Department for
Business, Energy
& Industrial Strategy

EVALUATION OF THE CONTRACTS FOR DIFFERENCE SCHEME

Allocation Round 3

November 2020

Acknowledgements

The Department for Business, Energy and Industrial Strategy (BEIS) commissioned Technopolis Group Ltd, in partnership with LCP Ltd to undertake a process and impact evaluation of the Contracts for Difference (CfD) scheme. This report presents findings from Phase 2 of the evaluation, which assessed the extent to which the CfD Allocation Round 3 (AR3) met its intended objectives. Prior to this report a separate Phase 1 report assessing CfD Allocations Rounds 1&2 was completed.

Disclaimer on Covid-19 pandemic

Fieldwork for this evaluation began prior to social distancing measures being implemented in the UK due to the Covid-19 pandemic. It was not within the scope of this evaluation to assess the impact of Covid-19 on potential risks to delivery of AR3 projects or any wider policy implications. The report should be regarded in this context.

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Contents

List of Abbreviations

ACT	Advanced Conversion Technologies
AR	Allocation Round
CfD	Contracts for Difference
CHP	Combined Heat and Power
CMO	Context Mechanism Outcome
CA	Contribution Analysis
CAGR	Compound Annual Growth Rate
DDM	Dynamic Dispatch Model
DSCR	Debt Service Cover Ratio
EMR	Electricity Market Reform
FC	Financial Close
FiT	Feed-in-Tariff
FIDER	Final Investment Decision Enabling for Renewables
HLQ	High Level Evaluation Question
JR	Judicial Review
LCCC	Low Carbon Contracts Company
LCOE	Levelised Cost of Electricity
MDD	Milestone Delivery Date
NGESO	National Grid Electricity System Operator
PPA	Power Purchasing Agreement
PT	Process Tracing
REPD	Renewable Energy Planning Database
RO	Renewables Obligation
RIW	Remote Island Wind
SPV	Special Purpose Vehicle
TNUoS	Transmission Network Use of System

Introduction

The Department for Business, Energy and Industrial Strategy (BEIS) commissioned Technopolis Group Ltd, in partnership with LCP Ltd to undertake a process and impact evaluation of the Contracts for Difference (CfD) scheme. This report presents findings from Phase 2 of the evaluation, which assessed the extent to which the CfD Allocation Round 3 (AR3) met its intended objectives. Prior to this report a separate CfD Evaluation Phase 1 report[1] assessed the two previous Allocations Rounds (AR1 and AR2).

Background to the CfD scheme

Policy Background

The Energy Act (2013)[2] implemented regulations to enable the CfD scheme to meet a range of Electricity Market Reform (EMR)[3] programme objectives. The strategic objectives for the EMR at the time it was implemented include:

> *Ensure sufficient investment in sustainable low-carbon technologies to put us on a path consistent with our EU 2020 renewables targets and our longer-term target to reduce carbon emissions by at least 80% of 1990 levels by 2050.*
>
> *Maximise benefits and minimising costs to the economy as a whole and to taxpayers and consumers - maintaining affordable electricity bills while delivering the investment needed.*

In 2019, the government updated its decarbonisation targets to achieve net zero carbon emissions by 2050.[4] Alongside the Offshore wind sector deal, the CfD scheme will also play a major role in securing the investment needed to achieve the government's target for Offshore wind to contribute up to 40GW of generating capacity by 2030.

CfDs aim to give developers a higher level of confidence and certainty to invest in low carbon electricity generation by agreeing to a fixed price for the sale of electricity. Generators are awarded a 15-year CfD and a set of obligations to deliver the contracted capacity within a specified timeframe. The contract guarantees additional revenue to developers when the wholesale market price, the "reference price", is below the "strike price", which is a measure of the cost of investing in a renewable electricity technology (see Figure 1). When the reference price is higher than the strike price, developers are required to make payments back to the counterparty, the Low Carbon Contracts Company (LCCC). The CfD scheme aims to reduce developers' risks by providing more certainty in revenue and to support investment in a wide range of renewable technologies with different levels of maturity. Annex B of the Phase 1 report[5] provides a more detailed description of the design features of the CfD scheme.

[1] https://www.gov.uk/government/publications/evaluation-of-the-contracts-for-difference-scheme
[2] https://www.legislation.gov.uk/ukpga/2013/32/contents/enacted
[3] Implementing Electricity Market Reform. DECC. 2014. See: https://www.gov.uk/government/publications/implementing-electricity-market-reform-emr
[4] https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law
[5] https://www.gov.uk/government/publications/evaluation-of-the-contracts-for-difference-scheme

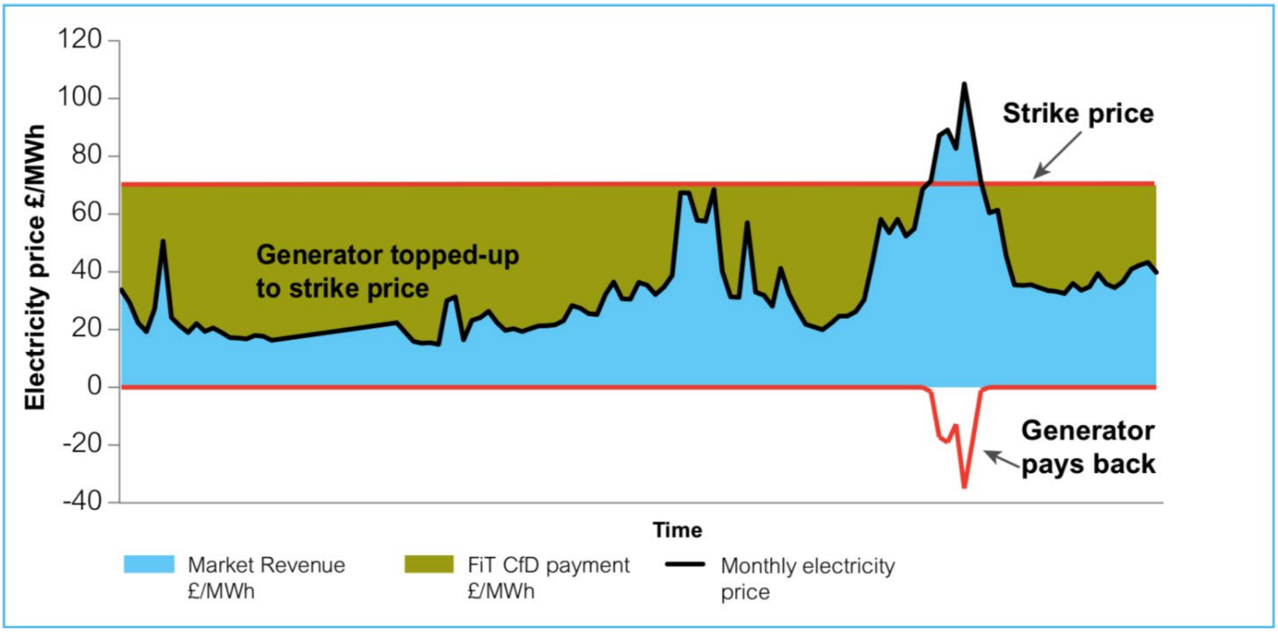

Figure 1 CfD Payment mechanism. Source: Planning Our Electric Future White Paper. DECC 2011

So far, three allocation rounds have been held (in 2014/15, 2016/17, and 2019) and these have awarded contracts to around fifty renewable electricity development projects in total. This number includes three projects which did not sign their contract after it was awarded. Prior to this, eight other projects were awarded a CfD through bilateral negotiation in the Final Investment Decision Enabling for Renewables (FIDER) process. The FIDER CfDs process has been evaluated separately,[6] and these projects have therefore been outside the scope of this evaluation. Details on the characteristics of projects awarded a CfD in AR1 and AR2 are provided in the CfD Evaluation Phase 1 report.

Brief Overview of CfD Scheme Design

Allocation Rounds are announced by BEIS publishing a "Allocation Round Notice" and other notices including a "Budget Notice". The Budget Notice sets out the budget available for specific years of electricity generation delivery, and the technologies eligible for the allocation round. The third CfD allocation round opened on 29 May 2019.

In previous auctions, technologies have been divided into two pots:

> *Pot 1 'Established' technologies: Onshore Wind (>5 MW), Solar Photovoltaic (PV) (>5 MW), Energy from Waste with Combined Heat and Power (CHP), Hydro (>5 MW and <50 MW), Landfill Gas and Sewage Gas, and Biomass Conversion.*
>
> *Pot 2 'Less established' technologies: Offshore Wind, Wave, Tidal Stream, Advanced Conversion Technologies, Anaerobic Digestion (>5 MW), Dedicated Biomass with Combined Heat and Power (CHP) and Geothermal.*

BEIS announced in November 2018 that participants would be competing for an annual budget of £60m in AR3, with successful bidders expected to commission in delivery years 2023-24

[6] Independent evaluation of FID enabling investment for renewables. Grant Thornton on behalf of DECC. 2015 See: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/468258/Independent_evaluation_of_FID_Enabling_for_Renewables_-_Final_report_-_1....pdf

and 2024-25. This budget was subsequently increased slightly to £65m in the final budget notice published on 1 May 2019.[7] This third allocation round was capped at 6GW of capacity.

The AR3 Pot design was similar in scope to AR2 as it was also only open to Pot 2 "less established" technologies. However, distinct from AR2, bids for Remote Island Wind (>5MW) projects were also eligible in AR3.

Overview of Phase 2 Evaluation Aims and Methods

Aims of the evaluation

The overall aim of this evaluation is to assess the extent to which the CfD scheme is on track to meet its objectives. In addition, it aims to assess the effectiveness of delivery processes to help inform policy development around ways in which delivery processes may be improved for future allocation rounds. The evaluation explores five High-Level Questions (HLQ):[8]

1. To what extent, how and why, is the CfD scheme contributing to its intended objectives? And do its outcomes, both intended and unintended, differ for different groups (project developers, investors, technology types)?
2. Are the design parameters of the CfD scheme and auction allocations appropriate for achieving the intended objectives?
3. Is the CfD scheme being delivered as intended?
4. Does the CfD scheme present good value for money?
5. What are the implications of the findings for the future contribution of renewable technology to the Electricity Market?

Approach to the Evaluation

Addressing these questions requires a combination of impact, process and economic evaluation approaches. The evaluation is theory-based, combining a mix of qualitative and quantitative data collection and analysis techniques. The evaluation also presents modelling of forecast electricity generation and economic cost-benefit analysis to address questions around whether the scheme presents good value for money in comparison to a modelled counterfactual scenario of continued Renewables Obligation (RO) policy.

The Phase 1 evaluation report focussed on AR1 and AR2 and provided clear evidence in support of the scheme's core aims and Theory of Change – in that an award of a CfD is attractive to both developers and investors and contributes to lowering costs for consumers. Phase 1 also explored differences in outcomes and views towards the scheme by differences in contexts, including by types of technologies developed and stages of project development.

For Phase 2, the overall programme Theory of Change was investigated further, specifically testing if the CfD scheme has met the objective to: "Increase investor confidence to attract

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[7] See: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/798885/Final_Budget_Notice_AR3.pdf

[8] The evaluation also addresses a series of more specific sub-questions, linked to the five High Level Questions. The full list of questions can be found in Annex B. CfD Phase 2 evaluation annexes: https://www.gov.uk/government/publications/evaluation-of-the-contracts-for-difference-scheme

greater investment at a lower cost of capital and from a wider pool of sources". For this Phase, the focus was on gathering more evidence on *how* and *why* the scheme has led to cost reductions, as well as the relative contribution of different aspects of CfD scheme design features have made on attracting investment and reducing costs, over and above other external contributory factors.

Testing and development of this Theory of Change was used to address the following HLQ1 sub-questions:

(h) What has been the impact of the scheme on developer confidence, and how and why has this occurred?

(i) What has been the impact of the scheme on financial investor confidence, and how and why has this occurred?

(j) How has this impact on investor confidence subsequently impacted on the hurdle rates of different projects/technologies?

Contribution Analysis (CA) was used as an overarching framework for synthesising evidence across mixed strands of data collection in order to draw conclusions on the extent to which the CfD scheme has contributed towards cost reduction, over and above other external contributing factors. This approach is designed to reduce uncertainty about the contribution an intervention is making to observed results independently from other influencing factors.

Process Tracing (PT) was used to assess the strength of different strands of evidence within the overarching Contribution Analysis framework. Process Tracing makes causal inferences by identifying different types of evidence (or 'clues') that would either support or reject programme hypotheses if observed. This was used in combination with Contribution Analysis to develop a series of types of evidence that would support contribution claims (for example, whether observed outcomes, such as reduced strike prices for Offshore wind, may be attributable to features of the CfD and/or other external factors (such as technology innovation and economies of scale from industrial production of Offshore Wind, etc)). For details of the Contribution Analysis/Process Tracing framework, including a list of each hypothesis that was tested and criteria for assessing whether or not each test was passed, see Annex C.[9]

Phase 2 Data Collection and Analysis

Primary research interviews with scheme participants and wider stakeholders formed a key component of the data collection for the evaluation of AR3. Phase 2 included a similar mix of primary research interviews as Phase 1, with a series of semi-structured telephone interviews with various stakeholder groups including:

- Lead developer firms that won a CfD contract through AR3.
- Developers of renewable electricity projects in the UK without a CfD at AR3 – these were identified as organisations with projects listed in the Renewable Energy Planning Database (REPD) that may, in theory, have been eligible for an AR3 CfD but did not obtain one. This group was used to obtain views of unsuccessful applicants to AR3 on aspects of the scheme's design.

[9] CfD Phase 2 evaluation annexes: https://www.gov.uk/government/publications/evaluation-of-the-contracts-for-difference-scheme

- Wider financial institutions – organisations known to invest in the UK renewables sector including: Banks, fund managers, insurance companies and rating agencies.
- Representatives of renewable energy generation sector trade bodies.

Limitation of data collected

Representatives of all twelve renewable development projects that won a CfD at AR3 were successfully recruited and interviewed. However, due to the Covid-19 pandemic, research interviews with other stakeholders were stopped before the full number of intended interviews with these groups was carried out, as summarised below:

- Among developers without a CfD at AR3, nine interviews were completed, out of the twenty originally planned. The aim of interviews with this group was to gather qualitative insights on the views of developers of different types of technologies who may have applied at AR3 but were unsuccessful. The number and identity of unsuccessful applicants to the CfD scheme is not disclosed by the National Grid ESO (EMR) Delivery Body (due to licence conditions), who manage the applications, so the population size of unsuccessful applicants is not known. Although the sample of nine achieved interviews was lower than expected, those interviewed represented a good spread of developers of different types of technologies (including Offshore Wind, Remote Island Wind, Tidal stream, ACT and Bioenergy technologies). The interviews met the aim of providing qualitative insights on the perspective of unsuccessful applicants from different technologies, although they may not be representative of the wider population of all unsuccessful applicants.
- Among wider financial institutions, seven interviews were carried out, out of the twenty originally planned. The aim of interviews with this group was to gather qualitative insights on whether the introduction of the CfD scheme had reduced risks for different types of investors and why. The seven respondents interviewed represented institutions covering all of the sub-groups targeted: banks, fund managers, insurance companies, and credit rating agencies. Although these interviews provided useful insights across all of the topics covered, the breadth and depth of qualitative data collected can be considered lower than would otherwise be expected if the full programme of interviews had been completed.
- Two interviews were carried out with renewable energy sector trade body representatives, to assess their views on the CfD Scheme design and suggestions on areas for change.

Results from analysis of the interview transcripts were triangulated with other secondary sources where available. This included checking information on the size, timescales and ownership of renewable development projects with the REPD and the Low Carbon Contracts Company (LCCC) CfD Register. It also included cross-checking information on financial investment deals and trends in reducing costs of renewable electricity in the UK and internationally with Bloomberg Terminal data. Finally, it included BEIS Costs of Electricity Generation reports and other published literature (referenced throughout this report where applicable). This sense checked the findings gathered from interviews and informed an assessment of the strength of evidence for Process Tracing test results.

Further information on the approach to interviewing, the profile of respondents, methods for analysing data collected and any limitations with the data is provided in Annex A.[10]

Value for money assessment

To address the evaluation question "*Does the CfD scheme represent good value for money?*", the analysis uses the BEIS Dynamic Dispatch Model (DDM). The analysis compares the costs of supporting low-carbon deployment through the CfD regime to a counterfactual assuming the RO scheme had continued. A description of the DDM, the approach to the VFM assessment and limitations of the analysis is provided in Chapter 2.

[10] CfD Phase 2 evaluation annexes: https://www.gov.uk/government/publications/evaluation-of-the-contracts-for-difference-scheme

1. Overview of Allocation Round 3

Key findings:

All applicants awarded a CfD in AR3 projects signed their contracts by October 2019. As of summer 2020, all capacity was on track to be delivered by 2027.

The total generation capacity awarded in AR3 will equate to 5.78GW of new capacity by 2027, which would power more than seven million UK homes.

The majority of capacity awarded will come from Offshore wind which amounts to 5.47GW out of 5.78GW in total. Four Remote Island Wind (RIW) projects won a CfD (accounting for a combined total 275.22 MW capacity) and Advanced Conversion Technologies (ACT) developers were awarded two contracts with 33.60 MW in total.

Introduction

This chapter provides an overview of the outcome of Allocation Round 3 (AR3), with breakdowns of projects' capacity by type of technology and the timing of their delivery.

Overview of all AR3 CfD projects, capacity, and equivalent homes powered[11]

Table 1 below provides an overview of all projects awarded a contract, their proposed generating capacity and estimates of the number of UK homes which they would be able to power[12]. The awarded CfDs are displayed by projects (note in some cases, this can include multiple CfD units if a project contains multiple phases). Although eligible to apply, no Anaerobic Digestion, Dedicated Biomass with CHP, Geothermal, Tidal Stream, or Wave projects were awarded a CfD in AR3. Further details on projects awarded a CfD can be found in Annex E.[13]

Table 1 Overview of CfD projects, capacity, and equivalent homes powered AR3

Technology Type	AR3 Projects Awarded (Capacity in MW)	Equivalent homes Powered
Advanced Conversion Technologies (ACT)	2 (33.6)	62,000
Remote Island Wind (RIW)	4(275.22)	266,000
Offshore Wind	6 (5,466.00)	6,857,000

[11] Data for Table 1 from official AR 3 Allocation Results Note. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/838914/cfd-ar3-results-corrected-111019.pdf
[12] In practice homes are powered by a variety of technologies, which balance variable demand and supply across the grid, and ensure continuity of supply when intermittent technologies such as wind are not producing power.
[13] CfD Phase 2 evaluation annexes: https://www.gov.uk/government/publications/evaluation-of-the-contracts-for-difference-scheme

Total projects / Capacity awarded / Homes powered[14]	12 (5,774.82)	7,185,000

Timescales for delivery of AR3 capacity

Based upon the Generator's Expected Start Dates (from the LCCC CfD Register), Figure 2 shows that the majority of AR3 CfD capacity is expected to come online between 2024 and 2026. Between 2024 and 2026 more than 1.5 GW will come online each year. All awarded CfD projects signed their CfD contracts in October 2019 and at the time of writing, none have been terminated. All capacity is currently on track to be delivered by 2027.[15]

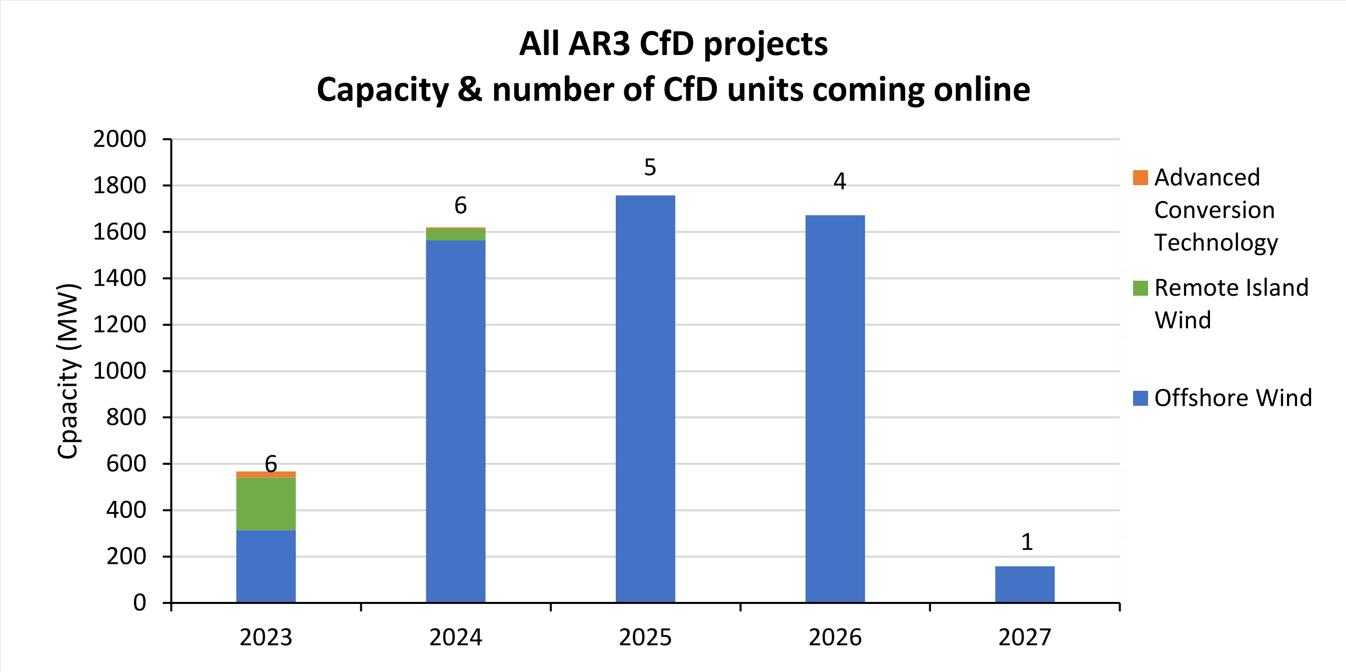

Figure 2 All AR3 CfD projects capacity per delivery year & number of units (phased projects treated as multiple units). Source: Technopolis based on CfD Register. LCCC 01/08/2020

Figure 3 shows that the cumulative CfD capacity from AR3 will surpass 5.5 GW by 2026, when the penultimate Offshore wind project is delivered. By 2027 the full 5.78 GW of AR3 capacity is expected be online.

[14] There were 22 individual CfD generation units in AR3 since the Doggerbank projects (Single Metering), Seagreen (Apportioned), and Sofia (Apportioned) are phased projects with 3 separate CfD units each but contracted as one 'project'.

[15] LCCC (2019). Allocation Round three projects sign on the dotted line - Press Notice issued on 18th of October 2019

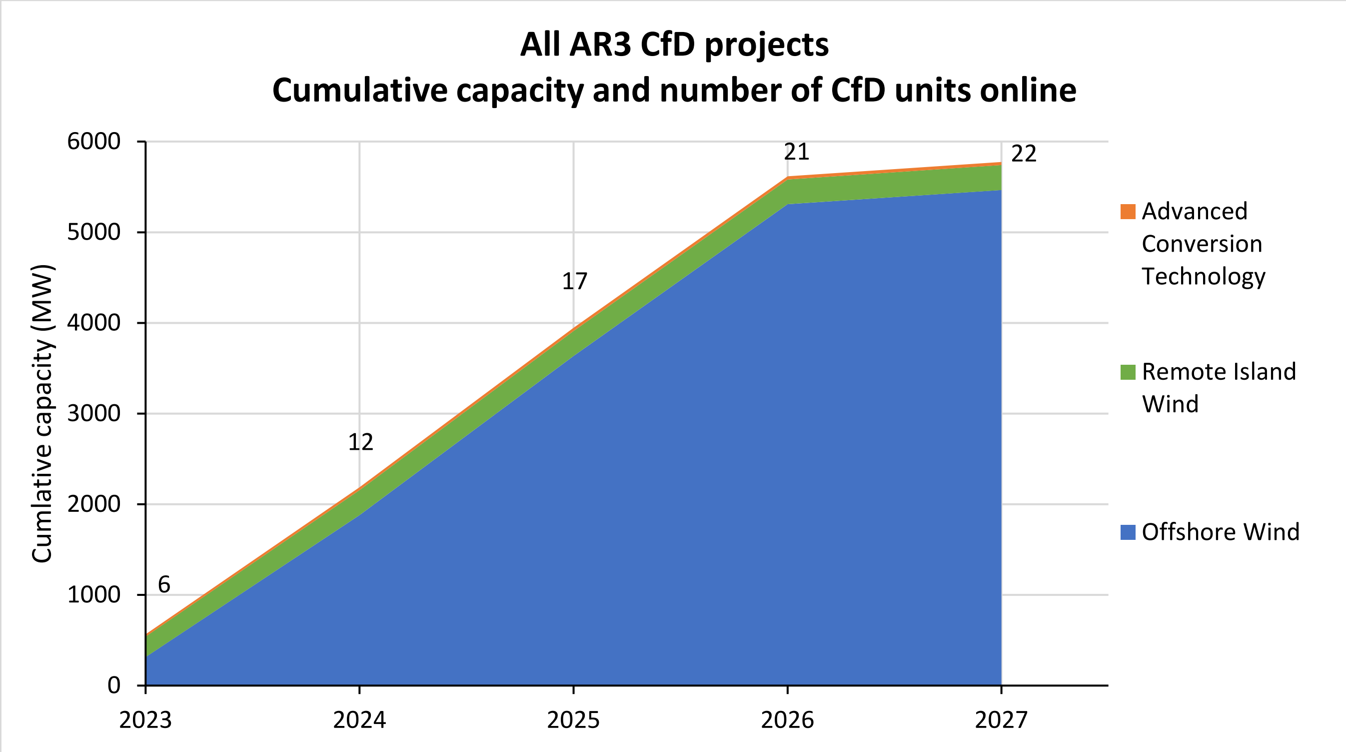

Figure 3 All auctioned CfD projects cumulative capacity & number of units (phased projects counted as multiple units). Source: Technopolis based on CfD Register. LCCC 01/02/2020

2. Value for Money

Key findings:

Based on our modelling estimates, the CfD scheme will reduce the cost of renewables deployment on consumer bills under all scenarios modelled in both reference cases used,[16] as compared with the RO policy that preceded it.

The reduction in costs to the consumer due to the CfD projects auctioned in AR1, AR2 and AR3 is estimated at around **£3bn** (higher and lower demand reference case, present value terms) in comparison with supporting the same projects under the RO. The scenarios tested produced upper and lower bound estimates of **£2bn and £5bn**.

The lower support costs under the CfD regime are primarily driven by the lower hurdle rates assumed compared to under the RO. With up to 85GW of projected future CfD projects (excluding nuclear) also included prior to 2050, the total potential consumer cost savings of the CfD regime through to 2050 (including AR1, AR2, AR3 and projected future supported projects) are estimated at around £10bn (higher and lower demand) compared to the RO scheme, with a range of £5bn to £15bn in the scenarios tested.

Introduction

This section addresses the evaluation question "*Does the CfD scheme represent good value for money?*" To answer this question, the analysis uses the BEIS Dynamic Dispatch Model (DDM).[17] The analysis compares the costs of supporting low-carbon deployment through the (CfD) regime to a counterfactual assuming the RO scheme had continued.

Approach and key assumptions

The modelling covers the period from 2016 (when the first CfD projects came online) to 2050, and considers two groups of CfD supported generators:

- Generators allocated CfDs via allocation rounds: AR1, AR2 and AR3 (primary focus).
- Generators projected to be allocated CfDs in the future, based on BEIS's 2019 net zero consistent higher and lower demand reference cases in the DDM.

[16] Key modelling inputs for the development of the energy system over the projection period (2016 to 2050) have been set using BEIS 2019 reference case assumptions. BEIS currently maintain two net zero consistent reference cases to account for uncertainty in future generation capacity and demand growth, "Higher Demand" and "Lower Demand". Both have been utilised in this analysis.
[17] The DDM is an in-house electricity market model that BEIS uses to model the GB power market over the medium to long term.

Potential future nuclear and gas Carbon Capture, Utilisation and Storage (CCUS) CfD contracts are considered outside the scope of this analysis,[18] and no variation in their support is modelled. Additionally, generators allocated a CfD under the preceding Final Investment Decision Enabling for Renewables (FIDER) policy have not been included in the reported totals.

The modelling **assumes that BEIS policy objectives would have remained the same** as if the RO scheme had continued. This includes the same target level of renewable deployment and the same supported technologies. As a result, the analysis focuses on the **costs of supporting the same level of deployment with the same project costs** under the RO scheme, rather than seeking to model any differences in deployment.

More detail on these assumptions and other key assumptions underpinning the modelling can be found in Annex D.[19]

Overview of Scenarios

Five comparison scenarios have been explored to understand the sensitivity of the results to key assumptions. Each of the scenarios includes a CfD baseline run and a RO counterfactual run, and each is also run under both the Lower Demand and Higher Demand reference cases. The five scenarios are:

1. CfD baseline vs RO counterfactual under central commodity price assumptions.[20]
2. CfD baseline vs RO counterfactual under low commodity prices.
3. CfD baseline vs RO counterfactual under high commodity prices.
4. CfD baseline vs RO counterfactual with reduced hurdle rates (-0.5 percentage points).
5. CfD baseline vs RO counterfactual with increased hurdle rates (+0.5 percentage points).

Commodity prices

Commodity prices (in this case gas, coal, oil and carbon) are a key input assumption for the modelling. They are an important driver of wholesale electricity prices and are therefore particularly important when calculating the required levels of support. To capture this significance, two scenarios for variations in commodity prices have been tested (Scenarios 2 and 3).

Hurdle rates

A “hurdle rate” is the minimum rate of return on a project or investment required by a project manager or investor. The hurdle rate reflects a project’s level of risk. The CfD scheme aims to reduce certain risks to developers and investors from exposure to fluctuations in wholesale electricity prices.

[18] Nuclear has a bilateral CfD outside of the allocation process, and Gas CCS is likely to need a different form of support due to the correlation between its fuel costs and the wholesale price.
[19] CfD Phase 2 evaluation annexes: https://www.gov.uk/government/publications/evaluation-of-the-contracts-for-difference-scheme
[20] Central assumptions as per BEIS reference case. Note that under central assumptions projects supported under RO were assumed to have higher hurdle rates than under CfDs

The hurdle rates of supported projects are then a key modelling assumption. Lower hurdle rates are assumed under the CfD regime because of the reduced risk to investors. This is the primary driving factor in the CfD regime representing value for money relative to the RO. Evidence from the interviews has corroborated assumptions made in the reference cases that CfD-supported plants are given lower hurdle rates than similar projects under the RO (within a range of up to 2 percentage points lower). As qualitative interviews do not provide sufficient quantitative evidence to form the basis of these assumptions, we tested the sensitivity of results to changes in these assumptions under Scenarios 4 and 5. The interview findings outlined in Chapter 4 provide more explanation as to how the CfD affects investment decisions and ways in which this contributes towards lowering costs.

Modelling results

The following sections summarise the results of the modelling. This primarily focuses on the difference in support costs required under the RO and CfD. Due to very similar trends being observed under both higher and lower demand reference inputs (referred to as HD and LD from here on), all charts shown will be from HD runs, but figures will be quoted from both.

Detailed results for Scenario 1: RO counterfactual vs CfD baseline under central assumptions – AR1-AR3 only

The modelling estimates that the cost of CfD support payments to the AR1, AR2 and AR3 projects under our baseline is £9bn (HD) and £8bn (LD) in 2016 present value (using a 3.5% social discount rate, 2019 real). Annual support costs average just under £1bn (HD and LD) per year over the 2023 to 2037 period, after which costs fall sharply as projects reach the end of their 15-year contracts. Offshore wind makes up the majority of the capacity supported and is projected to make up 88% of total support costs. This is shown below in Figure 4.

Figure 5 (below) shows the support costs under the RO counterfactual and Figure 6 (below) shows the RO/CfD support cost difference.

Under the counterfactual scenario, where the RO scheme remains in place, support payments to the AR1, AR2 and AR3 projects are estimated to cost £12bn (HD and LD, 2016 present value using a 3.5% social discount rate, all in 2019 real terms). This is £3bn more than under the CfD baseline (differences don’t exactly match quoted CfD and RO cost differences due to rounding). This higher cost is driven by the higher hurdle rates assumed under the RO regime, as well as the increased contract length and that RO contracts are RPI linked rather than CPI linked.

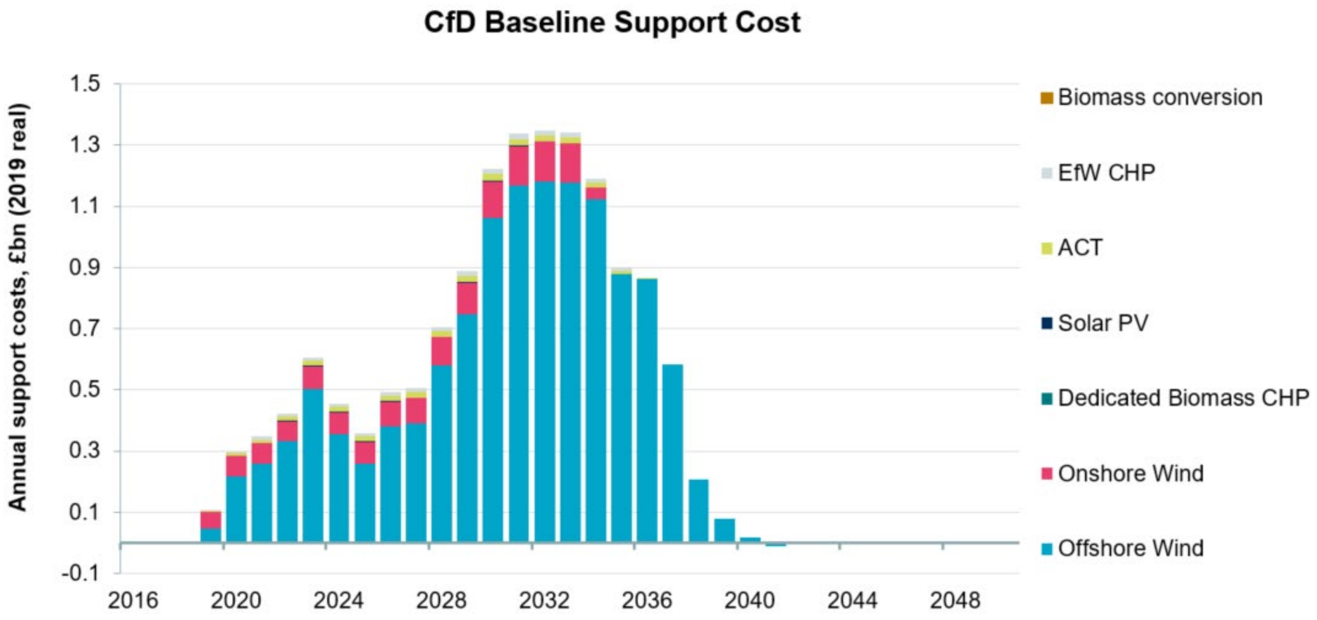

Figure 4: Modelled support costs in CfD baseline and RO counterfactual (HD) for AR1, AR2 and AR3 projects. Source: LCP analysis using BEIS DDM

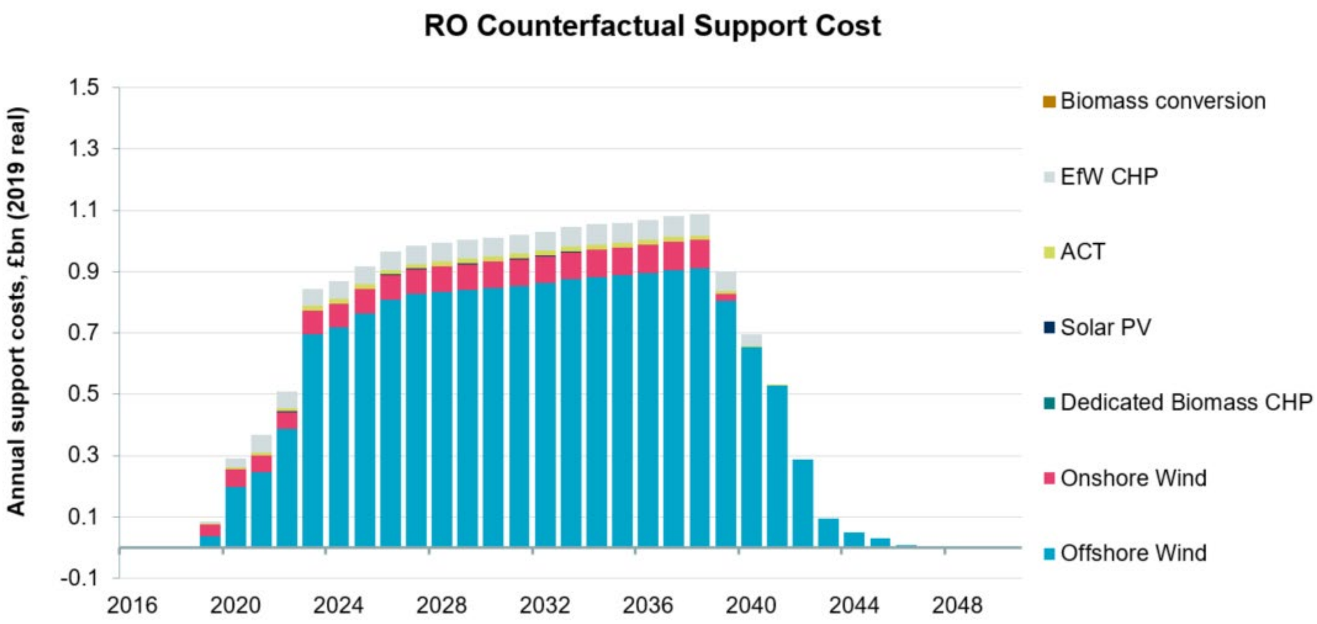

Figure 5: Modelled support costs in CfD baseline and RO counterfactual (HD) for AR1, AR2 and AR3 projects. Source: LCP analysis using BEIS DDM

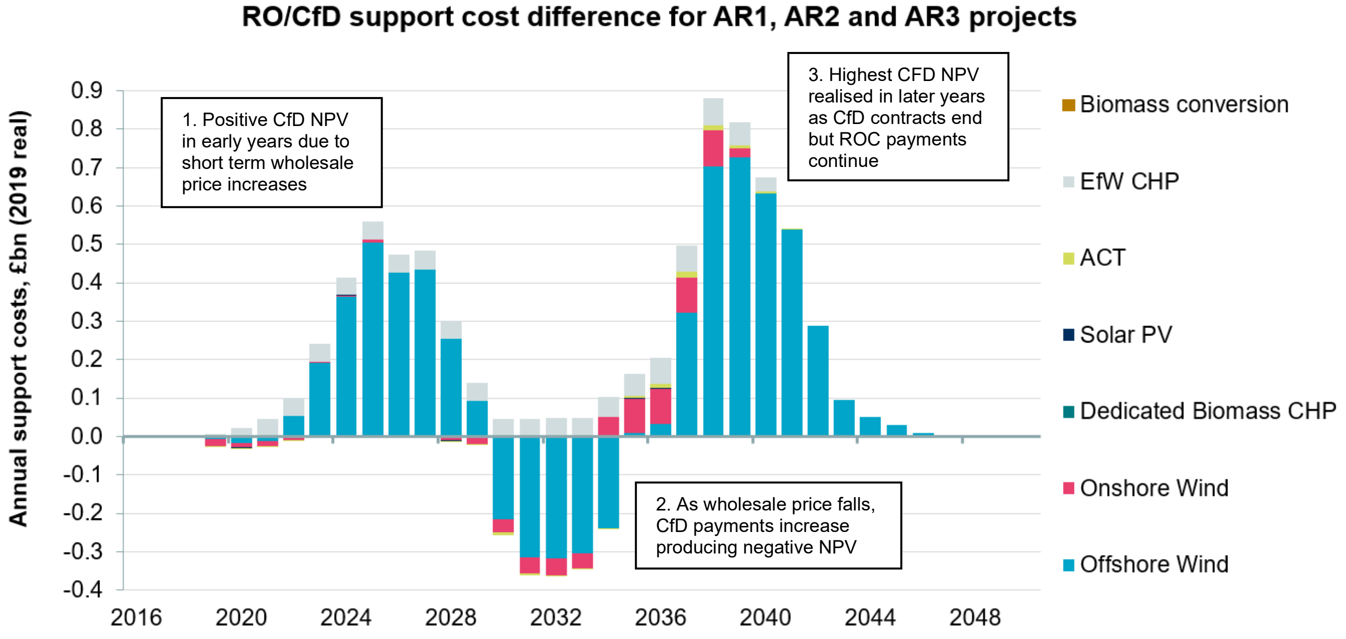

Figure 6: Difference in modelled support costs between CfD baseline and RO counterfactual (HD) for AR1, AR2 and AR3 projects. Source: LCP analysis using BEIS DDM

Figure 6 shows a negative benefit of the CfD scheme when compared to the RO scheme in the late 2020s and early 2030s. In these years, support payments for CfD supported plants increase significantly due to decreasing wholesale price projections whereas RO support payments remain relatively flat. This differs from results in Phase 1 of the CfD evaluation which displayed positive benefit for the CfD scheme in almost all years due to higher wholesale price projections. The impact of wholesale price projections is explored further in Scenarios 2 and 3.

Note that the RO/CfD support cost difference in Figure 6 shows a small RO benefit for certain technologies in early years. This is due to the longer contracts (payments spread across 20 years rather than 15 years), and the RO payments trending upwards over time due to RPI indexing. The lower support payments in the RO counterfactual in the late 2020s and early 2030s is a result of low wholesale prices. This is discussed in more detail later in this section.

Detailed results for Scenario 1: RO counterfactual vs CfD baseline under central assumptions – including future projects

Although the projects awarded contracts in AR1, AR2 and AR3 were the main focus of the analysis, the change in support costs for future CfD projects (as projected in the latest BEIS reference case) were also assessed under the same counterfactual where the RO scheme had continued. Figure 7 shows the difference in support costs associated with all AR and future CfD-supported projects contained in the latest BEIS HD reference case (excluding nuclear). Figure 8 shows the wholesale price over the same period. The CfD baseline costs and RO counterfactual costs for all projects are also individually displayed.

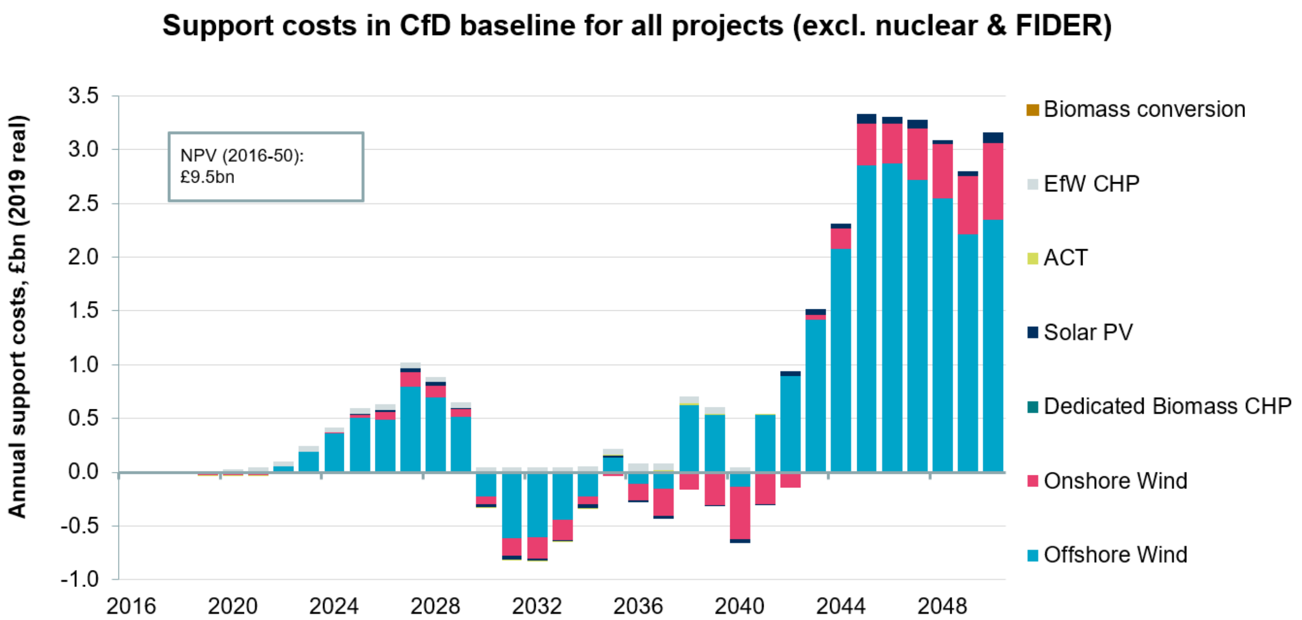

Figure 7: Difference in support costs between CfD baseline and RO counterfactual for existing and projected projects (excl. nuclear and FIDER). Source: LCP analysis using BEIS DDM

The trends in policy costs displayed in the above figures by all supported plant are comparable to the trends seen when only AR1, AR2 and AR3 supported plants are taken into account, but at a larger scale. RO and CfD costs are both initially low whilst wholesale price remains steady, though RO costs exceed CfD costs. Initially CfD support costs are lower, but from 2030 to the early 2040s this is reversed with lower RO support costs. Finally, in later years CfD support costs become lower again when 15-year CfD contracts begin to expire and RO contracts continue for an additional 5 years.

This pattern can be explained by considering the wholesale prices during the run period (further detail can be found in the wholesale price impact section below). In the central price scenario, prices remain relatively consistent with current levels until around 2025. After 2025, increasing levels of low-carbon deployment cause the price to drop rapidly as a result of higher cost thermal generation being displaced by low marginal cost renewables, a phenomenon known as 'price cannibalisation'. The reduced wholesale price then leads to an increase in CfD top-up payments.

A large volume of renewable capacity is included in both the 2019 BEIS higher demand and lower demand reference cases, with an average of over 5GW CfD/RO non-nuclear supported capacity coming online annually between 2025 and 2050.[21] This is consistent with the introduction of the UK's net zero by 2050 legislative target, and marks a significant increase in the average annual volume of CfD/RO supported capacity projected to be brought online during the same period in the modelling analysis in Phase 1 of the evaluation (approximately 1 GW per year).

Given the lower hurdle rate assumptions, the modelling shows lower support costs under the CfD regime than under the RO, with £9bn (HD) and £11bn (LD) in savings over the 2016-2050 period (discounted to 2016 at 3.5%).

[21] It should be noted that the annual supported renewable capacity included in the reference case in no way indicates the expected longevity of the CfD scheme, which remains to be confirmed.

Summary of results for all scenarios

All five scenarios tested show an increase in support costs under the counterfactual where the RO had remained in place, indicating that the CfD regime represents value for money. The main reason for this is the higher hurdle rates assumed under the RO regime. Annex D provides tables summarising the results of all scenarios under both input references.

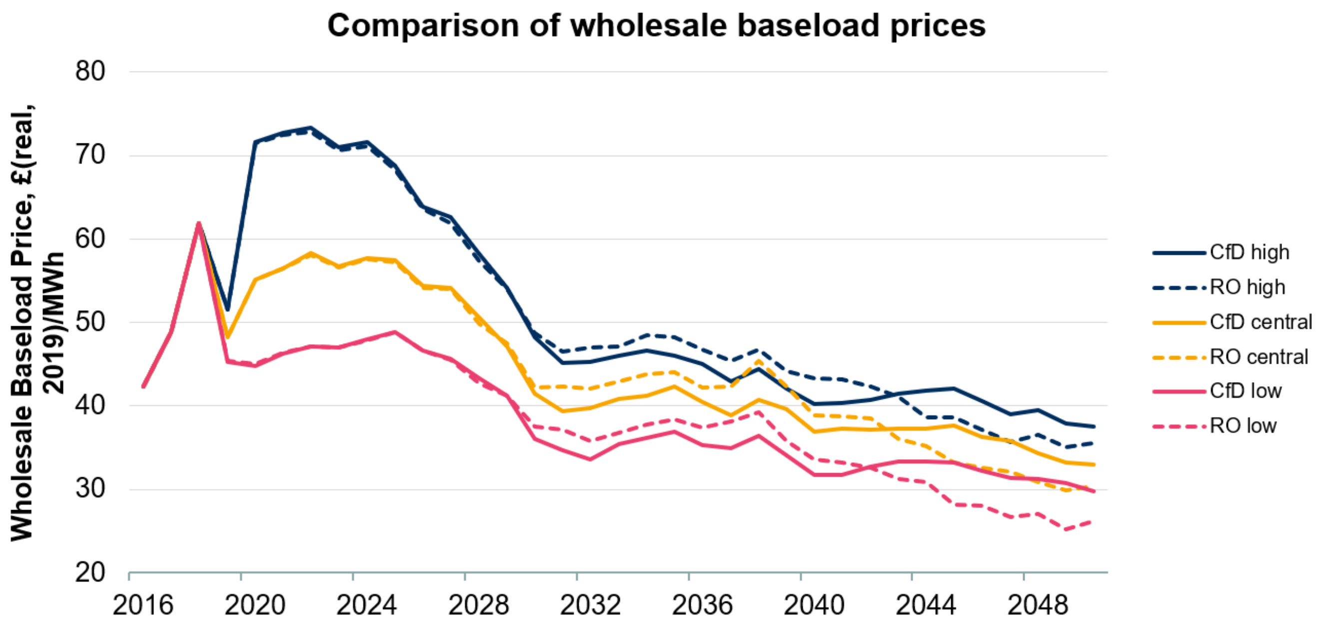

Figure 8: Modelled wholesale prices in both CfD baseline and RO counterfactual for all modelled commodity price scenarios. Source: LCP analysis using BEIS DDM

Consumer cost impact – AR1, AR2 and AR3

Support payments to AR1, AR2 and AR3 projects are higher under the RO counterfactual in all scenarios in both the HD and LD reference cases. The RO counterfactual shows an increase in costs faced by the consumer of between £2bn and £5bn in the HD and LD reference case across all scenarios.

The least significant increase in consumer cost is observed in the low commodity price scenario under lower demand (£2bn) and -0.5% RO hurdle rate scenario under higher demand (£2bn). In the former, lower wholesale prices mean CfD top-up payments are higher. In the latter, ROC supported projects require a lower rate of return than in central, hence receive lower banding levels.

Conversely, the greatest consumer cost increase is observed in the high commodity price scenario under both higher and lower demand (£5bn in either case). In both of these scenarios, CfD top-up payments are lower due to higher wholesale price projections in GB.

Consumer cost impact – all existing projects and projected projects

The increase in support costs in the counterfactual where all CfD projects through to 2050 (excluding FIDER and nuclear) are supported under the RO scheme ranges from £5bn to £15 bn under HD and £6bn and £16bn under LD across the five scenarios. Note that these figures do not include the impact of the support schemes on wholesale price (covered below).

Future projects (£3bn to £12bn HD, £4bn to £11bn LD) make up the majority of the cost increase. While discounting reduces the overall cost impact of future projects, the vast quantity of future projects coupled with decreasing wholesale price projections lead to these having a significant weighting on the results.

Comparing Scenario 1 with Scenarios 2 and 3 highlights the issues associated with price uncertainty under the different regimes. In the high prices scenario, CfD savings are higher than in the central scenario by £3bn, while in the low prices scenario, CfD savings are £1bn lower than the central scenario (but still represent a saving compared with the RO). This is because CfD support costs are higher under the low-price scenario and lower under a high price scenario.

Wholesale price impact – all projects

The annual baseload electricity wholesale price calculated during the model runs differs significantly (by up to £4.50/MWh in HD and £3.90/MWh in LD) between the CfD baseline and ROC counterfactual in certain years. High levels of low-carbon capacity deployment in the reference cases, over the modelling period, means supported low-carbon plant set the wholesale price in a significant number of periods. This means the differences in the support levels of plant under both schemes flows through to impact the wholesale price. Further deviations occur due to the additional contract years present in the ROC scheme causing a mismatch in the capacity of supported plant under both schemes and hence their impacts on the wholesale price.

Figure 9 shows the difference between the wholesale price in the CfD baseline and RO counterfactual for all three commodity price scenarios under the HD reference case. A positive cost difference indicates higher wholesale prices under the CfD scheme and vice versa for negative cost differences.

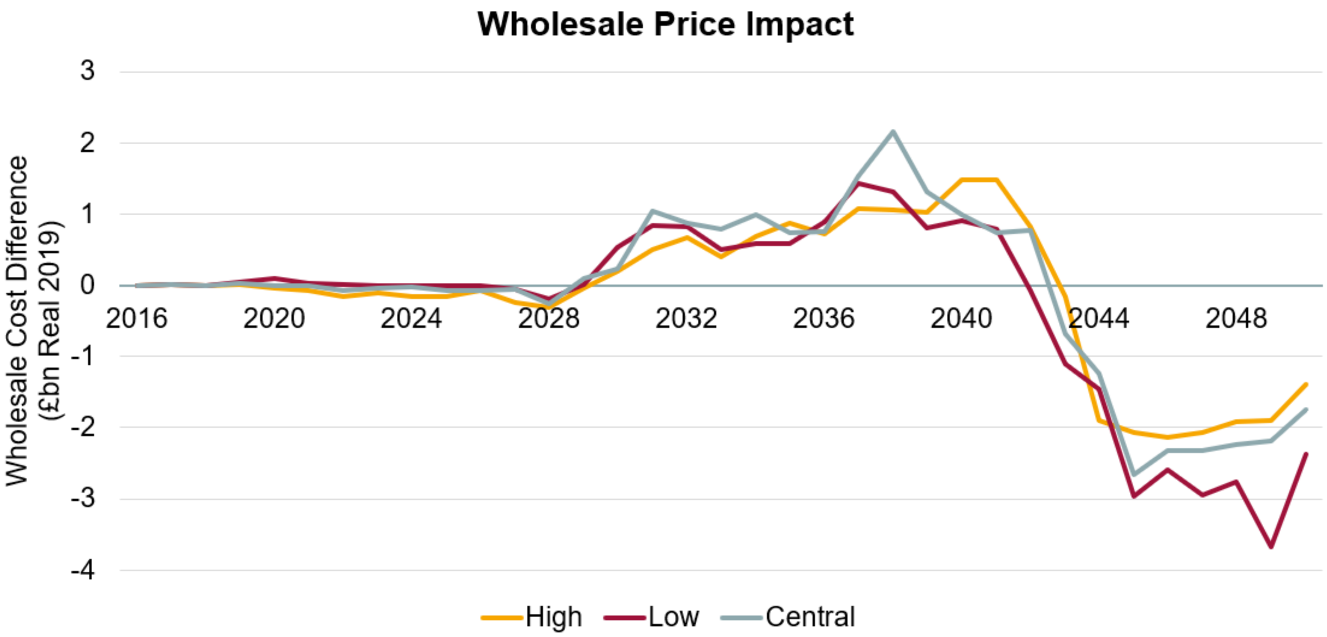

Figure 9: Modelled wholesale cost differences between CfD baseline and RO counterfactual for the 3 commodity price scenarios (HD). Source: LCP analysis using BEIS DDM

The trend observed in wholesale costs mirrors the trend observed in support cost differences. Pre-2025, CfD and RO run wholesale prices are very similar as there is a relatively small amount of low-carbon capacity online, hence supported low-carbon generation does not typically set the wholesale price. Wholesale prices in the RO runs rise above wholesale prices in the CfD runs after approximately 2028, as low carbon capacity increases and CfD supported plant are willing to bid in lower than ROC supported plant (as CfD top ups are higher than RO top ups when prices are low). By the early 2040s, many CfD contracts have expired whilst the equivalent ROC contracts are still active, hence the price in RO runs suddenly drops considerably lower than the price in CfD runs.

The net effect for consumers is that the RO regime lowers wholesale costs relative to the CfD regime in the majority of scenarios. This is due to the extended contract length of ROC support, which drives wholesale prices down significantly in later years.

However, despite the RO regime reducing wholesale prices more than in the CfD baseline scenarios, the reduction in support costs in the CfD regime outweighs the consumer surplus benefit from the RO regime in every scenario.

Higher demand versus lower demand

The trends observed in runs using the BEIS higher demand reference case were very similar to the trends observed in runs using the BEIS lower demand reference case.

The lower volume of low-carbon capacity under lower demand did, however, lead to a slightly higher average wholesale price (£45.30/MWh, averaged over 2016-2050) over the course of the run than under higher demand (£44.30/MWh). This resulted in lower CfD top-up payments under lower demand so, excluding the effect on wholesale costs, in most scenarios the CfD benefit over ROC support was greater in lower demand than higher. However, including the impact of lower wholesale costs on consumers effectively cancels out this increased benefit in the central price scenario.

Limitations of this analysis

As with all modelling of future outcomes, there is a significant degree of uncertainty in the projections. To understand this uncertainty, variations in the key assumptions that drive the differences between the costs of the two regimes, such as hurdle rate differences and wholesale price levels have been tested.

However, several uncertainties remain. This analysis has focused on estimating the changes in cost of supporting a fixed level of low-carbon deployment under the two regimes. The level of deployment, and the mix of technologies deployed, has been held constant, in line with BEIS's latest reference cases. The magnitude of the savings under the CfD scheme would likely vary materially under a different level and mix of low-carbon deployment.

3. Impact of CfDs on Attracting Finance and Lowering Costs of Renewables

Key findings:

Responses from investors and developers interviewed support the Theory of Change that the Contracts for Difference (CfD) 15-year price stabilisation mechanism provides more certainty over future revenue, reduces risks for investors, and leads to lowering the costs of capital for developers.

Findings also support the programme theory that the CfD scheme contributed towards attracting new investors to the UK renewables sector, enabling investment deals that would not happen in a scenario of merchant price exposure. The increased competition among financial investors further contributes to reductions in interest and hurdle rates.

The price stabilisation mechanism also contributes towards increasing gearing ratios, which supports increases in equity returns, further enabling strike price reductions.

Introduction

The strike prices awarded in Allocation Round 3 (AR3) reached a record new low. As shown in Figure 10, the strike prices for Offshore wind in AR3 have fallen by nearly a third compared to AR2. AR3 strike prices are now at only one third of what they were in AR1 - with a drop from around £120 MWh down to around £40/MWh for Offshore wind and ACT.

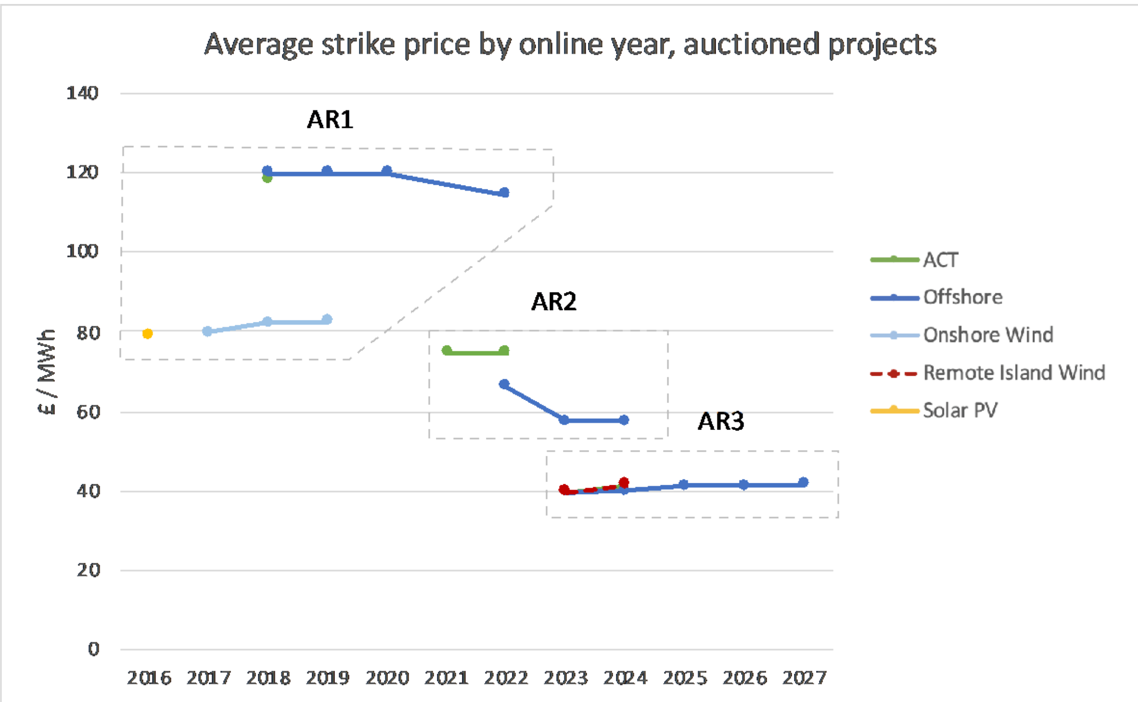

Figure 10 Strike price development AR3

This section explores the main contributing drivers of the cost reductions and details the implications of the falling strike prices on the market and on project delivery. It presents evidence about the CfD scheme's influence in investment decisions and ways in which it contributes towards cost reduction, in relation to other external contributing factors.

CFD Contribution to Lowering Cost of Capital

Lowering cost of capital by reducing interest and hurdle rates

A core programme objective that this evaluation aims to assess is the extent to which the CfD supports reductions in the cost of capital by protecting investors from wholesale price fluctuation. As illustrated in Figure 11, the CfD Theory of Change assumes that the price stabilisation mechanism reduces risks by increasing price certainty.[22] Because revenues of energy generation projects are a product of energy production and prices, more stable prices lead to more stable revenues. If investors face lower risks of revenue fluctuations, the minimum rate of return they require to make the investment (hurdle rates) lowers. Likewise, credit scores should improve, and interest rates charged by banks or other lenders would be lower.

Figure 11 CfD's influence in cost of capital

Developers and investors interviewed were asked if they believe that the price stabilisation mechanism reduces risk, and if that is reflected in lower interest and hurdle rates. Most respondents agreed that this feature does reduce risk for financial investors (detailed further below). The majority of respondents also supported this theory and explained that, in comparison to RO, the CfD had a greater impact on reducing costs of capital.

Most respondents were not able to provide precise quantitative estimates on the extent to which the introduction of the scheme reduced their hurdle rates or costs of capital. This was because respondents found it difficult to isolate the effect of the introduction of the CfD scheme from external market trends (such as the maturity of Offshore wind) or to consider the comparison with a hypothetical scenario whereby the RO continued.

Among those who provided estimates, answers varied significantly. Estimates ranged from between no effect at all and up to 200 basis points difference[23] (2 percentage points). To illustrate what this represents, consider the hypothetical example of a project funded with a £500m debt to be repaid in 15 years. A 200-basis points reduction in the interest rate would mean that the project will pay £9.6m less in interest on the first year.[24] Throughout the 15 years of debt term, this would generate savings of almost £75m. Even a 50-basis points reduction would lead to £2.4m less interest in the first year and £18.5m on savings over 15 years.

[22] How clear the future prices are to predict for investors; e.g. merchant prices have low price visibility because it fluctuates in a fashion that is hard to predict in the medium/long term horizon.
[23] Basis points refers to a common unit of measure for interest rates and other percentages in finance. One basis point is equal to 1/100th of 1%, or 0.01%, and is used to denote the percentage change in a financial instrument.
[24] Considering that the debt has no grace period and will be repaid under the Constant Amortization System.

So, having that revenue certainty opens you up to more financial institutions, and almost by definition, if there are more institutions then the cost of capital will fall [as competition among lenders leads to offering more attractive rates]. *So that gets factored into a 1 to 2 percent reduction to hurdle rates. (CfD Developer).*

I think yes, more investors were more comfortable with the CfD, broadly speaking, I would suggest there is potentially a 75 to 100 basis points reduction [to overall cost of capital] and return requirement under a CfD. (Fund Manager).

If you said to me there are two identical projects one CfD one not CfD, let say ROCs … All the things being equal, they score one notch difference in rating (e.g. AA+ and AAA) … You could be talking about 20 basis points" (Fund Manager).

Attracting new financial institutions

Another intended benefit of the CfD is that by reducing price fluctuation risks, new types of investors will be attracted to the UK renewables sector. Increasing the pool of investors leads to competition to provide more attractive rates for debt finance to developers, further contributing towards reductions, as illustrated in Figure 12.

Figure 12 Theory of Change on attracting finance

Our interviews with developers and investors explored this Theory of Change. Most respondents agreed there had been an increasing diversity of sources of finance for energy assets in the UK in recent years, and the CfD scheme was commonly considered as a contributing factor. Having certainty from an agreed strike price is considered an important feature for international banks and funds when comparing investment opportunities in the UK with other markets internationally. As one respondent said:

We've been investing in different countries across Europe in Offshore wind and we're fairly comfortable with all the different models. But we know that there's a number of investment banks out there that cannot get comfortable with other structures and prefer the stability of the CfD and therefore liquidity in the UK is very strong compared to other areas.

The CfD is much more attractive to a wide range of banks and investors than the ROC regime. It takes away any merchant or power price exposure. And that's where I think it really make it more attractive for financing. (Investment Bank).

For some financial institutions, the price stabilisation mechanism was reported to be a key enabler of securing investment deals that would not otherwise be agreed. Some types of investors (e.g. pension fund managers) are more risk averse and often have internal guidelines to not invest into, or have little exposure to, assets which are not "investment grade".[25]

[25] An asset is considered "investment grade" when its credit score given by a rating agency is above a certain threshold. Risk Rating firms like Fitch, Standard & Poor's and Moody's use different designations, consisting of the upper- and lower-case letters "A" and "B," to identify a bond's credit quality rating. For Fitch Ratings and Standard and Poor's, ratings of BBB- or better are considered investment grade. In Moody's rating scale, ratings of Baa3 or better are investment grade. Below this threshold the investment is considered "speculative grade", meaning that there is a significant risk of default on the asset's obligations.

Together with construction risk,[26] price fluctuation was considered a significant risk faced by the renewable energy investors interviewed. The track record and experience of established developers may be used by investors to assess the construction risk. In contrast, the volatility of generation revenues from fluctuations in wholesale market energy prices can be difficult to assess. Hence, for some financial institutions, greater price certainty appears to be a key element in justifying an investment decision.

> *Players like us are not equipped to deal with merchant risk. We don't have a team of traders … We may have some sort of view formed with consultants of where prices could go, but that's not a well-informed view and we're not equipped to deal with that. So, if the prices change, we would just have to take the hit. We wouldn't be able to react to it. So even when the CfD is at 50 pounds per megawatt hour, it still is an extremely useful contract for people like us to invest in Offshore wind because of the visibility of the tariffs. (Pension Fund).*

> *I think that hurdle rate may fall sort of 1 to 2 percent. So, you know, it's material. But that return certainty also opens up investment to other institutions that look for lower risk projects. It's not a case of 'if it's this risk profile I'll charge you X, if it's a bit riskier, I'll charge you X plus Y'. They would say if you have that risk profile, I'll charge you X. If it's a riskier profile, I won't do it. (CfD Developer).*

Even among investors who are willing to be exposed to merchant risk, there is a consensus among those interviewed that the CfD's price stabilisation mechanism is an attractive feature and that it has allowed investors to enter the UK renewable energy market.

> *A lot of the Asian banks, Japanese banks and the Chinese and Korean etc … If you just look at the composition of bank groups from the ROCs to the CfD, you'll see that there's a significant increase in the number of institutions who are looking at the sector. (Investment Bank).*

> *Having some price stabilisation contract to protect against low prices was really key to ensure the investment decision. Investors need to see certainty of revenue. And so, the CfD has generated more interest among wider, international investors. (CfD Developer).*

> *The merchant element of the ROCs might have prevented some financial players like pension funds to participate. The CfD further offers inflation protection which they like. So, this attracted a little bit more cheap capital to the market, but it is hard to quantify. For some of the players these kinds of investments might have been a little bit of a red flag before. (CfD Developer).*

The interview findings with both developers and financial institutions suggest that the availability of new sources of finance has increased competition among lenders, allowing developers to choose cheaper forms of finance, further contributing to bringing costs down.[27]

[26] Construction (or completion) risk is related to the risk of the project construction not meeting its deadlines and budget and quality goals. It considers the project's complexity and scale, the contractor's expertise and the construction implementation plan, the availability of replacement contractors, the construction contract's terms and the liquidity available to meet unexpected costs, etc.
[27] Some of these causal links were tested through process tracing analysis. The results are presented in Annex C. CfD Phase 2 evaluation annexes: https://www.gov.uk/government/publications/evaluation-of-the-contracts-for-difference-scheme

You've got a huge amount of bank capital and projects financed by banks. So, when we come along … the message we're getting is 'we've got loads of capital available for the project, and we probably don't need institutional capital'. So, the good news for developers is there's a lot of capital available in that market for Offshore wind. (Fund manager)

Having that revenue certainty opens you up to more financial institutions, and almost by definition, if there are more institutions lending then the cost of capital will fall [as competition among lenders leads to offering more attractive rates]. So that gets factored into a 1 to 2 percent reduction to hurdle rates. (CfD Developer).

This positive view of the CfD’s influence on attracting finance was not supported by all developers. Developers of technologies included in Pot 1, or other technologies within Pot 2 that have been less likely to win a CfD through the competitive auctions, explained that the closure of the RO has reduced investment opportunities for developing their technologies. Under the RO, developers of different types of technology were not required to compete against one another in auctions for a contract. Higher ROC banded prices were allocated to developers of innovative emerging technologies with higher LCOE that required support to commercialise, such as marine, ACT and other bioenergy technologies. Some respondents noted that the competitive auction-based approach for CfDs favours mature technologies over emerging technologies and is therefore less favourable for attracting investment in non-Offshore wind technologies. This issue is explored in more detail in the Phase 1 report.

No. The opposite. It hasn’t attracted more institutional investors because it was more attractive before (with ROCs). (CfD Developer, ACT technology)

The ROC regime provides a lot more confidence because it was specifically designed for a technology demonstration. A CfD as it currently is supposedly for a new technology or for less established technology, but it is very commercially driven as you can see from the prices that have cleared. (CfD Developer).

In summary, the findings support the Theory of Change that the CfD scheme helped to attract more financial institutions and reduce costs of capital. However, this varies according to technology type. It has supported investment in Offshore wind in particular but varies according to the prevalence of CfDs being awarded to other technologies.

Impact on gearing ratios

Background context on the financial structure of renewables projects

In general, there are two common ways to finance energy projects, through equity or debt.[28] Equity is raised through the issuing of the company’s shares. In the case of large-scale renewable development projects, the parent developer company often sets up a subsidiary Special Purpose Vehicle (SPV) company for the purpose of managing this asset. The equity investor subscribes and pays for the shares issued by the company, thus owning part of the company and benefiting from its future profits and share appreciation. The value paid by the incoming investor becomes part of the company’s share capital and the company can use it to make investments.

[28] There are intermediary instruments that have characteristics of both debt and equity, e.g. mezzanine loans.

Debt finance, in contrast, is a consequence either of a bank loan or a bond (or other debt instrument) issued by the company. In return for lending the money, the investor (lender or bond holder) becomes a creditor and receives interest payments according to an agreed schedule until the debt is repaid. An important difference between these two ways of raising capital is the risk and return relationship that each one entails. For the investor, equity finance is usually riskier but provides higher potential gains. For the company that is raising funds (developer), debt finance is usually cheaper (reflecting risk exposure) and, because debt is a cost, it generates tax benefits. Together, the cost of equity and cost of debt compose the cost of capital of the project, as shown in Figure 13 below.

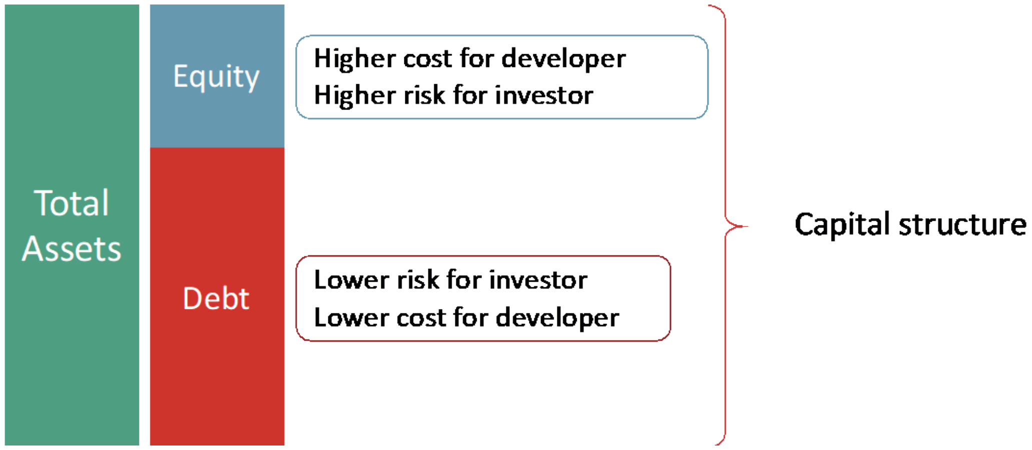

Figure 13 Capital structure of model infrastructure project

As the market becomes more competitive (for example, through competition to win a CfD in auctions), there is increased pressure for developers to reduce costs to develop competitive bids, including the costs of capital of their projects. This can be done not only by reducing the cost of equity and of debt, but also by changing the capital structure of the project (share of debt and equity). Because the cost of equity is usually higher, reducing the share of equity contributes to reducing the cost of capital. The share of debt vs equity is known as the “gearing ratio” - a measure of how much of a company's operations are funded using debt versus the funding received from shareholders as equity.

Evidence gathered in interviews suggests that the CfD has a significant impact on gearing ratios. Exposure to merchant prices has a significant impact on the credit score for debt investments. Rating agencies usually limit the rating score given to a debt when the project is exposed to market price fluctuations or in the absence of price certainty during the term of the debt. A representative of one major rating agency explained that to be able to give an investment grade rating score to a renewable energy project, they would require a minimum Debt Service Cover Ratio (DSCR)[29] of 1.3 if the project has a 100% price certainty. However, if the same project has 100% of its revenues exposed to merchant prices, the minimum DSCR required for an investment grade score is 1.7 which significantly reduces the maximum share of net operating income which can be used to cover debt service.

Several respondents had the view that projects with a CfD can reach higher leverage.

> *When we have tested the different sets of assumptions* [for investing in generation units with or without a CfD]*, what we have seen is that the gearing is*

[29] The DSCR is the basic ratio used by banks and fund managers to define the size of a project’s debt. It estimates how much debt service the project’s cash flow supports with some safety margin and is calculated by dividing the net operating income by the debt service. With all else constant, allowing a smaller DSCR when there is no merchant exposure means that the project’s leverage can be higher.

quite different because basically the banks would take very conservative assumptions on the business case they are ready to finance and that is limiting the debt that you can raise. So, when the CfD projects can get up to 70, 75 percent, gearing a merchant's project will be probably limited by 40, 50 depending on the technology (Financial Advisor).

I think a lot of people are concerned about the reality that you could arguably debt finance merchant risk, but your level of debt is going to be very low relative to what it is in CfD (Fund Manager).

Allowing for more debt in projects may be an important channel through which a CfD helps bring cost of capital (and by extension, strike prices) down.

So, the gearing is on average higher overall for CfDs … It achieves exactly the objective of the CfD which is to reduce the cost capital. So, the WACC goes down (Fund Manager).

Other factors contributing towards cost reduction

Although most respondents recognised the role the CfD price stabilisation mechanism played in helping to bring prices down, there was no consensus that this mechanism was the key driver of falling strike prices between AR1 and AR3. This was caused by a complex interplay of ‘other contributing factors’.

The most commonly mentioned ‘other contributing factors’ were: the competitive nature of CfD auctions; technology maturity and cost reduction through innovation; reductions in supply chain costs; and wider macro-economic trends, such as reduced rates of return from other sectors and markets, leading pension fund managers to become increasingly attracted to infrastructure projects.

Many of the ‘other contributing factors’ are interlinked (such as market maturity and reduced supply chain costs) and, therefore, it is difficult to isolate the relative impact of one factor over another, but together they have brought strike prices down. The section below considers the most commonly cited factors in view of: a) CfD scheme design and other government renewables subsidies; and, b) wider market trends and external factors.

Factors related to CfD and government support

1. Competitive Auctions

The competitive nature of the CfD auction was mentioned by some respondents as the most important driver for strike price reduction between AR1 and AR3.

I suppose the main difference with ROCs is that you weren't forced to go into a competitive auction process. And I think it's fair to say that the competitive auction process has accelerated cost reduction much more quickly than if we just stayed in a status quo. (CfD Developer).

The competition promoted by CfD auctions was the main driver of the cost reductions. Of course, there is technological development, but competition was very important. (non-CfD Developer).

2. Market Maturity of Offshore wind and cumulative benefits of historic investment

Pot 2 technologies, such as Offshore wind, have now participated in three Allocation Rounds. In addition, Offshore wind development has benefited from over a decade of support from the previous RO policy and innovation funding. The cumulative historic track record of delivering projects within budget has also contributed to raising investor confidence. Investors reported that they now view Offshore wind projects as less risky assets, attracting more risk averse investors.

> *When we bought our first Offshore wind farm, not a lot of people were buying Offshore wind farms. Now everyone buys Offshore wind. I think it's not only related to the CfD, but just generally people getting comfortable with construction risk, getting comfortable with wind risk, etc. The more track record, the more people get comfortable with the industry (Fund Manager).*

> *The margins for Offshore winds have come down substantially from, you know, from the early days as people got more comfortable with the technology and the perceived risk (Investment Bank).*

3. Effects on the supply chain from notice of future Allocation Rounds

The announcement by BEIS in 2018[30] of its intention to hold Allocation Rounds every two years after the 2019 round was noted by some respondents as providing more certainty of future demand, helping the wider supply chain for Offshore wind to invest and develop. The foresight of coming auctions helps firms to plan production, optimise investments and bring costs down.

> *This kind of stable pipeline of auctions coming up, it gives visibility to the industry. And this is how the whole supply chain managed to kind of reduce the costs of the Capex as well because they have an industrial view on this sector. (Financial Investor)*

In addition, the Budget Notice[31] in advance of each Allocation Round and setting of Administrative Strike Prices[32] were said to influence cost reduction by manufacturers in the Offshore wind supply chain.

> *When BEIS publish the Administrative Strike Price it sends a signal to all the supply chain on how much costs have to be reduced. All the supply chain firms know this, like the turbine manufacturers and the marine engineers, so they adjust their prices in line with what they think will be feasible to charge for within the budget. The large supplier firms create their own internal financial models of how much they estimate the total costs will be to develop the wind farms, and what the returns will be for the developer over time. (CfD Developer).*

Similarly, some respondents suggested that if BEIS could provide more advance notice on the design rules of future Allocation Rounds, this would improve visibility for suppliers and developers, allowing for better investment planning. This could include allowing for more time

[30] https://www.gov.uk/government/news/energy-minister-claire-perry-hails-success-story-of-offshore-wind-in-newcastle-today
[31] The budget notice publicises the CFD budget for a given Allocation Round.
[32] Administrative Strike Prices represent the maximum strike price a project of a particular technology type in a given delivery year can receive during an allocation round.

between the Budget Notice and the deadline for application submission. This is further discussed in Chapter 6.

Wider market trends and external contributing factors

4. Technology development and global trends in cost reduction for Offshore wind

Technology development is seen as another main driver of price reduction, particularly for developers. Wind turbines continue to grow in capacity and the CAPEX per installed MW has continued to fall.[33] Installing turbines with larger rotor diameters is more efficient, partly because the developer can achieve the required generating capacity while installing fewer turbines in the same area, thus reducing the costs for connection and O&M.

> *Before turbines were 3.6 MW, now one is up to 12 MW. So, the reduction in price here is consistent with the reductions in other countries. (CfD Developer).*

Globally, over the last decade, as the average capacity factors of Offshore wind farms have increased, the LCOE has fallen. A 2018 study[34] suggested that the LCOE of Offshore wind fell by around 32% globally between 2014 and 2018. Recent Bloomberg Terminal data (2020) shows an even faster reduction of around 65% on average from 2014 and 2019, for other European countries and globally. A similar rate of reduction was observed in the UK in the same period, with LCOE falling from USD 191.21/MWh in December 2014 to USD 70.19/MWh in December 2019 (a 63% decrease), suggesting that the LCOE changes in the UK follows a broader global trend (see Figure 14).

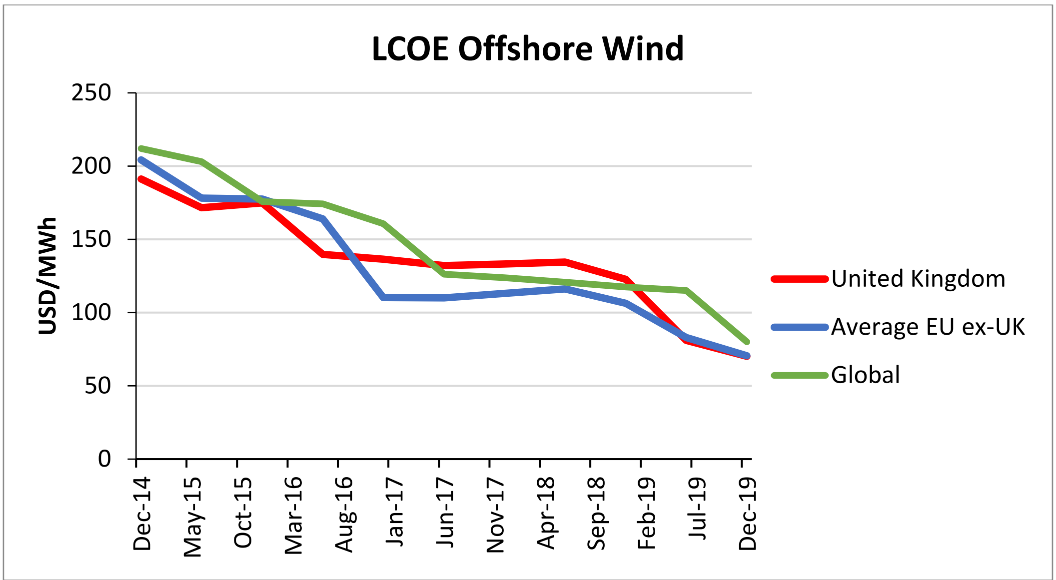

Figure 14 Levelised Cost of Electricity (LCOE) Offshore Wind (Source: Technopolis analysis of Bloomberg Terminal data (2020)

Global trends in reductions in the LCOE for Offshore wind are not wholly attributed to technology innovation and commercialisation. According to estimates for Offshore wind farms by the International Energy Agency (IEA 2017), one third of the LCOE comes from capital expenditure, and around one half from the cost of financing these wind farms. Therefore, policy

[33] IRENA, Renewable Power Generation Costs in 2018, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Renewable-Power-Generations-Costs-in-2018.pdf (accessed in 15th March, 2020).

[34]See: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/May/IRENA_Renewable-Power-Generations-Costs-in-2018.pdf

measures aimed at reducing the cost of capital (such as the CfD) have also contributed towards reductions in the overall costs of renewable energy deployment. Several other countries also hold competitive auctions to support renewables deployment and provide various other forms of subsidy. The role of other forms of government support, internationally, in reducing the LCOE of Offshore wind is discussed in more detail in a separate report delivered as part of the scoping stage to the CfD evaluation.[35]

5. Wider macroeconomic influences

The interest rates of central banks have been at near record lows recently, not only in the UK, but in several markets internationally following the monetary policies used by central banks used to combat the 2008 financial crisis (see Figure 15). This was reported to have contributed towards decisions by fund managers who traditionally invest in government backed securities to diversify their portfolio in search of more favourable rates of return from other assets, such as investing in infrastructure projects.

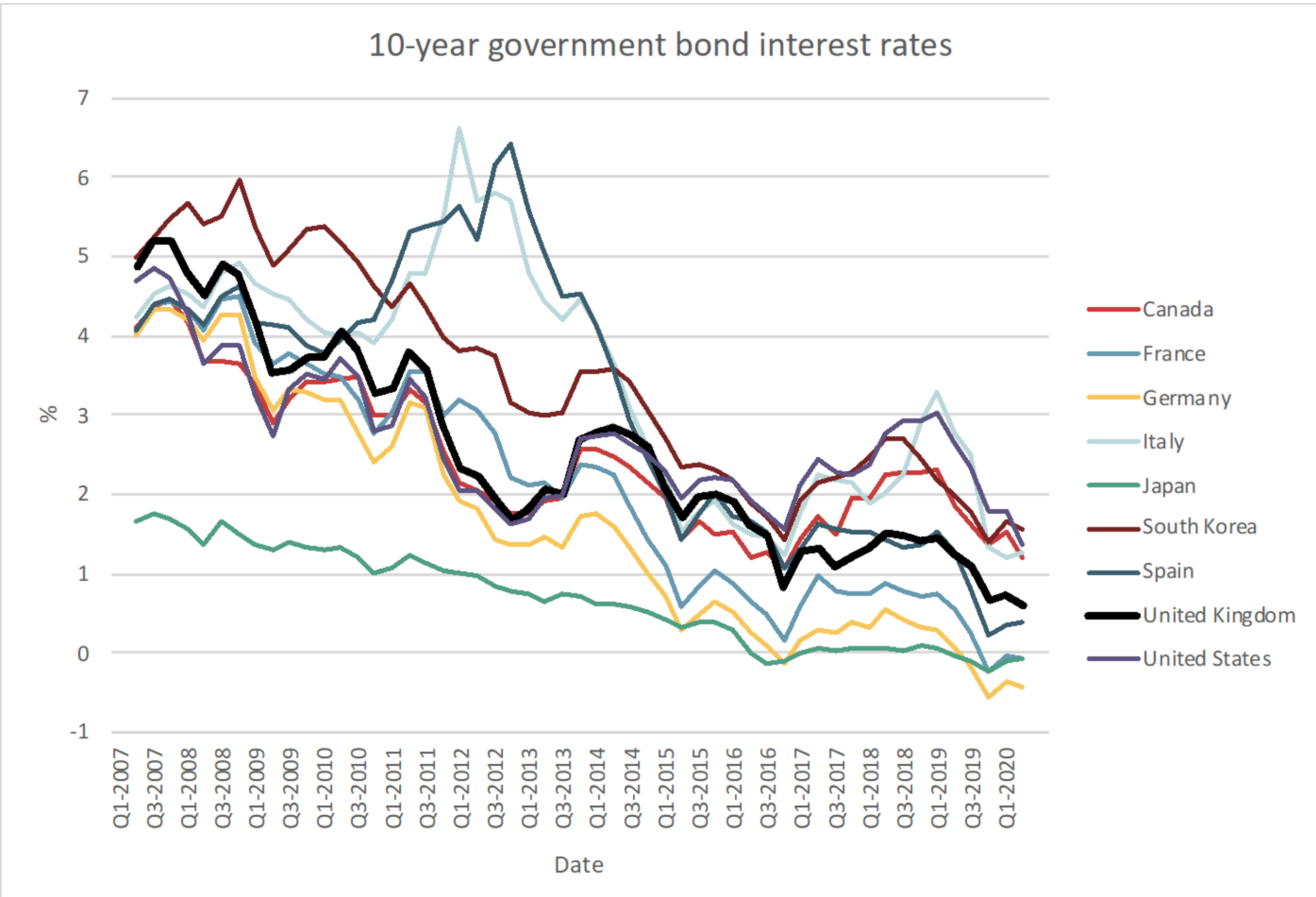

Figure 15 Long-term interest rate of selected countries (source: OECD)

In East Asia in particular, low returns in government and corporate bonds has been stimulating local investment funds and banks to look for assets with a good credit rating in other regions and sectors, such as Offshore wind.

> *More widely, the macro-economic environment low to negative interest rates seen in other countries in Asia, in Japan particularly, has meant that some of the*

[35] Rapid Evidence Assessment: The Role of Auctions and their Design in Renewable Energy Deployment. Technopolis 2018.

institutions there have looked further afield to get their returns, and renewables has been a stable of investment for them. And I'd say that that has probably became a relatively big contributor to the increase in liquidity over the last year [in UK Offshore wind sector]. *(Investment Bank)*

We're in a moment in time where we've had record low interest rates. So, what we've seen as a consequence of that is relatively cheaper financing costs as well as that there's quite a bit of competition in the lending community, which also helps. And that together with the kind of macro low interest rate that we're experiencing, has helped to lower the cost of debt. (CfD Developer).

Potential adverse consequences of low strike prices

As discussed in previous sections, strike prices reached record low levels in AR3, with winning bids around £41/MWh and below. Although this is beneficial for consumers, the effect on reduced cash flow raises new risks for investors and pressures the supply chain. Investors and developers expressed views that trends of reducing prices at this rate has raised the risk of generating unsustainably low returns. Both developers and investors noted issues with this, including:

- Aggressive strategies in auctions: Developers are basing their bids on future technological innovation to make projects viable.
- Delivery risk: The competition for CfDs would be lowering strike prices to such an extent that some projects may not be financially viable to deliver.
- Reduced attractiveness of UK market: Companies that have multi-national portfolios may focus their future investment on other countries where higher prices or more generous forms of subsidy are in place.

To succeed in highly competitive auctions some developers may be adopting aggressive strategies that rely on future technological innovations to make projects viable under the bidding prices.

The technology price is coming down, but I think the CfD scheme exacerbates that. I think people are bidding extremely aggressively on turbine models, and, when I say people, I mean the Offshore industry, is bidding on turbine models which do not exist yet. So, we are competing with that. (CfD Developer).

The competition for CfDs was said by some respondents to have lowered strike prices to such an extent that some projects may not be financially viable to deliver.

I think cost reduction has been phenomenal. But I think subsidy reduction has almost outstripped that and it's got to levels, due to the competitive nature of the auction, in which people with substantial sums of Devex [development expenses] *are having to bid at levels that make them broadly economic, but far from the returns they thought they were going to get when they went into those projects originally. But they are so scared about not getting a CfD and potentially having to wait two years, and the corporate PPA market not being developed enough, that they just have to bid at this level. Competition is a great thing and is reducing the prices to the consumer and so on, but I actually worry (with its impacts) in terms of deployment. (Fund Manager).*

However, if this risk of non-deployment does occur, with a well-functioning competitive market, in theory the market will eventually adjust, and strike prices will revert to viable levels. As one fund manager explained:

> *There is a question mark as to whether the competition has been so high that people are making too big bets. Developers are making aggressive bets and they might not make the returns that they were making in the past. And I think that's just a normal consequence of a market getting crowded in the long term that will adjust; because if people lose money in this round, they won't lose in the next round because they've learnt. (Fund Manager).*

Investment in many types of renewable energy technologies is an international market. Many of the parent companies owning Offshore/Onshore wind or Solar generation assets, and the financial institutions that invest in them, have a multi-national portfolio. Some respondents noted a risk that excessively low strike prices could deter developers and investors in the future and cause them to deploy in other countries where prices are higher or subsidies are more generous, corroborating the views of developers in Phase 1.

> *We have a global mandate and now we are seeing the UK as potentially ... not just potentially, as actually a less attractive market to invest in, due to, and this is a huge point, due to the lower subsidies, and the lower contracted revenue streams. When we compare that to, for example, what we are doing in Taiwan at the moment … much higher subsidies. Looking at Korea, looking at Japan, looking at Vietnam, even looking at North America … We are looking for as many opportunities as possible. As returns reduce to this level, then we will seek more attractive returns elsewhere. (Fund Manager).*

Conclusion

This section aims to address the evaluation questions:

- HLQ 1 (h): What has been the impact of the scheme on financial investor confidence, and how and why has this occurred?
- HLQ 1 (j): How has this impact on investor confidence subsequently impacted on the hurdle rates of different projects/technologies?

The Theory of Change that has been tested is that: the CfD scheme reduces risks for developers and their investors, which contributes towards reducing hurdle rates and costs of capital, which in turn, supports overall cost reduction for consumers.

Interviews with investors and developers were used to test this contribution claim. Although respondents did clearly attribute cost reductions to the price stabilisation mechanism provided by CfD, they also highlighted the difficulty in isolating the precise size of the effect in reducing overall costs from broader trends. The competitive nature of auctions in particular was highlighted as an important driver for reducing strike prices.

Interview findings suggest that CfDs play an important role in enabling finance deals that would not happen otherwise. The price stabilisation mechanism contributes towards increased gearing ratios, which further contributes to bringing cost of capital down and, hence, to the reduction of strike prices.

Additionally, wider macro-economic factors, such as lower interest rates in international markets, have contributed towards attracting financial investors to invest in the UK renewables sector (or Offshore wind at a minimum). Also, as more CfD projects have been implemented over time, investors have got more comfortable with the risks, attracting yet more investor institutions and offering more attractive rates.

The CfD Evaluation Phase 1 report provided a ‘policy map’ diagram and Theory of Change narrative to illustrate how the CfD scheme’s inputs and activities translate through to achieving its intended outcomes and impacts. Figure 16 shows an updated and refined diagram to illustrate these multiple contributing factors.

Figure 16 CfD Scheme Theory of Change

4. Risks to Delivery

Key findings:

Projects awarded a CfD at Allocation Round 3 (AR3) face particular risks to timely delivery. Some risks are context specific to specific technologies (such as securing transmission links for Remote Island Wind (RIW), while others are generic to the overall portfolio (such as the challenge of reaching Final Investment Decisions (FID) whilst a Judicial Review (JR) of AR3 was ongoing).

At the time of the research fieldwork for this report, a decision on the outcome of the JR was still pending. This presented a difficulty for projects to reach financial close and for commission development work to progress towards their Milestone Delivery Dates (MDDs). However, the JR was withdrawn in March 2020 (subsequent to fieldwork's completion). All AR3 projects were granted a 6-month extension to their MDD, TCW and Longstop Date milestones.

All RIW projects are still subject to Ofgem's approval of transmission links from the islands to the UK mainland. Not enough CfD capacity was awarded to meet the minimum capacity thresholds required for Ofgem to approve the respective transmission links on either the Western Isles or on Orkney. Potential changes to Transmission Network Use of System (TNUoS) charges presents an additional risk factor for RIW and these may influence their FID.

Introduction

The CfD has been successful in reducing market risk for those that have been awarded contracts. However, as with any programme Theory of Change which depends on future project implementation for benefits to be realised, there are certain delivery risks. This chapter introduces the delivery risks most relevant to AR3,including:

- Implications of the Judicial Review (JR) on AR3 projects.
- Issues related to Offshore wind turbines interfering with Ministry of Defence Radars.
- The requirement for RIW projects to secure transmission links to their islands.

The CfD Evaluation Phase 1 report, which assessed AR1 and AR2, has previously discussed some of more general risks of the CfD scheme design.

Judicial Review

In August 2019, after the AR3 application window had closed, the developer 'Banks Renewables' (which holds AR1 Onshore wind CfD contracts) commenced JR proceedings against the BEIS decision not to include Pot 1 technologies within the scope of AR3.[36] Some respondents said that the news of the JR created significant uncertainty for developers and their investors, and this prevented projects from reaching their Final Investment Decision (FID) while litigation was ongoing.

Despite the presence of the legal challenge, all projects signed their contracts within the specified timeframe. The legal challenge was withdrawn in March 2020 and LCCC subsequently confirmed that all 12 projects were granted a 6-month extension to their contractual milestones of Milestone Delivery Date (MDD), Target Commissioning Window end date and Longstop Date. This extension should enable the projects to reach FID and in turn enable them to meet their MDD requirement to commit 10% of project development costs or enter into contracts for material equipment which constitute a significant financial commitment within 12 months of signing the contract.

Offshore Wind

Offshore wind projects will deliver the majority of AR3 capacity. This section therefore outlines some of the risks specific to Offshore wind.

Risks related to interference with Ministry of Defence Radars

The number of windfarms and height/rotor diameter of wind turbines has rapidly increased over the last decade. An ongoing challenge is that wind turbines have the potential to interfere with air traffic control and air defence radars. The Ministry of Defence's innovation hub, the Defence and Security Accelerator (DASA), specifies that more than half of currently planned wind farm developments are subject to objections from civil and military aviation sectors.[37] Offshore wind developers are aware of the risk that this has for project delivery if no solutions can be found. In March 2020, BEIS announced (in an Offshore wind Sector Deal update) that the Ministry of Defence (MoD) and the Offshore wind sector have set up a Joint Windfarm Mitigation Task Force. This task force reports back to an Aviation Management Board (AMB), which is chaired by BEIS to provide a high-level forum for discussing broad (not project specific) actions regarding the aviation impacts of both offshore and onshore wind. Initial studies have commenced to develop technology solutions, but to date, no solutions have been found for the different problems and this issue then therefore currently remains a risk to the delivery of Offshore wind projects.[38]

This issue was highlighted in the Offshore wind sector deal among other deployment issues related to, for example, aviation, marine navigation, or fishing. The government has said it is committed to collaboratively working with the sector on this issue. It is also highlighted as one of the current BEIS research priorities[39] and the Ministry of Defence's Defence and Security Accelerator (DASA) launched a £2-million innovation competition to mitigate this risk to the UK

[36] See: https://www.banksgroup.co.uk/2019/08/15/judicial-review-lodged-against-exclusion-of-onshore-wind-from-government-cfd-energy-auctions/

[37] See: https://www.gov.uk/government/publications/windfarm-mitigation-for-uk-air-defence/competition-document-windfarm-mitigation-for-uk-air-defence

[38] See: https://www.gov.uk/government/publications/offshore-wind-sector-deal/offshore-wind-sector-deal-one-year-on

[39] BEIS. Areas of Research Interest - Interim Update 2020 (2020). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/862777/beis-areas-research-interest-interim-update-2020.pdf

radars.[40] The competition is funded by BEIS, and outlines the problem and focusses on three challenges to be addressed: alternatives to radar, technologies applied to the wind turbine or installation, and technologies applied to the radar, its transmission or its return.

Despite the broad sector deal commitment to support innovation on this issue, some developers stated that they see this as an ongoing risk, which government should resolve if plans to expand the Offshore wind sector are to be achieved.

Remote Island Wind

Remote Island Wind (RIW) was introduced as an eligible but less mature technology in AR3. The 2017 BEIS impact assessment for the inclusion of RIW[41] characterised RIW as being different from Onshore wind due to several factors, which include: higher wind speeds, more exposure to extreme weather events, higher deterioration due to environmental factors, and "*significantly higher costs of connecting to, and using, the electrical transmission system*." A broader but important additional point to consider here is whether new projects could be subject to higher Transmission Network Use of System (TNUoS) charges than Onshore wind generators.

While four RIW projects won a CfD at AR3 (two on Orkney and two on the Isle of Lewis), they were developed as part of business plans in which more projects would be awarded a CfD on these islands in order to reach the relevant capacity thresholds required by Ofgem to approve their transmission link.

This section discusses issues relating to two planned transmission links: the 600 MW transmission link from the Western Isles (Druim Leathann Wind Farm & Muaitheabhal Wind Farm); and, the 220MW transmission link from Orkney Islands (Costa Head Wind Farm & Hesta Head Wind Farm). Both of these transmission links are planned to be developed by Scottish and Southern Electricity Network's subsidiary Scottish Hydro Electric Transmission (SHE-T). As of April 2020, no transmission link has been approved for either the Western Isles or Orkney, which raises a risk to the timely delivery of all four RIW projects.

Transmission Links

Orkney

On Orkney, two projects were awarded a CfD: the Costa Head Wind Farm and the Hesta Head Wind Farm. Both of these projects are led by the Scottish developer Hoolan Energy. Following a consultation, Ofgem announced in September 2019 (before the outcome of AR3) a conditional approval[42] for a 220MW transmission link developed by Scottish Hydro Electric Transmission's (SHE-T) which would allow wind projects on Orkney to export their wind power to the UK mainland. The approval was conditional on the condition that by December 2021 at least 135MW of generation projects must be either awarded a CfD or likely to go ahead without one.

[40] See: https://www.gov.uk/government/news/dasa-seeks-innovative-ideas-to-mitigate-radar-risk-of-windfarms
[41] See: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/714079/F_-_RIW_Impact_Assessment.pdf
[42] See: https://www.ofgem.gov.uk/system/files/docs/2019/09/conditional_decision_on_orkney_final_needs_case_2.pdf

This was higher than the initial 70MW minimum generation capacity proposed by SHE-T, which was set at their stated break-even point. Ofgem reasoned that a threshold below 135 MW would not provide value for money for consumers.

Costa Head Wind Farm and Hesta Head Wind Farm have initial capacity estimates of 16.32MW and 20.40MW respectively, providing 36.72MW capacity in total and falling short of the Ofgem threshold by nearly 100MW. Progress with these two CfD projects may therefore be dependent on additional renewable electricity projects being developed on the island in order to meet the required threshold for the transmission link to be built.

Western Isles

Two Western Isles projects have been awarded CfDs. These are both located on the Isle of Lewis (Druim Leathann Wind Farm & Muaitheabhal Wind Farm). In 2018, SHE-T submitted a needs case to Ofgem for accommodating RIW transmission from the Western Isles to the Scottish Mainland and proposed to build a 600MW electricity transmission link between the Western Isles and mainland Scotland (this was based on two major windfarms, Stornoway and Muaitheabhal Wind Farm, securing CfDs). The cost estimate was £623.8m.[43] However, Ofgem has stated that they consider the Final Needs Case put forward by SHE-T risked consumers paying for a significantly underutilised link and thus may not represent long term value for money for consumers. Ofgem also stated that, subject to no material changes to the information reviewed, they would approve a revised submission for a 450MW transmission link, if SHE-T's stated condition was met.

In October 2019, the Druim Leathann Wind Farm (49.50MW) and Muaitheabhal Wind Farm (189MW) were awarded a CfD in AR3, whereas the Stornoway project, which had around 180MW capacity planned[44] was not awarded a CfD. After this result, Ofgem stated that it would review any revised needs case from SHE-T since the present needs case, based on a minimum of 369MW, was not met. As explained in Ofgem's statement:

> *"We would expect SHE-T to continue working alongside the ESO to consider the appropriate next steps for ensuring an economic and efficient transmission network in its area. This may be expected to include engaging with generators in light of the CfD auction results and with other local stakeholders, as appropriate. If the outcome of that process is a revised Final Needs Case submission by SHE-T, in accordance with the SWW condition in SHE-T's licence, we will consider whether the Final Needs Case is sufficiently well justified and represents long term value for money for existing and future consumers. We will endeavour to consider any such revised submission as soon as possible and we will consult on our updated views on any revised Final Needs Case submission ahead of reaching a decision." (Ofgem).*[45]

As of April 2020, no revised Needs Case for a transmission link has been submitted to Ofgem, and therefore the situation described above continues to apply.

[43] See: https://www.ofgem.gov.uk/system/files/docs/2019/10/update_on_the_final_needs_case_western_isles_0.pdf
[44] See: https://www.ofgem.gov.uk/ofgem-publications/151095
[45] https://www.ofgem.gov.uk/system/files/docs/2019/10/update_on_the_final_needs_case_western_isles_0.pdf

5. Application and contract award processes

Key findings:

The majority of developers (successful and unsuccessful) found the application process reasonably straightforward, with sufficient and clear information provided in advance.

Several developers felt the application process was too tailored towards the requirements of Offshore wind projects. The majority of non-offshore wind developers felt that the application process would benefit from additional technology-specific guidance.

The new online portal was viewed as a positive step to streamlining communications. However, there is some confusion on which of the delivery partner organisation’s websites is the best source of information.

The 10-day Initial Conditions Precedent window was considered too short to gather the necessary documentation and seek the advice of external legal counsel.

Introduction

This section discusses the experience of participating in the CfD scheme from the perspective of applicants, including both developers who were awarded a CfD and developers who were not. This section shares insights on the application process, together with applicants’ experiences of working with BEIS and other CfD scheme delivery bodies, and their opinions on what worked well and less well.

The CfD Evaluation Phase 1 report evaluated wider aspects of the CfD scheme’s design and delivery processes, including ways in which contracts are managed through each stage of the project development journey (i.e. through meeting Milestone Delivery Dates to commencing generation within the Target Commission Window). These aspects of the CfD scheme delivery processes are not discussed again here, due to the relatively early stage in the implementation process that AR3 projects are currently at.

Pre-application phase information and guidance

The application process consists of three main stages, which are categorised as: (1) Application stage; (2) participating in the Auction; and, (3) Contract signing. These are outlined in Figure 17.

In the Application stage, developers gather the necessary information surrounding the scheme’s regulations, design variables, application procedures and on eligibility before making a bid. This includes developing their understanding of the eligibility criteria, the bidding process and supply chain mapping. Additional support is available to developers, including workshops designed by delivery partners which lay out these requirements prior to making the application and allow for developers' questions.

Figure 17 Technopolis summary of CfD Allocation Round 3 Application Process[46]

During the application process, developers are required to submit information and connect with multiple different agencies. These include:

- BEIS: overall Scheme guidance and submitting Supply Chain Plans.
- (EMR) Delivery Body, National Grid Electricity System Operator (NGESO): pre-application stage guidance and to submit applications.
- Ofgem: appeals for unsuccessful applicants.
- LCCC: award and ratification of the contract, and ongoing contract management.

In general, successful and unsuccessful applicants expressed general satisfaction with the pre-award application process. While the majority found the process to be resource-intensive, it was seen as a reasonably straightforward undertaking. The majority of developers noted that there was sufficient information made available to understand the requirements for submitting an application and for participating in the Allocation Round. NGESO account managers were highlighted as providing helpful support, particularly in terms of explaining eligibility criteria and providing feedback on initial application validation checks.

Developers who had participated in previous application rounds noted that they had become familiar with the application process due to their prior experience. They also felt that the delivery bodies had built on the experience of earlier Allocation Rounds to improve the process.

[46] https://www.cfdallocationround.uk/

The importance of holding workshops was highlighted by the majority of developers as providing a helpful overview of the process, offering the opportunity for in-person Q&A in addition to the written guidance and online videos.

> *We went down to London for the introductory session and that was really, really useful just to try and get a good overview and understanding. You could take notes and just sort of compare to what you're doing on online. Initially, it looks a bit daunting but when you get into it, it's relatively straightforward. The online video really helped prior to submitting the physical application itself, for example, understanding and how to set the price and everything. (CfD Developer).*

However, other applicants noted that the wider application process appeared to be geared towards Offshore wind developers, with many parts of the guidance and forms not applicable to, or mindful of, other technologies.

> *Most of it [the pre-application process] was geared towards Offshore obviously. I'm looking through the checklist that I kept. I think project description, things like that, they were very definitely not tailored for Remote Island Wind in any way…. The session we went to was very heavily geared towards Offshore wind as you'd expect, and other technologies. I think Remote Island Wind was an afterthought (CfD Developer).*

Demonstrating eligibility and submitting an application

Several developers found the validation checks to be a useful exercise and they were viewed positively overall. Developers in AR3 were assigned a dedicated account manager to answer questions regarding their application and run a validation check in order to foresee errors and avoid disqualification or time-sensitive challenges. The response to the validation checks was positive overall with many developers finding it to be a useful exercise.

> *[Regarding the initial application validation checks] That was really useful. And again, our National Grid account manager was really fantastic on that point. We essentially went through both application forms line by line. He flagged up a couple of things which could have been issues. We were then able to make absolutely sure that there was there was no room for any confusion whatsoever. So, the application went straight through, there were no questions. (CfD Developer).*

The addition of the new online 'portal' implemented in AR3 was also viewed by applicants as a positive change. However, responses did suggest some room for improvement in order for it to successfully act as a single point of entry regarding information and advice on matters related to the application process. Applicants found themselves looking for resources on the National Grid, BEIS and LCCC websites, which created confusion and reduced the efficacy of the online portal. This suggests the online portal could benefit from enhanced signposting from other websites to give developers confidence that the portal contains the most up to date documentation.

> *The resources that were available in the portal were okay, but it was pretty jumbled. You weren't confident you were looking at the most recent version, or the correct version of the document. You've got National Grid, you've got BEIS and you've got the Low Carbon Contracts Company that will have different roles*

at different points. If you haven't been through that process before, you can't focus in on exactly what you need to because you're nervous that you're missing something. So, I would say that portal was a step in the right direction, but I didn't necessarily trust it [in terms of providing most up to date information] (CfD Developer).

Contract Award and Sign Off

After winning bids have been selected, successful applicants must fulfil a set of conditions within ten business days as part of the Initial Conditions Precedent. These conditions make up the first delivery milestones. They include: (1) a legal opinion confirming the Generator's ability and power to enter into the CfD; (2) completed 'Know-Your-Customer' form with supporting information; and, (3) a facility description along with a facility plan detailing relevant assets.[47] Many developers reported this stage of the process as being a challenge, due to a lack of clear/detailed guidance on the specific steps required to sign off each form. The short ten day turn around for signing the contract, once awarded, was also highlighted as particularly challenging by many developers.

In terms of Know Your Customer, we had absolute nightmares with this. We were very reluctant to email [LCCC] any documents, there was supposed to be a secure data room to receive sensitive documentation, but it never got set up. They took ages to be reviewed and, in the end, there were some issues raised with the documents. By then we had probably 24 hours left to obtain certain signatures [before deadline], but with the most senior people in the company not in the country. It was an absolute nightmare and very nearly cost us the contract. (CfD Developer).

[With regards to turnaround for company signatures] *At board level, you've signed this off. They have produced personal bank statements; extremely sensitive information, and they've then had to do it all over again because there was a delay to the auction. The documents which were in date were not in date [anymore]. Can you imagine? So that I would say that stage of the process was pretty poorly managed by the LCCC. (CfD Developer).*

The CfD Standard Terms and Conditions requires applicants to obtain legal counsel on the contract. More specifically, it states a requirement for '*a legal opinion from the legal advisers to the Generator confirming that the Generator is duly formed and validly existing under the laws of the jurisdiction of formation and has the power to enter into and perform, and has taken all necessary action to authorise its entry into and performance of the Contract for Difference.*[48]

While the legal counsel requirement is detailed in the CfD Standard Terms and Conditions, which were available up to six months prior to the round opening, some developers (particularly smaller firms) found this requirement to be logistically complicated and expensive to accomplish within the required ten-day timeframe. If consulting external legal counsel remains a requirement, developers would benefit from additional/more detailed information in advance, in order to better prepare and avoid the challenges around short turnaround times.

[47] https://www.lowcarboncontracts.uk/key-cfd-terms
[48] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/799137/AR3-Standard-Terms-and-Conditions.pdf p. 245

We've got basically four days to find a lawyer [who] has had to have read and reviewed and understood a 500 page badly drafted contract within a week. In the end, we found a solution that worked for us, the law firm and LCCC, but it still cost us ten thousand pounds. Just something that we didn't need to do and provided LCCC with no greater protection than if we'd been able to do what they wanted. We're not like the big Offshore wind companies who have massive internal legal teams. We have one guy. (CfD Developer).

Conclusion and suggestions for improvement

Overall, developers were satisfied with the application process, noting that there was sufficient information available online and that the process had become more streamlined with each iteration of the Allocation Rounds. The account managers and introductory sessions were seen as beneficial and gave developers adequate guidance throughout the process.

Suggestions on areas for improvement include:

- Tailoring the application process more to specific technologies, to address perceptions of the auctions being overly focused on Offshore wind. This may include technology-specific workshops.
- Enhancing communications to give confidence that the online portal can act as a 'single source of information' which contains the most up to date and relevant information (rather than websites of delivery partners). This may include extensive cross-referencing from the websites of delivery partners to assuage developer concerns that they are looking at the right source.
- Reviewing whether ten days is the optimal timeframe to allow developers to complete requirements of the Initial Conditions Precedent and sign and return the contract. Consideration should be given to whether certain steps within this process could be made more efficient and providing developers with more confidence on the handling of sensitive documentation, such as uploading all documents onto a secure portal rather than sending via email.

6. Views on Scheme Design and Future Changes

Key findings:

Overall, developers feel that a continuation of the CfD scheme is necessary to meet targets on energy decarbonisation. Relying purely on a merchant-based business model for new build generation, or Corporate Power Purchase Agreements (PPA) was viewed as insufficient for developing new build generation at a large scale.

Developers expressed mixed views towards the concept of a 'price floor' model. Support for this was dependent on how the price of the floor was set and how such a scheme would work in practice.

There were significant trade-offs between contract length and strike prices. Overall, longer contracts were preferred, and shorter contracts would require higher strike prices.

Developers' opinions varied on contract award selection criteria. Many believed that community benefits should be considered but acknowledged these may be difficult to fairly assess across projects.

Introduction

This section addresses the evaluation question: '*Are the design parameters of the CfD scheme and auction allocations appropriate for achieving the intended objectives*?'. The CfD Evaluation Phase 1 report reviewed various aspects of the CfD scheme's design, including the "pay-as-clear" bidding method used in auctions and the impact of Pot structure of AR1 and AR2 on auction outcomes. In Phase 2 of the evaluation, specific topics explored in relation to this evaluation question included the following:

- Developers' views on the extent to which CfD Allocation Rounds will be needed in future years in order to incentivise investment in renewables development.
- The main implications of moving towards a 'price floor' payment model.
- Views on how the allocation of technologies into different Pots should be changed in future rounds.
- Whether fifteen years is still the right length of a CfD contract, and the possible implications of changing this.
- Whether CfD being awarded primarily on the basis of price per unit of renewable electricity delivers optimum outcomes or whether there are other factors that should be considered when allocating contracts.

The section summarises findings in relation to developers' views on each of the topics above. It should be noted that none of the above ideas are planned changes and that developers were asked about these potential changes in order to gauge interest and discuss their ability to help facilitate or hinder the progress of the CfD scheme.

The need for continuation of CfD Allocation Rounds in future

Views on the growth potential of Corporate Power Purchasing Agreements (PPAs)

Some evidence from Bloomberg NEF (BNEF) and other renewable energy sector literature suggests that there has been a growth in Corporate PPAs across Europe in recent years. While BNEF suggests that corporate PPAs account for around 8GW of generation capacity across Europe, Middle East and Africa (EMEA), this is still a small fraction of total renewables supply for the region.[49] In addition, a recent report[50] by the sector analysts, Independent Commodity Intelligence Services (ICIS) suggests there has been a slowdown in growth of corporate PPAs within the UK in 2019.

Views on the outlook for the development of CfD-free merchant-based deployment models and Corporate PPAs varied across the developers and investors interviewed. However, there was a general consensus that although some examples of Corporate PPAs are emerging in the UK (deals between a generator and a private buyer) they are not yet a viable route-to-market to build the volume of clean electricity required to meet government decarbonisation targets.

A common concern expressed for corporate PPAs was the lead in time required to develop renewable energy projects from the planning permission phase up until the generation unit is operational and electricity is supplied to the buyer. Respondents felt there was a discrepancy between the development timeline of the project and a private company's energy forecasting and purchasing timeline. Developers require long term agreements in order to attract the necessary investment, while private buyers prefer shorter term contracts.

> *A corporate [buyer] wants their PPA to start in a month or two, not in three years. [You have to tell them] 'well, I don't know. Might be 39 months if we get a bit delayed or 33 months if everything goes according to plan'. They want to know their time horizon which is very different from the development timeline of a project. (CfD Developer).*

Some felt that there was not enough demand for corporate PPAs in the market to bring the concept to large scale deployment.

> *There is not enough volume of corporate PPAs for large scale Offshore wind projects. And if you want to create a pool of corporate PPAs, it is very hard to align them all in terms of timing and conditions. Also, CfDs give you predictability for almost 20 years (±3 years of construction, +15 years of contract). No corporate PPA gives you that. And probably won't. (non-CfD Developer Offshore Wind).*

[49] BloombergNEF 2018, as referenced by Elgin Energy: https://www.elgin-energy.com/2018/12/12/the-rise-of-corporate-ppas-in-2018/

[50] https://www.icis.com/explore/resources/news/2019/05/16/10365103/corporate-power-purchase-agreement-slowdown-to-prove-temporary

Some developers expressed concern that corporate PPAs may not be an equitable means of spreading the cost of renewable generation across the consumer base. This point was echoed in the findings of the CfD Evaluation Phase 1 report. Some developers also cautioned that some form of government support will be necessary for the UK to continue to attract the large scale of investment required for decarbonisation, given renewables investment is an international market.

> *We've built this industry using the Renewables Obligation, which was very successful in building the industry we have today. Consumers have paid for that. So why should corporates be the only ones to benefit from the lower costs now? It's only the CfD that pays back consumers. The corporate PPA route doesn't. (non-CfD Developer).*

> *We need a bit more thought into how energy markets should work, rather than it just being a case of 'we need to cap consumer pricing, and everybody will provide the assets because they will.' Because the warning I would give you is that they won't, because there are more attractive markets to go to [internationally]. (non-CfD Developer).*

Price floor model

A 'price floor' model could amend the current CfD rules, which guarantee the generator protection should the reference price drop below the minimum 'floor price' (in £/MWh). The price floor model would allow generators to benefit from an uptick in power prices above the floor price to the degree that any subsidy received has been first repaid.[51]

Developers expressed mixed views towards the concept of a price floor model, and firm support for it would be dependent on how the price of the floor was set and how such a scheme would work in practice.

> *From a developer perspective, if you are then able to capture some more of the upside, that's going to be a good thing. But it depends on what that floor is, and whether it would lead to a kind of a race to the bottom [with unsustainably low prices]. (CfD Developer).*

Some developers were concerned over how a price floor may impact the ability to attract debt finance.

> *I think it would also decrease the amount of debt finance you could get into the projects and make funding them more difficult because the banks would probably size the debt on the floor level rather than on a fixed strike price, which would be higher. (CfD Developer).*

15-year duration of contract

Developers were asked whether fifteen years was still the right length of a CfD contract, and what were the implications of changing this. Most developers preferred longer contract lengths (e.g. at least fifteen years or more) in order to provide their investors with the risk protection required to secure investment.

[51] https://www.newpower.info/wp-content/uploads/2019/01/CfD-floor-price-letter-to-BEIS.pdf

> *Generally speaking, obviously when you're getting finance, the longer the better is the case. There was a lot of concern when the 15 years (contract length) was first introduced that it would be quite damaging given that the RO is 20 years. It's different for different technologies as well, especially those kinds of more mature technologies which find it difficult to drop their costs significantly between auctions. One of the main ways they can reduce that cost of capital is reduce their overall costs, which means a longer period around with to finance it is useful. (Trade Body).*

The prospect of shortening the duration of the contract to ten years could make some projects not economically viable.

> *Shorten it to 10 and it becomes pointless because these plants last 30+ years [for ACT]. You're never going to be able to pay back an investor with any kind of decent return within 10 years. If you say, 'You have got 15 years of certainty', that will generate you a minimum return. But if you say, 'We've got revenue certainty for 10 years, and it won't get your money back. And then you've got 15 years of market risk, so actually it's a market risk project', the investors will say, 'We're not doing it.' (ACT CfD Developer).*

While the majority of developers agreed that the contract should not be shortened, lengthening the contract prompted varying opinions. Many developers felt that increasing the contract to twenty years would better align with other project timelines, therefore increasing the utility of the CfD to development of renewable energy technologies.

> *Well, I think the RO was obviously for 20 years, planning consent lasts for 20 years, normally. Your land agreements land for 20 years, normally. Your turbines will last for 25 years, normally. So, the introduction of [a] 15 year [CfD] obviously has an impact, a negative impact and reducing that to ten would have a further negative impact. (Remote Island Wind CfD Developer).*

Some developers did feel that a shorter contract could be feasible, but that this would have to be compensated for in other ways, such as increased strike prices.

> *To my mind, whatever the length the contract, the market would adjust in some way. So, if you went with a shorter length of time, the price would be higher (Offshore Wind CfD Developer).*

In conclusion, there is a trade-off whereby the contract must be of sufficient length and price to achieve the necessary returns required to attract investment. Developers (both successful and unsuccessful) generally preferred the concept of longer contracts (i.e. fifteen to twenty years). More mature technologies (e.g. Offshore wind) may be able to proceed with shorter contracts but may require higher strike prices to compensate.

Pot structure

The CfD scheme allows for auctions to be held in separate technology 'pots' in order to separate technologies by maturity and ensure that the budget is distributed amongst mature and less established technologies. Allocation Round 3 (AR3) was open to all technologies within Pot 2 ('less established' technologies). Pot 2 included the following:

- Advanced Conversion Technologies, Anaerobic Digestion (>5MW), Dedicated Biomass with CHP, Geothermal, Offshore Wind, Remote Island Wind (>5MW), Tidal Stream and Wave.

The majority of respondents felt that the current CfD scheme design should be changed to increase the technology types benefitting from the CfD. Several respondents noted that the scheme design favoured Offshore wind, and that it should no longer be considered a ‘less established technology’.

> *Different technologies have different cost of capital. The market view right now is that Offshore wind has got to be considered an established technology now. It's been going on for so many years now. (non-CfD Developer).*

Many felt that the success of developing the Offshore wind sector through CfD has prevented other less established technologies from progressing to full scale commercialisation stage, where there is scope for future cost reduction. This point was also raised in the CfD Evaluation Phase 1 report, where it is discussed in more detail.

> *What the government has done is effectively excluded marine and tidal from developing … and largely excluded remote island wind. There were several high-profile remote island wind projects which were not successful. Those technologies did not have a fair chance of winning a contract in this auction. (CfD Developer).*

Developers’ opinions varied on how the Pot structure should be designed in future auctions. Some respondents preferred the use of ‘technology-agnostic’ Pots, assigned based on maturity of technology. Other respondents indicated a preference for ‘technology-specific’ Pots, in order to ensure the development of each technology type. Some respondents also felt that, if existing regulatory tools within the CfD scheme design were used (e.g. maxima and minima criteria to allocate proportions of budget to certain technologies that require subsidy to support future cost reduction), a reform of the Pot structure would be unnecessary.

> *If the ACT bucket had been separated out, I think you would find a number of ACT projects coming forward and the strike price would have averaged out somewhere in the £50 range. And that's at a level that they could have gone ahead. In which case by the time you got to AR4, those technologies would be a bit more developed, investor awareness and comfort with those technologies would have been a bit more developed and what had been £50-60 pounds in AR3 would become £45-55. So, this kind of killed all that new technology development. (CfD ACT Developer).*

Overall, the key findings related to Pot structure remained consistent with the findings from the CfD Evaluation Phase 1 report. Developers understand the policy rationale for a separate Pot for emerging technologies. However, now that the prices for Offshore wind have dropped significantly, it is no longer seen as a level playing field for other emerging technologies. There was a consensus amongst developers that: 1) the Pot structure does not account for varying levels of technology costs, or their different stages of progression along Technology Readiness Levels and, 2) that the Pot structure would benefit from being more tailored to support the development of individual technologies with potential for future cost reduction.

6GW Capacity Cap

Allocation Round 3 (AR3) introduced a 6GW generating capacity cap. This cap was technology neutral and applied across all Pot 2 technologies, in order to increase competitive pricing and reduce State Aid.[52] The LCCC's briefing on CfD AR3 results states that '*the 6GW capacity cap was the limiting factor on successful projects, not the budget cap of £65m. Since the strike prices are significantly under the reference prices set for this auction, budget usage is actually negative, with the total impact amounting to -£307m from 2026/27 onwards, for the duration of the contract*'.[53]

Some respondents commented that this generating capacity cap appeared to miss the opportunity for a greater number of projects to have come forward within the same financial budget (given the capacity cap was reached before the budget cap). This was felt to have slowed the pace of deployment needed to meet the government's long-term decarbonisation aims.

> *[Considering] the kind of volume of projects that are needed to deliver net zero at the pace of delivery, we feel that the cap is an arbitrary limit on a scale of deployment and particularly given the prices we've seen in Allocation Round 3. (Offshore Wind non-CfD Developer).*

One developer felt that the cap was aimed at securing short-term benefits for budget management instead of the long-term benefits of clean electricity deployment.

> *[The cap] was to constrain the budget available and the cost to the consumer because actually, the cost of not decarbonising the electricity system is higher to the consumer in the long term. This is short termism, by saying let's cap the auction to keep costs low for consumers, implying that renewable energy is somehow extremely expensive, but then they don't deploy enough of it in order to make sure that the strike prices can stay low. You're literally putting caps on what you can do [in terms of deployment] (RIW CfD Developer).*

Some financial institutions investors acknowledged the role that the 6GW generating capacity cap had on increasing competitive tension at the auctions, which may have further contributed towards lower bids and costs reduction.

> *Regarding the six-gigawatt cap - I think there's no doubt this had an impact … By giving clearer guidance (on budget and capacity), I think from a government point of view, it's probably successful in creating competitive tension which is ultimately going to drive down pricing.*

One suggested change was to implement some flexible margins in the cap, so that following a competitive auction, projects which were listed as being only slightly more expensive could still come forward. This suggestion was also referenced in the Allocation Round 4 (AR4) consultation.

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[52] The European Commission's case for State Aid in the UK's Electricity Market Reform noted that 'setting this cap will suitably limit capacity to increase competition, ensuring that aid awarded is kept to a minimum, whilst enabling smooth deployment of sufficient generating capacity to ensure a cost-effective trajectory towards meeting the UK's decarbonisation objectives'.

[53] https://www.lowcarboncontracts.uk/sites/default/files/2019-10/190920%20CfD%20Allocation%20Round%203%20Results%20Briefing%20-20191018.pdf

> *In order to make sure the auction works properly; I think there should be some sort of flexibility in that cap. Let's say you've added up the bids and you've got to 85 Megawatt. So, then we turn up with a 30MW plant but we're only five pence more expensive. Is it better to exceed the capacity cap and get all that extra technology, and the extra 30 MW development for, really, a marginal increase in subsidies? So let's say they could have two caps: capacity cap 1 and a capacity cap 2. You certainly cannot breach cap 2, but if the price is right, you could breach 1. (ACT CfD Developer).*

Contract Award Selection Criteria

Currently, the CfD scheme allocates capacity based on a competitive bidding process in which projects offering the best price (£/MW) are prioritised. Some respondents felt this did not sufficiently recognise the wider environmental benefits of certain technologies and was not well aligned with other areas of government policy.

For example, DEFRA's 2018 Waste and Resource Strategy[54] encourages the development of technologies such as Anaerobic Digestion (AD) and Energy-from-Waste (EfW), stating '*we will work across Government on opportunities to promote synergies between food waste and other bio-waste and renewable energy to support decarbonisation of transport, heat and power*'. The strategy also stated that 'anaerobic digestion represents the best environmental outcome for food waste that cannot be prevented or be redistributed to others' and that 'if anaerobic digestion or composting are not possible, [waste] should be treated via energy from waste in preference to landfill'.

> *You've got wider government aims of reducing waste, maximising recycling, and maximising recovery. We've got technology which can usefully take and recycle and recover energy from waste. We're talking a hundred and fifty thousand tonnes of waste a year to one of our plants. If it doesn't go to us, where's it going to go to? Is it exported it? Is it burned in a much less efficient process? A much more polluting process? And surely that can't be right. To my mind, that should get factored into the evaluation of bids from Waste to Energy projects for CfD.*

> *You have government saying we want to encourage Advanced Conversion Technologies because we think waste to gas to fuel is the best way of using waste in a renewable situation. [But] the CfD structure basically said, 'but my goal in the CfD scheme is to get the cheapest power possible'. Cheap power is Offshore wind. When I put it all together, there's tension between one part saying yes, we do want you and another bit of government saying actually we don't care. It's just not joined up. (CfD Developer).*

Similarly, RIW developers noted wider community benefits and local investment opportunities:

> *[Remote island wind] provides, per Megawatt a far higher level of community investment and benefit than other projects. So, by way of example, these projects are helping to underpin a needs case for New Interconnector, which provides us with greater employment. There's a supply chain benefit there. So yes, I do think that community benefits should be recognised. There should also be industry consultation on how those are assessed and what these are and how they can be*

54 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/765914/resources-waste-strategy-dec-2018.pdf

improved rather than government imposing a list of requirements the projects then have to meet. (CfD Developer).

However, other developers expressed concerns about how community benefits may be difficult to quantify and fairly assessed across projects.

I have to confess, I'm always quite suspicious of bringing these things [alternative benefits] in because it becomes more about how you tell it. You start saying, if you put a plant in this place rather than that place, it will have spin out benefits on employment and the economy in the area. I worry about that sort of thinking because it opens it up to much more manipulation. (non-CfD Developer).

7. Conclusions

This evaluation of the CfD scheme has aimed to assess the extent to which the introduction of the CfD scheme had met its core objectives. These objectives include: giving investors the confidence they need to invest in UK renewable energy projects and to attract greater investment at a lower cost of capital and from a wider pool of sources. The CfD scheme aims to support increased supply of renewable electricity, whilst delivering value-for-money for consumers.

When compared against the RO, the evidence from this evaluation suggests the CfD scheme is meeting the above objectives. Interviews with developers and investors provided strong support for the CfD scheme's Theory of Change, whereby the offer of a fifteen-year price stabilisation contract reduced risks for investors by reducing exposure to wholesale price volatility and which then lowered hurdle rates for developers. This was reported to have increased access to the provision of finance from a wider pool of investors, resulting in competition among lenders and more attractive interest rates being offered. CfDs play an important role in enabling finance deals that would not happen otherwise. CfDs also contribute towards increased gearing ratios, which further contributes to bringing cost of capital down and, hence, to the reduction of strike prices.

Whilst this evaluation's respondents did clearly attribute cost reductions to the price stabilisation mechanism provided by CfD, they also highlighted the difficulty in isolating the precise size of the effect in reducing overall costs from other contributing factors and broader sector trends. In particular, the competitive nature of auctions was highlighted as an important driver for reducing strike prices. Additionally, wider macro-economic factors, such as lower interest rates in international markets have contributed towards attracting financial investors to invest in the UK renewables sector (for Offshore wind at least). Finally, as more CfD projects have been implemented over time, investors have become more comfortable with the risks, attracting yet more investor institutions and offering more attractive rates.

It can be assumed that some of the above external factors to cost reduction may have occurred in a counterfactual scenario, whereby the CfD scheme was not introduced and the RO continued. Therefore, when estimating the impact of the scheme on reduced costs to consumers, the scenarios modelled focus on estimating the effect of CfDs on reducing hurdle rates for developers, driven by the scheme's unique features in reducing risk from exposure to wholesale prices. The reduction in costs to the consumer due to the CfD projects auctioned in AR1, AR2 and AR3 is estimated at **around £3bn** (in comparison with supporting the same projects under the RO). With up to 85GW of projected future CfD projects (excluding nuclear) also included prior to 2050, the potential consumer cost savings of the CfD regime through to 2050 are estimated at **around £10bn**, with a range of £5bn to £15bn in the scenarios tested.

The impact of the CfD scheme in supporting investment and cost reduction in Offshore wind seen by developers as its main success story. However, the extent to which the CfD scheme has increased investment in other technology sectors has varied according to the level of opportunity available to those technologies to be allocated a contract, and their ability to compete on cost with Offshore wind.