Report D4.1-UK, April 2016

Auctions for Renewable Support in the United Kingdom: Instruments and lessons learnt

About the project

Auctions for Renewable Energy Support: Effective use and efficient implementation options (AURES)

This project helps assessing the applicability of different auction types to renewable support under different market conditions. It also explores which auction types and design specifications suit particular requirements and policy goals in European countries. By establishing best practices and a knowledge sharing network, we contribute to informed policy decision-making and to the success of auction implementations across Europe.

Target-oriented analysis: Through analysis of empirical experiences, experiments and simulation, we will create a flexible policy support tool that supports policy makers in deciding on the applicability of auction types and certain design specifications for their specific situation.

Capacity building activities: We undertake specific implementation cases to derive best practices and trigger knowledge sharing amongst Member States. We strive to create a strong network with workshops, webinars, bilateral meetings, newsletters, a website that will serve as capacity building platform for both policy makers and market participants (including project developers, auctioneers, etc.). Wherever required, we can set up specific bilateral and multilateral meetings on specific auction issues and facilitate cooperation and knowledge sharing. Additionally, we offer sparring on specific implementation options, drawing from insights gained during the first phases of the project (empirical analysis of previous auctions in Europe and the world), conceptual and theoretical analysis on the applicability of specific designs in certain market conditions and for certain policy goals issues and facilitate cooperation and knowledge sharing. Additionally, we offer sparring on specific implementation options, drawing from insights gained during the first phases of the project (empirical analysis of previous auctions in Europe and the world), conceptual and theoretical analysis on the applicability of specific designs in certain market conditions and for certain policy goals.

Project consortium: eight renowned public institutions and private firms from five European countries and combines some of the leading energy policy experts in Europe, with an impressive track record of successful research and coordination projects.

This report deals with the CfD auction, which was introduced to allocated contracts to renewable electricity projects in the UK in 2014.

The report contributes to the first and second of three tasks in work package 4 of the AURES project:

T4.1 Providing a characterisation of the different auctions

T4.2 Making an assessment of auctions and case-specific lessons learnt

T4.3 Interpreting and summarising the general lessons learnt and resulting and thereby outline specific recommendations

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Auctions for Renewable Support in the United Kingdom: Instruments and Lessons Learnt

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Sonja Förster (Ecofys)

Project deliverable:

WP4 - Empirical aspects of auctions for RES-E: Learning from real experiences.
Task 4.1 Characteristics of auctions

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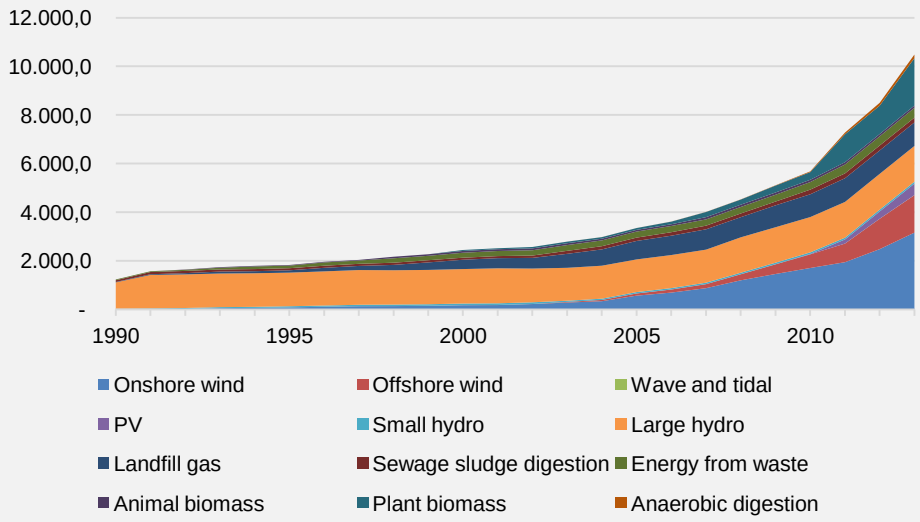
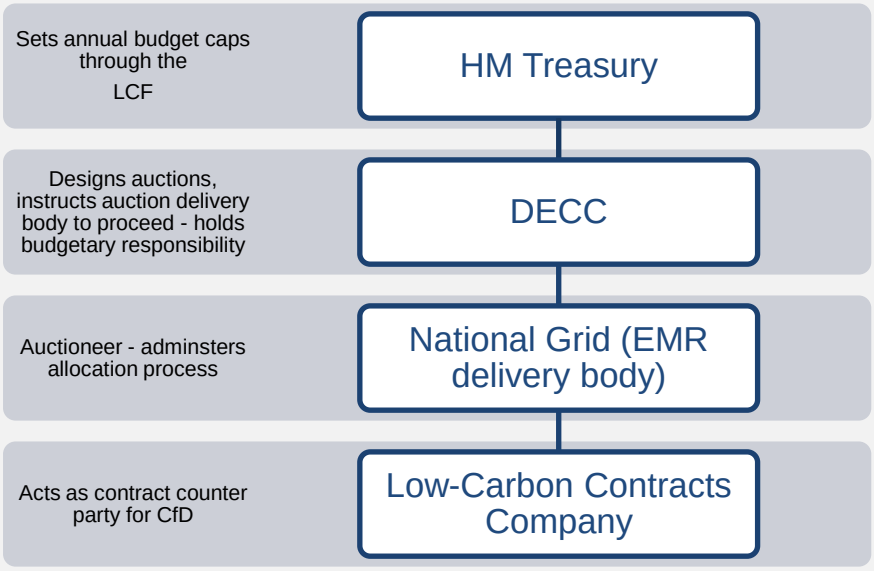
1. Characteristics of auctions in the United Kingdom

Table 1. Characterisation of auctions

Characteristics	Description
Country characteristics	The UK has a population of ca. 64 million and in 2014 its final energy consumption was 143 Mtoe. Electricity made up 18.5% of the UK's final energy consumption (26Mtoe/339TWh). 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). In 2014, renewables accounted for just under 20% of electricity generation, and overall renewables supplied 7.8% of final energy consumption (DECC, 2015c). On the basis of current performance, the UK may not meet its EU commitments – recent leaked emails from the Department of Energy and Climate Change projected that the UK might miss its target by around 3.5%[1]. The UK currently has 4GW of interconnection capacity with France, the Republic of Ireland, Northern Ireland and the Netherlands. More 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. 

[1] http://www.theecologist.org/_download/398070/amber-rudd-letters-ecologist.pdf

Characteristics	Description
	Figure 1: UK installed renewable electricity capacity (MW)(Source: Digest of UK Energy Statistics)
Market characteristics	The UK has liberalised electricity generation and retail markets. However, despite some recent trends increases in independent electricity supply, electricity generation and supply in the UK remain dominated by six vertically integrated firms often referred to as the Big Six. Together, the Big Six account for more than 90% of domestic electricity supply and own approximately 70% of the UK's generation capacity. They also dominate non-domestic electricity supply (Ofgem, 2015). Renewable electricity has been supported since 1990. The Non Fossil Fuel Obligation (auction) ran from 1990 – 1998. This was replaced by the Renewables Obligation (RO) (quota) in 2002. Large scale solar (>5MW) have been excluded from RO support since April 2015. Onshore wind will be excluded from April 2016. The RO will expire for all other technologies 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.
Name of auction scheme	Contracts for Different (CfDs), part of a wider Electricity Market Reform package.
Objectives	The 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 and doing so at least cost to consumers. The original policy objectives of the CfD auctions were primarily to introduce competition within technology groups as a means of limiting producer surplus. There is an intention to move towards technology neutrality in the future (unspecified date) (DECC, 2011).
Contracting authority	Several bodies are involved in the administration and functioning of the CfD auctions. The main government department in charge of the auction design and ultimate responsibility for the auctions is the Department for Energy and Climate Change (DECC). Although the CfD contracts are funded entirely through a levy on consumers' bills rather than taxation, the Treasury has control over the budgetary implications of the auctions through a tool known as the Levy Control Framework (LCF). The running of the auctions (accepting bids, declaring awards etc.) along with other elements related to the Energy Act 2013 is carried out by the electricity market reform (EMR) Delivery Body, a position currently held by the TSO of Great Britain, National Grid.

Characteristics	Description
	Finally, the contracting counterparty is a newly formed statutory Government-owned corporation known as the Low-Carbon Contracts Company (LCCC).  *Figure 2: Roles and responsibilities for CfD auction administration*
Main features	The CfD auctions are multi-unit, sealed-bid, uniform price auctions. The system employs technology-specific ceiling prices known as 'administrative strike prices' intended to represent similar investor returns to the previous support mechanism, the Renewables Obligation (DECC, 2013a). It also allows for technology capacity minima and maxima to be set. 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 spending implications of the auction – 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. 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 (5 - 50 MW), landfill gas and sewage gas. It consisted of £50m (€64m) for projects commissioning from 2015/16, and an additional £15m (€19m) (i.e. £65m (€83m) in total) for projects commissioning from 2016/17 onwards. The second pot, for less established technologies, included offshore wind, biomass

<table>
<tr><th>Characteristics</th><th>Description</th></tr>
<tr><td></td><td>
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, although it may be in future rounds

The results of the first allocation round are presented in Table 1[2].
Table 1: CfD auction results (Source: DECC, 2015b)
<table>
<tr><th>Project Name</th><th>Developer</th><th>Technology</th><th>MW</th><th>Strike Price £(€)</th><th>Delivery Year</th></tr>
<tr><td>BHEG Walsall</td><td>BH EnergyGap (Walsall) Ltd</td><td>Advanced Conversion Technologies</td><td>26</td><td>114.39 (146)</td><td>2018-2019</td></tr>
<tr><td>Energy Works (Hull)</td><td>Energy Works (Hull) Limited</td><td>Advanced Conversion Technologies</td><td>25</td><td>119.89 (154)</td><td>2017-2018</td></tr>
<tr><td>Enviroparks Hirwaun Generation Site</td><td>Enviroparks Operations Ltd</td><td>Advanced Conversion Technologies</td><td>11</td><td>119.89 (154)</td><td>2017-2018</td></tr>
<tr><td>Wren Power and Pulp</td><td>Gent Fairhead & Co. Ltd</td><td>Energy from Waste with CHP</td><td>49.75</td><td>80 (103)</td><td>2018-2019</td></tr>
<tr><td>K3 CHP Facility</td><td>Wheelabrator Technologies</td><td>Energy from Waste with CHP</td><td>45</td><td>80 (103)</td><td>2018-2019</td></tr>
<tr><td>EA 1</td><td>ScottishPower Renewables (UK)</td><td>Offshore Wind</td><td>714</td><td>119.89 (154)</td><td>2017-20181</td></tr>
<tr><td>Neart na Gaoithe</td><td>Mainstream Renewable Power</td><td>Offshore Wind</td><td>448</td><td>114.39 (146)</td><td>2018-2019</td></tr>
<tr><td>Dorenell Wind Farm</td><td>Infinergy</td><td>Onshore Wind</td><td>177</td><td>82.5 (106)</td><td>2018-2019</td></tr>
<tr><td>Kype Muir Wind Farm</td><td>Banks Renewables</td><td>Onshore Wind</td><td>104</td><td>82.5 (106)</td><td>2018-2019</td></tr>
<tr><td>Clocaenog Forest Wind Farm</td><td>RWE Innogy UK Limited</td><td>Onshore Wind</td><td>96</td><td>82.5 (106)</td><td>2018-2019</td></tr>
<tr><td>Middle Muir Wind Farm</td><td>Banks Renewables</td><td>Onshore Wind</td><td>60</td><td>82.5 (106)</td><td>2018-2019</td></tr>
<tr><td>Brenig Wind Farm – Brenig Wind</td><td>Brenig Wind Limited</td><td>Onshore Wind</td><td>45</td><td>79.23 (102)</td><td>2016-2017</td></tr>
</table>
</td></tr>
<tr><td>Year of introduction</td><td>The first allocation process was launched in October 2014 with awards announced in February 2015.</td></tr>
</table>

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

<table>
<tr><th>Characteristics</th><th>Description</th></tr>
<tr><td>Technology focus and differentiation</td><td>In addition to differentiating between mature and immature technologies (i.e. the established and less-established pots), the mechanism has separate budgetary constraints for the two groups. This gives the ability to set a minimum capacity volume for a particular technology, although the overall ceiling price still applies. It is also possible to set a maximum level of capacity for a technology.</td></tr>
<tr><td>Lead time before auction</td><td>There is a lengthy pre-qualification process. The actual allocation process for CfDs is begun by the publication of an Allocation Round Notice by the Secretary of State (SoS) for Energy. The start of the allocation round must be at least 10 working days after the Notice is published. The allocation round closes a further 10 working days after that.

Bidders have one week between the auction notice and the submission deadline. However, there are several stages to the process that occur over the preceding months including a prequalification process which determines whether a project is eligible for the auction process.

The timeline for the first allocation round is shown in Table 2.
Table 2: CfD 1 allocation round auction timeline
<table>
<tr><th>Milestone</th><th>Date</th></tr>
<tr><td>Allocation Round Notice</td><td>29 Aug 14</td></tr>
<tr><td>DECC published final budget notice</td><td>2 Oct 14</td></tr>
<tr><td>Allocation round commenced</td><td>14 Oct 14</td></tr>
<tr><td>Application closing date</td><td>28 Oct 14</td></tr>
<tr><td>Eligibility Results Day</td><td>13 Nov 14</td></tr>
<tr><td>Deadline for applicants to raise a review of non-qualification</td><td>By 20 Nov 14</td></tr>
<tr><td>Auction notice</td><td>28 Jan 15</td></tr>
<tr><td>Sealed bids submission closing date</td><td>By 4 Feb 15</td></tr>
<tr><td>CfD notifications sent to Low Carbon Contracts Company</td><td>26 Feb 15</td></tr>
<tr><td>LCCC sends contracts to successful applicants</td><td>By 12 Mar 15</td></tr>
<tr><td>Applicants sign and return CfDs</td><td>By 27 Mar 15</td></tr>
</table></td></tr>
<tr><td>Min. /max. size of project</td><td>The auctions are for projects with a capacity >5MW.</td></tr>
<tr><td>What is auctioned?</td><td>Auction winners are awarded a contract for difference (CfD), a financial instrument which guarantees additional revenue to those from selling power into the wholesale power market. Addition payments per MWh are calculated as the difference between the contract or ‘strike price’ and a measure of the wholesale market price known as the ‘reference price’ (Figure 4). The level of the contract strike price is determined in the</td></tr>
</table>

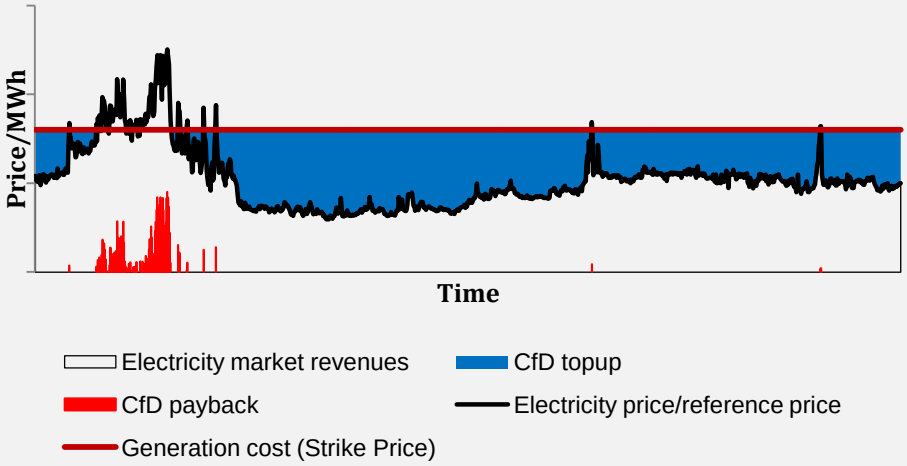
<table>
<tr><th>Characteristics</th><th>Description</th></tr>
<tr><td></td><td>auction. In instances where the wholesale power price is higher than the strike price, the contract requires that the generator makes payments to the contract counterparty.
 

Figure 3: Functioning of the CfD</td></tr>
<tr><td>Budgetary expenditures per auction and per year</td><td>CfDs are one of a series of mechanisms constrained by a Treasury limit known as the Levy Control Framework (LCF). The LCF is intended to restrict the aggregate amount of money that suppliers can levy from consumers for low carbon electricity and the Capacity Mechanism. CfDs are contained within this overall LCF.

The budget available for the auction is announced by the SoS for Energy and Climate Change 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 in each year, rather than for spending on projects which start generating in a particular year.

The actual budget allocated to the different technology pots is show in Table 4.
Table 3: Budget available for the first CfD auction (Davey, 2014; 2015)
<table>
<tr><th rowspan="2">Budget £million (€)</th><th colspan="6">Delivery Year</th></tr>
<tr><th>2015/16</th><th>2016/17</th><th>2017/18</th><th>2018/19</th><th>2019/20</th><th>2020/21</th></tr>
<tr><td>Pot 1 (established)</td><td>50 (64)</td><td>65 (83)</td><td>65 (83)</td><td>65 (83)</td><td>65 (83)</td><td>65 (83)</td></tr>
<tr><td>Pot 2 (less established)</td><td>-</td><td>155 (199)</td><td>260 (334)</td><td>260 (334)</td><td>260 (334)</td><td>260 (334)</td></tr>
<tr><td>Total</td><td>50 (64)</td><td>230 (295)</td><td>325 (417)</td><td>325 (417)</td><td>325 (417)</td><td>325 (417)</td></tr>
</table>

All the budgets are calculated on the basis of 2011/12 prices. The budgets will be inflated by a CPI factor of 1.0195.</td></tr>
</table>

Characteristics	Description
Frequency of auctions	The first auction process took place between October 2014 and February 2015. Initially it was expected that there would be a subsequent round in October 2015 but this has not been announced, and there is no indication of when it might take place
Volume of the tender	The volume of the tender is decided by the budget in each of the pots.
Auction design elements	See Table 2

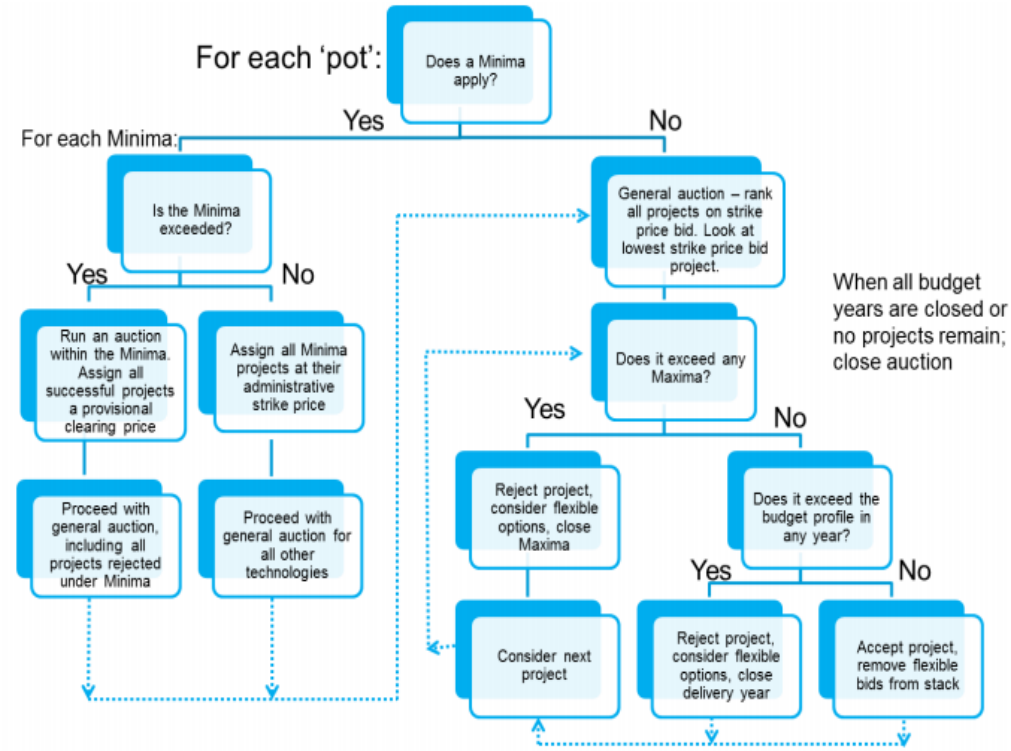
Design elements for the assessment of auction schemes for RES-E

Table 2. Design elements for the assessment of auction schemes

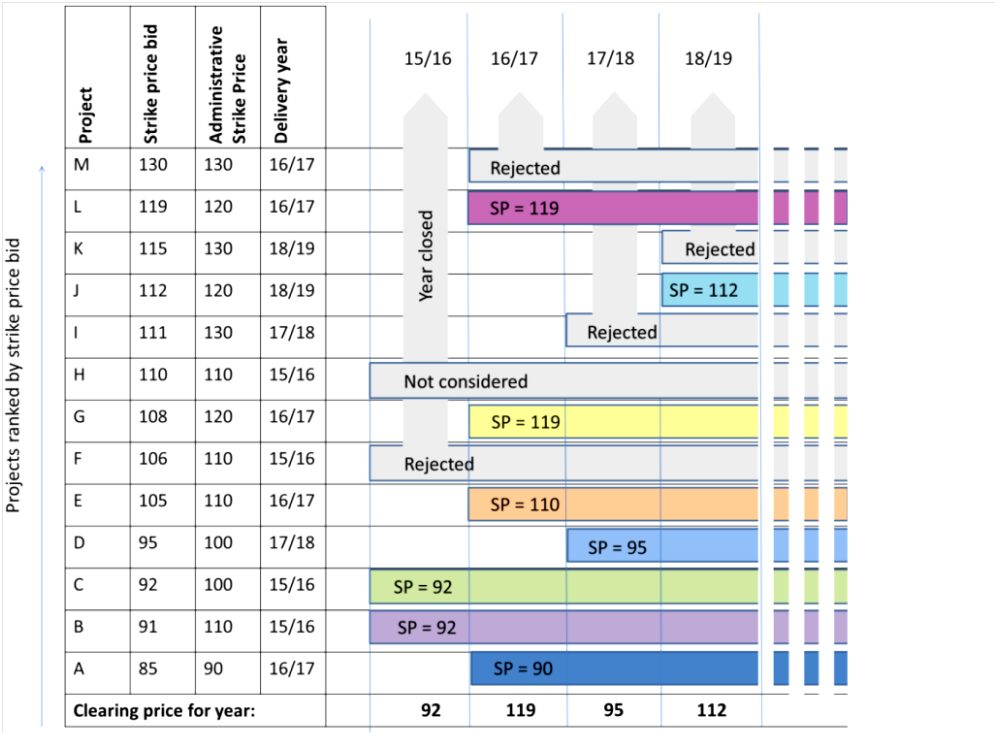
Design elements	
Single- or multiple-item auctions	Multiple
Auction procedure	Sealed bid procedure. The SoS can set a minimum budget reservation (either in MW or ££s) for specific technologies, or groups of technologies. In the first allocation round there was a minimum of 10MW for wave and tidal stream technologies. The SoS 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. Applicants can submit flexible bids into the auction process. The flexibility applies to the capacity, price and/or delivery date of a project. The auction process is 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)

[3] DECC (2014, contract for Difference: Final Allocation Framework for the October 2014 Allocation Round, October, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404405/Contract_for_Difference_Final_Allocation_Framework_for_the_October_2014_Allocation_Round.pdf

Design elements	
	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 9ie the Target Commissioning Date) 4. If the SoS 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; 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. The figure below shows the decision tree outlines how awards and prices emerge from the process:

Design elements	
	 *Figure 4: CfD auction decision tree (DECC, 2014a)* Figure 5 shows how this might work in practice[4]:

[4] DECC (2014), CFD Auction Guidance, September, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/358132/Auction_guidance_Final.pdf

Design elements	
	 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 5: Illustrative Auction Results*
Pricing rules	Pay-as-clear (uniform pricing within each year) with a separate price determined for technologies for which a minimum volume has been set, unless the general clearing price for that year is higher than the clearing price for the protected technology. If there is a minimum capacity set for a technology, a number of projects of the technology to which it applies - up to the minimum capacity - is given a reserved price (the price at which the auction would have cleared if the protected technology were the only entrant). The budget impact of the protected technology is calculated alongside the other technologies. If the general clearing price is higher than the price for the protected technology, the protected technology receives the general price. If a technology has been assigned a maximum in the pre-auction framework, the first project to breach the capacity of the maximum is rejected as are all subsequent bids from that technology.
Ceiling price	Prices for the auctions are capped at a price known as the ‘administrative strike price’. This price is based on estimates of technology and finance costs. In the event that the

Design elements	

clearing price for a particular delivery year is higher than the ceiling price in that year for technology, the ceiling price is awarded as the contract price.

The ceiling prices reduce over the period for which contracts are offered to reflect expected reductions to the cost of renewable electricity production.

Table 4: Administrative strike prices (ceiling prices) by technology type and year (2011/12 prices) (Source: DECC, 2013b)

Ceiling price, £/MWh (€/MWh)	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Pot 1 (established)					
Onshore Wind (>5 MW)	95 (122)	95 (122)	95 (122)	90 (115)	90 (115)
Solar Photo-Voltaic (>5MW)	120 (154)	120 (154)	115 (148)	110 (141)	100 (128)
Energy from Waste (with CHP)	80 (103)	80 (103)	80 (103)	80 (103)	80 (103)
Hydro (>5 MW and <50MW)	100 (128)	100 (128)	100 (128)	100 (128)	100 (128)
Landfill Gas	55 (71)	55 (71)	55 (71)	55 (71)	55 (71)
Sewage Gas	75 (96)	75 (96)	75 (96)	75 (96)	75 (96)
Pot 2 (less established)					
Offshore Wind	155 (199)	155 (199)	150 (192)	140 (180)	140 (180)
Tidal Stream	305 (391)	305 (391)	305 (391)	305 (391)	305 (391)
Wave	305 (391)	305 (391)	305 (391)	305 (391)	305 (391)
Advanced Conversion Technologies (with or without CHP)	155 (199)	155 (199)	150 (192)	140 (180)	140 (180)
Anaerobic Digestion (with or without CHP) (>5MW)	150 (192)	150 (192)	150 (192)	140 (180)	140 (180)

Design elements	
	<table><tr><td>Dedicated Biomass (with CHP)</td><td>125 (160)</td><td>125 (160)</td><td>125 (160)</td><td>125 (160)</td><td>125 (160)</td></tr><tr><td>Geothermal (with or without CHP)</td><td>145 (186)</td><td>145 (186)</td><td>145 (186)</td><td>140 (180)</td><td>140 (180)</td></tr><tr><td colspan="6">Pot 3</td></tr><tr><td>Biomass Conversion</td><td>105 (135)</td><td>105 (135)</td><td>105 (135)</td><td>105 (135)</td><td>105 (135)</td></tr></table>
Qualification criteria	A fixed-length period or 'target commissioning window'[5] is set by the Government within which contracts will come into force. Applicants state the Target Commissioning Date (TCD) and the start of the commissioning window in the application process. There are several qualification criteria against which projects are measured: • all spatial planning requirements are met and permits issued to allow the project to go ahead; • a connection agreement must be held; • the project must be shown to not be in receipt of funds from other RES policies (the Renewable Heat Incentive, the Renewables Obligation and the Capacity market scheme) (DECC, 2014c) • if the installed capacity is to be more than 300MW a 'supply chain plan' which details how the project will promote competition, innovation and skills in the supply chain must be submitted and approved (DECC, 2014c)[6]; In addition, phased offshore wind have supplementary requirements for eligibility: • There can be up to 3 phases of the project • Taken together, these 3 phases must not exceed 1500MW • Installed capacity of the first phase must be at least 25% of the total project capacity The first phase must have a Target Commissioning Date no later than 31 March 2019. The final phase must have a TCD no later than 2 years after the TCD of the first phase
Penalties	There are two scenarios in which applicants/developers can be penalised:

[5] one year for all technologies except solar PV (3 months) and landfill gas (6 months) (DECC, 2014c)
[6] Also: (HM Government, 2014)

Design elements	
	1. Being offered a CfD and refusing to sign it 2. Signing a CfD and failing to deliver the project, or alternatively failing to meet various milestones during the construction phase of the project. The primary penalty is the exclusion of any project on the same physical location from future auctions for a period of thirteen months from the date at which a contract is offered or, if already signed, terminated (DECC, 2015d).
Monitoring of realisation progress	DECC is ultimately responsible for monitoring realisation progress of the contracted projects, informed by the EMR Delivery Body.
Exceptions from requirements for small plants/developers ?	The CfD option is intended to apply to larger low-carbon projects (generally >5MW) with a targeted feed-in programme available for smaller scale projects.
Support auctioned	In principle, two model contracts are offered to bidders: an intermittent CfD applying to low and zero marginal cost technologies such as solar and wind and a baseload CfD. applying to dispatchable plant such as fuelled renewables and hydro generators. The baseload CfD could also be auctioned to nuclear operators but nuclear generators were not included in the contracts available in the first auction which was reserved entirely for renewables (DECC, 2014e)[7]. Bidders may also indicate their willingness to be 'flexible' by suggesting an alternative project capacity and/or delivery date to enable the auctioneer to adjust the stack to meet the budget constraint in each year. If a flexible bid is accepted, all other combinations offered from the same project are removed from the selection process. The bidder may indicate up to ten flexible bids with no more than three in each delivery year, and all at different prices (DECC, 2014c; Oxera, 2014).
Transferability of support right	With 10 days' notice, a generator may transfer the rights and responsibilities of the CfD to another party through sale or to a lender as part of a financial arrangement (DECC, 2014d).

[7] A CfD for the Hinkley Point C nuclear project has been agreed separately with EDF. The strike price for this was set administratively at £92.50/MWh rather than through a competitive process.

2. Evaluation criteria for the assessment of auction schemes for RES-E

Actor variety and social acceptability

A wide range of actors, from large utilities to small independent developers, were able to participate and no participant won more than a single contract. Within the current political discourse about renewable energy in the UK, the government is likely to view low out-turn cost (static efficiency) as the most reliable indicator of social acceptability.

Policy effectiveness (effectiveness of auctions)

As a budget allocation system, the CfD auction of 2014/15 had limited success. Though it failed to allot large sums of budget in the first four years for which a budget was set, the auction managed to allocate substantial amounts 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 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).

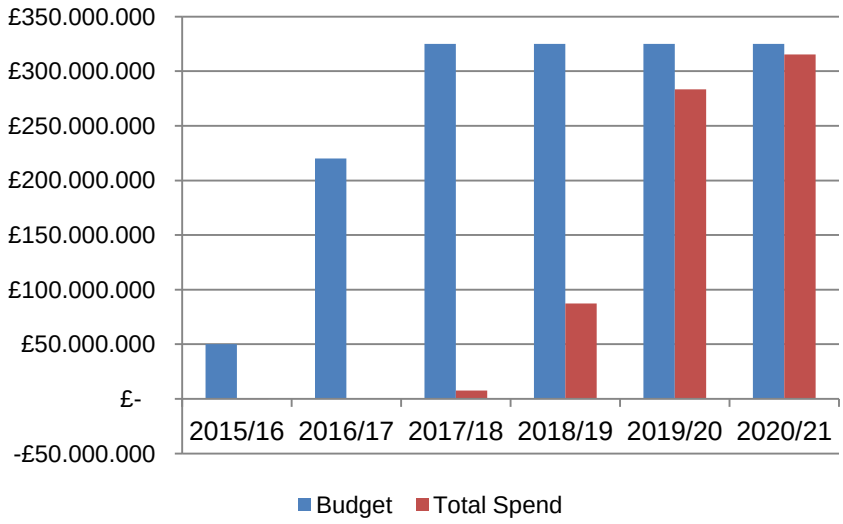


Figure 6: Budget versus total spend

The failure to allocate much of the pot 1 budget in 2015, 2016 and 2017 may be attributed 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). At the time of the auction, wind appeared to be eligible for the RO until the end of March 2017 (Ofgem, 2014a), although that date now seems likely to move forward to 2016 (Rudd, 2015)).

Since the budget profile was more-or-less flat from 2017 to 20121 and each project's cost is counted every year, later years of the allocation were likely to fill up first, depending on the random date order in which the price stack was constructed. Put another way, the first delivery year could only be filled up with projects wishing to start on that date, while later years would have to account for projects starting in earlier years.

Static efficiency or cost effectiveness (including transaction and administrative costs)

The average contract prices achieved in the first auction round appear to be competitive when compared with the administrative strike prices or cost estimates, as well as the Final Investment Decision (FIDeR) contracts awarded to several offshore wind farms earlier in 2014.

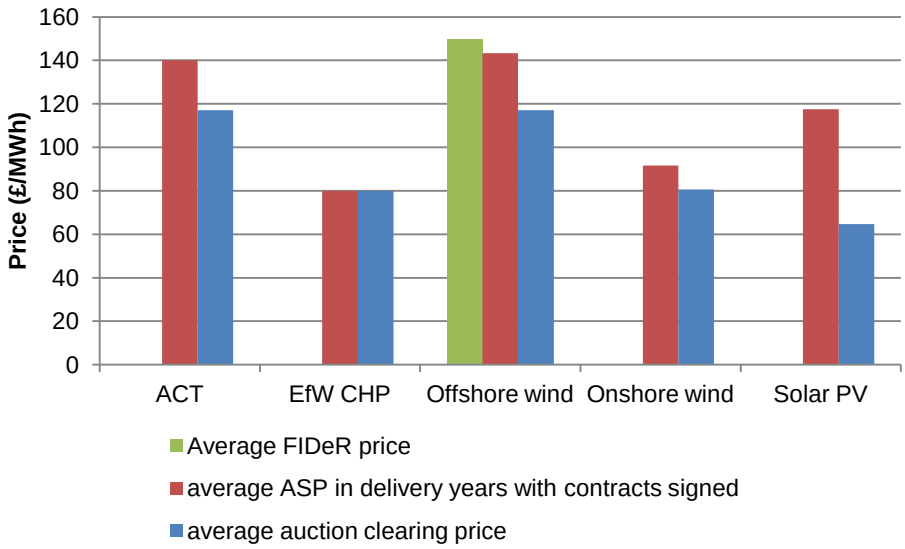


Table 5: Auction outturn prices (National Audit Office, 2014; DECC, 2015a)

One notable feature of the auction outcome was the very low pot 1 (established technologies) clearing price for the first delivery year. 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 will not be held within 13 months of the first auction have turned out to be zero) contributed to bidders placing very low bids.

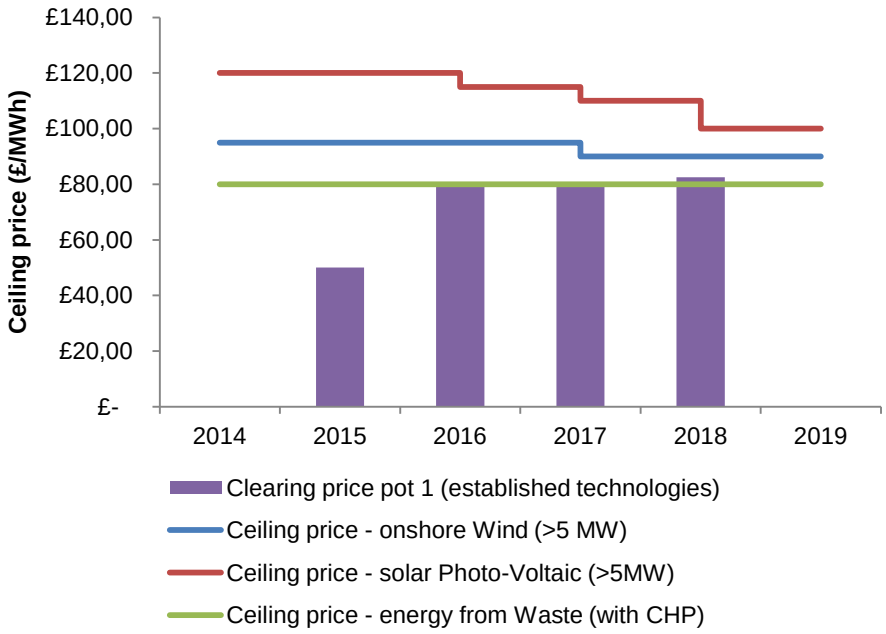


Figure 7: Pot 1 auction results and ceiling prices of winning technologies

While projects knowingly placed bids that were not commercially viable, 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[8]. 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.

Pot 2, for less established technologies, appeared to offer a result more in line with expectation, with the clearing price being significantly lower than the ceiling price in both years for which contracts were allocated but within the range understood to be viable.

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

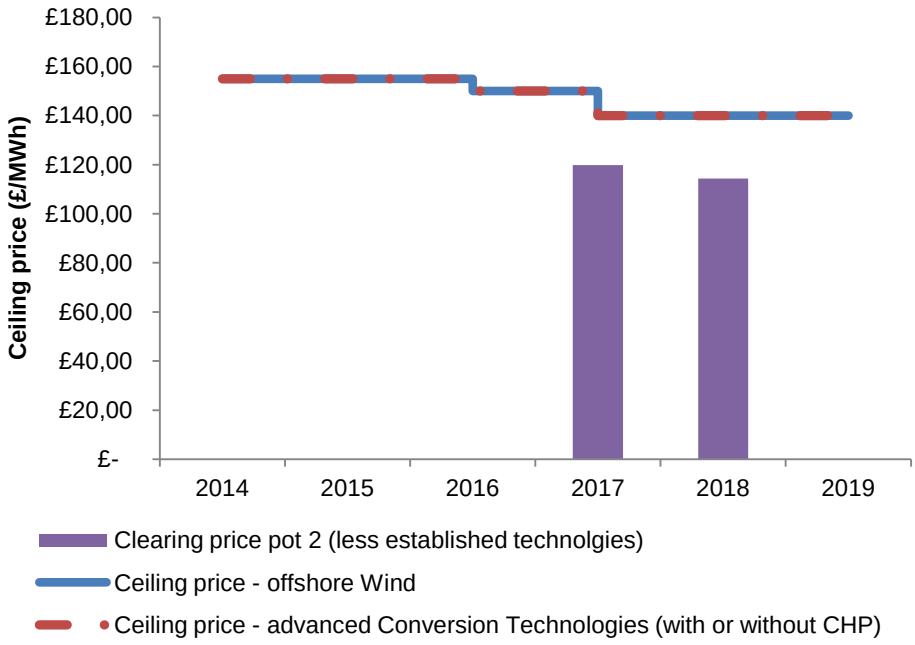


Figure 8: Pot 2 auction results and ceiling prices of winning technologies

Dynamic efficiency

The ability of the CfD auction system to promote continued reduction in energy costs from the targeted technologies is mixed. On one hand there was a very strong weighting of the auction design in favour of immature technology. The size of 'pot 2' – the budget portion reserved for 'less established technologies' – was nearly three times the size of the mature technology 'pot 1'. Similarly the ability of the system to impose minimum contributions for particular technologies has the potential to support innovation in less mature sectors.

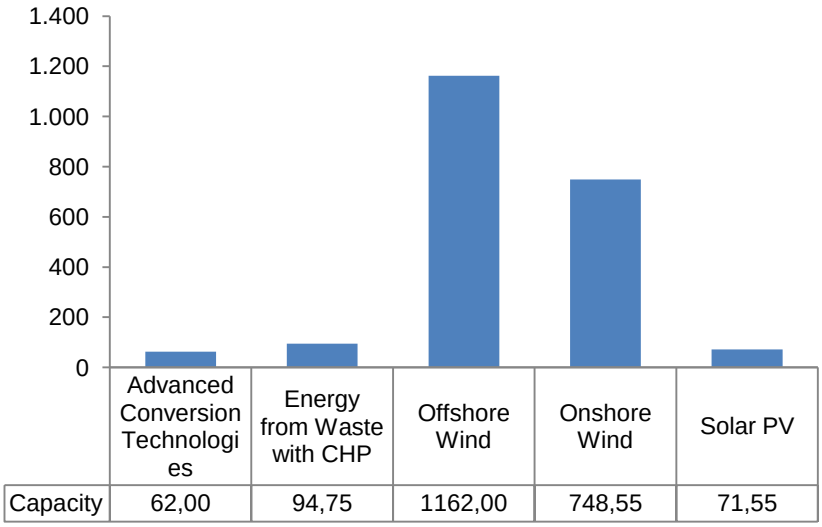


Figure 9: Capacity allocation by technology across both technology groups

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.

Another decision which had a significant impact on the outcomes was to include both wind and solar in the same technology group. 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.

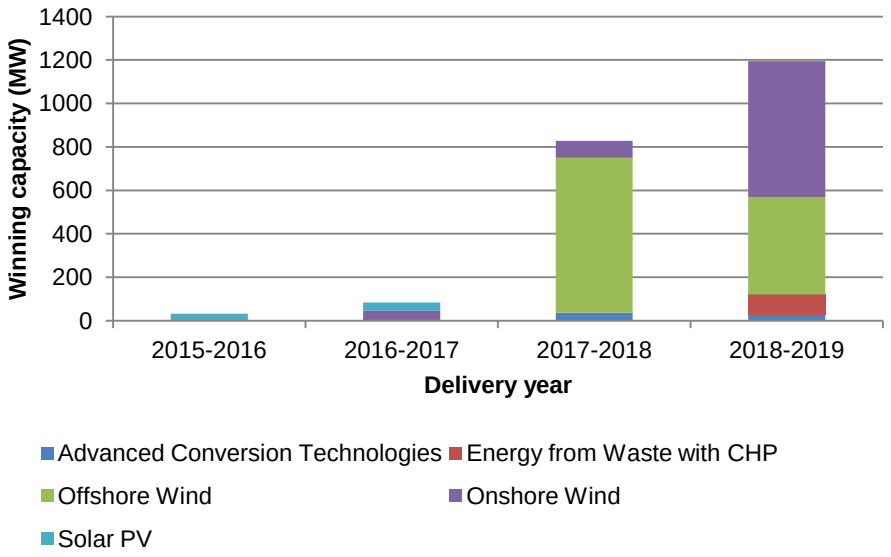


Figure 10: Capacity allocated by technology and delivery year

Compatibility with market principles and integration

Creating a framework which maintains or increases the exposure of renewable generators to the wholesale power markets was a principle of the EMR programme (DECC, 2011). The nature of the contract appears to have achieved that aim.

Distributional effects & minimisation of support costs

The combination of low contract prices and strictly managed budgets mean the overall support costs are tightly controlled. The costs incurred by the contract counterparty are funded by a levy on all licenced electricity suppliers.

3. Lessons learnt: key best practices and pitfalls identified

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 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 encouraged bidders to keep away from the margin with some very low bids
- 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 big or sophisticated players 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 SoS. 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 there have been no other bidding rounds announced

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