D2.1, September 2019

Auctions for the support of renewable energy in the UK

Updated results and lessons learnt

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D2.1, September 2019, Auctions for the support of renewable energy in the UK

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Contents

Table of tables

Table of figures

1 Background to this study

This report serves to restate and update the findings of AURES report D4.1-UK published in March 2016 (Fitch-Roy and Woodman 2016)[1]. While the fundamental design of the UK auctions system remains largely unchanged, substantial shifts in the policy context and the additional experience and data from two further auction processes (one completed, another in progress at the time of writing) warrant an updated evaluation and report.

The UK has been a frontrunner in the use of RES auctions. From early experiences with the Non Fossil-Fuel Obligation (NFFO) auctions in the 1990s to the current auction system, first announced in 2011, the use of competitive allocation mechanisms has been central to the UK's approach to supporting new renewable electricity generation projects.

However, the use and design of renewable auctions remain a source of policy debate and discussion in the UK. For example, the potential for a combination of auction dynamics and the application of a cap on the volume of 'fuelled' renewable technologies led to higher than necessary support costs being awarded to some projects has been the subject of an enquiry by the national audit office (NAO 2018).

This remainder of this report adopts the following structure:

- Section 2 provides an updated overview of the UK electricity sector
- Section 3 outlines the key features of the UK RES auction system, including recent rule changes
- Section 4 updates our earlier evaluation of the programme in light of recent auctions
- Section 5 concludes

[1] http://auresproject.eu/publications/auctions-renewable-energy-support-in-the-united-kingdom-instruments-and-lessons-learnt

2 Overview of the United Kingdom electricity sector

The UK has a population of 66 million (Office for National Statistics 2018) and in 2017 its final energy consumption was 149 Mtoe. Electricity made up 18.5% of the UK's final energy consumption and the UK total generating capacity in 2017 is 103.5GW (BEIS 2019c; Ofgem 2018). The UK has liberalised electricity generation and retail markets. However, despite some recent trends increases in independent electricity supply and a general trend away from vertical integration, electricity generation and supply remains moderately concentrated with the domestic and non-domestic electricity markets in GB (the UK excluding Northern Ireland) exhibiting an Herfindahl-Hirschman Index (HHI) of 1,034 (Ofgem 2018). However, this HHI is well below the threshold of 2,000 the European Commission deems to indicate a highly concentrated market and places GB among the least concentrated European markets (CEER 2018) . Together, the six largest retailers account for more than 76% of domestic electricity supply and the eight largest generation companies account for 71% of UK generation volumes (Ofgem 2018). A surge in new entrants to the UK electricity retail market has slowed since 2016 as greater price volatility and increasing supply costs have put smaller retailers under pressure. From 2016 onwards, a number of such independents have exited the market, either by choice or the revocation and reallocation of the supply license by the regulator.

The expansion of renewable electricity has been supported by public policy since 1990. The Non Fossil Fuel Obligation (auction) ran from 1990 – 1998. This was replaced by the Renewables Obligation (RO) (quota) in 2002. Following a slow start in encouraging renewables deployment, changes to the design of the RO in 2008/09 led to a greater uptake, largely as a result of investor risk being reduced. Following some media and public opposition to the costs of subsidising renewables, and the unexpectedly fast growth of the solar pv sector, the ruling Conservative Government decided to exclude the more publically unpopular technologies from further support. Large scale solar (>5MW) has been excluded from RO support since April 2015 and onshore wind from April 2016. The RO was closed to all new projects in 2017. Its replacement - the Contracts for Difference scheme - is an auction mechanism, and the first round of bidding took place in late 2014, with the results announced in February 2015. The exclusion of onshore wind with planning consent from the third allocation round (2019) has been challenged in the courts by Banks on the grounds that preventing them from bidding will not result in lowest cost decarbonisation, and therefore that it contradicts stated Government policy (Banks Group 2019). A legal decision is yet to be made on the case.

Small scale renewable generation (<5 MW) was supported by a Feed in Tariff from 2010, although this scheme closed to new projects on 31 March 2019. Due to changes made to the licences required to operate an electricity supply business, from 2020, sub-5MW installations will be able to access export tariffs under a net-metering scheme known as the Smart Export Guarantee (HM Government 2019). However, the legislation only compels suppliers with more than 150,000 customers and does not specify a minimum level for the tariffs offered. The CFD scheme is open for projects under 5 MW if they are an eligible technology.

The UK enjoys a location on the windy Atlantic fringe of Europe and has excellent renewable energy resources. Under EU Directive 2009/28/EC, the UK is bound to meet 15% of energy consumption across all sectors from renewable sources by 2020 which translates to approximately 30% in the electricity sector (DECC 2009). Recent growth in renewable electricity has been strong, largely driven by on- and offshore wind, and in 2017, renewables accounted for 29.3% of electricity generation. However, overall renewables supplied only 10.2% of final energy consumption, with slow progress in heat and transport making achievement of the 15% target seem unlikely by 2020 (BEIS 2019c).

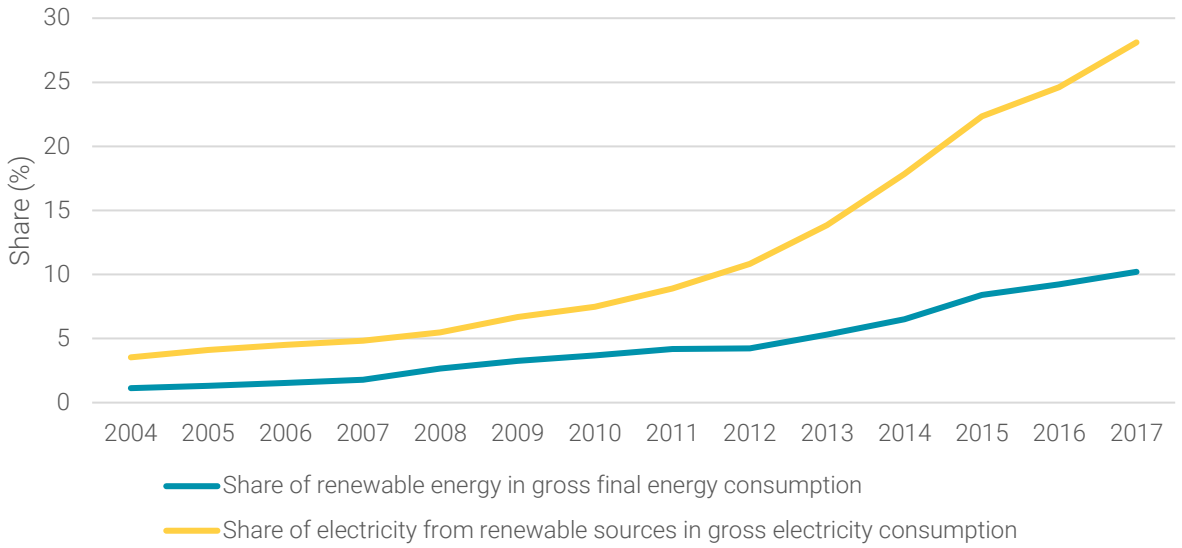


Figure 1: UK progress towards its Renewable Energy Directive 2020 target (Eurostat Code: T2020_31) and increasing proportion of electricity from renewable sources (Eurostat)

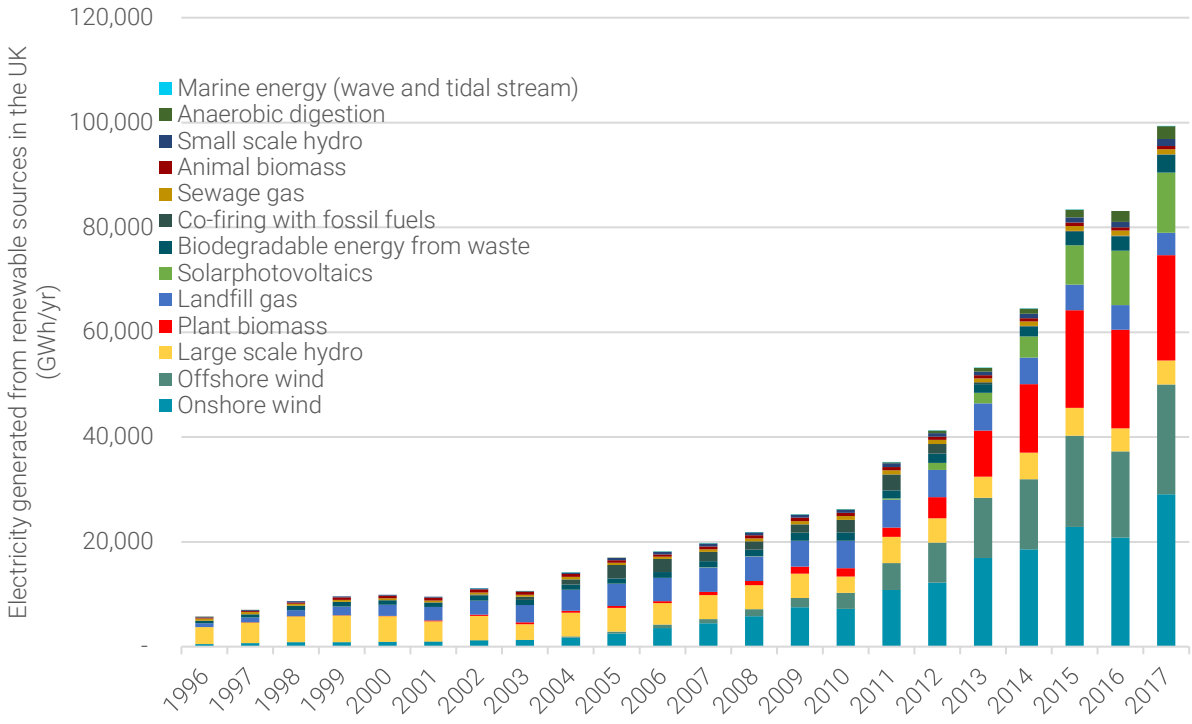


Figure 2: UK renewable electricity generation (GWh/yr) (Source: Digest of UK Energy Statistics table 6.4)

The UK as an island is largely electrically isolated from mainland Europe. However, the UK does have 4GW of interconnection capacity with France, the Republic of Ireland, Northern Ireland and the Netherlands. Despite the decision taken by referendum in 2016 to leave the European Union more interconnectors are planned in the future, possibly to Belgium, Norway, France and Denmark, meaning that the UK could become increasingly integrated into the wider European electricity network.

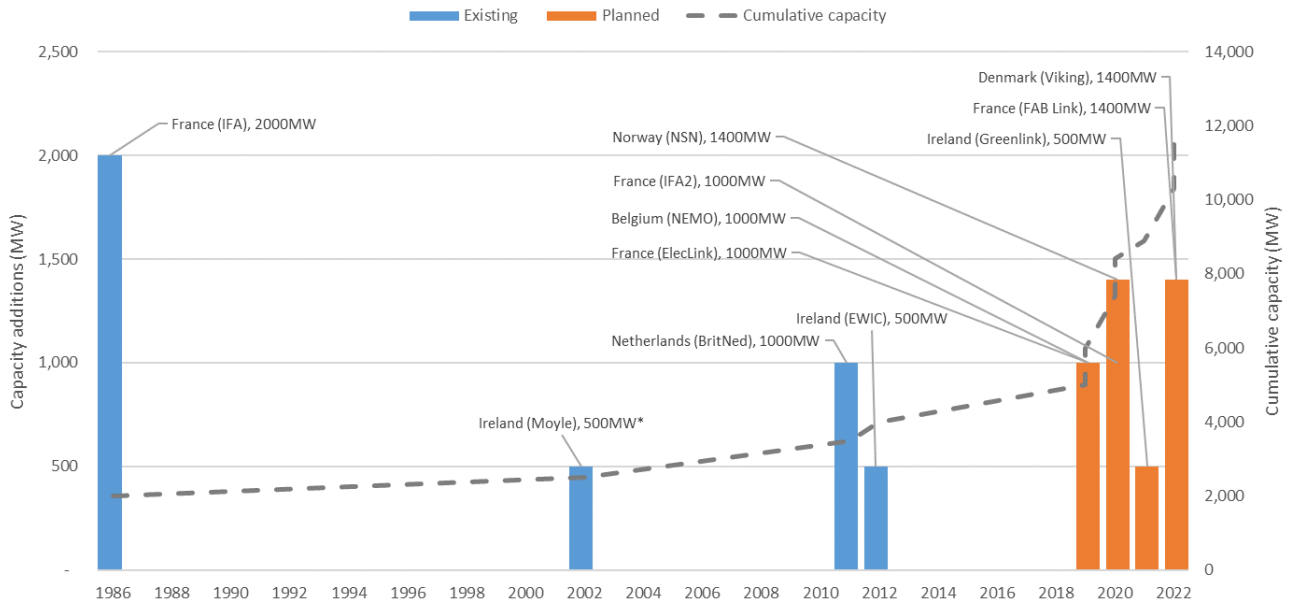


Figure 3: Current and planned UK-mainland electrical connection projects (data source: Ofgem 2019)

3 Characteristics of RES-E auctions in the United Kingdom

The CfD auctions held in the UK are multi-unit, sealed-bid, uniform price auctions for 15 year contracts for generation. The auction involves the Government setting technology-specific ceiling prices known as 'administrative strike prices' intended to represent similar investor returns to the previous support mechanism, the Renewables Obligation (DECC 2013). Participants in the auction are required to bid at or below these ceiling prices, with lowest bidding projects being awarded contracts. The Government can also set technology capacity minima and maxima. The auction system runs two independent tracks with dedicated budgets: "pot 1" auctions include established technologies such as onshore wind and solar PV while "pot 2" auctions include less established technologies such as offshore wind. Within the current framework, the two auctions can be held independently or simultaneously. There is also a third technology Pot – Pot 3 – for biomass conversion though this has yet to be included in an auction.

Auctioned volumes are determined by strict budgetary constraints with some notable features arising from the way the budgets are apportioned. Budgets are capped year-by-year rather than the overall spending implications of the auction. Essentially, in addition to meeting the overall affordability criterion, a winning bid must not breach the budget cap for any of the years for which a cap has been set. Not knowing into which years other projects may apply may complicate the assessment of the likely overall competitiveness of a bidder's project. See Section 3.3 for a more detailed description of the auction process.

3.1 Government goals

The broad objectives of the CfD auction are closely linked to the Electricity Market Reform (EMR) process started by the UK Government in 2009 and which aimed to deliver the three familiar objectives of ensuring security of supply, decarbonising the electricity system, including meeting its EU RED target, and doing so at least cost to consumers.

Coupled with this is the Government's desire to create an attractive environment for investment in new nuclear plants. Under EU State Aid rules, nuclear stations would not have been able to be awarded a subsidy unless other low carbon technologies were equally subsidised. As a result, the CfD system is applied to both renewables and nuclear power, although the price for the contract awarded to the only nuclear station currently under construction was determined through bilateral negotiation between the Government and developer, EDF, rather than through a competitive bidding system.

The original policy objectives of the CfD auctions for renewables were primarily to introduce competition within technology groups as a means of limiting producer surplus and so limit the cost to consumers of supporting renewables generation. There is an intention to move towards technology neutrality in the future (unspecified date) (DECC 2011). More recently, however, the auctions system has become much more closely aligned to the UK's Industrial Strategy, particularly in the emphasis given to one of the key sectors targeted in the Strategy, offshore wind (BEIS 2017c).

3.2 The contract

Auction winners are offered a Contract for Difference (CfD), a private-law contract between the generator and a publicly-owned corporation known as the Low Carbon Contracts Company (LCCC). CfDs are in effect a financial instrument which guarantees additional revenue to those from selling power into the wholesale power market. Additional payments per MWh are calculated as the difference between the contract or 'strike price' (determined through the auction) and a bespoke index of the wholesale market price known as the 'reference price',[2] (Figure 4). In instances where the wholesale power price is higher than the strike price, the contract requires that the generator makes payments to the contract counterparty.

[2] A seasonally calculated 'baseload price' for dispatchable generation and a day ahead hourly price for 'intermittent' generators: See Table 2 for more detail.

The contract counterparty, a government-owned independent corporation, oversees a system of levies through which the overall support costs are recouped from consumers via electricity suppliers.

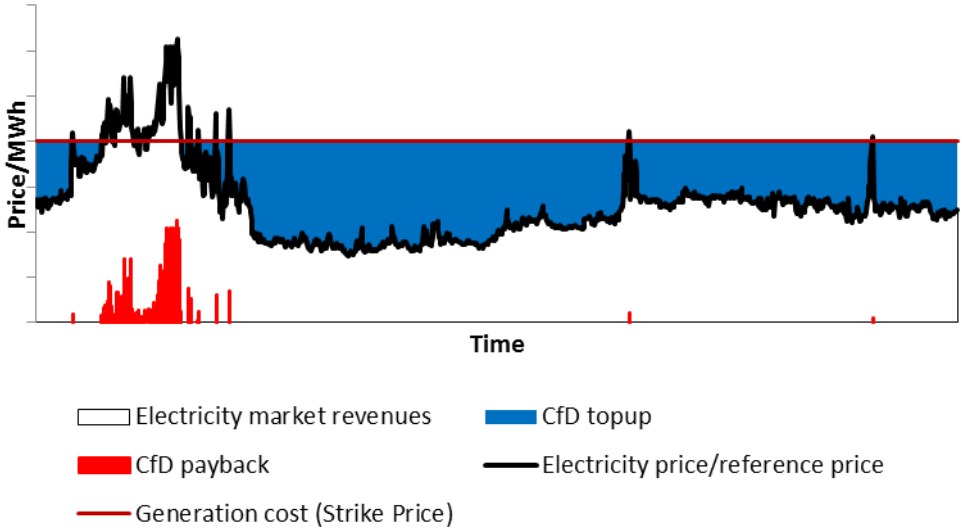


Figure 4: Functioning of the CfD

3.3 Auction process

The Secretary of State can set a minimum budget reservation (either in MW or ££s) for specific technologies, or groups of technologies. In the first allocation round there was a minimum of 10MW for wave and tidal stream technologies.

The Secretary can also set a maximum budget reservation (either in MW or ££s for specific technologies or groups of technologies. No maxima were set in the first allocation round but a 150MW cap was placed on 'fuelled' technologies (mainly biomass) in the second round (BEIS 2017a).

Applicants can submit flexible bids into the auction process. The flexibility applies to the capacity, price and/or delivery date of a project. In effect, it means that project developers can put forward multiple (up to ten) applications for the same project with various combinations of capacity and delivery date, each with its own unique price. The lowest priced bid will be considered first, but in the event it is not funded due to budgetary constraint, a smaller capacity (but higher priced) bid will be considered and so on (DECC 2014a). In this way, it is hoped that bidders are able to present the full range of viable project permutations that can be selected to suit the budgetary limits. However, the implications for bidding strategy are not clearly understood.as individual bids are not publically available

The auction process is rather complex and involves several steps[3]:

1. If applications do not exceed the applicable budget pot, applicants will be offered a CfD at the prevailing Administrative Strike Price (unconstrained allocation)
2. An auction is triggered if applications exceed the available budget pot, or if the capacity of technologies subject to the maximum limit is exceeded.
3. If an auction is necessary, the Delivery Body notifies the applications inviting sealed bids. Applicants have 5 working days to submit a bid stating the strike price that they are willing to accept for the project and the delivery year for the project (ie the Target Commissioning Date)

[3] For a more comprehensive description of the process, please see the earlier AURES report on the UK system: (Fitch-Roy and Woodman 2016)

4. If the Secretary of State has stated a minimum capacity for any technology, bids for that technology are ranked by bid price and accepted up to the minimum capacity. Any projects that are not accepted at this stage are considered with the other projects in that technology's relevant pot the highest price up to the minimum sets the price for all projects subject to that minimum in each delivery year;
5. For each pot all bids excluding those accepted as part of the minimum are ranked by price;
6. Starting from the lowest price bid, the budget impact of the bids (in addition to the bids accepted under a minimum) is assessed for each bid in ascending price order for all years for which budget constraint has been announced in the Budget Notice;
7. If the budget for any year is exceeded, the project's alternative 'flexible' configurations are tested against the budget. If the budget cannot be made to work with the alternatives, the project is rejected. Bids which exceed a capacity maximum, if it is set, are also rejected;
8. The process is continued until there are no more projects or no more budget in any year;
9. The award prices are the marginal prices *within each year* up to the technology's ceiling price or the marginal price within a capacity minimum. Effectively, each delivery year has an independent uniform price for all awarded projects within that delivery year.

Figure 5 shows the decision tree outlining how awards are made, while Figure 6 shows the selection process ('stacking') for bids during the auction and how prices emerge from the process:

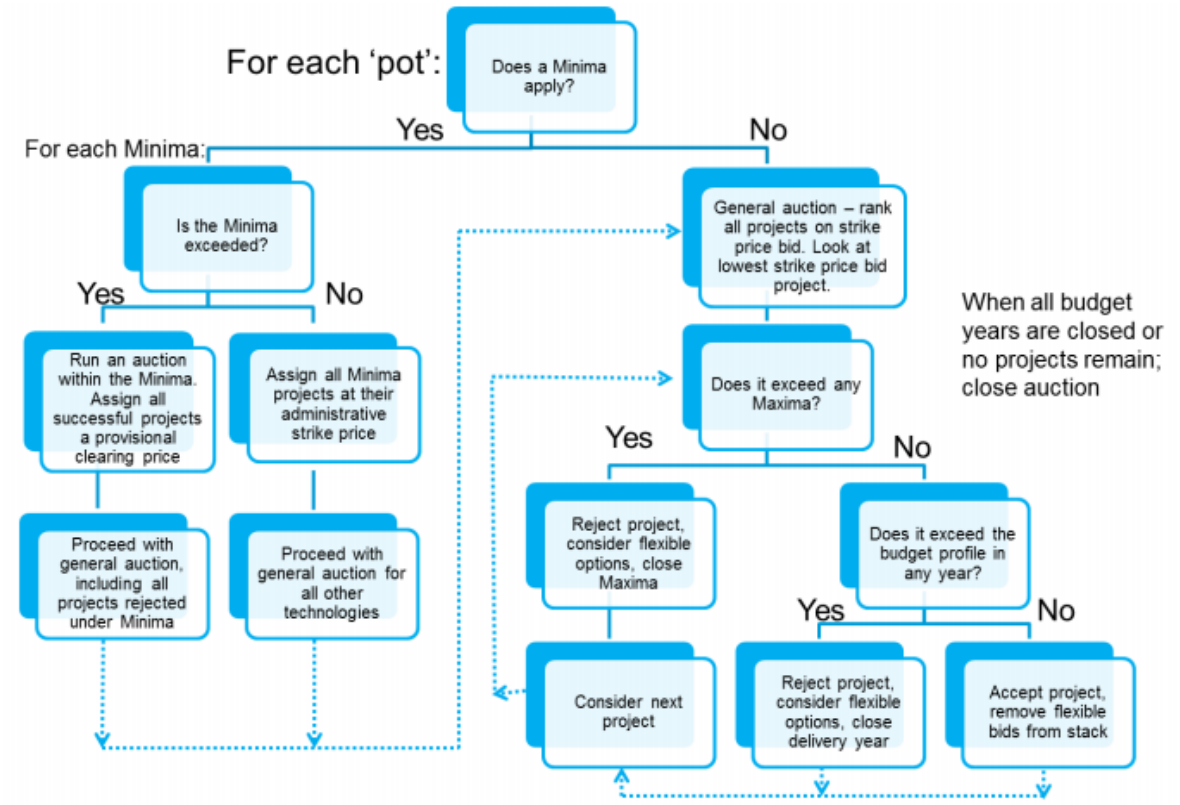
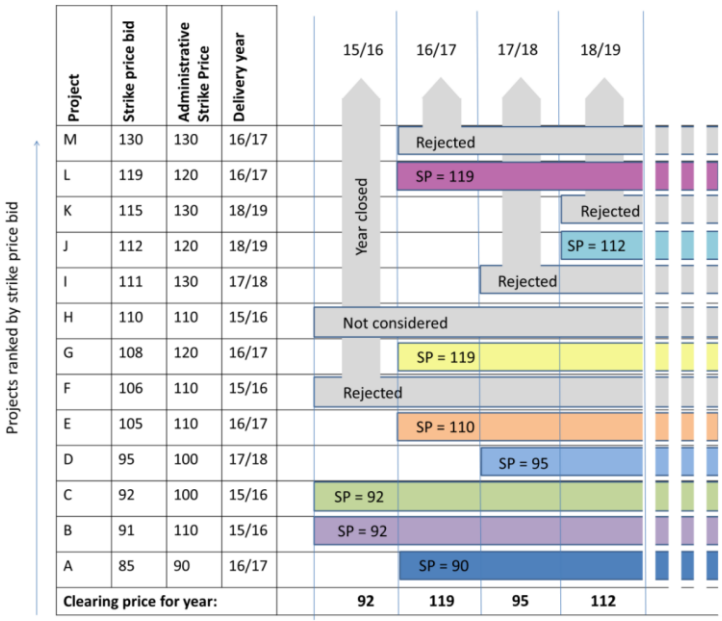


Figure 5: CfD auction decision tree (DECC 2014a)



The lowest strike price bid project in any year (project A) is considered first. The highest accepted strike price bid in any year sets the clearing price for that year. The amount paid to any project is capped at its Administrative Strike Price (ASP). For example, the clearing price for 2016/17 is £119/MWh, but project A is capped at £90 (its ASP), and projects E is capped at £110. Once a project has been rejected in a given year, no more projects for that year are considered. For example, project F has been rejected, so project H is not considered. NB. This simplified result does not use real project or strike prices, and is not intended to suggest a given auction outcome. This example assumes that no projects submitted flexible bids.

Figure 6: Auction stack procedure

3.4 Design details of UK RES-E auctions

The Government's legally-binding commitment to holding RE auctions was confirmed in the Energy Act 2013. The details of implementation are set out in various subsequent legislative instruments and Regulations. Successful bidders are offered a 15 year fixed price contract for output. Two auctions have been held to-date (AR1 2015 and AR2 2017). A third (AR3) is currently underway (2019). The following tables outline the main characteristics of the auction system and the detailed design elements as elaborated in AURES report

Table 1: Main characteristics of auctions and framework conditions

Characteristics	Description
Characteristics of the national electricity market	Electricity generation and supply is privately owned and the market is liberalised. The sector is dominated by 6 large, mainly vertically integrated companies (The Big Six). These 6 companies are responsible for 76% of domestic supply, and around 61% of generation (Ofgem 2018). Electricity is traded through the British Electricity Trading and Transmission Arrangements (BETTA). The transmission system is operated by National Grid, and distribution networks are owned and operated by 14 Distribution Network Operators.
Name of auction scheme	Contracts for Difference (CfD) allocation rounds

Contractual counterparty (auctioneer? provider of support?)	The contract counterparty is the Low Carbon Contracts Company (lowcarboncontracts.uk), which is a privately limited company wholly owned by the Secretary of State for Business, Energy and Industrial Strategy (BEIS).
Main features (e.g. cross-border auction?/multinational auction?)	Multi-technology auctions for projects based in England, Wales and Scotland. Auctions are constrained by annual budget caps (as shown in the next section). AR2 (2017) had a cap of 150MW for fuelled technologies (biomass, advanced conversion technologies (ACT[4]) etc), and AR3 (2019) auction included a capacity target of 6GW for all technologies.
Technology focus and differentiation (eligible technologies)	Technologies are divided into 2 'Pots' according to their technological maturity. Pot 1 is for established technologies, Pot 2 for less established technologies. There is an additional pot (Pot 3) for biomass conversion which has not been included in any auction to date. There have been some slight amendments in the requirements for technologies eligible for auctions, particularly the requirement for CHP (or not) in Pot 2 projects. AR3 includes a new category of Remote Island Wind, an exception to the policy that there should be no further subsidies for onshore wind. The 2015 Auction (AR1) was for Pots 1 and 2 and covered: Pot 1: Onshore wind (>5MW), solar pv >5MW, Energy from Waste with CHP, Hydro >5MW and <50MW, Landfill Gas, Sewage Gas Pot 2: Offshore wind, Tidal Stream, Wave, ACT with or without CHP, Anaerobic Digestion with or without CHP >5MW, Dedicated Biomass with CHP, Geothermal with or without CHP The 2017 Auction (AR2) was for Pot 2 technologies only: Offshore Wind, ACT with or without CHP, Anaerobic Digestion with or without CHP, Dedicated Biomass with CHP, Wave, Tidal Stream, Geothermal with or without CHP The 2019 Auction (AR3) was also for Pot 2 technologies only: ACTs, Anaerobic Digestion >5MW, Dedicated Biomass with CHP, Geothermal, Offshore wind, Remote Island Wind >5MW, Tidal Stream, Wave
Lead time before auction	The gap between the announcement of the intention to hold and auction and the actual auction have varied from round to round. However, once the auction is confirmed a timetable is published in an official BEIS Budget Notice. The Budget Notice is based on the Contracts for Difference (Allocation) Regulations 2014 which sets out the timetable for the conduct of an auction: the start of the allocation round must not be earlier than 10 working days after the date of the Budget Notice, and the end must be no later than 6 months after the start date. The Notice also includes the application closing date (HM Government 2014).

[4] e.g. pyrolysis and gasification

	As an example, the AR3 had the following timetable (BEIS 2019a): • the commencement date of the round was 29 May 2019 • the application closing date of the round was 18 June 2019 • successful bids announced 20 September • contracts to be signed and returned to LCCC by 18 October
Min./max. size of project	The eligible technologies and any size restrictions (maximum and minimum) are confirmed in the Budget Notice announcing the auction round.
What is auctioned? Auctioned bids (in terms of budget, electricity or installed capacity)	The contracts are for output (MWh) based on price. However, the number and size of the contracts allocated is restricted by a budget cap. The AR3 has also introduced a capacity cap, used as the basis of the budgetary calculation (up to 6GW) (BEIS 2019a).
Budgetary expenditures per auction and per year	The budget cap for individual years is set out in the Budget Notice for the auction round. CfDs are one of a series of consumer levy-funded instruments constrained by a Treasury spending limits. The first two auctions were held in line with a system known as the Levy Control Framework (LCF). The LCF was developed in 2011 to restrict the aggregate amount of money that suppliers can levy from consumers for low carbon electricity and the Capacity Mechanism (Lockwood 2016). The budget for an auction is therefore constrained by the annual amount available in the LCF. Since 2017, however, the LCF has been replaced with a control on the introduction of new levies (HM Treasury 2017). The overall budget committed to future and ongoing CfD allocation is £557m (2012 prices) and it committed only to auctions for 'less established' technologies (BEIS 2017d). The budget available for a particular auction cycle is announced by the Secretary of State for Energy in a budget notice ahead of the auction but not ahead of the call for applications. The budget notice sets out the overall size of the budget per year and the breakdown by technology group as well as the technologies in each group. Importantly, the budgets are for **total spending for all successful projects in each year**, rather than for spending on projects which start generating in a particular year. All the budgets are calculated on the basis of 2011/12 prices. The budgets will be inflated by a consumer prices index (CPI) factor which is set out in the Budget Notice officially announcing the auction. In response to wider trends in the cost of renewable energy technologies (especially offshore wind), the budget cap was very substantially tightened in the current auction (AR3). Rather than levy spending constraints, however, this is primarily a result of seeking to ensure supply chain consistency with budget allocations calculated on the basis of capacity addition targets and reflects assumptions about the cost-reductions in key technologies illustrated by auctions in the UK and elsewhere. (BEIS 2019a). The actual budget (total support payments for all projects) allocated to the different technology pots in each of the ARs is shown below:

Budgets for Auction Rounds 1 – 3 (prices in 2012GBP)

	Auction Round 1 (2015)						Auction Round 2 (2017)		Auction Round 3 (2019)	
Delivery year	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**
Pot 1 (established)	50	65	65	65	65	65	0	0	0	0
Pot 2 (less established)	-	155	260	260	260	260	290	290	65	65
Total	**50**	**230**	**325**	**325**	**325**	**325**	**290**	**290**	**65**	**65**

Frequency of auctions	The execution of the first 2 ARs was delayed be several months from the original intended dates. The Government announced in July 2018 that AR3 would begin in May 2019 and this timetable has been met. It also committed to holding an auction round in 2021, and that it intended that further ARs will take place every two years from then (HM Government 2018).
Volume of the tender	This varies in each allocation round
Grid connection/access related costs	Generators connecting to a distribution network pay for the installation of 'sole use' assets to connect the project to the network. In addition, they will pay a portion of any cost required to upgrade the network to accommodate the new generation. Generators connecting to the transmission network pay for the cost of assets solely for their own use, but do not generally pay connection charges beyond that – ie they do not generally pay for other network upgrades. Offshore wind farms have their own transmission arrangements given that the projects will require the construction of new assets offshore. Generators can choose to build their own assets, and then transfer them to an Offshore Transmission Operator (OFTO), or they can allow an OFTO to build the assets. The regulator (Ofgem) then conducts competitive tenders between Offshore Transmission Operators (OFTOs) to manage the offshore transmission on the basis that competition will deliver the best value for money for consumers. The overall system operator (National Grid) provides a fixed 20 year revenue stream to the OFTO. This is linked to the availability of the transmission infrastructure rather than the performance of the wind farm, so providing a relatively risk free investment opportunity for the OFTO.

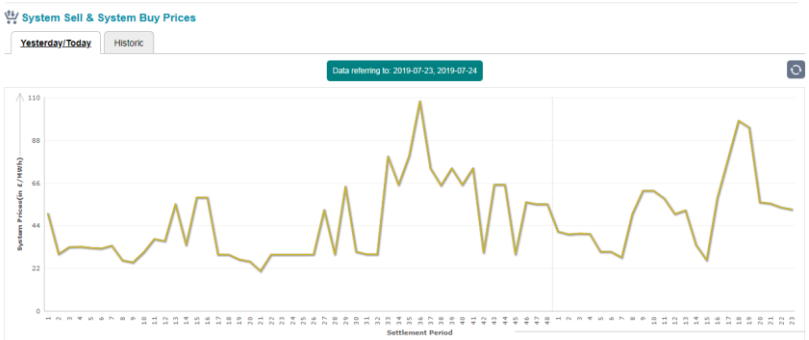
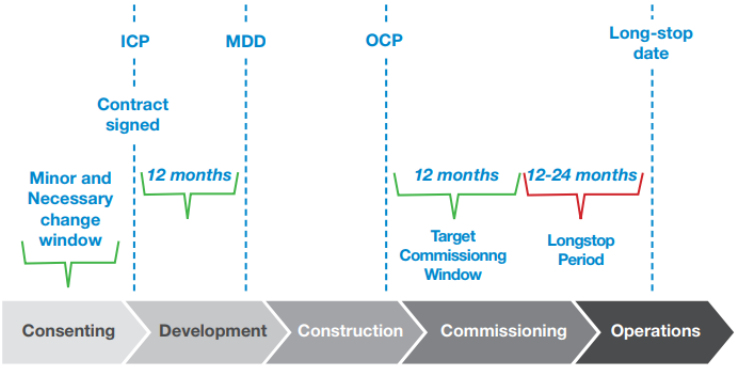
	Generators (including offshore generators) also pay Use of System charges and Balancing System Use of System charges at transmission and distribution level as appropriate. These cost vary widely but in 2016 the government published cost estimates including 'connection and use of system charges' that ranged from around £1,300/MW/yr for solar PV and onshore wind up to £50, 000/MW/yr for offshore wind farms. However, these estimate include the very substantial cost of connecting offshore generation to the transmission system which generators in the UK must cover (BEIS 2016) Renewable generators do not have priority access to the grid at either distribution or transmission level.
Balancing and profile costs	Under the British Electricity Trading and Transmission (BETTA), all participating generators are responsible for paying system balancing if they over- or under- generate against their contracted positions. There were originally two separate imbalance prices: System Buy Price (payment *from* the seller to the system operator) and System Sell Price (payment *to* the seller from the system operator), although these are now in practice the same. The Prices are intended to reflect the costs incurred by the system operator (National Grid) to keep the system in balance (ELEXON 2019). Imbalance prices are calculated for each half hour period throughout the day to reflect the different levels of supply and demand at different times. So, for example, in periods of high demand, imbalance charges could be very high because of a lack of availability of low cost generation to compensate for any shortfall in contracted generation. See Figure below  More detail on imbalance pricing can be found at: https://www.bmreports.com/bmrs/?q=balancing/systemsellbuyprices Partly because of the risks associated with imbalance pricing, and also the high transaction costs of participating in BETTA, many independent renewable generators sell their output through PPAs with electricity suppliers. Larger vertically integrated companies are better able to absorb the risks and costs of trading in BETTA.

Table 2: Design Elements

Design elements	Description
Auction format	Multi-unit
Eligible technologies and participation technologies?	Eligible technologies are announced when the auction is confirmed. AR3 includes a capacity limit of 6GW for all technologies
Auction procedure	Static (reverse)
Pre-qualification requirements - Financial - Material (falling either on the *project developer* (e.g. experience in RES development), or the *project (*e.g. building requirement or environmental impact assessment, grid connection, etc.)	For AR3, developers are required to show (Low Carbon Contracts Company 2019a): • Connection agreements with the network operator • Evidence of planning permission for the project • If the project is greater than 300MW, applications will also need a Supply Chain Approval Certificate In addition, the developer must complete the following before submitting the application • Declaration that the project will not be cross-subsidised with other support mechanisms (eg RO) • Evidence of Incorporation, or a list of Parties within an Unincorporated Joint Venture • Target Commissioning Date window for the project • Crown Estate Agreement for lease (Offshore wind only) • Provisional capacity requirements for the project (Offshore wind only)
Auction volume	The volume of the auction is primarily determined by budget caps which vary for each auction. The budget cap for AR3 is £65 million for projects beginning operation in 2023/24 and 2024/25
Pricing rule	Uniform (pay as clear)
Award procedure	Contracts are awarded based on price
Price limits	The Government sets out ceiling prices, known as Administrative Strike Prices, for each auction round.
Support period	15 years
Favourable treatment of specific actors	Once the auction is announced, there are no special rules or preferences to favour different size projects or ownership. However, the scope of the auction can clearly favour specific technologies, as is shown by the emphasis on Pot 2 technologies in AR2 and AR3. In addition, the introduction of Remote Island Wind projects into AR3 as an exception to the general policy that onshore wind should not receive public subsidy.
Realisation time limit	Contracts are awarded for delivery (ie start up) in a particular year. For example, AR3 contracts were awarded for delivery in 2023/24 and 2024/25. Project development is therefore driven by the contractual requirement to deliver on time.

	If the project is delayed, there is an additional period of 12 – 24 months beyond the original target start date known as the Long Stop. A specified proportion of the project must be commissioned by the end of the Long Stop period or the contract could be terminated.
Penalties	In the first auction, the penalty for being offered a CfD and refusing to sign it, or signing a contract and then failing to deliver the project was exclusion for any project at the same location from future auctions for 13 months from the date of refusal, or if the contract is withdrawn (DECC 2015b). Notably, given the delays between AR1 and AR2, this penalty would not have had any practical impact on project developers. The rules, known at the Non-Delivery Disincentive, were subsequently amended to exclude any CFD Unit (ie the project) OR any other project on the same site from future auctions for 13 months from the date of refusal or termination, AND to exclude the unit from the first CfD AR taking place within 24 months of the contract being awarded (Government 2016).
Way of monitoring progress of realisation	The Low Carbon Contracts Company monitors project progress but does not have an obligation to intervene where projects are not on track. Project milestones are set out in the contract. Figure 7: Key contract milestones  Key dates are: • Milestone Delivery Date (MDD): the date by which generators must show that they are committed to delivering the project, either by providing evidence that they have spent 10% of the project's pre-commissioning costs, or evidence of other commitments such as a Board resolution or supply contracts. The MDD is 12 months after signing the contract. • Operational Conditions Precedent (OCP): evidence of metering, grid connection etc. The OCP must be met by the end of the project Longstop Date • Target Commissioning Window: 12 month period in which the operator should begin commissioning the project. • Start date • Longstop date: the date by which the generator must have commissioned the project. The LCCC has the right to terminate contracts for projects which do not meet the MDD at the beginning of the project, or failed to commission the project by the end of the Longstop period except in cases where delay can be shown

	to be due to *force majeure*. There are a number of other situations in which the LCCC can terminate a contract (Low Carbon Contracts Company 2019a). These are: • Insolvency of the generator • Non-payment by the generator to the LCCC • Fraudulent activity by the generator • Failure to declare any transfer arrangements • Failing to comply with metering requirements In cases where there can be deemed to have been a 'construction event' the initial contract capacity can be altered by up to -25%. The contracted capacity cannot be increased.
Form of support auctioned	Support is offered in the form of a fixed price for output through a contract for difference.
In case of premium schemes describe the method of reference wholesale price calculation	Additional payments per MWh are calculated as the difference between the contract or 'strike price' (determined through the auction) and a measure of the wholesale market price known as the 'reference price' (see Figure 4 on p10). For intermittent generation, the reference price is calculated using the GB Day Ahead Hour Price to produce the Intermittent Market Reference Price. For baseload generation, the Baseload market Reference Price is calculated on a seasonal basis ex post using a traded volume weighted average based on forward season data collected during a 'sample period' of every trading day in the season prior to delivery. The seasons run from 1 April to 30 September, and 1 October to 31 March (Low Carbon Contracts Company 2019a). In instances where the wholesale power price is higher than the strike price, the contract requires that the generator makes payments to the contract counterparty.
Support level adjustments	The budgets and strike prices for each AR are published in 2012 prices, which allows direct comparison between each auction round. The actual budgets are then calculated using the Consumer Price Index Inflator. For AR3, the Inflator used for calculating the actual available budget was 1.0193 (BEIS 2019a). Once awarded, the strike price in the contract can also be adjusted: • Annual CPI Indexation for the Strike Price in 2012 prices • Adjustment to Balancing System Charges to cover Use of System charges and Residual Cashflow Reallocation Cashflow (RCRC). This allows the amended strike price to reflect any difference between the actual charge paid by the generator and the indexed initial Balancing System Charge included in the contract • Transmission Losses to reflect any change in the Transmission Loss Multiplier, which is an adjustment for transmission losses These adjustments differ from generator to generator, and the exact conditions and applications are set out in individual CFD contracts
Transferability of support right	Yes, with the written consent of the LCCC

4 Evaluation of the auction results

This section of the report evaluates the auction system for allocating CfD contracts to renewable electricity generators in the UK. First, 4.1 looks at the results of each of the two completed rounds in turn. Secondly, 4.1.3 updates the earlier AURES report on the UK to evaluate the overall scheme against key criteria for RES auction performance.

4.1 Auction results by round

This subsection outlines the results of each of the two rounds completed to-date.

4.1.1 First auction: AR1 (2014-2015)

Budgets for the first auction were divided into two 'pots', one for established technologies, the other for less established technologies, effectively creating two simultaneous auction processes.

The first pot, for established technologies included onshore wind and solar, energy from waste with CHP, hydro (>5MW and <50MW), landfill gas and sewage gas. It consisted of £50m for projects commissioning from 2015/16, and an additional £15m (i.e. £65m in total) for projects commissioning from 2016/17 onwards.

The second pot, for less established technologies, included offshore wind, biomass CHP, wave, tidal stream, Advanced Conversion Technologies, Anaerobic Digestion and geothermal. It consisted of £155m for projects commissioning from 2016/17 onwards, and an additional £105m (i.e. £260m in total) for projects commissioning from 2017/18 onwards.

There is also a notional third pot, for biomass conversion. However, no budget was allocated to this for the first auction. The results of the first allocation round are presented in Table 1[5]:

Table 3: first CfD allocation auction results (DECC n.d.)

Project Name	Developer	Technology	MW	Strike Price (£)	Delivery Year
BHEG Walsall	BH EnergyGap (Walsall) Ltd	Advanced Conversion Technologies	26	114.39	2018-2019
Energy Works (Hull)	Energy Works (Hull) Limited	Advanced Conversion Technologies	25	119.89	2017-2018
Enviroparks Hirwaun Generation Site	Enviroparks Operations Ltd	Advanced Conversion Technologies	11	119.89	2017-2018
Wren Power and Pulp	Gent Fairhead & Co. Ltd	Energy from Waste with CHP	49.75	80	2018-2019
K3 CHP Facility	Wheelabrator Technologies	Energy from Waste with CHP	45	80	2018-2019
EA 1	Scottishpower Renewables (UK)	Offshore Wind	714	119.89	2017-20181
Neart na Gaoithe	Mainstream Renewable Power	Offshore Wind	448	114.39	2018-2019
Dorenell Wind Farm	Infinergy	Onshore Wind	177	82.5	2018-2019

[5] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/407059/Contracts_for_Difference_-_Auction_Results_-_Official_Statistics.pdf

Kype Muir Wind Farm	Banks Renewables	Onshore Wind	104	82.5	2018-2019
Clocaenog Forest Wind Farm	RWE Innogy UK Limited	Onshore Wind	96	82.5	2018-2019
Middle Muir Wind Farm	Banks Renewables	Onshore Wind	60	82.5	2018-2019
Brenig Wind Farm - Brenig Wind	Brenig Wind Limited	Onshore Wind	45	79.23	2016-2017

4.1.2 Second auction: AR2 (2017)

Following a commitment by the governing Conservative party not to provide 'subsidy' to new onshore wind projects, the second auction held in 2017 had budget *only* for pot 2 (less mature technologies). The budget allocation was £290m for projects that deliver in financial years 2021/22 and 2022/23 (BEIS 2017b). A maximum volume (150MW) was applied to any 'fuelled' renewable energy technology[6]. The table below provides an overview of the auction results:

Table 4: Second CfD allocation auction results (BEIS n.d.)

Project Name	Developer	Technology	MW	Strike Price (£)	Delivery Year
Drakelow Renewable Energy Centre	Future Earth Energy (Drakelow) Limited	Advanced Conversion Technologies	15.00	74.75	2021/22
Station Yard CFD 1	DC2 Engineering Ltd	Advanced Conversion Technologies	0.05	74.75	2021/22
Northacre Renewable Energy Centre	Northacre Renewable Energy Limited	Advanced Conversion Technologies	25.50	74.75	2021/22
IPIF Fort Industrial REC	Legal and General Prop Partners (Ind Fund) Ltd	Advanced Conversion Technologies	10.20	74.75	2021/22
Blackbridge TGS 1 Limited	Think Greenergy TOPCO Limited	Advanced Conversion Technologies	5.56	74.75	2021/22
Redruth EfW	Redruth EFW Limited	Advanced Conversion Technologies	8.00	40.00	2022/23
Grangemouth Renewable Energy Plant	Grangemouth Renewable Energy Limited	Dedicated Biomass with CHP	85.00	74.75	2021/22
Rebellion	Rebellion Biomass LLP	Dedicated Biomass with CHP	0.64	74.75	2021/22
Triton Knoll Offshore Wind Farm	Triton Knoll Offshore Wind Farm Limited	Offshore Wind	860.00	74.75	2021/22
Hornsea Project 2	Breesea Limited	Offshore Wind	1,386.00	57.50	2022/23
Moray Offshore Windfarm (East)	Moray Offshore Windfarm (East) Limited	Offshore Wind	950.00	57.50	2022/23

[6] Dedicated Biomass with CHP, Advanced Conversion Technologies (with or without CHP) and Anaerobic Digestion (with or without CHP)

4.1.3 Third auction: AR3 (2019)

The third allocation round in 2019 was again open only to 'pot 2', less mature technologies. £65m in support payments were available for projects delivering in 2023/24 or 2024/25 (BEIS 2019a). Included in the auction was a new category of technology 'remote island wind' including onshore wind farms on isolated Scottish islands. The table below provides an overview of the results:

Table 5: Third allocation round results (BEIS 2019b):

Project Name	Developer	Technology	MW	Strike Price (£)	Delivery Year
Bulwell Energy Limited	Bulwell Energy Limited	Advanced Conversion Technologies	27.5	39.65	2023/24
Small Heath Bio Power Limited	Small Heath Bio Power Limited	Advanced Conversion Technologies	6.1	41.611	2024/25
Costa Head Wind	Costa Head Wind Farm Limited	Remote Island Wind	16.32	39.65	2023/24
Druim Leathann Windfarm Limited	Druim Leathann Windfarm Limited	Remote Island Wind	49.5	41.611	2024/25
Hesta Head Wind	Hesta Head Wind Farm Limited	Remote Island Wind	20.4	39.65	2023/24
Muaitheabhal Wind Farm	Uisenis Power Limited	Remote Island Wind	189	39.65	2023/24
Doggerbank Creyke Beck A P1	DoggerbankOffshoreWindFarm Project1ProjcoLimited	Offshore Wind	1200	39.65	2023/24
Doggerbank Creyke Beck B P1	DoggerbankOffshoreWindFarm Project2ProjcoLimited	Offshore Wind	1200	41.611	2024/25
Doggerbank Teeside A P1	DoggerbankOffshoreWindFarm Project3ProjcoLimited	Offshore Wind	1200	41.611	2024/25
Forthwind	Forthwind Limited	Offshore Wind	12	39.65	2023/24
Seagreen Phase 1	Seagreen Wind Energy Limited	Offshore Wind	454	41.611	2024/25
Sofia Offshore Wind Farm Phase 1	Sofia Offshore Wind Farm Limited	Offshore Wind	1400	39.65	2023/24

4.2 Evaluation against key criteria

To evaluate the effectiveness of the auctions requires an interpretation of the policy goals for the project, which may not always cohere with the rationale provided explicitly. For the UK CfD auction scheme, the most important goals are seen to be:

i. Delivery of low carbon capacity within a strict budget limit
ii. the ability to reveal "true" short-term project costs through the application of competitive pressures
iii. the effectiveness within which the instrument allocates the budget to projects that can and will deliver promised renewable generation capacity and
iv. the ability to contribute to ongoing innovation that may deliver on goals such as long-term cost reduction

4.2.1 Policy effectiveness (effectiveness of auctions)

4.2.1.1 Budget allocation

As a budget allocation system, the CfD auction of 2014/15 was a limited success with a failure to allocate large sums of budget in the first four of the six years for which a budget was set but successful allocation of the budgets in later years (Figure 6). It is notable that the total spending commitment for the first delivery year is actually slightly negative. This is because the successful bids were lower than the reference wholesale power price assumption for that year, meaning that the two-way CfD, in which the generator must pay back any revenues above their strike price, would be forecast to be revenue-positive for the government-owned counterparty (LCCC).

Overall, the average proportion of the annual budget allocated in AR1 was low, although the peak total support cost forecast in delivery year 2020/21is close to the annual budget cap of £325m – the point beyond which the year closes for new projects. In AR2, the peak estimated support cost occurs in valuation year 2023/24 at £176m, some way short of the total available budget of £290m.

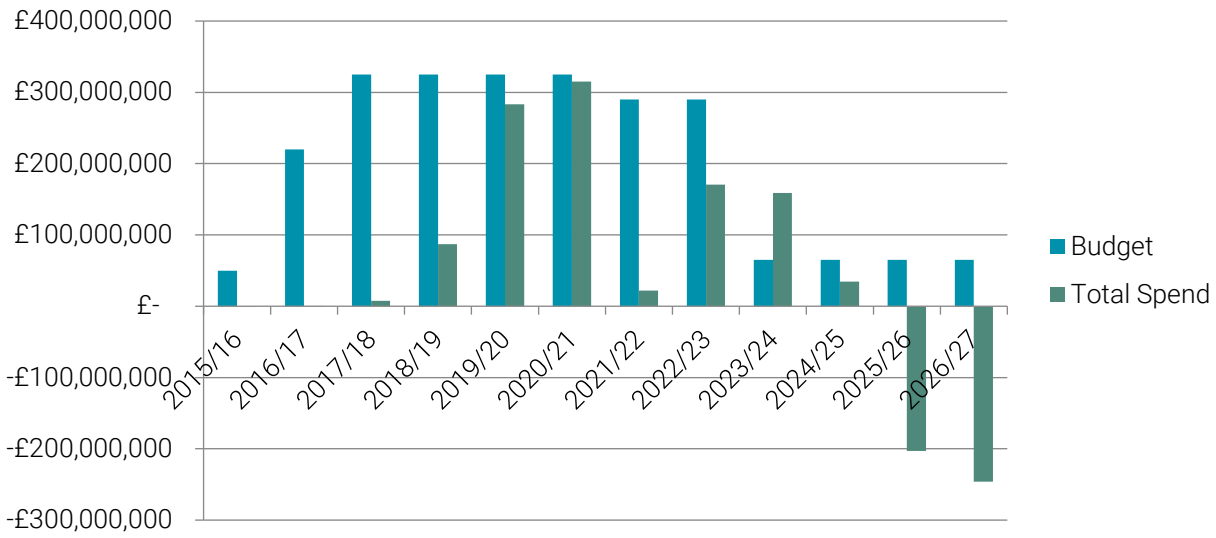


Figure 7: Budget versus total spend

The failure to allocate much of the AR1 pot 1 budget in 2015, 2016 and 2017 may be attributable to the external policy environment. Large-scale (>5MW) solar projects were prevented from accessing the major alternative policy, the RO from April 2015 because solar was 'deploying faster than could be afforded' (DECC, 2014f, p.12).

The third auction round saw contract prices lower than the projected electricity market reference prices used to calculate the budgetary impact. The nature of the CfD used in the UK, which requires generators to 'pay back' when market prices are lower than references prices results in very strongly negative spend (i.e. net revenues to generators that are lower than the projected wholesale price of electricity). One consequence of this reversal in budgetary impact was that rather than a budgetary cap, the 6GW capacity cap introduced for this round appears to have been the main constraint. A total of 5,775MW was offered contracts, slightly lower than the cap. Also, the winning offshore wind farms appear to have been awarded their full consented capacity, rather than lower capacity, higher unit cost 'flexible bid' alternatives also invited (see section 3.4).

Since the budget profile was more-or-less flat from 2017 to 2020/21 and each project's cost is counted in every year, the later years of the allocation was likely to fill up first, depending on the order in which budget years' budget cap was reached and the year closed for new projects. Put another way, the first delivery year could only fill up with projects wishing to start on that date while later years would have to account for projects starting in earlier years (see Section 3.3).

The 'valuation year' for large projects may also differ from the delivery year; offshore wind developments are permitted to phase commissioning with valuation taking place up to two years following the target commissioning date (BEIS 2019a).

4.2.1.2 Project realisation

In the original AURES report addressing the UK, no empirical assessment could be made of project realisation since none of the contracted projects were due for completion. However, the second auction, AR1 allocated contracts to projects aiming to complete between 2015/16 and 2018/19, enabling an evaluation. As can be seen from the table below, many projects are now online. However, the table also shows that:

- Many of the projects missed the Delivery Year for which they were awarded a CfD. One project, Neart na Gaoithe offshore wind farm has experienced significant delays because of opposition to the environmental impacts of the projects. The LCCC terminated the contract for the project in May 2016 because of the delays caused by the dispute, but following an appeal by the developers (Mainstream Renewable Power) the contract was reinstated in March 2017 (Low Carbon Contracts Company 2019b). The original delivery year for the project was 2018-19, but this has now been delayed to 2022.
- Others – eg Brenig Wind Farm and Solwaybank Wind Farm - have also experienced delays of several months.
- In addition to the Neart na Gaoithe episode, 3 contracts have been terminated to date (July 2019). Netley Landfill Solar was terminated because the LCCC refused to extend the project's Milestone Delivery Date deadline (NAO 2018; Solar Power Portal 2016). The reasons behind the termination of the contracts for two ACT plants (Enviroparks Hirwaun and BHEG Walsall) are not public, but could include not being able to secure a timely and affordable grid connection, or a change in the project's viability.
- Two PV projects originally offered a CfD on the basis of a very low strike price did not sign the contracts. The low price of the CfD is a clear indication of strategic bidding on the part of the project developers (further details below).

It should be noted firstly that the volume of terminated contracts is extremely small compared to overall auctioned volumes. Secondly, the delays beyond the target commissioning date of some projects are within the *force majeur* contingencies or other reason afforded by the contract. While overall project delivery in terms of both capacity and number of projects delivered is good, it is clear that ACT and solar projects have not performed well, and many projects have experienced delays.

Table 6: Project milestone progress for awarded projects

	Technology	Capacity (including any reductions)	Initial strike price (£/MWh)	Current strike price (£/MWh)	Delivery year 01/04/xx - 31.03/xx	Target commissioning date	Actual start date	Generator's expected start date	Contract termination date
Enviroparks Hirwaun Generation	ACT	11	119.89	134.86	2017-18	31/03/18			29/05/19
Energy Works (Hull)	ACT	25	119.89	134.86	2017-18	01/01/18		31/08/19	
BHEG Walsall	ACT	23.4	114.39	128.67	2018-19	01/12/18			15/05/19
Wren Power and Pulp	EfW with CHP	49.75	80	89.99	2018-19	30/05/18		Not specified	
K3 CHP Facility	EfW with CHP	45	80	89.99	2018-19	15/12/18		11/11/19	
EA Phase 1	Offshore wind	179	119.89	136.08	2017-18	31/03/18		21/08/19	
EA Phase 2	Offshore wind	285	119.89	136.08		31/03/19		27/11/19	
EA Phase 3	Offshore wind	250	119.89	136.08		31/03/20		29/03/20	
Neart na Gaoithe	Offshore wind	448	114.39	129.88	2018-19	31/03/22		15/09/22	
Brenig Wind Farm	Onshore wind	38.6	79.23	89.12	2016-17	30/03/17	29/03/19		
Sneddon Law Community Wind Farm	Onshore wind	30	79.99	89.98	2017-18	30/06/17		Under review	
Mynydd Y Gwair Wind Farm	Onshore wind	33.6	79.99	89.98	2017-18	31/03/18	20/03/19		
Middle Muir Wind Farm	Onshore wind	50.73	82.5	93.92	2018-19	31/03/19	09/01/19		
Common Barn Wind Farm	Onshore wind	6.15	82.5	92.8	2018-19	30/03/19	18/06/18		
Moor House Wind Farm	Onshore wind	11.96	82.5	92.8	2018-19	29/09/18	03/04/18		
Kype Muir Wind Farm	Onshore wind	88.4	82.5	93.92	2018-19	31/03/19	02/03/19		
Tralorg Wind Farm	Onshore wind	18.8	82.5	93.92	2018-19	30/06/18		20/12/19	
Clocaenog Forest Wind Farm	Onshore wind	96	82.5	92.8	2018-19	01/11/18		05/09/19	
Bad a Cheo Wind Farm	Onshore wind	26.65	82.5	93.92	2018-19	31/03/19	31/03/19		
Nanclach Wind Farm	Onshore wind	39.1	82.5	92.8	2018-19	31/10/18		13/07/19	
Achlackan Wind Farm	Onshore wind	10	82.5	92.8	2018-19	31/10/18	08/04/19		
Coire Na Cloiche Windfarm	Onshore wind	30	82.5	92.8	2018-19	31/10/18		15/05/19	
Dorenell Wind Farm	Onshore wind	177	82.5	93.92	2018-19	30/04/19	20/12/18		
Solwaybank Wind Farm	Onshore wind	30	82.5	92.8	2018-19	29/03/19		30/01/20	
Wick Farm Solar Park	Solar PV	19.1	50		2015-16				Not signed
Netley Landfill Solar	Solar PV	12	79.23	83.22	2016-17	31/6/16			21/03/16
Royston Solar Farm	Solar PV	13.78	50						Not signed
Charity Farm	Solar PV	13.74	79.23	89.12	2016-17	30/06/16	30/06/16		
Triangle Farm Solar	Solar PV	10.9	79.23	89.12	2016-17	01/07/16	18/07/17		
			Projects delivered later, or projected to deliver later than their CfD Delivery Year						
			Contracts terminated, not signed or under review						

It is too early to meaningfully evaluate realisation rates for AR2. However, it is notable that 4 of the 8 ACT/biomass projects offered contracts are no longer part of the CfD scheme. One – Redruth ACT – did not sign a contract as it had bid unsustainably low in the auction round. Three others – Drakelow, Station Yard and Grangemouth – have had their contracts terminated for not achieving the MDD. It is not always clear what the reason behind this is. Drakelow has been redesigned and will apparently be built and operated subsidy-free. Station Yard and Grangemouth both failed to reach the MDD target, though there is no information on what the problems were with the projects. Some other projects – eg IPIF Fort Industrial REC – are experiencing minor delays on their target commissioning date.

Table 7: Allocation Round 2 progress

	Technology	Capacity (MW)	Strike price (£/MWh) 2012 prices	Delivery year	Target commissioning date	Expected start date	Contract termination date
Drakelow renewable energy centre	ACT	15	74.75	2021/22	01/04/21		09/11/18
Station Yard CFD 1	ACT	0.05	74.75	2021/22	01/04/21		02/10/18
Northacre Renewable Energy Centre	ACT	25.5	74.75	2021/22	01/04/21	01/04/21	
IPIF Fort Industrial REC	ACT	10.2	74.75	2021/22	01/12/21	01/03/22	
Blackbridge TGS1	ACT	5.56	74.75	2021/22	01/04/21	01/04/21	
Redruth EfW	ACT	8	40	2022/23			Not signed
Grangemouth Renewable Energy Plan	Biomass with CHP	85	74.75	2021/22	01/07/21		08/10/18
Rebellion	Biomass with CHP	0.64	74.75	2021/22	01/04/21	01/04/21	
Triton Knoll Offshore Wind Farm	Offshore wind	860	74.75	2021/22	01/04/21	02/05/21	
Hornsea Project 2	Offshore wind	1386	57.5	2022/23	31/03/23	03/04/23	
Moray Offshore Windfarm (East)	Offshore wind	950	57.5	2022/23	01/04/22	03/04/22	

4.2.2 Static efficiency or cost effectiveness

The average contract prices achieved in the first and second auction round appear to be competitive when compared with the administrative strike prices determined for those auctions as well as the Final Investment Decision (FIDeR) contracts bilaterally awarded to several offshore wind farms in 2014 (see (Fitch-Roy and Woodman 2016) for more detail on the FIDeR contracts).

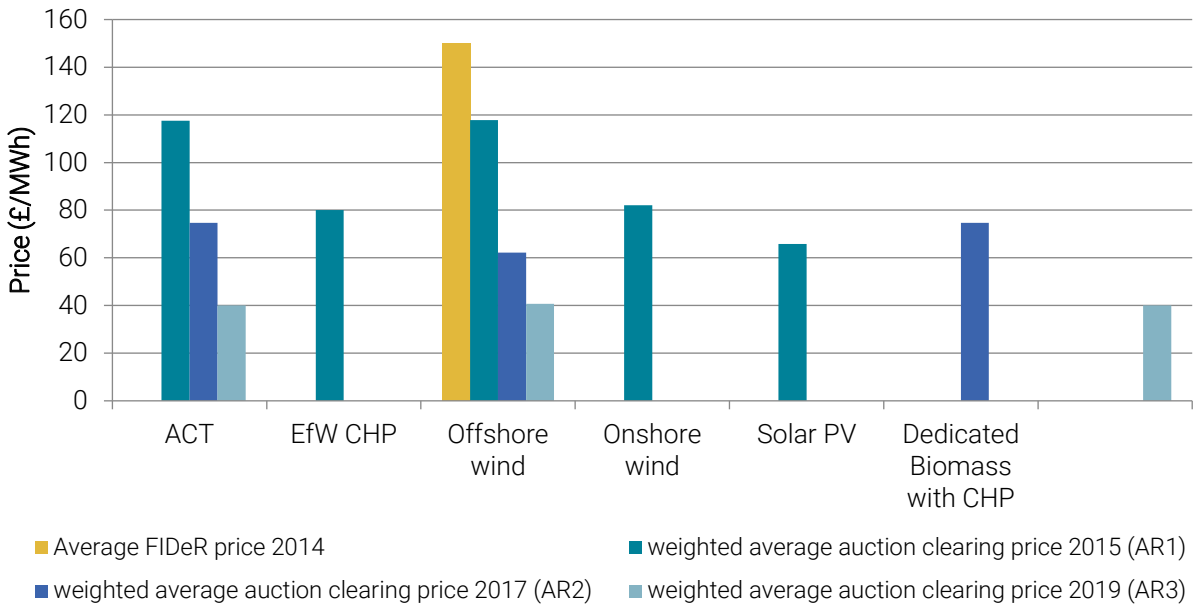


Figure 8: Auction outturn prices (auctions prices weighted by project capacity) (BEIS 2017b; BEIS n.d.; DECC 2015a; National Audit Office 2014)

One notable feature of the auction outcome was the very low pot 1 (established technologies) clearing price for the first delivery year (Figure 9). The only projects awarded contracts in that year were two solar farms offered contracts at £50/MWh. The developers of these projects have since declined to sign the offered contract with one stating that £50 was never a feasible price at which to build a project (Business Green 2015). The pay-as-clear pricing rule may have contributed to the perception by some bidders that a very low bid was the only way to win a contract. Also, the very small penalties (which, since another auction was not held within 13 months of the first auction have turned out to be zero) contributed to the decision making of bidders placing very low bids.

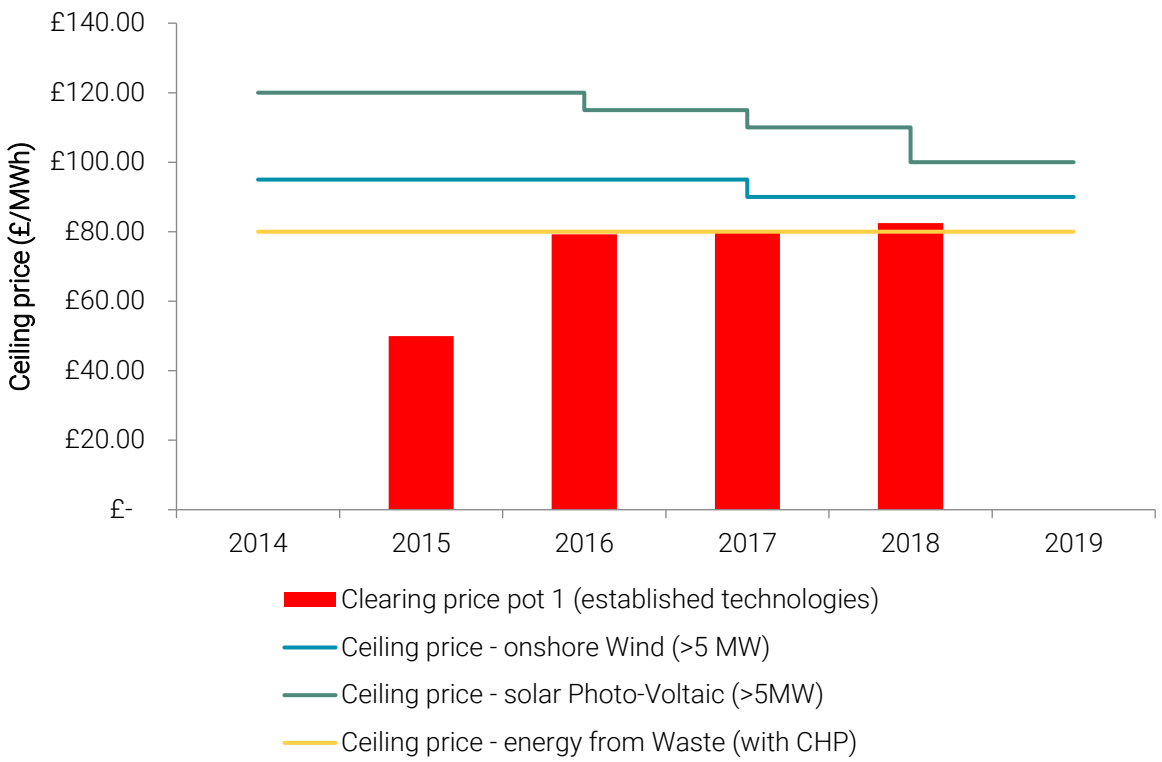


Figure 9: Pot 1 auction results and ceiling prices of winning technologies

While the projects did place bids in the knowledge that they were not commercially viable, clearly there was an expectation that at least one project would place a bid in their delivery year which would clear the auction at a viable price. A calculation that the downside of bidding a commercial price and missing out on a contract by a small margin was seen to be greater than receiving a contract at too low a price and rejecting it. The fact that solar was excluded from any other policy revenue stream in the run up to the auction may have also been a factor in this strategy, as did the relatively small non-delivery penalty of exclusion from CfD auctions for 13 months[7]. Since data concerning unsuccessful bids are unavailable, it is not possible to know whether other bidders pursued a similar strategy but the decision to run the auctions as pay-as-clear, taken late in the design process (DECC 2014b), may have contributed to this kind of 'over optimistic' bidding behaviour.

A similar picture of strategic bidding appears to be present in the Redruth ACT project in AR2. The developer appears to have placed an unsustainably low bid in an attempt to gain a contract but was subsequently unable to sign a CfD.

As explained below, some controversy surrounded the AR2 due to changes in the way the 150MW capacity cap on 'fuelled technologies' was implemented. Essentially, a rule change to prevent large fuelled projects from 'blocking' capacity combined with the ability for bidders to submit multiple 'flexible' bids created a situation in which larger fuelled projects were rejected in favour of smaller, more expensive ones, thereby increasing the clearing price paid to very large offshore wind farms (although still well below the ceiling price) and therefore greater than necessary expenditure (NAO 2018).

The National Audit Office is a Parliamentary body which scrutinises Government spending of public money. In 2018 it published a report on AR2, and whether its design had led to higher costs for consumers (National Audit Office 2018). The report focuses on the changes made to how a capacity cap operated. In AR1, if any capacity cap was breached, the auction would stop for *any* projects. However, for AR2, BEIS changed this rule to allow the auction to continue for other projects of the same technology even if the cap had been breached by one project. The other projects bidding at the same or higher price would be awarded a contract

[7] In fact it looks likely that the bidders would not face any penalty since the second auction has been delayed

as long as they themselves came in under the capacity cap and did not exceed the budget cap.

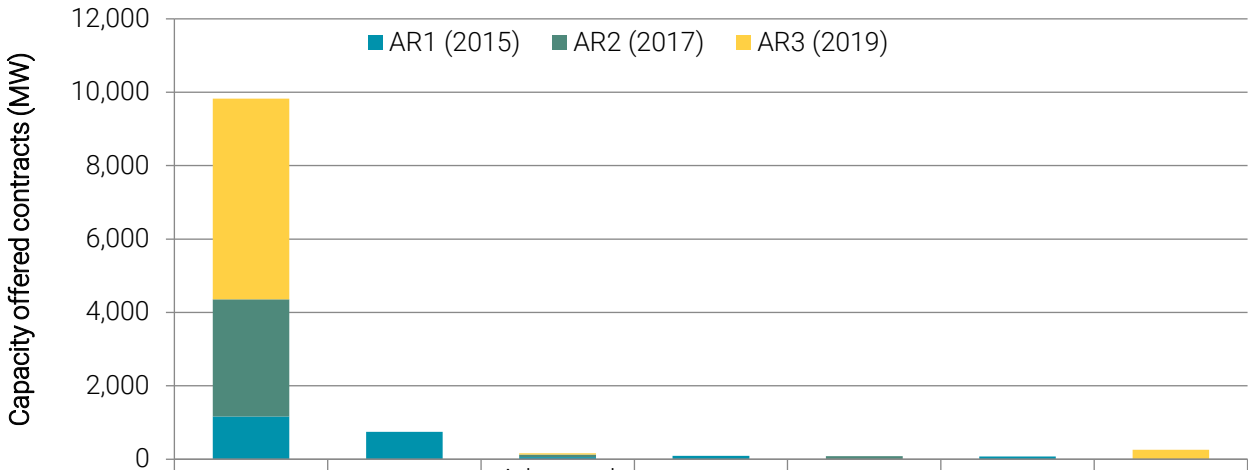
AR2 had a capacity cap of 150MW for fuelled technologies (ie biomass). The practical impact of the changes outlined above was that some larger projects were excluded from the auction, while smaller projects were awarded contracts even though they were bidding at a higher price than the large projects. This in turn meant that the small projects awarded contracts pulled up the strike prices for other projects in that delivery year. In the 2021/22 delivery year, ACT projects set the strike price of £74.75/MWh, and this was also therefore awarded to the Triton Knoll offshore wind farm which is also meant to begin operation in 2021/22 (BEIS n.d.) However, offshore wind farms bidding for the 2022/23 delivery year (where there were no ACT bids) were awarded a strike price of £57.50, leading to concern that the Triton Knoll offshore wind project had been over rewarded as a result of the price setting by small ACT projects. The National Audit office obtained the bid data (not publicly available) and has calculated that this will cost consumers around £1.5 billion over the course of the 15 year contracts.

There are clearly some scenarios when this rule change could have resulted in lower prices, particularly if offshore wind projects had bid at the higher prices predicted by the Government at the beginning of the auction process. However, this episode emphasises the importance of getting specific details 'right' when designing auctions.

Some of the dramatic falls in technology costs cause potential cost effectiveness difficulties in the legal flexibility allowed for in the contract. For example, the Neart na Gaoithe offshore wind farm contract was reinstated following a successful appeal asserting that the problems faced by the project fell within the *force majeur* provisions (see previous section). However, the value to the developer of delivering later than originally forecast is likely very high given the strong falls in technology costs. In essence, the developer will be able to deliver the project for lower capital costs than reflected in the original auction price.

4.2.3 Dynamic efficiency

The ability of the CfD auction system to promote continued reduction in energy costs from the targeted technologies is mixed. There has been a very strong emphasis in the auctions in favour of immature technology, particularly offshore wind, and mature technologies have been excluded since AR1. Similarly the ability of the system to impose minimum contributions for particular technologies has the potential to support innovation in less mature sectors.



	Offshore Wind	Onshore Wind	Advanced Conversion Technologi es	Energy from Waste with CHP	Dedicated Biomass with CHP	Solar PV	Remote island wind
AR3 (2019)	5,466	-	34	-	-	-	255
AR2 (2017)	3,196	-	64	-	86	-	-
AR1 (2015)	1,162	749	62	95	-	72	

Figure 10: Capacity allocation by technology and by allocation round across both technology groups

The impact of the decision to make three quarters of the funds available to the less-established technology group is illustrated clearly by the fact that more than half of the capacity contracted by the first auction was offshore wind, a pattern that intensified in the second and third allocation rounds. Overall, 87% of the capacity offered contracts in the first three rounds was to offshore wind projects.

Pot 2, for less established technologies appeared to offer a result more in line with expectation with the clearing price significantly lower than the administratively determined ceiling price in all years for which contracts have been allocated but within the range understood to be viable. Note the strong divergence between offshore wind technology and other pot 2 technologies as the ceiling price was reduced dramatically in preparation for allocation round 3 (for delivery between 2023 and 2025) (BEIS 2019a). This is illustrated clearly in the figure below. It is notable that AR3 displayed an increase in price for the later of its two delivery years, reversing the pattern of the two earlier rounds.

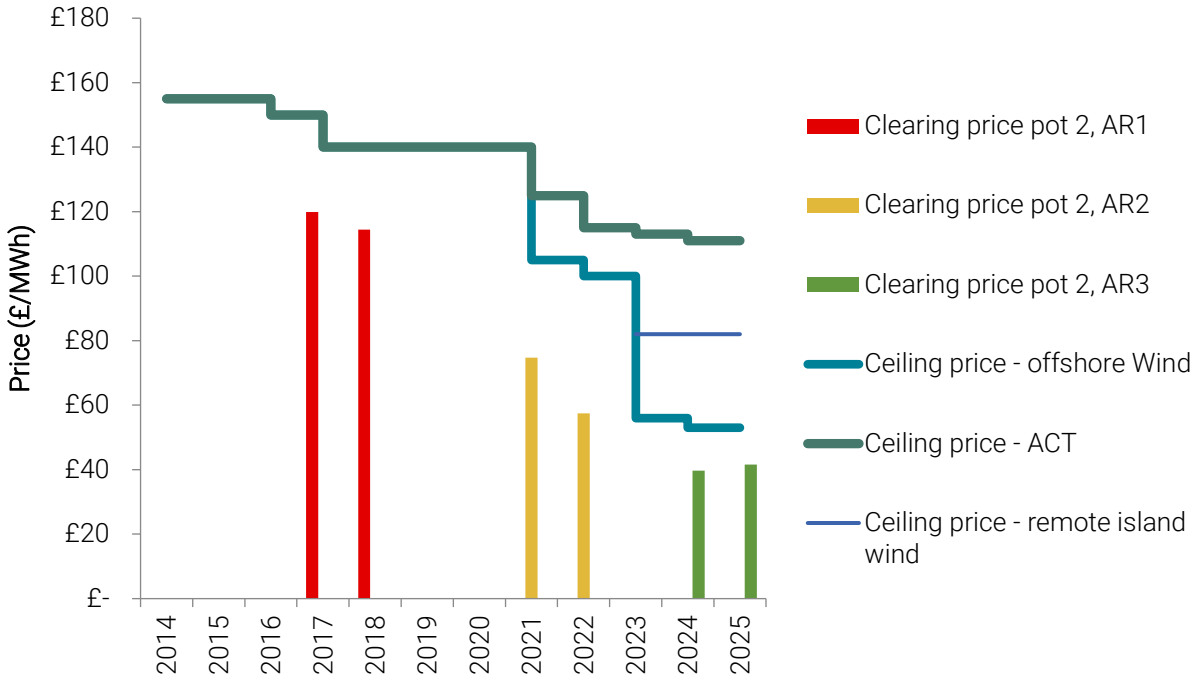


Figure 11: Pot 2 auction results and ceiling prices (administrative strike prices) of winning technologies

Another decision which had a significant impact on the outcomes was to include both wind and solar in the same technology group in allocation round 1 in 2015. Competition between the technologies meant that onshore wind - which is currently accepted to be cheaper than solar in the UK - was awarded the vast majority of the capacity in pot 1.

5 Conclusions

Design of the UK auction is complex, which could act as a barrier to entry for small players. The emphasis on offshore wind has led to dramatic price falls, and is a key element of the UK's Industrial Strategy with the only suggestion of a long term programme of auctions directed at that sector. However, this had led to a lack of diversity in the UK's renewable mix which will only increase in coming years.

The success rate (in terms of number of projects rather than capacity) is not perfect, with projects in both AR1 and AR2 having their contracts terminated. ACTs seem particularly vulnerable. The reasons for this are not clear although the overall impact on delivery volumes is small enough to be considered negligible so long as supporting specific technologies is not a strong policy objective.

There is evidence of strategic bidding in both AR1 (solar pv projects) and AR2 (Redruth ACT). In both auction rounds, developers put in 'aggressively' low bids in the hope of gaining a contract but other projects did not raise the prices in the delivery year for which they were bidding.

Only one CfD round has taken place to date, and the projects awarded contracts are still under construction. It is therefore too early to make definitive statements about the effectiveness of the mechanism in the UK. However, there are some points which are worth raising as possible future lessons:

- While the high level design of the auction process is reasonably straightforward, allocation of the contracts is complex compared to auctions in other countries
- Pay as clear and low non-delivery penalties encouraged bidders to keep away from the margin with some unfeasibly low bids in both completed auctions
- Separate clearing prices for each year mean that there was always a risk that a low bid would be the marginal bid
- In the first two years this was magnified by the split of the RO phase out – two years earlier for solar than wind
- Few solar projects appear to have even bid. This may be due to solar developers choosing to finish RO projects before their cut off, focusing on the non-CfD sub 5MW projects to avoid the cost/risk of an auction,
- The complex auction design favoured large or sophisticated actors able to navigate the quite complex process
- While the ASP is an administrative process, the split between pots was very much a political decision taken by the Secretary of State for Energy. The budget split was very favourable to offshore wind…(as a political priority)
- Since the budget is announced per auction through the budget notice there is no long term signal about future prices in any future auctions. It is clear that there was strategic bidding from at least one solar developer who was subsequently unable to sign a CfD contract. However, the penalty for failing to do so (exclusion from any future auctions within 13 months) is insignificant given that the irregularity with which auctions have been held to-date

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APPENDIX

Interviews conducted for this update report

Carly Leighton. Department of Business, Energy and Industrial Strategy. 23/4/2019

Alex Coulton. Low Carbon Contracts Company. 08/7/2019.

AURES II is a European research project on auction designs for renewable energy support (RES) in the EU Member States.

The general objective of the project is to promote an effective use and efficient implementation of auctions for RES to improve the performance of electricity from renewable energy sources in Europe.

www.aures2project.eu

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