| | |
|---|---|
| **Title:** Classifying remote island wind as a separate technology in the Contracts for Difference (CfD) scheme<br><br>**IA No:** BEIS011(F)-18-CE<br>**RPC Reference No:** N/A<br>**Lead department or agency:** Department for Business, Energy and Industrial Strategy<br>**Other departments or agencies:** N/A | **Impact Assessment (IA)**<br>**Date:** TBC<br>**Stage:** Final<br>**Source of intervention:** Domestic<br>**Type of measure:** Secondary legislation<br>**Contact for enquiries:** BEISContractsForDifference@beis.gov.uk |

## Summary: Intervention and Options

**RPC Opinion:** Not Applicable

| Cost of Preferred (or more likely) Option | | | | |
|---|---|---|---|---|
| **Total Net Present Value** | **Business Net Present Value** | **Net cost to business per year** (EANDCB in 2014 prices) | **One-In, Three-Out** | **Business Impact Target Status** |
| £0-800m | N/A | N/A | Not in scope | Non qualifying provision |

**What** is the problem under consideration? Why is government intervention necessary?

Electricity generation accounts for over 20% of UK greenhouse gas emissions and without government intervention market incentives are not sufficient to meet the UK's climate change commitments. The Contracts for Difference (CfD) scheme is the government's primary means of supporting low carbon power generation. CFDs are typically allocated by means of a reverse, sealed bid auction. For the purposes of such allocation rounds technologies compete for support within one of two distinct groups ('pots'). The Government considers that wind projects situated on remote islands (RIW projects) have characteristics which make them more suited to compete with other less established technologies in "Pot 2". Government intervention is necessary to establish a distinct sub-class of generating station in respect of which a CFD application can be made and to ensure that RIW projects are eligible to take part in in future CFD allocation rounds as a Pot 2 technology.

**What are the policy objectives and the intended effects?**

The Government's objective is to enable potential generators of RIW projects to compete in the CfD scheme. This could increase diversification of the UK electricity supply and increase competitive tension within Pot 2 of the CfD scheme, bringing down the costs of electricity decarbonisation and improving the security of supply. Where RIW projects cannot compete on price with other technologies in Pot 2, they will not be awarded a CfD.

**What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)**

The following options have been considered in this IA:
(i) **Do nothing**: wind projects on the remote islands of Great Britain would not be defined as a distinct sub-class of eligible generating station and would not therefore be eligible to take part in future CFD allocation rounds as a Pot 2 technology. Although remote island wind projects would continue to be eligible to compete in future CFD allocation rounds as Pot 1 technology (onshore wind), they would be unlikely to be competitive against other more established technologies;(ii) **Classify remote island wind as a distinct sub- class of generating stations**: under this option a separate administrative strike price would be set for RIW projects, and future CFD allocation frameworks would specify that such projects would be eligible to compete as a Pot 2 technology.
Option (ii) is the preferred option as it achieves the government's objectives and has the potential to generate net benefits to the electricity system.

**Will the policy be reviewed?** It will not be reviewed. **If applicable, set review date:** N/A

| | | | | |
|---|---|---|---|---|
| Does implementation go beyond minimum EU requirements? | No | | | |
| Are any of these organisations in scope? | **Micro** Yes | **Small** Yes | **Medium** Yes | **Large** Yes |
| What is the $CO_2$ equivalent change in greenhouse gas emissions? (Million tonnes $CO_2$ equivalent) | **Traded:** -5.6 | **Non-traded:** 0 | | |

***I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.***

Signed by the responsible Minister: ............................................ Date: ..............................

# Summary: Analysis & Evidence — Policy Option 2

**Description:** Classify remote island wind as a distinct sub- class of generating stations.

**FULL ECONOMIC ASSESSMENT**

| Price Base Year 2012 | PV Base Year 2022 | Time Period Years 25 | Net Benefit (Present Value (PV)) (£m) | | |
|---|---|---|---|---|---|
| | | | **Low:** 0 | **High:** 800 | **Best Estimate:** N/A |

| COSTS (£m) | Total Transition (Constant Price) | Years | Average Annual (excl. Transition) (Constant Price) | Total Cost (Present Value) |
|---|---|---|---|---|
| **Low** | - | | - | **0** |
| **High** | - | | - | **0** |
| **Best Estimate** | - | | - | **N/A** |

**Description and scale of key monetised costs by 'main affected groups'**

The costs of the proposal depend heavily on the extent to which RIW projects are competitive in future allocation rounds as a Pot 2 technology. Where no RIW projects are competitive, the gross costs would be zero. Where RIW projects are successful in securing a CfD, costs have been illustratively estimated for the cost of generation (up to PV £1,500m). However RIW would displace other more expensive renewables and therefore on a net basis would represent a generation cost saving captured in the benefits below.

**Other key non-monetised costs by 'main affected groups'**

None identified.

| BENEFITS (£m) | Total Transition (Constant Price) | Years | Average Annual (excl. Transition) (Constant Price) | Total Benefit (Present Value) |
|---|---|---|---|---|
| **Low** | - | | - | **0** |
| **High** | - | | - | **800** |
| **Best Estimate** | - | | - | **N/A** |

**Description and scale of key monetised benefits by 'main affected groups'**

The benefits of the proposal also depend on the extent to which RIW projects are successful in future CfD allocation rounds. Where no RIW projects are successful, the benefits would be zero. Where RIW projects are successful, illustrative benefits have been estimated for reduced generation costs (up to PV £500m, assuming generation is held fixed), and carbon savings (up to PV £300m).

**Other key non-monetised benefits by 'main affected groups'**

Where RIW projects are successful in securing a CfD, further benefits would be anticipated in terms of diversification leading to improved security of electricity supply, innovation among other less established technologies (particularly resulting from the infrastructure that could accompany RIW projects), improvements in the efficiency of the local electricity grid arising from better connections to the mainland, and potentially local and national air quality improvements from avoiding the use of combustible fuels for generation. The potential household bill savings have been estimated at up to £1 per year.

**Key assumptions/sensitivities/risks** — **Discount rate** 3.5

1) The extent to which RIW projects are able to compete against other Pot 2 technologies is highly uncertain. As a result, a range of scenarios have been tested.
2) The capacity and deployment mix of future projects is illustratively based on one commissioning year from CfD allocation round 2.
3) The costs estimated do not include wider electricity system impacts, such as balancing costs. These are covered qualitatively only but are expected to be small.

**BUSINESS ASSESSMENT (Option 1)**

| Direct impact on business (Equivalent Annual) £m: | | | Score for Business Impact Target (qualifying provisions only) £m: N/A |
|---|---|---|---|
| **Costs:** N/A | **Benefits:** N/A | **Net:** N/A | N/A |

## Section 1: Problem under consideration

1. There is potential for electricity generation from wind farms on the remote islands of Great Britain, particularly in Scotland, to contribute to the longer term energy mix in the UK and to help the government to meet its renewable energy and decarbonisation objectives.

2. Some remote islands are completely electrically isolated (with no connection at all to the mainland). Others do have distribution network connections, but these have no or very limited capacity. This means that any new renewable generation projects have limited ability to sell the power they produce - and have little ability to export any electricity they produce which is surplus to the islands' immediate needs. The construction of new, larger, transmission connections from the GB grid to, in particular, Orkney, Shetland and the Western Isles, are dependent on sufficient new generating capacity being installed on the islands to effectively underwrite the cost of investment.

3. Wind projects on remote islands would have characteristics - including in many cases higher construction and operating costs, including from connecting the islands to the main electricity grid, which would only be partly offset by increased load factors – which sets them apart from onshore wind projects elsewhere in the UK. Under the current (CfD) scheme design, remote island wind (RIW) is not differentiated from onshore wind, which itself is classed as an established ("Pot 1") technology. The Government considers that the higher costs faced by RIW projects mean that at present they would find it difficult to effectively compete with the more established technologies in Pot 1, including "mainland" onshore wind projects.

## Section 2: Rationale for intervention

4. Electricity generation accounts for over 20% of UK greenhouse gas emissions[1] and without government intervention market incentives are not sufficient to meet the UK's climate change commitments. These barriers and market failures are set out in detail in previous Electricity Market Reform Impact Assessments.[2]

5. The Government recently consulted on a proposal to set a separate administrative (i.e. maximum) strike price for RIW projects and for those projects to be eligible to take part in future CFD allocation rounds as a Pot 2 technology (such that they compete for available budget with other less established technologies only). The rationale for this policy is to maximise the potential benefits that may arise from deploying RIW, which include:

   - **Increasing competition to drive down costs**: RIW projects face higher costs compared to mainland onshore wind. For example, projects on the Scottish Island groups of Orkney, Shetland and the Western Isles that would connect to the transmission network are estimated to cost between £19 and £30 more per MWh of generation than mainland onshore wind (2014 prices, see Annex A for further details), and more broadly the conditions faced by RIW projects likely result in higher operating and maintenance costs. Such additional costs could make RIW projects uncompetitive against established technologies, whereas competing against less established technologies may be a catalyst for cost reductions, thereby reducing the cost of decarbonising the GB power system.
   - **Diversification**: There is significant longer term potential for the development of RIW projects,[3] and there are already over 1 GW of projects in relatively advanced stages of planning. The inclusion of RIW as a separate technology in the CfD allocation process provides the opportunity for further diversification of the UK's energy supply.
   - **Driving innovation**: The development of RIW projects has the potential to enable innovation across other less established renewable technologies. For example, successful RIW projects could require the construction of new transmission links, the

[1] See: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2015
[2] For example see Section 2 of the January 2013 EMR Delivery Plan Impact Assessment, available here: http://www.parliament.uk/documents/impact-assessments/IA13-002.pdf
[3] An independent study by Baringa in 2013 suggested that around 2.4GW of RIW could be deployed if the barriers to deployment, particularly grid constraints, could be resolved. Report available here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/199038/Scottish_Islands_Renewable_Project_Baringa_TNEI_FINAL_Report_Publication_version_14May2013__2_.pdf

establishment of which could reduce certain barriers to entry currently facing innovative tidal and wave generation technologies.

- **Enhancing local security of supply**: Support for RIW projects available through the CfD may, to an extent, offset the need for support that would otherwise be required to maintain security of supply on the islands. In addition, the existence of any new transmission links facilitated by remote islands wind could reduce the cost of delivering energy security.

## Section 3: Policy objective

6. The primary policy objective is to enable potential RIW projects to compete in the CfD scheme, including off the coast of Scotland, where they may directly benefit local communities. This should improve the diversity of renewable electricity supply and increase competitive tension among less established technologies to reduce the long term costs of decarbonising the power sector.

7. To qualify as a RIW project, the project would have to meet all of the following criteria:

- it generates electricity from the use of wind;
- it is connected to the national transmission system for Great Britain or to the distribution system
- it is located on an island located in offshore waters all parts of which are at least 10 km from mainland Great Britain (GB); and
- either:
  - the generation circuit between the CFD unit and the main interconnected transmission system consists of not less than 50 kilometres of cabling, not less than 20 kilometres of which is subsea cabling; or
  - where the CFD unit connects to the distribution network, the electrical connection between its grid supply point and the main interconnected transmission system consists of not less than 50 kilometres of cabling, not less than 20 kilometres of which is subsea cabling.

8. The proposed amendment is consistent with the original policy intention underlying the CfD scheme and does not have any further impact upon its overall design, operation, budget or purpose. In particular, RIW projects would be subject to the same competitive allocation process which applies to other Pot 2 technologies.

## Section 4: Description of options considered

9. The following options are considered in this IA:

   i) Do nothing: Do not classify RIW projects as a distinct sub-class of generating station. Under this option, RIW projects would continue to be eligible to take part in CFD allocation rounds as a Pot 1 technology (onshore wind).

   ii) RIW projects would be classified as a distinct sub-class of generating station: under this option, a separate administrative strike price would be set for RIW projects, and future allocation frameworks would specify RIW as a Pot 2 technology.

10. Alternative options, such as providing a separate subsidy to the monopoly transmission operator for investment in the necessary connections to the remote islands alongside the competitively allocated CfD, have been considered but it was concluded that this would create a greater risk of distortions because of the hidden subsidy and the distortion in charging to other potential system users. Provision of separate subsidies to generation and to transmission investment would also raise concerns in regard to the obligations on independent and cost reflective regulation of transmission charges in accordance with Directive 2009/72/EC (the “Third Package”). The provision of alternative investment aid to the transmission operator would also require an alternative source of funds, and would be a departure from the preferred model where transmission infrastructure is funded through on-going charges. Further, direct subsidy to cover

transmission charges would not overcome all barriers facing RIW projects, in particular for those connecting to the distribution network.

### Option 1 – Do nothing

11. Under this option, RIW projects would not be defined as a distinct subclass of eligible generating station and would not therefore be eligible to compete in future CfD allocation rounds as a Pot 2 technology. They would still be eligible to compete as onshore wind in any future allocation rounds for established technologies but, because of their higher costs when compared to mainland onshore wind projects, would be unlikely to win support. They could also decide to deploy on a merchant basis or look for support through, for example, a corporate Power Purchasing Agreement. However, because of their higher costs relative to other technologies, particularly mainland onshore wind (see above), both of these potential routes to market are unlikely to be viable.

### Option 2 – Define remote island wind as a distinct technology

12. Under this option, RIW projects would be classified as a distinct sub-class of generating station and future allocation frameworks would specify that such generating stations would specifiy RIW projects as a Pot 2 technology. The proposed maximum support level (the administrative strike price) and the delivery years that would be available for RIW projects would be decided before the opening of any such future allocation round.

## Section 5: Analytical approach

13. Due to the uncertainties associated with forecasting, specifically auction outcomes, a scenario-based analysis has been carried out for this impact assessment. This analysis models the impact of the policy in a range of scenarios. These scenarios are illustrative, using evidence from the most recent CfD allocation round but should not be interpreted as forecasts of future outcomes or Administrative Strike Prices (ASP).

14. In order to calibrate the analysis against recent CfD outcomes, the scenarios are based around variations of the outcomes of the second CfD allocation round in terms of capacities, technology mixes, and clearing price for the commissioning year 2021/22.[4] For comparability and simplicity, a fixed RIW capacity of 500MW (around half of the current estimated pipeline) is assumed to be competing and the total annual generation from projects winning a CfD is assumed to be constant. This means that we do not assume that any CfD support cost savings associated with a cheaper technology taking part are reallocated towards procuring increased generation capacity, as would happen in a future allocation round, but capture this impact in terms of cost savings (which are therefore illustrative only). This limits the already significant uncertainty in the analysis about the mix of technologies winning a CfD in future. Further detail on how these scenarios are constructed and the key assumptions are set out in Annex B.

15. Table 1 summarises the scenarios which have been tested. The factors which vary between those scenarios include the degree to which RIW projects are able to effectively compete against other less established technologies in Pot 2 as well as the total capacity and the bid prices of the other competing technologies.

[4] For further details see: https://www.gov.uk/government/publications/contracts-for-difference-cfd-second-allocation-round-results. Some offshore wind bid price assumptions are based on clearing prices for the commissioning year 2022/23.

*Table 1: Description of illustrative scenarios used to demonstrate potential impact, 2012 prices*

| Scenario | RIW Capacity (Bid strike price) | Fuelled Technology Capacity (Bid strike price) | Offshore Wind Capacity (Bid strike price) | Clearing Price | Technologies winning CfDs |
|---|---|---|---|---|---|
| 1A (Do Nothing) | N/A | 150MW (£74.75/MWh) | 860MW (£57.50/MWh) | £74.75/ MWh | Fuelled technologies<br>Offshore wind |
| 1B (Do Nothing) | N/A | 150MW (£66.13/MWh[5]) | 860MW (£74.75/MWh) | £74.75/ MWh | Fuelled technologies<br>Offshore wind |
| 2A | 0MW (£75.50/MWh) | 150MW (£74.75/MWh) | 860MW (£57.50/MWh) | £74.75/ MWh | Fuelled technologies<br>Offshore wind |
| 2B | 500MW[6] (£56.50/MWh) | 0MW (£74.75/MWh) | 670MW (£57.50/MWh) | £57.50/ MWh | RIW<br>Offshore wind |
| 2C | 500MW (£56.50/MWh) | 150MW (£66.13/MWh) | 415MW (£74.75/MWh) | £74.75/ MWh | RIW<br>Fuelled Technologies<br>Offshore wind |

Note: Options assume that total generation of electricity remains the same across all scenarios.

16. Scenarios 'Option 1A' and 'Option 1B' are two illustrative outcomes of the 'Do Nothing' Option 1. In option 1A offshore wind is assumed to be cheaper than fuelled technologies[7] and for option 1B the reverse is true.

17. Scenarios 'Option 2A', 'Option 2B' and 'Option 2C' are illustrative outcomes of policy Option 2, where RIW competes with fuelled technologies and offshore wind. In scenario 'Option 2A' RIW bids at a price above both fuelled technologies and offshore wind and is compared to Option 1A. In scenario 'Option 2B' RIW is more competitive than both alternative technologies and as fuelled technologies are assumed to be the most expensive technology are displaced. Scenario 'Option 2B' is compared to a baseline of scenario 'Option 1A'. In scenario 'Option 2C' RIW is more competitive than both alternatives but some offshore wind is assumed to be the most expensive in this scenario and so is partially displaced. Scenario 'Option 2C' is compared against baseline scenario 'Option 1B'.

18. In the following section the costs of each scenario are estimated and compared on the basis of:

   i. **Generation costs**: this reflects the capital, operating, transmission and insurance costs of building and operating the relevant generating stations. These are calculated based on the 2016 BEIS Generation Costs Report estimates of levelised cost of electricity for offshore wind and fuelled technologies and BEIS internal analysis for Remote Island Wind (see Annex B)[8]. Adjustments are made as necessary to be consistent with the assumed strike prices set out in Table 1. This only reflects the generation cost, and not the whole impact of the generation on

[5] This is an illustrative bid price and is an average of the observed offshore wind bid price of £57.50/MWh (the CfD round 2 auction clearing price for commissioning year 2022/23) and the assumed fuelled technologies bid price of £74.75/MWh (the CfD round 2 auction clearing price for commissioning year 2021/22).
[6] This is an illustrative capacity and does not reflect BEIS expectation of successful bidding technologies at future auction rounds.
[7] 'Fuelled technologies' are defined here as a mixture of Advanced Conversion Technologies (ACT) – Energy from Waste and Dedicated Biomass with combined heat and power. See Annex B for further details.
[8] Available here: https://www.gov.uk/government/publications/beis-electricity-generation-costs-november-2016. Load factor for offshore wind is drawn from the Renewables Obligation Setting Publication for 2018/19: https://www.gov.uk/government/publications/renewables-obligation-level-calculations-201819

the electricity system (for example, differences in balancing and network costs) which are described qualitatively in this IA. Note that whilst the IA estimates the change in the costs of delivering a fixed level of generation, in future CfD auctions it is likely that any reduction in costs would mean that 'saving' being allocated to supporting more capacity.

ii. **Carbon impacts**: different generating technologies produce different amounts of greenhouse gas emissions for each MWh of electricity, and altering the technology mix across the scenarios affects the emissions intensity of the generation. The analysis has calculated the carbon impact from a scenario where RIW replaces fuelled technologies in the generation mix (scenario 'Option 2B'). Fuelled technologies, which have the potential to reduce emissions compared to fossil fuels, may still produce greenhouse gas emissions as the fuel is burned to produce electricity. Scenarios 'Option 2A' and 'Option 2C' do not have any carbon impacts as there is no assumed change in generation from fuelled technologies.

iii. **Air quality impacts**: similarly, different generating technologies give rise to different levels of particulates that can affect air quality. This impact is considered only in qualitative terms.

iv. **Support cost impacts**: these are calculated as the difference between the wholesale electricity price and the strike price assumed to be given to winning projects. This does not form part of the cost-benefit analysis as it represents a transfer between consumers and generators, but the illustrative magnitude of support costs are estimated to demonstrate the potential differences in costs to consumers.

19. All impacts have been monetised in 2012 prices for comparability to the assumed strike prices (which are set in 2012 prices), and discounted in accordance with the HM Treasury Green Book.[9] Further details of the analytical approach and key assumptions are set out in Annex B.

## Section 6: Cost benefit analysis

### 6.1 Generation costs

20. Generation costs are estimated as the resource costs involved in producing electricity. They encompass pre-development expenditure, capital costs, operating costs, financing, insurance costs, and generation over the 25 year appraisal period, and are discounted using the HM Treasury 'Green Book' social discount rate of 3.5%. These are similar but not the same as strike prices, which are the CfD price paid per MWh over the 15 year contract life. A generation cost per MWh under each scenario has been estimated to be consistent with the strike prices assumed.

21. The estimated generation costs for each scenario are set out in Table 2. Under the illustrative scenario 'Option 2A', RIW projects are assumed to bid for CfDs at a price that is uncompetitive when compared to offshore wind and fuelled technologies, and so are unsuccessful in securing a CfD. As a result, there is no change in total Pot 2 generation costs when compared to the do nothing baseline, Scenario 'Option 1A'[10], as the generation mix of technologies continues to consist of offshore wind and fuelled technologies only.

[9] Available at: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

[10] To ensure comparability, Option 2A and Option 2B are compared against Option 1A, where fuelled technologies set the clearing price. Option 2C is compared against option 1B, where offshore wind sets the clearing price.

*Table 2: Illustrative changes in generation costs of policy scenarios, present value 2022/23-2047/48*

| Scenario | Offshore Wind Generation cost (PV £m) | Fuelled Technologies Generation Cost (PV £m) | Remote Island Wind Generation cost (£m) | Present Value of Total Generation Cost (£m) | Avoided generation costs against the appropriate baseline (£m) |
|---|---|---|---|---|---|
| Option 1A | 3,000 | 1,200 | 0 | 4,300 | N/A |
| Option 1B | 3,800 | 1,100 | 0 | 4,900 | N/A |
| Option 2A | 3,000 | 1,200 | 0 | 4,300 | 0 |
| Option 2B | 2,300 | 0 | 1,500 | 3,800 | 500 |
| Option 2C | 1,800 | 1,100 | 1,500 | 4,400 | 500 |

Note: rows may not sum due to rounding to the nearest £100m.

22. Scenario 'Option 2B' results in a reduction in generation costs of around £500m compared to a baseline of scenario 'Option 1A'. Under this scenario RIW bids in at a price that is cheaper than offshore wind and fuelled technologies, and therefore RIW displaces all fuelled technologies and some of the offshore wind capacity. In this scenario, RIW is assumed to have a cheaper generation cost per MWh than the alternatives (assumed to be £55.45 compared to £70.75 for fuelled technologies), which results in a saving in generation costs.[11]

23. Scenario 'Option 2C' results in a reduction in generation costs of around £500m compared to a baseline of scenario 'Option 1B'.[12] In this scenario it is assumed that the generation cost of RIW is £55.45/MWh. The baseline – scenario 'Option 1B' – assumes that fuelled technologies have a lower generation cost than offshore wind, therefore here it is assumed that offshore wind is displaced in this scenario, rather than fuelled technologies. All five options assume the same amount of electricity generation is purchased.

### 6.2 Impact on greenhouse gas emissions

24. The estimated changes in the value of greenhouse gas emissions from electricity generation for each scenario is set out in Table 3. 'Option 2B', is the only scenario where there is an impact as this is the only scenario where RIW displaces fuelled technologies, which generate greenhouse gas emissions from the fuels burned in generating electricity. This is estimated by applying an estimated carbon intensity per MWh of generation for the fuelled technologies, derived from historical data under the Renewables Obligation, and valuing the resulting emissions estimates in line with the supplementary Green Book guidance on valuing greenhouse gas emissions.[13]

*Table 3: Illustrative changes in value of carbon, present value, 2012 prices*

| Scenario | Value of saving in greenhouse gas emissions (£m) | Description |
|---|---|---|
| Option 1A | N/A | Do nothing Option A |
| Option 1B | N/A | Do nothing Option B |
| Option 2A | 0 | No change against scenario 'Option 1A' as RIW is assumed to be more expensive than alternatives |
| Option 2B | 300 | RIW displaces fuelled technologies leading to a reduction in emissions |
| Option 2C | 0 | No change against scenario 'Option 1B' as RIW displaces offshore wind and so 150MW of fuelled technologies still remain |

[11] Note that these are levelised costs, which are consistent with, but not the same as, the strike prices assumed for the technologies considered in this IA. See Annex B for more details.
[12] Scenario 'Option 2C' is compared against a baseline of scenario 'Option 1B' for consistency of assumptions around technology costs and which technology would set the auction clearing price.
[13] Available here: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

### 6.3 Air Quality

25. The scenarios are likely to result in a zero impact or an improvement in air quality as a result of the displacement of fuelled technologies in certain scenarios. Scenarios 'Option 2A' and 'Option 2C' should not have any impact. Scenario 'Option 2B' is likely to improve air quality as a result of less combustible fuel being burned to generate electricity. It has not been possible to monetise these impacts.

### 6.4 Combined cost-benefit analysis of illustrative scenarios

26. The combined estimated impact of the scenarios considered in this IA are set out in Table 4. Scenario 'Option 2A' has zero impact as no RIW is deployed; whilst scenario 'Option 2B' generates net benefits of £800m comprised of around £500m of reduced generation costs and approximately £300m carbon savings from avoided fuelled technology generation Scenario 'Option 2C' generates net benefits of around £500m from lowering the cost of generation by displacing fuelled technologies and some offshore wind. Further detail on these scenarios can be found in Annex B.

27. These scenarios imply an illustrative range of impacts from £0 to £800m in net present value terms. No central estimate is made as the outcomes of future CfD allocation rounds are highly uncertain.

*Table 4: Summary of cost-benefit analysis for the illustrative scenarios, Net Present Value, 2012 prices*

| PV, £m | Scenario Option 2A | Scenario Option 2B | Scenario Option 2C |
|---|---|---|---|
| Value of avoided generation costs | - | 500 | 500 |
| Value of carbon savings | - | 300 | - |
| Net Present Value (£m) | 0 | 800 | 500 |

### 6.5 Support costs

28. Whilst not forming part of the cost-benefit analysis, the CfD support costs have been estimated by comparing the relevant strike prices to a projection of the wholesale price over the lifetime of the projects (see Annex B for further detail). Administrative strike prices – which specify the maximum price per MWh that a particular technology can receive, irrespective of the auction clearing price – have not at this stage been set for any future allocation rounds. As a result, a range has been tested where the 'low' estimate assumes that each technology's bid price is the maximum administrative strike,[14] and 'high' assumes that all administrative strike prices are above the clearing price.[15] These results are illustrative only and should not be read as an indication of government policy on administrative strike prices of future allocation rounds.

*Table 5: Illustrative gross support costs under policy scenarios over the lifetime of the CfD, 2012 prices*

| Scenario | Change in support costs over the 15 year CfD lifetime (£m) | |
|---|---|---|
| | Low estimate | High estimate |
| Option 2A | 0 | 0 |
| Option 2B | -300 | -1,200 |
| Option 2C | -500 | 0 |

[14] For example, if fuelled technologies are assumed to bid at £74.75/MWh, then it is assumed that the administrative strike price is also set at £74.75/MWh. Similarly, if offshore wind is assumed to bid at £57.50/MWh then it is assumed that the administrative strike price is also set at £57.50/MWh.

[15] For example, if the auction clearing price is £74.75/MWh, then in this scenario it is assumed that all winning projects are awarded a contract at £74.75/MWh.

29. Scenario ‘Option 2A’ is estimated to have no support cost impacts as RIW projects are assumed to be uncompetitive in this scenario. Scenario ‘Option 2B’ has potentially the largest support cost savings under the high estimate due to the reduction in clearing price from £74.75 to £57.50. Scenario ‘Option 2C’ generates 0 saving in support costs in the high scenario as the clearing price still remains at £74.75.

### 6.6 Impact on consumer bills

30. The support costs estimated in Table 5 would be passed through to electricity consumers. In scenario ‘Option 2B’, where RIW has the effect of lowering the clearing price of the CfDs awarded, lower consumer bills would be expected. This impact has been estimated at up to £1 per year on the average household electricity bill over the 15 year CfD period.

### 6.7 Impact on jobs

31. Development of wind projects on remote islands could result in benefits to local areas through an increase in direct, indirect and induced jobs. Construction and operation of wind farms as well as developments in the supply chain could result in an increase in employment on the islands, as well as in the UK more widely. Some of this potential would be a result of displacement in other locations or other sectors i.e. either a decrease in jobs associated with the technology displaced or a decrease in jobs in other locations in the UK. There is uncertainty around the extent to which jobs are displaced in other (non-power) sectors, and also the extent to which there is leakage of jobs outside the UK. Any net economic impact will be dependent on these factors.

### 6.8 Wider impacts

32. Allowing remote island wind projects to compete for CfD support as part of Pot 2 should give the transmission owner the confidence to submit to Ofgem needs cases for building proposed transmission links. In turn, this may lead to the availability of additional capacity over proposed transmission links for other renewable projects on remote islands, including further wind projects, but also wave and tidal, which have significant potential if costs come down, to connect in the longer term. This additional renewable generation will contribute towards long term decarbonisation.

33. Whilst the Western Isles, Orkney and Shetland currently have adequate security of supply, renewable generation and associated transmission links could provide further benefits to local security of supply and the cost of local generation. Onshore wind generation on those islands could contribute towards meeting local energy demand. If RIW displaces local diesel generation in those islands, this could be further generation, carbon and air quality savings. The support for remote island wind projects available through the CfD may, to an extent, offset the need for support that would otherwise be required to maintain security of supply. The addition of a transmission link would also benefit other projects already producing on the islands. These generators may not have had the ability to export to the mainland due to capacity constraints on the distribution links but could benefit from additional capacity on the transmission link. This could enhance security of supply at a national level and take advantage of the benefits from fluctuating wind patterns in different parts of the country. In addition, the existence of transmission links facilitated by remote islands wind could reduce the cost of delivering energy security.

34. Adding any new capacity (e.g. RIW, fuelled technologies, offshore wind) to the generation mix has implications for total system costs:
    i. by displacing more expensive generation at the margin in the wholesale market;
    ii. affecting reliability at peak and the need to procure capacity in the capacity market;
    iii. by having characteristics that either increase or decrease the need for system balancing and ancillary services;
    iv. by being located close or far from demand centres and therefore either increasing or decreasing network costs.

35. The size of these impacts will differ by technology type and some technologies will have a greater impact on the system than others. Overall given the relatively small capacity of 500MW of RIW added to the system total system in the scenarios considered in this IA, wider system costs are not expected to be significant.

36. Scenario ‘Option 2A’ would result in no changes to total system costs, when compared to the baseline, as RIW is assumed to be uncompetitive in this scenario and so the generation mix would remain the same as the baseline scenario option 1A.

37. In Scenario ‘Option 2B’ RIW displaces dispatchable fuelled technologies, which clear the auction in the baseline (Scenario ‘Option 1A’). In the wholesale market RIW displaces expensive generators at the margin; however, relative to dispatchable fuelled technologies, it is less able to capture high price periods due to the variable nature of its output. Therefore, RIW is likely to create wholesale market cost reductions than dispatchable fuelled technologies. RIW is less reliable than dispatchable fuelled technologies and so is likely to bring less savings in the capacity market. RIW is more uncertain than generation from dispatchable fuelled technologies and doesn’t have any inherent inertia; therefore RIW is likely to increase system balancing and ancillary service costs. Due to its remote location RIW is also likely to result in larger network costs as electricity may have to travel further to demand centres if connected to the transmission network compared against more centrally located fuelled technologies.

38. In scenario ‘Option 2C’ RIW displaces Offshore wind, which clears the auction in the baseline (Scenario ‘Option 1B’). Offshore wind and RIW have many similar characteristics and therefore are likely to be similarly beneficial for the system. The key difference between the two could be the higher network costs from RIW if projects are located further from demand centres.

## Section 7: Risks and Uncertainties

39. The key areas of uncertainty identified are:

- Competitiveness of remote island wind projects: CfDs are awarded competitively, and therefore RIW projects will only secure a CfD if they can compete with other technologies on a cost per MWh basis. In this IA a range of scenarios have been tested to demonstrate the illustrative impact, however the extent to which one scenario is more likely to occur over another is highly uncertain.

- Future deployment: the impact of RIW will depend on the scale and mix of other less established technologies that bid and are successful in securing a CfD. This IA has used scenarios based on variations of a single commissioning year’s outcome from CfD Allocation Round two to illustrate the potential impact, however there are a wide range of other future outcomes that may result in different impacts to those described here.The proposal will have zero impact if RIW is not competitive, and a likely positive outcome where RIW can compete.

- The overall impact on the electricity system: Whilst the analysis has considered the generation costs quantitatively, the whole system impact on the electricity system such as network, transmission and balancing costs have only been considered qualitatively. Due to the relatively small scale of potential RIW projects this is likely to be relatively low risk.

## Section 8: Summary and preferred option

40. Option 2 is the preferred option for meeting the government’s policy objective. If one or more RIW projects are cost competitive relative to other projects in the allocation round then the NPV would be positive (all other things being equal) as the generation costs (and potentially the carbon costs and costs to consumers) would be lower for any given quantity of generation. If no RIW projects were cost competitive and they were not successful in the allocation round then the NPV would be zero.

# Annex A: Remote Island Wind Costs

The most important difference between RIW and other onshore wind projects is the significantly higher costs of connecting to, and using, the electrical transmission system. The charge faced by each generator to use the network is therefore calculated to reflect the costs that connection of the new generator imposes on different parts of the transmission network. The long new connections to the Main Interconnected Transmission system which would be required for RIW projects to be developed mean that, under the transmission charging regime, new projects could be subject to Transmission Network Use of System (TNUoS) charges up to order of magnitude higher than the average for onshore wind generators located elsewhere in the UK.

There are other differences between RIW and onshore wind projects on the GB mainland which will affect their Levelised Cost of Electricity (LCOE). RIW projects face high air moisture and salinity, as they would be built in maritime conditions with similarities to those experienced by offshore wind projects. This will in many cases require the use of offshore class turbines and related technologies; all internal components are likely to require an offshore specification, and all turbine exteriors, transformers, hubs, air intakes and nacelles are expected to require offshore class anti-corrosion protection.

Remote islands have consistently higher wind speeds compared to onshore wind, meaning that their expected load factors are at levels much closer to offshore wind and considerably above those achievable by onshore wind projects on the GB mainland. This is advantageous in terms of increased renewable electricity generation, however it does bring some operational challenges which, when combined with more complex access arrangements, may see operating costs much higher than that of an onshore wind farm on the mainland.

Remote islands, like offshore sites, are also subject to extreme weather events. In practice, this means turbines being capable of withstanding wind speeds comparable to those found at far-offshore wind sites. Developers need to balance this requirement for turbines that can cope with highly demanding ‘offshore wind’ conditions, with the inevitable practical limitations on the maximum turbine size (both as a result of local planning considerations on maximum tip heights that limit scope for larger offshore-scale turbines, and limitations to what scale of turbine can feasibly be transported and installed on land). Whilst in some instances it might be possible to deploy larger turbines, in practice most projects are likely to use turbines in the 3-4 MW range, but with an enhanced level of robustness to environmental conditions. For comparison, the latest offshore wind projects are expected to deploy turbines in the 8-10 MW range, with even larger turbines in development.

Table A1 summarises, for illustrative examples of transmission connected projects on selected remote Scottish island groups, the estimated impact of higher transmission charges, operational costs, capex and load factor on the LCOE, relative to the LCOE of onshore wind. It shows that the higher costs that RIW projects face are only partially offset by their greater output.

*Table A1: Impact of different characteristics of remote island wind on levelised cost, compared to UK onshore wind (£/MWh LCOE, 2014 prices)*

<table>
<tr><th>Island Group</th><th>Increased power[16]</th><th>Capex</th><th>Construction cost / phasing</th><th>Lifetime</th><th>Hurdle rate</th><th>Opex</th><th>Transmission</th><th>Load factor</th><th>Overall impact</th></tr>
<tr><td>Orkney</td><td rowspan="3">-4</td><td rowspan="3">+6</td><td rowspan="3">+2</td><td rowspan="3">+4</td><td rowspan="3">+3</td><td>+11</td><td>+25</td><td>-28</td><td>+19</td></tr>
<tr><td>Shetland</td><td>+14</td><td>+40</td><td>-39</td><td>+25</td></tr>
<tr><td>Western Isles</td><td>+3</td><td>+34</td><td>-17</td><td>+30</td></tr>
</table>

Taken together, these differences result in higher levelised costs for RIW projects compared against other existing Pot 1 technologies, such that they would not be able to compete effectively in a Pot 1 CfD allocation process.

[16] To account for RIW potentially having a larger capacity than onshore wind - for example if coastal locations could accommodate more wind turbines within a specific surface area compared to an average onshore wind farm, or if turbine designs partially optimised for offshore wind could be deployed

# Annex B: Analytical approach and Key Assumptions

**Scenarios modelled**

The analysis has used evidence from the last auction round. The illustrative scenarios used in this impact assessment are set out in further detail below, including the key assumptions. Fuelled technologies (FT) are assumed to include Biomass CHP and Advanced Conversion Technologies in line with the capacity mixes delivered through the second CfD allocation round. OSW refers to offshore wind technologies and RIW is remote island wind.

*Chart B1: Scenario 'Option 1A' (Fuelled technologies set the clearing price)*

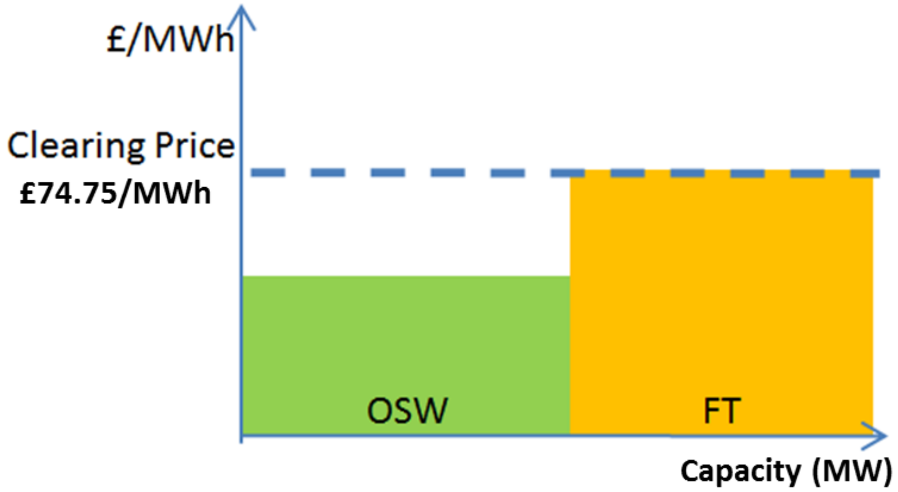


*Table B1: Detailed assumptions for Scenario 'Option 1A' (2012 prices)*

| | Offshore Wind | Fuelled Technologies |
|---|---|---|
| **Bid Price, £/MWh** *(Low support costs)* | £57.50 | £74.75 |
| **LCOE (£/MWh)** | £56.21 | £70.96 |
| **Capacity (MW)** | 860 | 150 |
| **Generation (000s, hrs)** | 3,535 | 1,058 |

| | |
|---|---|
| **Clearing Price, £/ MWh** *(High support costs)* | £74.75 |
| **Total Generation across (000s, hrs)** | 4,594 |

*Chart B2: Scenario 'Option 1B' (offshore wind sets the clearing price)*

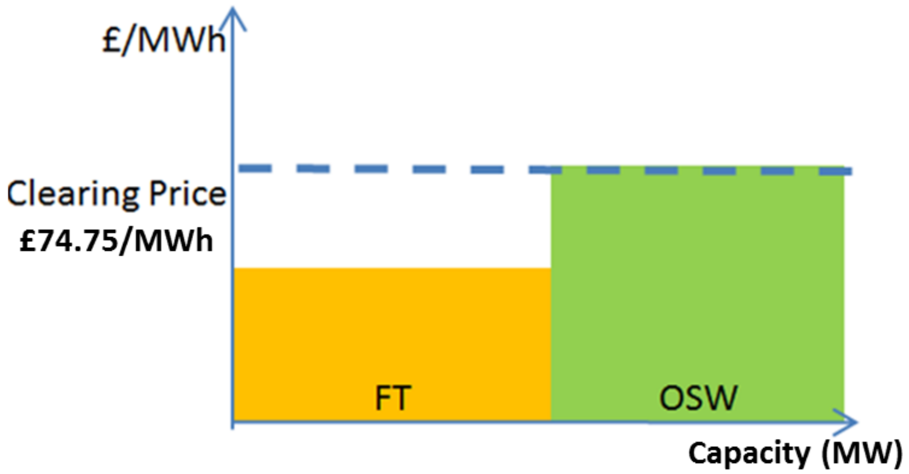


*Table B2: Detailed assumptions for Scenario 'Option 1B' (2012 prices)*

| | Fuelled Technologies | Offshore Wind |
|---|---|---|
| **Bid Price, £/MWh** *(Low support costs)* | £66.13 | £74.75 |
| **LCOE (£/MWh)** | £63.59 | £70.91 |
| **Capacity (MW)** | 150 | 860 |
| **Generation (000s, hrs)** | 1,058 | 3,535 |

| | |
|---|---|
| **Clearing Price, £/ MWh** *(High support costs)* | £74.75 |
| **Total Generation across (000s, hrs)** | 4,594 |

*Chart B3: Scenario 'Option 2A' (fuelled technologies set the clearing prices)*

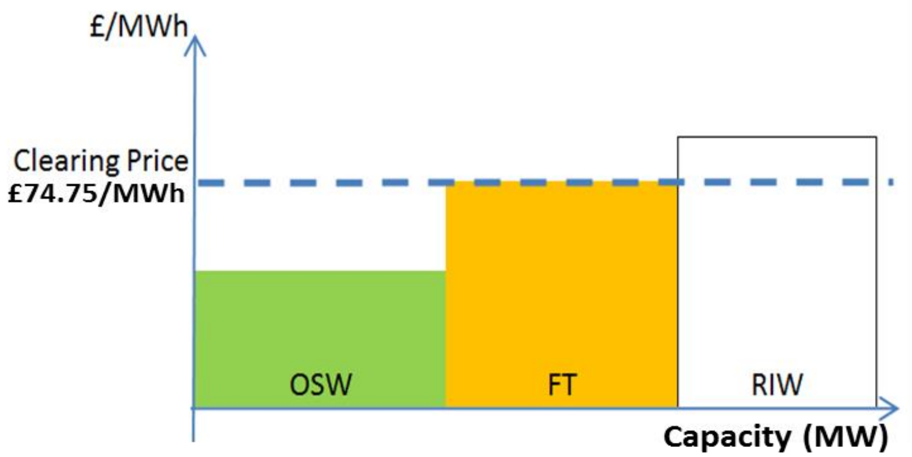


*Table B3: Detailed assumptions for Scenario 'Option 2A' (2012 prices)*

| | Offshore Wind | Fuelled Technologies | Remote Island Wind |
|---|---|---|---|
| **Bid Price, £/MWh** *(Low support costs)* | £57.50 | £74.75 | £75.50 |
| **LCOE (£/MWh)** | £56.21 | £70.96 | N/A |
| **Capacity (MW)** | 860 | 150 | - |
| **Generation (000s, hrs)** | 3,535 | 1,058 | - |

| | |
|---|---|
| **Clearing Price, £/ MWh** *(High support costs)* | £74.75 |
| **Total Generation across (000s, hrs)** | 4,594 |

*Chart B4: Scenario 'Option 2B' (offshore wind sets the clearing price)*

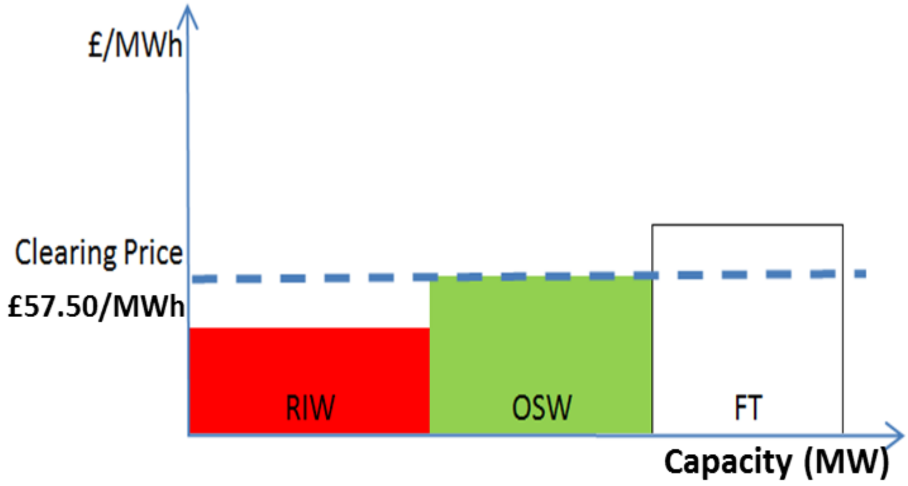


*Table B4: Detailed assumptions for Scenario 'Option 2B' (2012 prices)*

| | Remote Island Wind | Offshore Wind | Fuelled Technologies |
|---|---|---|---|
| **Bid Price, £/MWh** *(Low support costs)* | £56.50 | £57.50 | £74.50 |
| **LCOE (£/MWh)** | £55.45 | £56.21 | N/A |
| **Capacity (MW)** | 500 | 668 | - |
| **Generation (000s, hrs)** | 1,847 | 2,747 | - |

| | |
|---|---|
| **Clearing Price, £/ MWh** *(High support costs)* | £57.50 |
| **Total Generation across (000s, hrs)** | 4,594 |

*Chart B5: Scenario 'Option 2C' (offshore wind sets the clearing price)*

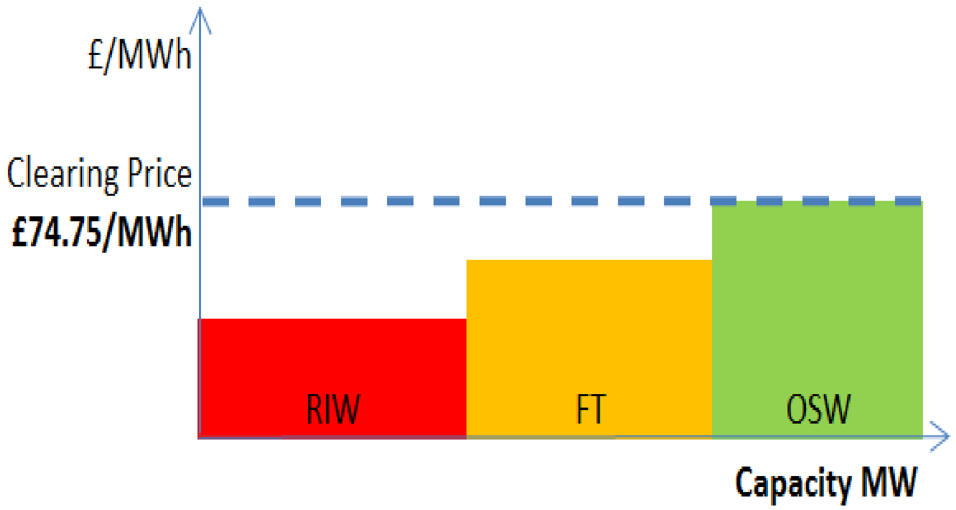


*Table B5: Detailed assumptions for Scenario 'Option 2C' (2012 prices)*

| | Remote Island Wind | Fuelled Technologies | Offshore Wind |
|---|---|---|---|
| **Bid Price, £/MWh** *(Low support costs)* | £56.50 | £66.13 | £74.75 |
| **LCOE (£/MWh)** | £55.45 | £63.59 | £70.91 |

| Capacity (MW) | 500 | 150 | 411 |
|---|---|---|---|
| Generation (000s, hrs) | 1,847 | 1,058 | 1,688 |

| Clearing Price, £/ MWh *(High support costs)* | £74.75 |
|---|---|
| Total Generation across (000s, hrs) | 4,594 |

## Bid Prices

Table B6 sets out the bid prices assumed for each technology. For the purposes of modelling, we have assumed one bid price for each technology, however in reality there are likely to be a range of bid prices for projects within each technology. These bid prices are used to calculate the change in support costs and estimate the LCOE. The LCOE's and bid prices of technology are highly uncertain and can change over time. As such the figures presented should not be taken to represent government's view of LCOE's and bid prices but simply present a range of potential outcomes.

*Table B6: Assumed Bid Prices, £/MWh, 2012 prices*

| Scenario | Offshore Wind | | Fuelled Technologies | | Remote Island Wind | |
|---|---|---|---|---|---|---|
| | Value | Rationale | Value | Rationale | Value | Rationale |
| Option 1A | £57.50 | Round 2 offshore wind clearing price in 2022/23[17] | £74.75 | Round 2 clearing price in 2021/22 for ACT and Dedicated Biomass with CHP | N/A | N/A |
| Option 1B | £74.75 | Flexes bid price to assume that offshore wind is more expensive than fuelled technologies (a variant of baseline option 1A to account for uncertainty of future auction outcomes). | £66.13 | Illustrative estimate to model a scenario where offshore wind sets the clearing price at £74.75. £66.13 is an average of Scenario 'Option 1A' price (£57.50) for offshore wind and fuelled technologies (£74.75) | N/A | N/A |
| Option 2A | £57.50 | Round 2 offshore wind clearing price in 2022/23 | £74.75 | Round 2 clearing price in 2021/22 for ACT and Dedicated Biomass with CHP | £75.50 | Illustrative estimate to model a scenario where remote island wind is less competitive than other Pot 2 technologies. |
| Option 2B | £57.50 | Round 2 offshore wind clearing price in 2022/23 | £74.75 | Round 2 clearing price in 2021/22 for ACT and Dedicated Biomass with CHP | £56.50 | Illustrative estimate to model a scenario where remote island wind is more competitive than other Pot 2 technologies. |
| Option 2C | £74.75 | Flexes bid price to assume that | £66.13 | Illustrative estimate to model a scenario | £56.50 | Illustrative estimate to model |

[17] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/643560/CFD_allocation_round_2_outcome_FINAL.pdf

| | | | | | | |
|---|---|---|---|---|---|---|
| | | offshore wind is more expensive than fuelled technologies. | | where offshore wind sets the clearing price at £74.75. £66.13 is an average of Scenario 'Option 1A' price (£57.50) for offshore wind and fuelled technologies (£74.75) | | a scenario where remote island wind is more competitive than other Pot 2 technologies. |

## Generation Costs

Generation costs are calculated by multiplying the levelised cost of electricity by the generation assumed for each technology. The levelised cost of electricity is a measure of cost per MWh of electricity produced and is a function of the lifetime of the technology, the hurdle rate[18] and the wholesale price of electricity. The key assumptions used to estimate the generation costs and LCOE are outlined in Table B7.

*Table B7: Generation Costs Input Assumptions.*

| Assumption | Offshore Wind | Fuelled Technologies | Remote Island Wind |
|---|---|---|---|
| Hurdle Rates | 8.90%<br>BEIS Electricity Generation Costs Report[19] | 11.01%<br>BEIS Electricity Generation Costs Report. The Hurdle Rate is a weighted average of ACT's and dedicated Biomass (weighted 60% towards biomass and 40% towards ACTs to reflect the mix from the previous auction outcome. | 7.30%<br>BEIS Internal Analysis, informed by hurdle rates for onshore and offshore wind published in the BEIS Electricity Generation Costs Report. |
| Operating Lifetime<br>(years) | 22<br>BEIS Electricity Generation Costs Report [20] | 25<br>BEIS Electricity Generation Costs Operating lifetime is the maximum of ACT and dedicated biomass with CHP. | 20<br>BEIS assessment of the Baringa report[21] |
| Load Factors | 47.3%<br>BEIS, Setting the Level of the Renewables Obligation for 2018/19[22] | 81.0%<br>BEIS Electricity Generation Costs - weighted average of ACT and Biomass technologies | 42.5%<br>BEIS assessment of Baringa report |
| Wholesale Electricity Prices[23] | £49 (2012 prices)<br>2017 EEP reference case[24] central fossil fuel assumptions (15 year average 2022/23-2036/2037) | | |

## Support Costs

The change in support costs have been estimated by calculating the difference between the technology price and wholesale price of electricity and multiplying this differential by the generation of each technology. The low estimate assumes that the bid price is the ASP for that technology whereas the high assumes that the highest bid price across technologies sets the clearing price. ASP's will be calculated prior to an auction round and so the ASPs presented here are not an indication of Government policy but have been used to provide a sense of scale of support cost impacts.  Support costs represent a transfer between consumers and generators and so have not been included as part of the cost benefit analysis.

[18] This is defined as the required rate of return above which a project would go ahead.
[19] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/566567/BEIS_Electricity_Generation_Cost_Report.pdf
[20] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/566567/BEIS_Electricity_Generation_Cost_Report.pdf
[21]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/199038/Scottish_Islands_Renewable_Project_Baringa_TNEI_FINAL_Report_Publication_version_14May2013__2_.pdf
[22] P.11 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/648424/Renewables_Obligation_2018_19_FINAL.pd
[23] Wholesale prices have been updated to the latest 2017 EEP wholesale price projections.
[24] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/671187/Updated_energy_and_emissions_projections_2017.pdf

BEIS wholesale electricity prices (loss-adjusted) 2017 EEP reference case central fossil fuel assumptions have been used. The relevant prices have been used from 2022/23 onwards over the 15 year contract for difference support lifetime.

## Greenhouse gas impact

Greenhouse gas impacts have been assessed in line with the government's supplementary *Green Book* guidance on the valuation of energy use and greenhouse gas emissions[25]. Traded carbon values have been used. We have deflated the values from the guidance into £2012 values using GDP deflators from table 19 of the IAG data tables and converted into financial years.

The carbon intensity of fuel has been calculated by BEIS using Ofgem Sustainability data[26]. The analysis assumes a carbon intensity of fuel for fuel technologies of 60.25 gCO2e/kWh. This is a weighted average of biomass (60%) and ACT (40%) reflecting the outcome of the second allocation round.

[25] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal
[26] https://www.ofgem.gov.uk/environmental-programmes/ro/applicants/biomass-sustainability