Department for
Business, Energy
& Industrial Strategy

Evaluation of the Contracts for Difference scheme

Phase 3

Final Report

March 2021

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. We are thankful to all the renewable electricity project developers and wider sector stakeholders who contributed their time and insights through interviews. The project reports have been improved through valuable steers and comments from various BEIS officials.

This report was written by Technopolis Ltd and LCP Ltd. The views expressed do not necessarily represent those of BEIS or any other government department.

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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
LCCC	Low Carbon Contracts Company
LCOE	Levelised Cost of Electricity
MDD	Milestone Delivery Date
PPA	Power Purchasing Agreement
PT	Process Tracing
RO	Renewables Obligation
RIW	Remote Island Wind

1. Introduction

The Department for Business, Energy and Industrial Strategy (BEIS) commissioned Technopolis Ltd, in partnership with LCP Ltd, to undertake a process and impact evaluation of the Contracts for Difference (CfD) scheme. This Phase 3 report provides an overall synthesis of findings from previous stages of the evaluation, as well as new evidence on the implications of the COVID-19 pandemic for the delivery of contracted projects. A separate report on Phase 2 of the evaluation assessed the extent to which the CfD Allocation Round 3 (AR3) met its intended objectives. Prior to this, a separate Phase 1 report assessing CfD Allocations Rounds 1&2 (AR1 and AR2 respectively) was completed.

Overview of the CfD scheme

Aims and Objectives

The Energy Act (2013) implemented regulations to enable the CfD scheme to meet a range of Electricity Market Reform (EMR)[1] 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[2]. Alongside the Offshore Wind sector deal, the CfD scheme will play a major role in securing the investment needed to achieve the government's target for Offshore Wind to contribute 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. 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' risk by providing more certainty in revenue and to support investment in a wide range of renewable technologies with different levels of maturity.

[1] Implementing Electricity Market Reform. DECC. 2014
[2] https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law

Purpose of evaluation

The evaluation assessed the extent to which the CfD scheme is meeting its intended objectives and to explore how and why any intended or unintended outcomes are being realised for developers of different technologies. The evaluation also assessed the effectiveness of delivery processes to help inform policy development around ways in which delivery of CfD Allocation Rounds could be improved in future. Findings from Phase 1 of the evaluation were used to inform the five-year Post Implementation Review of the Electricity Market Reform (EMR) Programme.[3]

The evaluation explores five high-level questions[4]:

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?

Summary of methods

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

Earlier phases of the evaluation developed and refined the scheme's Theory of Change. Phase 1 specifically tested the extent to which a CfD is attractive to both developers and investors and contributes to lowering costs for consumers. For this Phase, the focus was on exploring differences in outcomes and views towards the scheme by differences in contexts; including by types of technologies developed and stages of project development. Phase 2 further tested whether the CfD scheme has met the objective to: *Increase investor confidence to attract greater investment at a lower cost of capital and from a wider pool of sources*. This Phase focused 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.

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

[3] https://www.gov.uk/government/publications/energy-act-2013-5-year-review
[4] 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 scheme has contributed towards cost reduction. Further details of the overall evaluation methodology are provided as an annex to the Phase 2 report.[5]

As well as economic modelling (see Chapter 2), the evaluation gathered evidence via qualitative interviews with; renewable energy project developers, financial institutions, renewables sector trade bodies and CfD policy leads and programme managers from BEIS, LCCC, National Grid ESO and Ofgem. The number of interviews across all three phases is outlined in Table 1 below. In addition, in Phase 1, financial institutions (banks and fund managers who invest in renewables projects) were consulted via an online survey, which received 20 responses. Further details of these interviews, including approach to sampling and breakdowns by categories of organisation represented, can be found in Annex A of both the Phase 1 and Phase 2 reports.

Table 1. Interviews by Phase and stakeholder groups

Phase of Evaluation	Developers with a CfD	Developers without a CfD	Investors / Financial Institutions	Trade Bodies	CfD policy and delivery leads
Phase 1	23	17	0	0	6
Phase 2	12	9	7	2	0
Phase 3	13	0	2	3	3
Total	**97**				

Overview of interviews carried out in Phase 3 and limitations

Representatives from developers, investors, trade bodies and CfD policy and delivery leads participated in Phase 3 of the evaluation. Twenty-one interviews were carried out through December 2020 to February 2021. The aim of these interviews was to gather qualitative insights on the implications of the COVID-19 pandemic on project delivery and any new associated risks for investors. The interviews were also used to explore suggestions on areas for future change in scheme design. For Phase 3, the following interviews were conducted:

- Among developers with a CfD, 13 were completed across AR1, AR2 and AR3 with representatives from each awarded technology type (including one Onshore Wind developer, six Offshore Wind developers, two Solar PV developers, two Remote Island Wind (RIW) developers and two Advanced Conversion Technologies (ACT) developers). Firms developing these renewable projects do not necessarily focus on only one type of technology. For example, developers of Offshore Wind projects often manage a portfolio of generation units that include other technologies such as Onshore Wind and Solar. The sample provided a good cross-section of views on the ways in which the pandemic affected developers of different types of renewables technology.

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

- Among wider financial institutions, two interviews were carried out from an initial target sample of six. Although the institutions consulted had extensive experience in investing in UK renewables projects and the interviews provided useful insights across all of the topics covered, the breadth of qualitative data collected can be considered lower than would otherwise be expected if the full programme of interviews had been completed.

- Three interviews were carried out with renewable energy sector trade body representatives (achieving the target sample of three).

Across all three Phases of the evaluation, results from analysis of the interview transcripts were triangulated with other secondary sources where available, including; checking information on the size, timescales and ownership of renewable development projects with the REPD and the LCCC CfD Register; collating information on financial investment deals and trends in reducing costs of renewable electricity in the UK and internationally with Bloomberg Terminal data; plus BEIS Costs of Electricity Generation reports and other published literature (referenced throughout the reports where applicable). This sense checked the findings gathered from interviews and informed an assessment of the strength of evidence for the Contribution Analysis.

2. Overview of Allocation Rounds 1-3

Summary:

Almost[6] all applicants awarded a CfD in Allocation Rounds 1, 2 and 3 (AR1-3) have signed their contracts. All contracted capacity is currently on track to be delivered by 2027.

The total generation capacity awarded across all three rounds will equate to 11.0GW of new capacity by the end of 2026, which would generate enough electricity to power the equivalent of almost twelve million UK homes based on current consumption. The amount of non-terminated capacity clearing the round has increased from 1.9GW in AR1 to 3.2GW in AR2 to 5.8 GW in AR3.[7]

The majority of capacity awarded will come from Offshore Wind which amounts to 9.8GW out of 10.9GW in total. The bulk of the remaining projects are accounted for by Onshore Wind (15 projects totalling 679.7MW, all awarded in AR1) and Remote Island Wind (4 projects totalling 275.2MW, all awarded in AR3).

All remaining capacity is accounted for by Advanced Conversion Technologies (5 projects awarded across all three rounds and totalling 72.4MW), Energy from Waste (1 project totalling 45MW), Solar (2 projects, 22.8MW) and Biomass with CHP (1 project, 0.6MW).

Introduction

This chapter provides an overview of the outcome of the previous three Allocation Rounds, AR1, AR2 and AR3. Included are breakdowns of capacity of the projects by type of technology and allocation round as well as the timing of the delivery of all projects.

Overview of all CfD projects, capacity, and equivalent homes powered[8]

Table 1 below provides an overview of all projects awarded a contract, their proposed generating capacity and estimates of the equivalent number of UK homes which they would be

[6] Netley Landfill (Solar, 12 MW), awarded a contact in AR1, had its contract terminated in March 2016. Wren Power and Pulp (EfW, 49.8MW) and BHEG Walsall (ACT, 23.4 MW) were also awarded contracts in AR1 and had their contracts terminated in May 2019 and March 2020 respectively. Station Yard (ACT, 0.05 MW) and Grangemouth Renewable Energy Plant (Biomass with CHP, 85 MW), both awarded contracts in AR2, had their contracts terminated in October 2018. Drakelow Renewable Energy Centre (ACT, 15 MW) was also awarded a contract in AR2 and had its contract terminated in Nov 2018.

[7] After subtracting terminated contracts.

[8] Data for Table 1 from official AR1-3 Allocation Round Results Note(s). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/407059/Contracts_for_Difference_-_Auction_Results_-_Official_Statistics.pdf (AR1) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643560/CFD_allocation_round_2_outcome_FINAL.pdf (AR2) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/838914/cfd-ar3-results-corrected-111019.pdf (AR3)

able to power (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). Note that in some cases, one project may include multiple CfD units if a project contains multiple phases. Further details on projects awarded a CfD can be found in Annex E of the Phase 2 report.

Budget was only allocated to Pot 1 and 2 technologies in the first Allocation Round. A third pot for Biomass Conversion technologies was also created for AR1, but no budget was allocated to it. Remote Island Wind (RIW) was introduced as a distinct category in AR3.

Table 1 Projects and Contracted Capacity by Allocation Round (Note: Does not include unsigned/terminated contracts. Where no contracts have been awarded this has been indicated with '-')

Technology type	AR1 projects (Capacity in MW)	AR2 projects (Capacity in MW)	AR3 projects (Capacity in MW)	Equivalent homes powered (all AR)
Pot 1 – established tech				
Onshore Wind	15 (670)	-	-	310,000
Solar PV	2 (23)	-	-	16,000
Energy from Waste (EfW) with CHP	1 (45)	-	-	96,000
Hydro	-	-	-	-
Landfill Gas	-	-	-	-
Sewage Gas	-	-	-	-
Pot 2 – less established technologies				
Offshore Wind	2 (1,162)	3 (3,196)	6 (5,466)	11,006,000
Advanced Conversion Technologies (ACT)[9]	2 (36)	3 (41)	1 (6)	213,000
Remote Island Wind (RIW)	n/a	n/a	4 (275)	266,000
Biomass with CHP	-	1 (1)	-	1,000
Wave	-	-	-	-
Tidal Stream	-	-	-	-
Anaerobic Digestion (AD)[9]	-	-	-	-
Geothermal[9]	-	-	-	-

[9] Eligible with or without CHP.

Total projects / Capacity awarded / equivalent homes powered	22[10] (1,935)	7[11] (3,238)	11[12] (5,775)	11,908,000

Timescales for delivery of all pipeline capacity

Based upon the Generator's Expected Start Dates (from the March 2021 LCCC CfD Register), Figure 1 shows:

- Most AR1 CfD capacity has already come online[13]. Only Neart na Gaoithe Offshore Wind farm (448 MW) and Sneddon Law Community Wind farm (30 MW) have yet to begin generating; the former is expected to do so in September 2022 and the latter is in the process of finalising its construction schedule
- AR2 projects are expected to come online between 2021 and 2023 with the first, Rebellion Biomass plant with CHP, due to start generating April 2021
- AR3 CfD capacity is expected to come online between 2023 and 2026. All awarded CfD projects signed their CfD contracts in October 2019[14] and at the time of writing, all but one are continuing as planned.
- The cumulative CfD capacity from all allocation rounds will reach almost 11 GW by 2026, when the final three Offshore Wind projects begin generating.

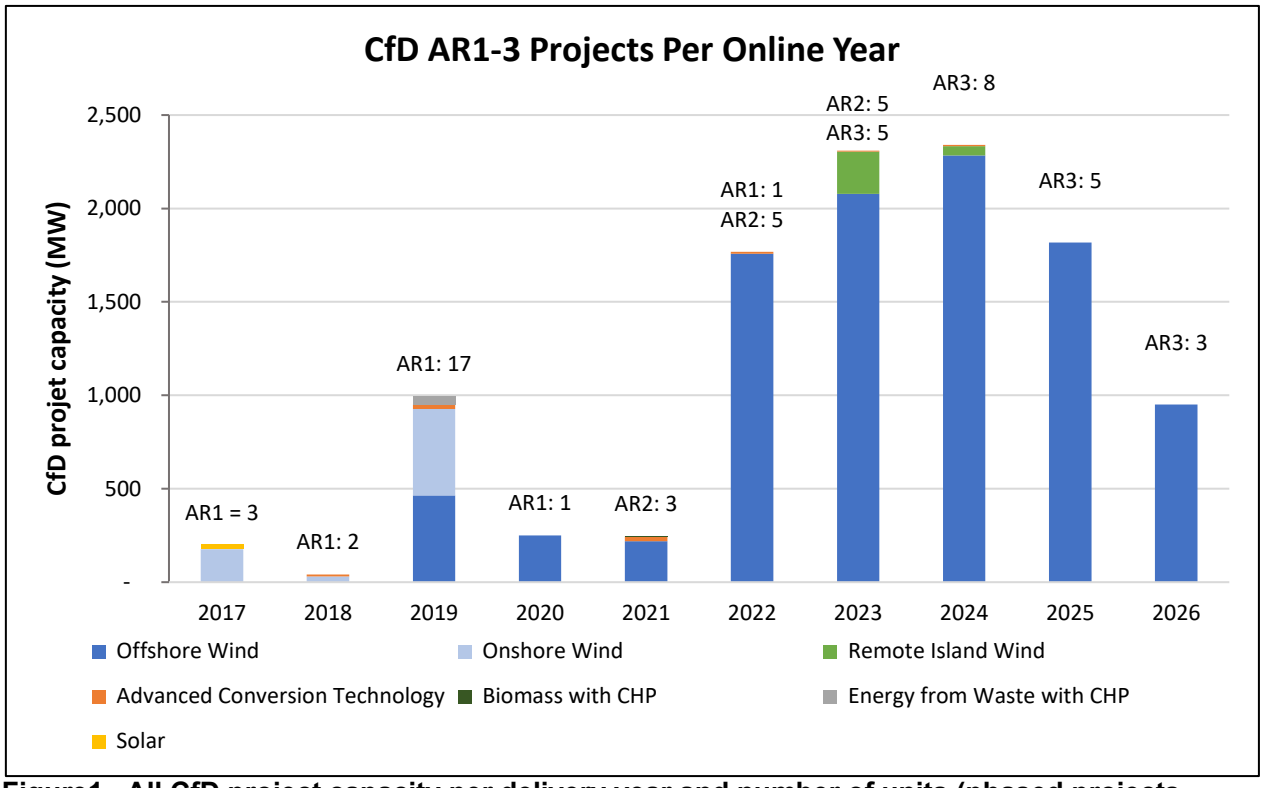

Figure1. All CfD project capacity per delivery year and number of units (phased projects treated as multiple units) per allocation round. Source: LCP Based on LCCC CfD Register 19/03/2021

[10] There were 24 individual CfD generation units in AR1 as the three phased East Anglia 1 Offshore Wind projects are each contracted as one project.
[11] There were 13 individual CfD generation units in AR2 as the three phased Hornsea Project 2, Moray and Triton Knoll Offshore Wind projects are each contracted as one project.
[12] There were 21 individual CfD generation units in AR3 as the Doggerbank projects, Seagreen, and Sofia are phased projects with 3 separate CfD units each but are each contracted as one project.
[13] As of March 2021
[14] LCCC (2019). Allocation Round three projects sign on the dotted line - Press Notice issued on 18th of October 2019

3. Impact of CfD scheme on cost reduction

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)[15] to compare the costs of supporting low-carbon deployment through the (CfD) regime to a counterfactual assuming the RO scheme had continued.

This analysis was complemented with interviews with project developers, investors and trade bodies on the impact of CfD on cost of capital of renewables. The evidence shows that, together with other factors, the CfD scheme was effective in reducing risks to investors, attracting finance and reducing the cost of capital for projects.

This section presents a summary of the findings of these two analyses and presents some further supporting evidence gathered in Phase 3.

Approach and key assumptions

The modelling considered the period between 2016 and 2050 and assumed the same policy objectives under both CfD and RO scheme (it focused on the costs of supporting the same level of deployment of the same types of technology, rather than differences in deployment). The analysis took into account projects awarded a CfD in AR1, 2, and 3 and an estimated group of projects to be allocated a CfD in future rounds.

Scenarios

Five scenarios have been modelled[16], considering differences in the price of key commodities (gas, coal, oil and carbon) and hurdle rates[17]. Each of the scenarios includes a CfD baseline run and a RO counterfactual run, under both the Lower Demand (LD) and Higher Demand (HD) reference cases[18]. The scenarios are:

1. CfD baseline vs RO counterfactual under central commodity price[19] assumptions

[15] The DDM is an in-house electricity market model that BEIS uses to model the GB power market over the medium to long term.
[16] The CfD Evaluation Phase 2 Annexes contain more information about the DDM and modelling approach: https://www.gov.uk/government/publications/evaluation-of-the-contracts-for-difference-scheme
[17] A "hurdle rate" is the minimum rate of return on a project or investment required by an investor. It reflects a project's risk as perceived by investors. The CfD scheme aims to risks to developers and investors by reducing the project's exposure to fluctuation in wholesale electricity prices.
The hurdle rates of supported projects are a key modelling assumption. Lower hurdle rates are assumed under the CfD regime because of the reduced risk to investors.
[18] Key modelling inputs for the development of the energy system over the projection period (2016 to 2050) were 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.
[19] Commodity prices here refer to the price of gas, oil, coal, and carbon.

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).

As with all modelling of future outcomes, there is a significant degree of uncertainty in the projections. To understand this uncertainty, we have tested 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.

However, a number of 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 case. The magnitude of the savings under the CfD scheme would likely vary materially under a different level and mix of low-carbon deployment. More information on the methodology can be found in the Annexes.[20]

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. Tables summarising the results of all scenarios under both input references may be found in Annex D of the Phase 2 report.[21]

Consumer cost impact – AR1, AR2 and AR3

Support payments over the 15-year contract length of 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 by 2050** in the HD and LD reference case across all scenarios.

The least significant increase in consumer cost of the RO counterfactual 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, RO supported projects require a lower rate of return than in central, hence receive lower banding levels.

Conversely, the greatest consumer cost increase under RO 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.

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

Consumer cost impact – all existing projects and projected projects

In the counterfactual where all CfD projects through to 2050 (excluding FIDER and nuclear) are supported under the RO scheme support costs are higher than the CfD baseline, ranging from £5bn to £15bn 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.

Future projects[22] (£3bn to £12bn HD, £4bn to £11bn LD) make up the majority of the higher cost of the RO counterfactual, compared with CfD baseline. 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 commodity 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.

The next section gives more explanation as to *how* the CfD affects investment decisions and ways in which this contributes towards lowering costs. The differences in hurdle rates is the primary driving factor in the CfD regime representing value for money relative to the RO.

Impact of CfD on risk reduction and lowering the cost of capital

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 2, the CfD Theory of Change[23] assumes that the price stabilisation mechanism reduces risks by increasing price certainty.[24] Because revenues of energy generation projects are a product of energy supplied and price, 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 2. CfD influence on cost of capital

[22] In November 2020, HM Government published The Ten Point Plan for a Green Industrial Revolution (available at https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution), which details the government's aim to produce 40GW of Offshore Wind by 2030. The modelling is consistent with this assumed level of Offshore Wind deployment by 2030.
[23] Note: A full programme Theory of Change is provided in the Phase 2 report. This section explores the specific causal pathways of the Theory of Change outlined in Figure 2.
[24] 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.

Impact of CfD scheme on cost reduction

Most Phase 2 and 3 respondents said that the CfD succeeded in lowering cost of capital to renewable energy projects.

> *"What the CfD does, more than anything else, is to reduce the cost of capital for projects".* – Offshore Wind developer

> *"That's the brilliant thing about a CfD. It says here's a contract, you'll get this price per MWh for the next 15 years. It's the certainty that CfD provides which is so critical when you are trying to establish what your returns will be over the course of a 10- or 15-year project. When there are so many changes in the power market that, in the absence of a CfD, there is a really wide series of error bars on what the power price might be in the future and if you are risk averse, you look at the bottom end of that and you think the power price may be as low as £20 in the late 2020s. You say, 'that's not enough to warrant a new project out of the ground'. Which has driven the cost of subsidy right down."* – ACT/EfW developer

Increased availability of finance

Another benefit of the CfD reported by respondents is that by reducing price fluctuation risks, new types of investors are attracted to the UK renewables sector. Because fluctuations in wholesale market energy prices can be difficult to assess, for more conservative financial institutions (e.g., pension funds), the price stabilisation mechanism is a key enabler of securing investment deals that would not otherwise be agreed. Increasing the pool of investors leads to competition to provide more attractive rates for debt finance to developers.

> *"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.*
>
> *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.

However, this positive view of the CfD's influence on attracting finance was not supported by all developers. Developers of less established technologies, which 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.

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

In summary, the findings support the Theory of Change that the CfD scheme helped to attract more financial institutions and reduce costs of capital (particularly for Offshore Wind), as illustrated in Figure 3 below. However, this increased access to finance varies according to types of technology.

Figure 3. CfD role in attracting finance and reduced cost of capital

Increased gearing ratios

By providing increased access to debt finance at lower rates of interest, this can enable developers to change the capital structure of the project (share of debt and equity). Because the cost of equity is often higher, reducing the share of equity can be one way of reducing the project's overall 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. Investors interviewed explained that projects with a CfD can reach higher shares of (cheaper) debt.

> *"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 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.

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

> *"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 to 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 pension fund managers to become increasingly attracted to infrastructure projects. Many of these 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 the evidence suggests they have brought strike prices down.

A summary of wider contributing factors towards cost reduction (and lowering strike prices) is provided below. A more detailed explanation of these factors is provided in the Phase 2 report.

- **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.

- **Market maturity:** after years of government support through CfDs, RO and innovation funding, the cumulative historic track record of delivering projects within budget has also contributed to raising investor confidence. For example, investors now view Wind (Offshore and Onshore) generation projects as less risky assets, attracting more risk averse investors.

- **Future signalling for the supply chain:** the foresight of coming auctions helps firms to plan production, optimise investments and bring costs down. BEIS' signal of having allocation rounds every two years was noted by some respondents as providing more certainty of future demand, helping the wider supply chain for Offshore Wind to invest and develop.

- **Technology development and global trends in cost reduction for Offshore wind**: some viewed the reduction in cost of capital as consistent to what is observed in other countries. As shown in Figure 4, Bloomberg Terminal data (2020) shows a reduction in the LCOE of Offshore Wind of roughly 65% from 2014 and 2019, for other European countries and globally. A similar rate 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).

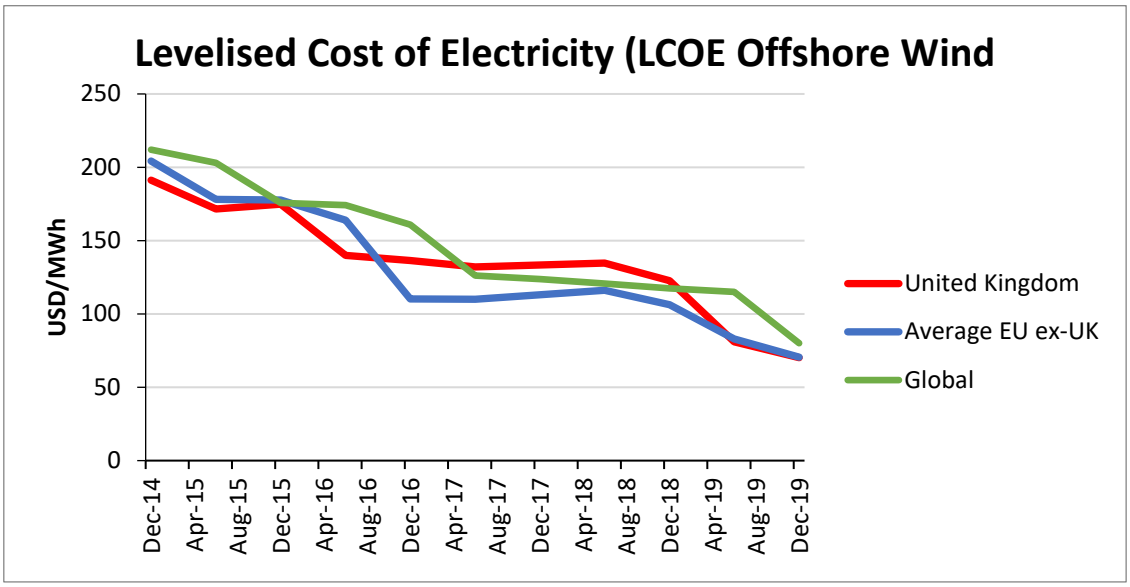

Figure 4 Levelised Cost of Electricity (LCOE) Offshore Wind (Source: Technopolis analysis of Bloomberg Terminal 2020 data)

This common trend suggests that external contributing factors (aside from the CfD scheme) are also important drivers of cost reduction of renewable energy (at least for Offshore Wind). The external contributing factors mostly cited by respondents were:

- **Technology development**: Wind turbines continue to grow in capacity and the CAPEX per installed MW has continued to fall.[25] Installing turbines with larger rotor diameters is more efficient, as the developer can achieve the same generating capacity while installing fewer turbines, thus reducing the costs for installation, connection and O&M. Larger turbines are also associated with higher load factors.

[25] 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).

- **Wider macroeconomic trends**: interest rates of central banks are in a long-term descending trend, currently near record lows[26]. This can be observed not only in the UK, but also in several countries following the monetary policies used by central banks to combat the 2008 financial crisis and the economic effects of the COVID-19 pandemic. This reduces the return of low-risk assets such as government bonds and stimulates investment funds and banks to look for assets with a good credit rating in other regions and sectors, such as Offshore Wind. As a result, the cost of finance also decreases.

[26] Source: OECD statistical series on long-term interest rates. See CfD evaluation Phase 2 report for more details.

4. Implications of COVID-19

Key findings:

The COVID-19 pandemic affected developers of CfD generation units in different ways; depending on technology type and what stage each project was at in the development phase or whether the generation unit was operational.

Overall, developers of generation units that are already operational felt COVID-19 had little to no impacts on them. Although the wholesale price of electricity dropped following the onset of the pandemic in 2020, the CfD top-up payment mechanism meant they were able to receive expected revenues.

Among developers of projects in the pre-operational development phase, the most common impact of the COVID-19 pandemic was a general 'slow down' of construction activity due to a combination of social distancing measures, as well as supply chain bottlenecks. Energy from Waste technologies as well as Offshore Wind projects (development stage only) appeared to be the most directly affected.

Developers' views on how BEIS/LCCC responded to the pandemic were mixed. Some expressed appreciation for the ways in which LCCC worked quickly with developers to review risks of delay, and also to ensure that timely top-up payments were made to CfD generators. The most common challenge expressed was the paperwork associated with demonstrating that delays were due to a *force majeure* event, which was perceived as being overly onerous.

Introduction

This section discusses the implications of the COVID-19 pandemic on projects that have been awarded a CfD, from the perspective of developers as well as renewables sector trade bodies. The section also includes some limited suggestions for ways in which BEIS/LCCC could support developers in similar situations in future.

Impact of COVID-19 on projects in construction phase

Developers were asked about the impacts of the COVID-19 pandemic on the development and construction of their CfD projects. Responses varied depending on when the project was to be commissioned, as well as by type of technology. Despite no official delays to Milestone Delivery Dates (MDD) being attributed to COVID-19, projects still in the developmental phase, in general, have incurred some delays and increased costs. Some developers did not feel that COVID-19 had any significant impact on timescales or costs for their project, either as they had already been commissioned or because the project had already been delayed due to wider factors (such as uncertainty over whether an interconnector will be built to enable Remote Island Wind (RIW) projects to progress).

Around half of the developers interviewed in Phase 3 felt that COVID-19 had either a small impact or no impact whatsoever on their CfD project.

> *"[COVID-19 had] no major impact. We had an issue figuring out if contractors were essential workers, but the clarification was made quickly and [we were able to] have everybody back in a week or two."* – Offshore Wind Developer

RIW developers who had yet to commission their CfD projects felt that COVID-19 did not have any impact and instead pointed to challenges with securing an interconnector grid connection as being the primary reason for delay.

> *"COVID-19 hasn't impacted the development at all. The issue has been its timing on Western Isles link which is out of our hands. This is a subsea cable between mainland Scotland and the Western Isles. Progress on the interconnector has been made, but it is minimal."* – RIW Developer

The remaining half of the developers noted some impacts of COVID-19, to varying degrees. It was said to have resulted in a general slow-down in ways of working, which was difficult to quantify in terms of impact on timescales or to pinpoint one particular challenge, given the all-encompassing nature of the pandemic.

> *"The initial impact really was in the first six months when people were trying to figure out how to work in the new environment. And there's been delays and just not as much communication between companies, and internally, to get an appropriate review and approval for the next steps. It has had an impact, but to be able to point out, to say that, 'yes, it's had a specific impact on the specific element', it's not as clear as that. The impacts are across the board. It just means that things have been slower to get done and not as moved as quickly as we originally anticipated."* – Offshore Wind Developer

Around a third of developers interviewed reported experiencing some challenges with their supply chains as a result of the COVID-19 pandemic. This was described as causing some delay, but not an obstruction to the project's overall ability to progress. Factories around the world have been closing at different times, in response to their respective government regulations, which has in some cases postponed production of components and also made travelling for quality assurance purposes difficult. Where manufacturing can continue, social distancing measures have limited the number of employees permitted to work at a site, reducing capacity and the speed of production. This was noted as having caused delays in the delivery of components.

> *"We [also] operate a manufacturing facility and production at that plant has been severely impacted by COVID-19. Making sure we can maintain physical separation between the staff means certain functions take longer to do. And you can't have two people working closely together, so one person has to do something else, move away, and some tasks will take longer."* – CfD Developer

Around a quarter of developers, all in the construction phase, also noted that there were some challenges in importing certain components at ports. This slow down can be partially attributed to workers at the port not being classified as key infrastructure workers. In addition, multiple developers commented on increased border checks which slowed down the process. One developer explained how this resulted in increased administration costs and delays.

> *"When COVID-19 started, there were a lot more border checks for a while and this was taking things an extra week or two to get through. What has been a very liquid system became sticky, and businesses who were selling less and became*

> *cash constrained, wanted to maintain cash buffers. Instead of collecting shipping containers from the harbour the day they land, they might leave them for a week because they then didn't have to pay for the goods in the container until they collected it, so it bought them an extra bit of working capital."* – CfD Developer

ACT developers explained how COVID-19 impacted the supply of feedstock fuel. This was corroborated by a trade body who noted that the quality and supply of waste wood decreased dramatically with the closure of construction sites and recycling centres, pushing the UK to import waste from continental Europe.

> *"In terms of getting a supply for the plant, the market for getting fuel was more challenging, but it wasn't like our supply chain was dried up. We were able to get the volumes, but the quality was compromised. For example, more people were drinking at home and were putting glass in the garbage, causing broken glass which blocked up our plants."* – ACT Developer

All Offshore and Onshore Wind developers interviewed said they had experienced some forms of construction delays due to the lockdown measures. While these measures differed across regions, there was near consensus that the construction delay was resolved quickly once energy infrastructure workers were classified as 'critical workers[27]'. Being classified as a 'critical worker' allowed workers to travel to and from work as well as allowing their children to remain in schools, thereby contributing to the successful reopening of construction sites.

A few developers commented on the cost implications of preparing the site for the return of workers.

> *"Onshore construction was closed while we agreed with the Scottish Government that the project was critical for Scottish infrastructure. But there was also designing the construction site for the welfare of people onsite. It slowed down the work because fewer people could be onsite. We needed more toilets and office space to keep people more separated. We had to separate the porta-cabins rather than having them stacked. We had to spend a lot more money to do it."* – Offshore Wind Developer

Two trade bodies noted the generalised slow down extended to planning applications for new proposed projects in future Allocation Rounds, with decisions on applications taking longer than anticipated. It is currently unclear whether these delays will prevent any potential AR4 projects receiving planning permission in time.

> *"I think the main impact might be on the planning side of things. What we were seeing was the projects were mainly being impacted by delays to the planning process, to hold enquiries et cetera. And although that seems to have kind of now come back on track, I think that everyone's just been working double time to try and get things ready and for the CfD."* - Trade Body

BEIS/LCCC Response to COVID-19

Among respondents with projects still in the development phase, many expressed appreciation that BEIS and LCCC promptly signalled that COVID-19 would constitute a Force Majeure

[27] The government's guidance on critical workers, whose children may attend schools in England, can be found on the gov.uk website: https://www.gov.uk/government/publications/coronavirus-covid-19-maintaining-educational-provision/guidance-for-schools-colleges-and-local-authorities-on-maintaining-educational-provision

(FM)[28] event. They were also generally satisfied with the proactive and regular levels of communication with LCCC. In addition, some welcomed the implementation of flexible ways of working for developers to demonstrate they had met contractual obligations, such as the Operational Conditions Precedent (OCPs)[29] - for example, bypassing the OCP requirement for physical site visits through the provision of photographic and video evidence.

> *"BEIS and LCCC have been immensely helpful and have carried out [the COVID-19 response] in an extraordinarily professional way. We have had a number of calls on Zoom and they have shown that they are willing to do whatever is required. I don't habitually deal with Civil Servants, but I've been astonished and surprised by how efficient they have been."* – Remote Island Wind Developer

Around half of all developers noted that, whilst the proactive declaration of COVID-19 as a FM event was welcome, the administrative burden of attributing project delay to COVID-19 was overly onerous. Developers felt that COVID-19 was an unusual FM event because delays are due to multiple ongoing consequences, rather than one single event. In isolation, these smaller impacts, such as the loss of subcontractors, implementing social distancing measures at a site, or a reduction in fuel quality, may have been tolerable, however, they lead to an accumulation of challenges.

> *"COVID-19 itself is not what was thought of as a FM event when people drafted the CfD contract. Usually FM events are clear events, to which you can then attribute all the consequences. COVID-19 is a grey area, and its effects are so multiple and indirect. We understand that LCCC will not be able to grant us anything unless proven legally. And therefore, it's kind of an open dialogue and trying to preserve future claims, but it's not helping us at the moment."* – Offshore Wind developer

Over a third of developers interviewed felt that the bureaucracy associated with proving COVID-19 as an FM event on an ongoing basis was challenging, with some developers stating they had to catalogue multiple indirect challenges every few weeks. Challenges included the requirement to obtain formal letters from Grid Network Operators to verify delays were attributable to COVID-19, even if they were willing to put that information in an informal email.

> *"BEIS/LCCC said they would be practical to any constraints, but in reality, it was very difficult to record the combined cumulative effect to the level of granularity that LCCC said they were expecting. The burden of proof was almost too much to run around cataloguing every incidence where COVID-19 tacked on a couple of days onto this or a couple of days onto that.*
>
> *I don't know if this was trying to galvanise us towards a deadline, but the indication I got that was that we would have had to have a real silver bullet justification to get an extension. This idea of COVID-19 just generally slowing things down wasn't going to fly."* – Energy from Waste Developer

[28] https://www.lowcarboncontracts.uk/sites/default/files/2020-04/Covid19%20impacts%20on%20CfD%20Generators%20-%20FINAL_1.pdf
[29] https://www.lowcarboncontracts.uk/sites/default/files/OCP_evidence_requirement_guidance%202.pdf

Impact of COVID-19 on project finance

This section explores the extent to which COVID-19 has altered risks for investing in renewable energy development. Views of developers and investors interviewed were mixed. Developers of projects that were at a more advanced stage of construction, or already operational, anticipated that COVID-19 will have little or no impact on their project's financial case. Most developers of projects yet to be commissioned stated COVID-19 had raised some new risks, but these were less significant than other wider market barriers.

> *"If I was to write a list of the impacts on our financial model, COVID-19 is far down. There are urgent and significant uncertainties, primarily created by the Ofgem charging review and lack of certainty on charging. COVID-19 doesn't feature on significant project risks. It's listed, but not the priority issue."* – Remote Island Wind Developer

Of those who said COVID-19 had an impact on their project's financial case (or anticipated it will do), most were unable to quantify with certainty what the impact will be. In part due to either uncertainty over what relief will be provided to their firms or wider economic implications out of their control. One developer expected a diminished financial return due to ongoing delays and increased development costs.

> *"Basically, we are facing materialising risks now in our contracts. So, it inevitably will diminish our financial return. By how much is difficult to say yet."* – Offshore Wind Developer

One ACT project developer felt COVID-19 was a contributing factor in leading to an investor deciding not to finance the project. This investor delayed reaching a Final Investment Decision while they monitored the impacts of COVID on their overall investment portfolio and eventually decided to invest in alternative projects which were perceived to be less risky.

> *"Investor appetite reduced during COVID because they needed to wait and see where they were going to deploy additional capital to make their existing portfolio financially secure. When you've got less money to deploy, you'll pick the higher value projects. So instead of being in the middle of the list in terms of desirability, they said 'it's a relatively complicated technical project, and the returns aren't great. I'll do another one instead'."* – ACT Developer

Suggestions for improvement in supporting CfD developers

Most felt unable to offer specific recommendations on how the BEIS/LCCC COVID-19 response could have been improved. However, for developers who had demonstrated they encountered delays to development work (constituting a FM event), it was suggested that allowing an overall period of extension would have been more efficient than having to demonstrate multiple individual challenges were COVID-19 related each time.

> *"We were constantly having to negotiate with LCCC to get extensions and have very regular communication on progress, when a more productive relationship would have been to say, 'just have another year and a half to get the plant up and running'. We have a fixed-term contract anyway* [e.g., 15-years from commissioning date]*, so the threat of termination didn't seem proportionate"* - Energy from Waste Developer

Additionally, one developer suggested that LCCC could provide a form of standardised template that all contractors could use in reporting information for Operational Conditions Precedents, and to generally aim to speed-up responses to FM claims.

> *"It would be good for LCCC to have a standard set of requirements for contractors, for the OCPs, and then the private sector can just use that as an annex in their contracts with their suppliers. Working to give reassurance for developers that they will be able to continue working, that the top up payments will be paid, and to have a quicker response on FM claims."* – Onshore Wind Developer

5. Forward look on support for renewables deployment

Key findings:

Most developers had positive views of the CfD scheme and its future role in supporting investment in renewables development. Developers of some less established technologies (such as Tidal and ACT) were less positive due to the requirement to compete on costs with other more advanced, lower cost technologies.

The government's commitment to net zero emissions by 2050 and sector specific targets (such as for the Offshore Wind Sector Deal) were seen as generally positive, although their benefits for wider technologies (non-Offshore Wind) ultimately depends on future policies that are put in place to support their deployment.

Views on changing CfD scheme design or award criteria in future were mixed. For example, there was no overall consensus on whether to include factors unrelated to strike prices as criteria on which to award contracts (e.g. levels of innovation or wider environmental benefits).

There was general consensus that reform of Pot structure for future Allocation Rounds was beneficial (e.g., separation of Offshore Wind from other less established technologies), although suggestions on the optimal design of Pot structure were mixed. Suggestions for improving the scheme in future included increasing the frequency of Allocation Rounds.

Introduction

This section provides an overview of respondents' views towards the future role of the CfD scheme in supporting renewables deployment, potential ways of reforming scheme design as well as views on wider forms of government support. The section also presents the views of stakeholders on potential future risks for investors, as well as the prospect of deployment at scale without government support.

Prospects for future investment in renewables

Overall, respondents presented a positive view of the CfD scheme and the prospect of continued increased investment in the UK for renewables deployment at a larger scale. Most respondents considered the investment environment to be positive and the government's vision for the wider renewables sector to be clear.

> *"There are a lot of things they monitor* [investors in Offshore Wind]*. There is nothing they've seen so far that would prevent them from investing. On the*

contrary. Government's target of net zero, and the role wind can play in the green recovery is a stimulus" – Offshore Wind developer

One noticeable exception was respondents representing the ACT sector. The main issue is the ability of ACT projects to raise capital.

"[On the prospect of future investment] Awful, if I'm being honest. The feedback we got from quite a few investors is: 'I know your technology works. However, when I take that to my investment committee, they will look at it and say there are six ACT companies that have all failed. Why is this one different? Are you willing to risk your personal credibility in this firm by pushing this ACT investment essentially against the flow of the stream?'. It doesn't matter how good somebody is unless he is from a company that can afford to invest 150 million pounds to get a full-scale plant." – ACT Developer

Impact of government setting targets

There was general consensus that setting targets on future levels of generation from certain types of technology was positive, including commitments in the Prime Minister's Ten Point Plan to produce 40GW of Offshore wind, including 1GW of floating Offshore Wind, by 2030. However, the impact of target setting in itself depends on the extent to which it is combined with policy or regulatory measures to enable acheivement of the targets.

"Targets are helpful. They do drive market in the right direction, but unless meaningful policy is there, they are limited in what they can achieve. For Offshore Wind, there was meaningful policy, so you have both target and policy. Just putting a target without policy will be less effective." – Trade Body

Developers of other technologies commented on how target setting improves confidence in the UK renewables market, but there was also agreement that setting a target alone would not translate into business decisions.

"Renewable energy plants will be built where it's economically viable. Government can put up all the targets they want, but without the necessary and correct subsidy structure, it won't ever happen." – ACT Developer

Trade bodies noted that the overall government target for reducing carbon emissions to net-zero by 2050 was encouraging, but further more specific initiatives are required to support investment in less established technologies.

"The Energy White Paper and Ten Point Plan have been very welcome and give a clear signal on where investment should be going. However they remain high level strategy documents, and for the last five years, we've only had high level documents without policy and there is only so long investors and developers will be reassured with high level documents. We also need the commercialisation funding to get over the valley of death which has been the UK's problem in the past few decades." – Trade Body

Offshore Wind developers also commented on how the net-zero targets were seen as helpful, but further regulatory reform is needed to address specific barriers. In December 2020 the

government published a Call for Evidence[30] to seek views on how industry is approaching the financing and deployment of renewable technologies to meet net-zero targets, and how this may change in the future.

> *"Net zero targets are good news, but the missing link is how to deal with negative pricing and cannibalisation of pricing. It is not clear how these problems will be solved, especially with margins close to zero."* – Offshore Wind developer

Key risks for future investment

Despite the general positive outlook, respondents raised concerns about certain risks affecting the business case for future projects. These include risks related to fluctuations in grid connection charges and to the changes in the rules around negative pricing. Respondents noted the way grid connection charges are calculated creates a locational signal to the market (as charges vary according to the location). However, they argued that they could not respond to this signal once the construction had started, so they have no choice but to absorb the financial loss of fluctuations in these charges.

> *"At the moment, our projects are not for risk averse people. They are some of the riskiest projects that our company, as an experienced early-stage developer, has ever encountered. Our grid charges have fluctuated to break our model multiple times. We have been patient, but I don't think many people would develop in the current context. It's not for the fainthearted." – RIW developer*

> *"Where we see the most uncertainty, is the significant level of uncertainty within the regulatory aspects of the UK market and specifically those of transmission charging. There's significant uncertainty around the charges at the moment. The UK had a very good regulatory regime. It's very clear, it is very certain, and to see this uncertainty creeping in already begun to raise a few more questions than we are used to."* – Offshore Wind developer

Changes to the way negative pricing is handled within the CfD framework were raised by respondents. Previous rules allowed CfD generators to receive difference payments in up to 6 consecutive hours of negative pricing when day-ahead prices are negative. In future CfD contracts, generators will not be paid for any settlement period in which day-ahead prices are negative. Respondents raised concerns about the potential impact on the financial case for projects and how investors will perceive it.

> *"I can see why BEIS might put incentives on generators to coexist with an efficient market. There's that period where generators may continue to generate in a negative pricing period. And I can appreciate why they would want to remove that. I do have specific concerns, however, with that proposal to remove all protection from negative pricing. Whilst, yes, I appreciate that would help solve the problem, what it does do is suddenly expose a project to a significant amount of risk around negative prices, which they wouldn't have had before. And what's important here is that there's no maximum downside. Technically there could be an unlimited amount of negative pricing and that's very, very difficult when looking at an investment case."* – Offshore Wind developer

[30] The path to meet net zero emissions by 2050 was the subject of a Call for Evidence, launched by BEIS, in December 2020. https://www.gov.uk/government/consultations/enabling-a-high-renewable-net-zero-electricity-system-call-for-evidence

It was noted that enabling greater investment in energy storage would give flexibility to generators while, at the same time, meet the objective of reducing costs to the consumer.

> *"I think we're going to end up in certain times of day on very negative territory. We saw bits of that with COVID-19, but I think it would happen without COVID-19, frankly. When you have a storm at the weekend or a sunny weekend, you see that happen. And what I think what is missing is a CfD for storage, long duration storage or flexible generation. So, pumped-hydro storage, hydrogen, these technologies have the ability to draw power during times of heights of supply and to discharge during periods of low supply. I think that is the missing piece."* – Onshore Wind developer

One developer also raised the point that different technologies have different capacity to rapidly respond to short-term prices.

> *"I think that would become start to become an issue for investors, particularly in ACT projects where you can't turn them off. You can start a wind turbine quite quickly, so you can stop producing power when the price is negative. You can't turn off something that's running at 1000 degrees within an hour - it takes three days for the unit to cool down. And we have to finish our production cycle."* – ACT developer

Respondents were asked about the implications of the UK's departure from the EU on the future outlook for investment in renewables. Some respondents thought that prior to the Trade and Cooperation Agreement being confirmed, there was a lot of uncertainty. However, the general consensus was that the industry had time to prepared itself for any implications, and no long-term negative impacted on the case for investing in UK renewables is expected.

> *"For projects that were about to import quite a bit of turbines, it was a concern. We had to provide contingency for it, but it turned out not to be needed."* - Offshore Wind developer

Short-term impacts on the importation of wind turbines were mentioned by Offshore and Onshore wind developers (mainly due to new importing processes in place) but those are seen as manageable and are expected to be resolved soon, once suppliers and jurisdictions adapt to the new procedures.

> *"We've seen a couple of contractors struggle because there were a couple of German suppliers who immediately after the new year, when the new paperwork came in, realised that they weren't prepared to deal with the paperwork, and had to stop shipping into the UK. That made it very difficult for a couple of contractors who had previously been told that it would be fine. So, I think that that's been a risk."* - Onshore Wind developer

Other risks noted include uncertainty around whether there may potentially be new import tariffs on the supply chain. In addition, some respondents reported uncertainty over their revenues due to changes in the Intermittent Market Reference Price (IMRP)[31].

[31] Under the CfD, when the reference price for the electricity generated by a CfD Generator is below the strike price set out in their contract, LCCC pays to the CfD Generator to make up the difference between the reference

Suggestions on potential future changes to the CfD scheme

Auction frequency

A common theme across the investors, developers and trade bodies interviewed was the suggested need for more frequent auctions. Many stated that the CfD has proven to be effective at driving down the cost of renewable energy technologies but that there is a limited route to market without the CfD. Therefore, respondents felt that the deployment of large-scale renewable energy projects is limited by the frequency of auctions (noting that Phase 2 of the evaluation found that the current auction mechanism is effective in driving competition).

> *"Anecdotally, you hear about the wall of money which needs to be released to drive net-zero, which has been pent up over the years from the investment community. They are keen to invest, but the pipeline of projects just isn't there and the CfD only happening every two years is a part of that problem. If there are more regular auctions, investors would be coming behind [projects] because they [now] understand the mechanism."* - Trade Body

Another trade body also pointed out that the infrequency of auctions also has a knock-on effect on investment decisions elsewhere in the supply chain. Suppliers are unlikely to invest early enough in the manufacturing process without a signed CfD, creating a rushed timeline once the CfD is signed.

> *"The supply chain want certainty, but developers can't sign contracts until they get a CfD; roughly 18 months before they start construction. Well, this is insufficient time for the supplier to take an investment decision to build a factory. The two are misaligned in terms of timing."* – Trade Body

Criteria for award of CfD contracts

Developers were asked whether or not additional criteria unrelated to cost should be included when assessing applications for a CfD. Most developers indicated that they would be concerned that introducing multiple policy objectives may result in overcomplicating the process, as well the objectives of the CfD scheme.

> *"I would oppose it [including additional criteria] because you have got too many policy objectives to be met. It just makes it impossible. Instead of creating a scenario where all objectives are met, you create scenarios where none of the objectives are met."* – Solar Developer

An exception to this were respondents from the Energy from Waste and ACT sectors. Echoing findings from Phase 2 of the evaluation, respondents felt there was some disconnect between government policies prioritising deployment of renewable electricity at least cost to the consumer and cutting down greenhouse gas emissions from waste.

> *"Defra says they really want to reduce GHG, to get rid of waste from landfill and to deploy the waste in more environmentally beneficial ways. And then BEIS says the policy is to get the cheapest renewable electricity. You know, if the waste goes to an incinerator, the emissions are a lot higher and there's hardly any*

price and the strike price. The reference price for intermittent generators (such as solar and onshore and offshore wind) is the IMRP. Because of UK departure from the EU, the UK left the Internal Energy Market (IEM) in 1 January 2021, and therefore, LCCC changed the IMRP methodology.

power generated. Or it could go to landfill where it leaches methane for the next 60 years." – ACT Developer

Pot structure and allocation of technologies

There was consensus amongst the developers that some form of pot separation and ringfencing should occur, though views on the precise design of this varied amongst respondents.

Several developers commented on the lack of Marine and Tidal projects being awarded a CfD, despite being included in Pot 2. This was attributed to their inability to compete with more mature technologies like Offshore Wind on price. Similarly, many developers felt that Floating Wind had now matured enough to be commercially viable but had concerns over its ability to compete with other Pot 2 technologies.

"I think it's important that some support remains for Pot 2 developing technologies. Pot 2 still contains a number of technologies that have been successful at achieving record low prices in AR3. I think it's important to be sure that they are still developing technologies. I mean, they [Offshore Wind] won the £40/MWh and were competing against Tidal and Wave, all of which have a strike price of above £100/MWh. Those [Offshore Wind] technologies should now be considered and established and moved into Pot 1." – Offshore Wind Developer

This issue has been addressed in Allocation Round 4, as the new Pot 3 exclusively includes Offshore Wind.

One developer also commented on the need for a clearer signal on whether or not Combined Heat and Power (CHP) technologies are supported by government policy.

"At the moment, CHP projects compete in technology pots with other similar projects which don't have CHP. If BEIS wanted to incentivise CHP a bit more, they could provide a clearer signal [such as] a separate pot [in which] CHP could compete against themselves." – EfW Developer

There was also the suggestion of applying the CfD in a new, innovative way through a 'CfD-lite' scheme to enable smaller projects to fill a gap in the market.

"What about a CfD-lite which could apply to smaller projects? There's a gap in the market for the 1-5Mw size of projects where the Feed-in Tariffs used to be. Could that size be enabled with a CfD-lite mechanism which streamlined the legal and complicated logistics?" – Trade Body

Most developers felt that some form of ringfencing of capacity or budget allocation towards less established technologies would be welcomed. One point noted in the Phase 2 evaluation report was that the fixed 6GW capacity cap at AR3 had resulted in the underutilisation of available budget. "Soft" capacity caps, which permit the project that breaches the cap to proceed, are being introduced in AR4; these may help to address this concern. Respondents suggested that some level of provision should be made for flexibility in caps in overall Allocation Round capacity, or for any ringfenced technology, whereby unused capacity may be redeployed to other technologies in order to ensure the maximum benefit from available budgets.

Introduction of a price floor

Developers were asked for views on implementing a hypothetical 'price floor' model of payments for generators. In a price floor model, generators would be guaranteed protection against price drops below a minimum 'floor price' but allow generators to benefit from an uptick in power prices once any top-up payments have been repaid. Of those interviewees who favoured the introduction of a price floor, they commented on how the guaranteed cash floor and potential upside reduced the risks from power price fluctuation. However, they still pointed to challenges in accurate forecasting.

> *"I think banking a project in 20 years of merchant is a very challenging proposition. If you give some people a floor, that's fine. But the floor has to be sufficiently high for the project to be financeable. I think it's challenging because you're asking people to make an assumption for a long term over something that people have difficulty forecasting even three years, four years from."* - Investor

Most developers did not view the introduction of a price floor favourably, citing concerns of overcomplication as developers were already comfortable with the system in place and it has proven to be successful. Similarly, one developer suggested that the introduction of a price floor may lead to an increase in speculative bidding in an effort to win auctions and potentially benefit from the upside.

> *"In reality, such long-term forecasts on merchant prices would not lead to the most competent developer winning the auction, but the most bullish one. It's a bit biased towards the most aggressive view on the market power prices, which I think developers don't have any further insights from anyone else."* – Offshore Wind developer

Seasonal difference in reference price

Respondents did not express particularly strong views either in favour or against the idea of introducing seasonal differences in the reference price. Some noted that seasonal differences from year to year would be challenging to get investors and developers accustomed to.

> *"As long as the seasonal differences are clearly defined, it could be OK. But I think it creates some a little bit of volatility in there if the seasonal difference is different from year to year. It would have to be something that's very predetermined and formulaic for people to get comfortable with."* - Investor

Deploying renewables at scale without support

Views were sought on the potential for renewables to be deployed at scale without the CfD in the future. In both Phases 1, 2 and 3 of the evaluation, the majority of financial investors, developers and trade bodies interviewed felt that without a CfD, or other form of price stabilisation support, no technology will be able to deploy at scale. According to respondents, forecasts of future price do not provide enough certainty to allow the type of long-term investment that is needed to meet targets for decarbonising the power sector, or will increase the cost of capital for renewables.

> *"There's discussion around 'Is there going to be a market for subsidy free renewables?'. If you went back just over 12 months ago, the market was moving*

> *in that direction. And that's true in UK and Europe. I think the impacts of the pandemic and seeing how the power prices sharply fell, I think this has made people realise that investing purely exposed to market power price risk is not straightforward."* – Investor

> *"When you look at the sort of analysis of power forecasts, every quarter or so often, they just change the whole basis of their forecasts. So, the idea of being able to use those forecasts on a very long-term basis is quite challenging. There is no doubt that if we want to mobilise capital at scale and importantly, at a reasonable cost of capital that ultimately flows, then, yes, it needs some form of revenue support."* – Investor

> *"The forward electricity price is not sufficient to support an investment decision on a multi-billion euro project."* – Trade body

A few respondents felt that some Offshore Wind, Onshore Wind and Solar projects could deploy without CfD, selling energy through corporate PPAs. However, the availability of quality PPAs is a constraint. Although the corporate PPA market is growing, it is widely seen as too small for the scale that is required to substitute the CfD scheme.

> *"Not in scale. If you're going to take every Offshore Wind that the UK. has planned and we're asking that to go through a private offtaker, I think it would be challenging to find people to take on that power."* - Investor

> *"There are talks about corporate PPAs but getting the kind of size that is required for an offshore wind project is very difficult. And whilst we're beginning to see a couple here and there, even if they are of the magnitude required, which I think they're very few and far between, we will run out of those companies who are able to deliver in those sizes."* – Offshore Wind developer

Finally, a few pointed out that, for Offshore Wind, at current strike prices the CfD is no longer a subsidy, rather a price stabilization mechanism. Because this feature has a value for developers and investors, strike prices could drop below average market prices, becoming a revenue generator for the government.

> *"The biggest value coming out of the CfD at the moment is long term price certainty and matching with the debt stream. So, you could get situations where the CfD the strike price is below the expected future average energy price. So, in fact, awarding a CfD will provide benefit to the Treasury instead of cost to the Treasury."* – Solar Developer

Views on Offshore Transmission Network Review

The Offshore Transmission Network Review (OTNR) is reviewing how the offshore transmission network is designed and delivered[32]. The review acknowledges that the current practice of leaving developers responsible for building the requisite transmission assets has played a vital role in maturing the development of the Offshore Wind sector in the UK. However, the review also acknowledges that in the context of increasing targets for Offshore Wind, constructing individual point to point connections for each Offshore Wind farm may not

[32] https://www.gov.uk/government/groups/offshore-transmission-network-review#background

provide the most efficient approach and it therefore is reviewing whether a more coordinated strategy is required.

Trade bodies and Offshore, Onshore and Remote Island Wind developers were asked for their views on the implications of the OTNR. Around two thirds of respondents were either positive or somewhat positive about the implications of the OTNR and one third gave no particular view. In general, there was significant concern over the rising charges for developers as well as uncertainty over the discrepancy of those charges dependent on region.

> *"Anything which will introduce meaningful competition and downward price pressure in the grid and networks area is very much welcome. Handing out very cheap contracts for Offshore Wind but then spending billions to upgrade the network results in the consumer paying for them in different ways. The whole systems costs aspect of each project needs to be taken into account."* – Trade Body

A few developers discussed how charges for grid network upgrades had increased in Scotland without adequate support for developers to manage the charges.

> *"We have absolutely no choice but to absorb the charges and they continue to go up. There's a highly complex methodology about how they do the charging, but the way the methodology is derived has led to this increasing disparity between different parts of the country."* – Onshore/Offshore wind developer

Developers felt that the uncertainty surrounding charges can create uncertainty in estimating future project costs, because the costs can grow and developers are locked into paying them due to their CfD commitment.

> *"If you've got such uncertain forecast coming up, you can end up in the scenario of a winner's curse. Whoever goes with the best forecast has enough of a differential so that project is likely to win. But what happens if those forecasts become the worst-case scenario? We made a decision when we bid into to the CfD, then we have seen change and we're [already] committed and we can't not build. Offshore wind cannot respond to the locational signal and cost prospectively once it's been built. I appreciate all the regulatory risk that's part of the CfD. But there's a difference between manageable regulatory risk and what comes to be seen as a very uncertain regulatory market."* – Offshore wind developer

One RIW developer noted that currently, Offshore Wind had been the only technology able to secure grid connections despite RIW, Marine and Tidal[33] being developed in the same region.

> *"We have Marine, Tidal, Offshore Wind and RIW being developed closely in a resource-rich area and yet Offshore Wind is the only technology able to secure grid connections. We need an 'interconnected' approach to deal with this."* – Remote Island Wind developer

[33] These Marine and Tidal projects do not have a CfD.

6. 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 a counterfactual of the previous RO scheme, the evidence from this evaluation suggests the CfD scheme is meeting the above objectives.

Interviews with developers and investors provided strong support for the theory that the CfD's fifteen-year price stabilisation contract reduced risks for investors by reducing exposure to wholesale price volatility, 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.

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), and UK cost reductions are broadly in line with those seen globally. Finally, as more CfD projects have been implemented over time, investors have become more comfortable with the risks, attracting yet more investor institutions and more attractive rates.

The reduction in costs to the consumer due to the CfD projects awarded contracts in AR1, AR2 and AR3 is estimated at **around £3bn**, with a range of £2bn to £5bn in the scenarios tested (in comparison with supporting the same projects under the RO). In models 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 £16bn in the scenarios tested.

The impact of the CfD scheme in supporting investment and cost reduction in Offshore Wind is seen by developers as its main success. However, the extent to which the CfD scheme has increased investment in other technology types 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. For example, developers of Wave and Tidal technologies have not been awarded a CfD contract, and there has not been an Allocation Round for Pot 1 technologies (including Onshore Wind and Solar), since the first Allocation Round in 2014/15 (although these technologies will be included in Allocation Round 4 in 2021).

The COVID-19 pandemic affected developers of CfD generation units in different ways. Developers of generation units that are already operational felt COVID-19 had little to no impacts for them. Although the wholesale price of electricity dropped following the onset of the

pandemic in 2020, the CfD top-up payment mechanism meant they were able to receive expected revenues. Among developers of projects in the pre-operational development phase, the most common impact of the COVID-19 pandemic was a general 'slow down' of construction activity due to a combination of social distancing measures, as well as supply chain bottlenecks.

Developers' views on how BEIS/LCCC responded to the pandemic were mixed. Many expressed appreciation for the ways in which LCCC worked quickly with developers to review risks of delay, and also to ensure that timely top-up payments were made to CfD generators. Some felt the paperwork associated with demonstrating that delays were due to a force majeure event caused an administrative burden and could have been streamlined.

Looking to the future, most developers had positive views on the role of the CfD scheme in continuing to support increased investment in renewables development. Developers of some less established technologies (such as Tidal and ACT) were less positive due to the requirement to compete on costs with other more advanced, lower cost technologies. There was a general consensus that increasing the frequency of Allocation Rounds would provide more certainty to developers and investors in forward planning projects and that Offshore Wind should be separated from the Less Established technologies Pot (which has now been implemented for Allocation Round 4).