators is shown, but with the hatched area corresponding to the bPPA exercise cost.

Figure 8: bPPA exercise cost evolution



It is worth noting that the aggregate cost levelised through the bPPA is in most cases a relatively small component of total system cost, meaning that PPA providers and wind generators will still absorb the vast majority of the total costs associated with an unexpected rise in imbalance costs. This should ensure that, even with the OLR in place, wind generators and PPA providers are sufficiently incentivised to minimise system costs through the way that the plant is designed and operated.

It is important to note the following assumptions on which these results are predicated:

- **Availability of OLR**: It is assumed that this discount applies to all Relevant Wind Generators commissioning in years between 2016 and 2020 (but not beyond that point).

- **Deployment profile:** These exercise costs apply in both the Competitive and Uncompetitive World in which the OLR is implemented. This is because, as explained above, it is assumed that the impact of the OLR in the Uncompetitive World is to eliminate all rents thereby returning the deployment profile for Relevant Wind Generators to that assumed for the Competitive World (with or without the OLR).

- **Exercise behaviour**: It is assumed for the purposes of this analysis that, in scenarios where the OLR is available, all Relevant Wind Generators exercise their right to a bPPA where the RtM costs exceed the level of the fixed discount in their bPPA. We apply this assumption irrespective of the RtM strategy assumed. In this way we are implicitly assuming that those Relevant Wind Generators that opt for LT PPAs voluntarily enter the OLR when RtM costs rise above the fixed discount in the bPPA by allowing their LT PPA provider to "buy them out" of any residual obligations (i.e. the PPA provider would pay the generator the difference between what they would have received under the original PPA and what the generator is able to secure in the OLR under its bPPA). It is important to note that this is a worst case assumption, as it is not entirely clear that generators would necessarily agree to such arrangements (either up front or at the time that high imbalance costs materialise). The effect of any departure from this assumption would be to reduce the exercise costs for consumers as PPA providers that are locked into LT PPAs would incur RtM cost below the level of the backstop discount that they would be unable to socialise more widely.

4.2. Distributional effects

By focusing on the direct cost of bPPA exercise to consumers, the analysis in the previous section implicitly assumes that in a world without the OLR (whether the Competitive or Uncompetitive World), none of those system costs would have been passed onto consumers. In other words, it assumes that the exercise costs shown in Section 4.1 represent the true cost to consumers relative to either counterfactual where the OLR did not exist. For this to hold, it must be assumed that these costs cannot be passed to consumers via an alternative route. Specifically, it assumes any PPA provider that is also a VIU will be unable to price any proportion of the losses it incurs from an out of the money PPA into the tariffs it charges its consumers.

- In the Competitive World, this may be a valid assumption. If it is assumed that in such a world supplier-offtakers are forced to compete with suppliers that are not exposed to high RtM costs associated with LT PPAs, it is reasonable to suggest that such costs must be borne entirely by VIU PPA offtakers.
- In the Uncompetitive World with no OLR, however, it might be reasonable to assume that lenders' restrictions with respect to bankable counterparties might ensure that the LT PPA market is dominated by the large VIUs. If each of these VIUs had exposures under LT PPAs signed with Relevant Wind Generators, there is a chance that they could pass a proportion of their losses onto consumers without necessarily jeopardising their competitive position relative to its competitors. The more evenly those losses are spread, the greater proportion of losses could be passed on. In this way, the exercise costs may not represent an accurate picture of the position of consumers relative to the position they would have been in if the OLR had never been implemented.

In order to explore this dynamic further, this analysis looks to establish what proportion of losses arising from the High or Extreme RtM Cost Cases would have to be passed onto consumers by VIUs in the Uncompetitive World with no OLR, for consumers to be in the same position as they are in a world where the OLR is implemented. In order to do this, we need first to make some assumptions in relation to the contracting strategies and PPA market composition in the Uncompetitive World, and how these might be affected by the implementation of the OLR. These hypothetical assumptions are set out in Table 4 below.

Table 4: Contracting behaviour and PPA market composition for the Uncompetitive World with and without OLR

	Without OLR	Impact of OLR
Contracting strategy chosen by Relevant Wind Generators	Relevant Wind Generators continue to require LT PPAs from creditworthy counterparties to secure financing. As such, it is assumed that **100%** of eligible wind generators opt for LT PPAs (with none able to finance using a short term contracting strategy).	The implementation of the OLR triggers a shift away from LT PPAs to ST PPA strategies. ▶ Therefore, we assume that **20%** of Relevant Wind Generators opt for LT PPAs ▶ With the remaining **80%** opting for ST PPAs.
LT PPA market composition	VIUs make up a large proportion of the pool of counterparties considered sufficiently creditworthy to provide bankable offtake arrangements. As such, it is assumed that: ▶ VIUs have a **80%** market share of the LT PPA Market; and ▶ Non-VIUs retain the remaining **20%** of the market	The implementation of the OLR triggers a shift away from a reliance on the offtaker traditionally considered creditworthy – i.e. the VIUs – with a number of new entrant aggregators without supply business moving into the LT PPA market and taking market share. As such, its assumed that ▶ VIUs market share drops to **20%**; and ▶ Non-VIUs increase their presence to **80%** of the LT PPA market
LT PPA discounts charged	It is assumed that the discounts charged under LT PPAs equal those calculated through the **monopolistic pricing** calculation carried out in Section 3.2 above.	It is assumed that the discounts charged under LT PPAs are **cost reflective** and therefore equal the discounts assumed by DECC in their strike price setting methodology (i.e. 10% for onshore wind and 5% for offshore wind).

It should be restated that whilst the above scenarios are two (plausible) descriptions of how the market might behave, they are intended to act as an illustrative set of background contracting assumptions to see the effect of OLR and the impact on consumers through cost pass-through. Equally, cost pass-through could be fixed to allow the sensitivity of the outcome to any of these assumptions to be tested.

Given these assumptions, however, Table 5 below sets out the percentage pass through that leaves consumers in the same position that they would have been in a world without OLR as they would be in a world in which OLR was in fact implemented. For each RtM Cost Case, this is calibrated to deliver two different results:

- **Absolute losses**: Percentage pass-through required to leave consumers with the same ***absolute*** losses with and without the OLR.

- **Relative losses**: Percentage pass-through required to leave consumers with ***proportionally*** the same losses with and without the OLR (i.e. on a £/MWh basis).

The reason that it is important to look at the point of equivalence of relative losses is that in the Uncompetitive World with OLR, the actual level of deployment is reduced relative to the scenario in which OLR is in fact implemented (as set out in Section 3.2.2 above).

The sizes of the pie charts in Figure 9 illustrate the total RtM cost (which is increased by OLR in line with increased deployment levels). The sector labelled "Consumers (via bPPA)" corresponds to the direct bPPA cost summarised in Table 2. Note that all these figures are based on a bPPA discount of £25/MWh.

These results illustrate some of the possible effects of OLR:

- Because more of the Relevant Wind Generators are likely to opt for a ST PPA strategy, they would be fully exposed to the escalating costs seen in the High and Extreme RtM Cost Cases
- Conversely, VIUs who would otherwise have been exposed to these RtM costs have their exposure reduced in two ways:
  - As described above, fewer generators opt for the insurance offered by LT PPAs
  - Non-VIU offtakers enter the PPA market

- How much this reduction in VIU exposure benefits customers depends on the extent to which VIUs would have passed through their escalating RtM costs. Without making assumptions about the extent of that pass-through, the sensitivity shows that:
  - Provided the pass-through exceeds 24%, consumers would be paying a lower share of the total RtM costs associated with the Relevant Wind Generators with the OLR in the High RtM Cost Case than without. This tipping point is still only 44% in the Extreme RtM Cost Case.

  - When considering the absolute difference in RtM costs consumers face from the Relevant Wind Generators, the VIU pass-through would need to exceed 55% or 97% (High and Extreme RtM Cost Cases, respectively). This is because the increased deployment that OLR brings about has an associated RtM cost that needs to be borne by the system.

Table 5: Consumer break-even points

Imbalance scenario	Basis of comparison	% pass through by VIUs to create equivalence
High RtM Cost Case	Absolute Loss	55%
High RtM Cost Case	Relative loss	24%
Extreme RtM Cost Case	Absolute Loss	97%
Extreme RtM Cost Case	Relative loss	44%

Figure 9: Cost equivalent on an absolute basis – High RtM Cost Case

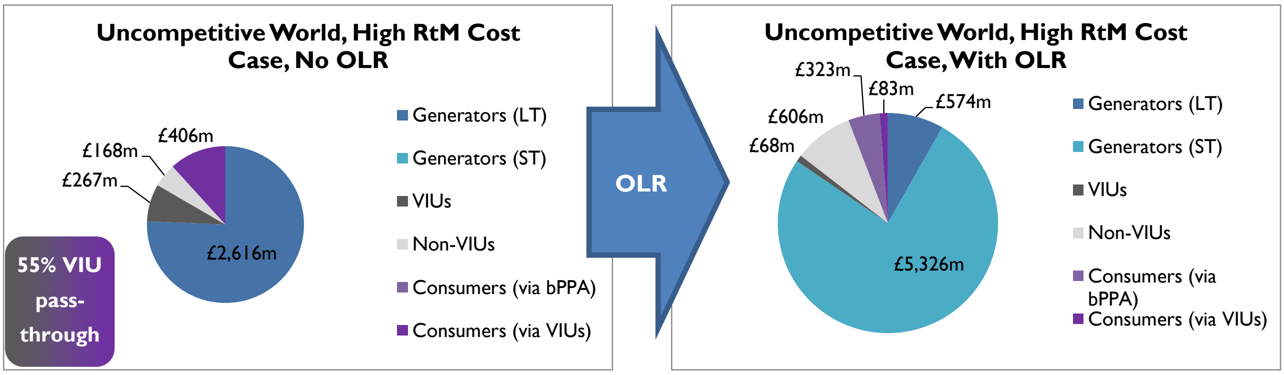


Figure 10: Cost equivalent on a relative basis – High RtM Cost Case

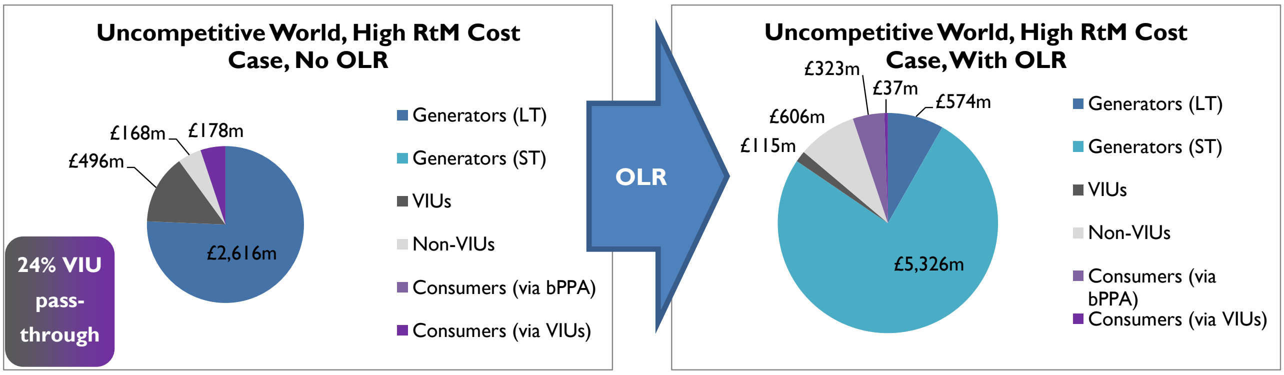


Figure 11: Cost equivalent on an absolute basis – Extreme RtM Cost Case

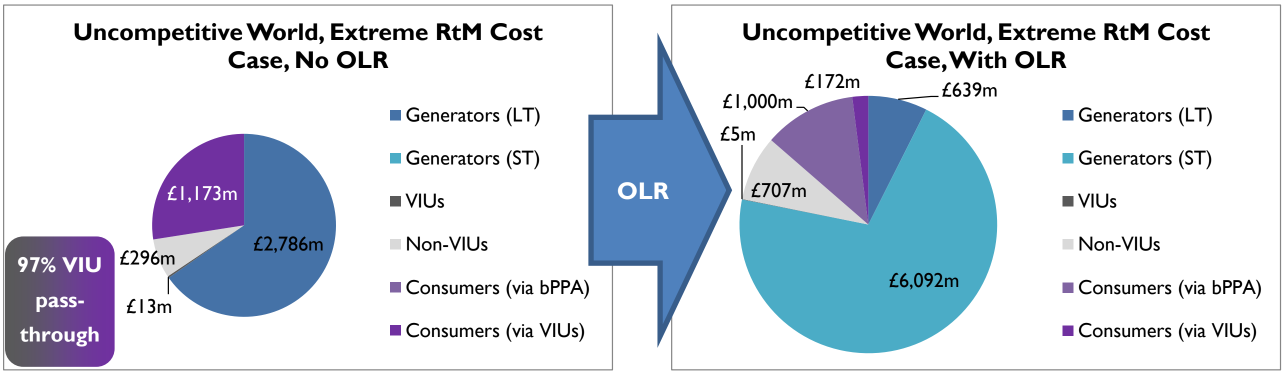
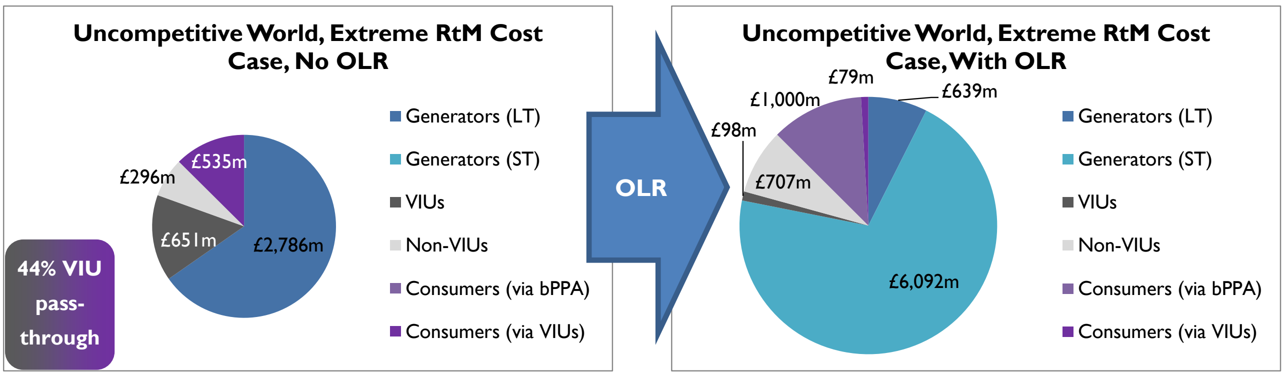


Figure 12: Cost equivalent on a relative basis – Extreme RtM Cost Case



It is important to note this analysis is illustrative, and is sensitive to the market assumptions made in Table 4. However, it demonstrates the following logic:

- bPPAs act as an insurance policy provided by consumers for eligible generators against escalating RtM costs.
- It is unlikely that bPPAs will be exercised, since RtM costs are likely to remain below the bPPA discount level. However, even if RtM costs escalate to the level assumed in the High RtM Cost Case it is quite likely that consumers would have been worse off without the OLR.
- If RtM costs in the region of the Extreme RtM Cost Case were to transpire, it is less likely that consumers would be better off with OLR.

There are too many uncertainties around the behaviour of the PPA and electricity supply markets, and the effectiveness of OLR in changing offtaker behaviour, to say whether the net impact on consumers under High and Extreme RtM Cost Cases would be positive or negative. However, the exercised bPPA costs are likely to be small compared to the overall escalation of RtM costs under any circumstance. Again, it should be stated that all the costs explored in this analysis arise from RtM Cost Cases that are themselves unlikely, so the most probable outcome for consumers of implementing the OLR is an increase in renewable deployment and a reduction in RtM costs which could lead to lower CfD strike prices with cost savings passed onto consumers.

5. SUMMARY

The potential benefits of the OLR come in the form of reduced PPA costs and a consequential increase in renewable energy deployment. Whether this effect materialises is dependent on whether the PPA market is indeed lacking in competition. The potential benefits are summarised in Table 6.

Table 6: PPA costs and deployment levels under the two counterfactuals

	Competitive World	Uncompetitive World
PPA cost	Scarcity rents do not exist in this world, so there is no associated benefit. In theory there is a reduction in PPA costs by capping offtaker risk, but the effect is too small to be material.	Rents are reduced by £476m (£5.7/MWh) for onshore and £677m (£8.1/MWh) for offshore wind between 2016 and 2035. Under competitive allocation of CfDs some of these cost savings for Relevant Wind Generators should be passed on to customers.
Deployment	Deployment of Relevant Wind Generators is largely unaffected since there is no rent reduction, and the PPA discount reduction is negligible.	As a result of reduced scarcity rents, generation by Relevant Wind Generators in 2020 increases (all other things being equal) by 5.9 TWh and 7.0 TWh for onshore and offshore wind, respectively.

The bPPA discount is to be set at a level above the expected RtM cost for wind generators and, as such, it is not expected to be called upon. Nevertheless, there is a risk that if RtM costs escalate to the extent modelled in this analysis, consumers will be exposed to the RtM costs above the bPPA discount. These potential costs are summarised in Table 7.

Table 7: NPV of bPPA Exercise costs accrued between 2016 and 2035

	High RtM Cost Case			Extreme RtM Cost Case		
bPPA Discount	Total bPPA exercise cost	Overall RtM cost	Consumer cost as % of total RtM costs	Total bPPA Exercise cost	Overall RtM cost	Consumer cost as % of total RtM costs
£20/MWh	£826 million	£6.98 bn	11.8%	£1,735 million	£8.62 bn	20.1%
£25/MWh	£323 million	£6.98 bn	4.6%	£1,000 million	£8.62 bn	11.6%
£30/MWh	£65m million	£6.98 bn	0.9%	£483 million	£8.62 bn	5.6%

However, if these High or Extreme RtM Cost Cases were to transpire, it is unlikely that consumers would be fully insulated from them in a world without the OLR. There is a risk that VIUs both offering long-term PPAs and acting in the supply market are able to pass through some of this cost to their consumers. The greater the role of VIUs in the LT PPA market, the more likely that pass through will occur.

The scope for such pass through is sensitive to the PPA and supply market composition with and without OLR, but some indicative assumptions have been made. On this basis, the break-even point of OLR for consumers under these very high scenarios of balancing costs is a function of the amount of cost pass-through that VIUs can achieve. These break-even points are given in Table 8.

Table 8: Consumer break-even points

Imbalance scenario	Basis of comparison	% pass through by VIUs to create equivalence
High	Absolute Loss	55%
High	Relative loss	24%
Extreme	Absolute Loss	97%
Extreme	Relative loss	44%

It is important to note this analysis is illustrative, and is sensitive to the market assumptions made in Table 4. However, even if RtM costs escalate to the level assumed in the High RtM Cost Case it is quite likely that consumers would be better off with the OLR.

There are too many uncertainties around the behaviour of the PPA and electricity supply markets, and the effectiveness of OLR in changing offtaker behaviour, to say whether the net impact on consumers under High and Extreme RtM Cost Cases would be positive or negative. However, the exercised bPPA costs are likely to be small compared to the overall escalation of RtM costs under any circumstance. Again, it should be stated that all the costs explored in this analysis arise from RtM Cost Cases that are themselves unlikely, so the most probable outcome for consumers of implementing the OLR is an increase in renewable deployment and a reduction in RtM costs which could lead to lower CfD strike prices with cost savings passed onto consumers.

ANNEX 1: ROUTE-TO-MARKET COST ASSUMTIONS

The RtM cost cases illustrated in Figure 6 are derived from work performed by Baringa for Ofgem's EBSCR, and are based on a single cash-out, marginal pricing scenario, which reflects Ofgem's current minded to position for reforming electricity cash-out. This case is designated as "Package 5" in the Ofgem's EBSCR policy report[12].

- The Base RtM Cost Case is derived from the forecast imbalance costs for independent wind generators under Ofgem's "minded to" position, assuming a Capacity Market is in place, but assumes no basis risk between the day-ahead market when the MRP is set and Gate Closure.
- The High RtM Cost Case is derived from the same "minded to" position. However, in order to produce high imbalance costs for the purposes of this exercise, it is assumed that no Capacity Market is in place, and that the full basis risk is taken between the expected position at the day-ahead stage when the MRP is set and position at Gate Closure.
- The Risk-adjusted RtM Cost Case is derived from the Base and the High cases to represent a risk-adjusted trajectory at the 70th percentile of outcomes.

A number of other caveats need to be given in respect of the analysis underpinning these case scenarios:

a) The model used to determine these scenarios was originally designed to make comparisons between potential policy options, not to provide forecasts of absolute imbalance costs
b) The analysis was performed on a subset of years and has then been interpolated
c) Some effects have been studied on one policy package, with the results applied to another
d) The model does not account for changing system configurations that would likely occur in response to these high imbalance scenarios (e.g. increased interconnection, demand-side response, regulatory change).

In all cases, scenarios given should not be viewed as a probabilistic statement about possible outcomes, but are intended to provide a basis for exploring the impact of OLR on the magnitude and distribution of imbalance costs.

12 https://www.ofgem.gov.uk/ofgem-publications/82294/ebscrdraftdecision.pdf