The Crown Estate
CELTIC SEA FLOATING WIND PROGRAMME

Peer Review of Draft Site Selection Methodology Approach in Offshore Wind Leasing Round 5

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Celtic Sea Floating Wind Programme
Peer Review of Draft Site Selection Methodology
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1 INTRODUCTION

1.1 The Crown Estate

The Crown Estate is a diverse organisation managing an asset value of £16.5 billion. It has a statutory duty under the Crown Estate Act 1961 to maintain and enhance the value of the estate and the returns obtained from it, with due regard to the requirements of good management. The net revenues generated by The Crown Estate go the UK Treasury. As managers of the seabed out to the 12-nautical mile (NM) limit, and with rights to the exploitation of natural resources to generate electricity within the Exclusive Economic Zone (EEZ) around England, Wales and Northern Ireland, The Crown Estate plays a major role in the development of the offshore renewable energy industry[1]. The Crown Estate, since 2000, has run seven rounds of offshore wind leasing in UK waters.

1.2 Background

The Crown Estate announced on 1st December 2020that it intended to accelerate the development of offshore floating wind in the UK and invited the market to come forward with views on how best to achieve this. After this initial call, in March 2021, The Crown Estate announced that it was commencing work to design and deliver a new leasing opportunity for 4GW of early commercial-scale floating wind projects in the Celtic Sea (hereafter, the 'Offshore Wind Leasing Round 5').

The work undertaken by The Crown Estate involved the analysis of marine spatial datasets to identify areas of lesser constraint in English and Welsh waters with respect to the potential for floating offshore wind development. This analysis considered the offshore generation asset area only i.e., offshore and onshore cable routes or grid connection have not been considered. Further, only floating offshore wind has been considered in this exercise i.e., excluding fixed structure wind.

The approach to the spatial constraints analysis has been described in The Crown Estate report "Celtic Sea Floating Wind Leasing Round 5: Site Selection Methodology" ("the Methodology Report") published in July 2022 (The Crown Estate, 2023).

The Methodology Report explains the process undertaken to identify the five broad Areas of Search (AoS), shown in Figure 1, which will be subject to further engagement and refinement to guide where floating offshore wind farms will be located (Project Development Areas).

[1] The Crown Estate also hold rights for marine aggregate extraction, salt and potash, gas storage, cables and pipelines.

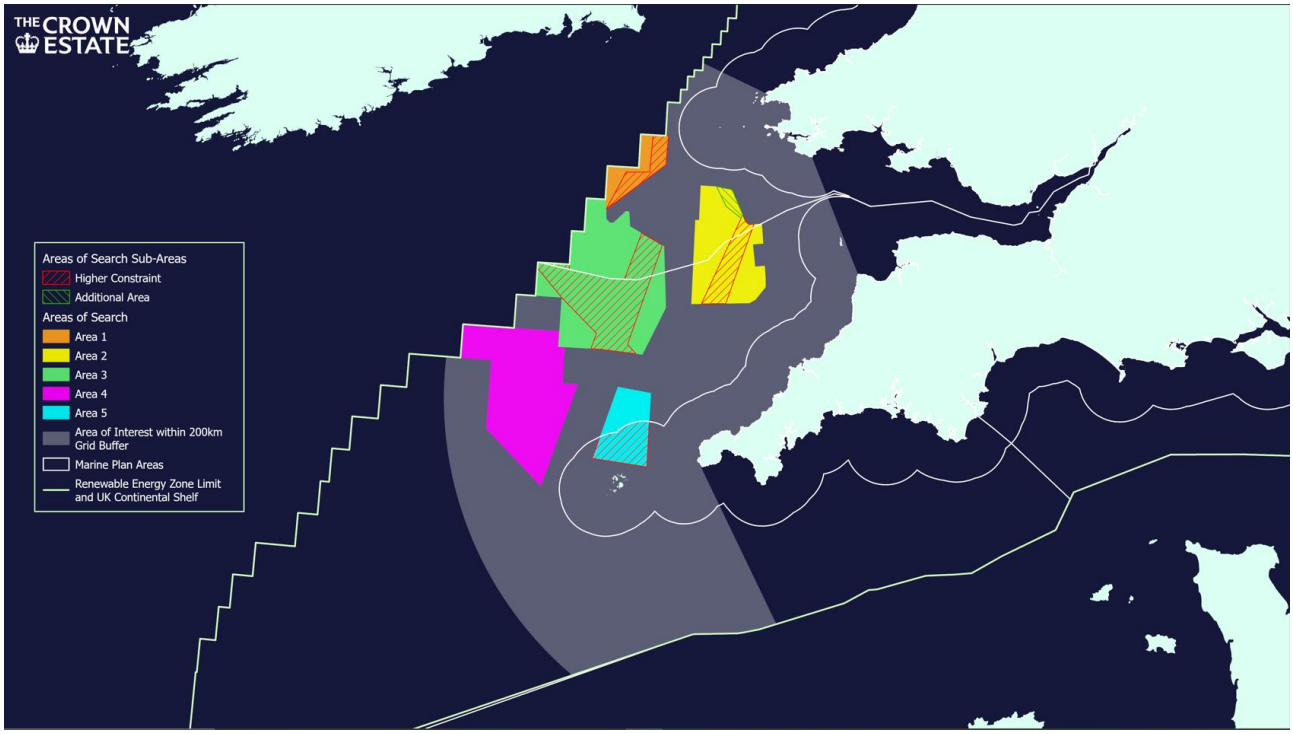

Figure 1 The five Areas of Search (AoS) identified through the spatial design process.

1.3 RPS Commission

In July 2022, RPS was commissioned by The Crown Estate ahead of the commencement of the detailed design process to undertake a peer review of the spatial methodology being undertaken for Offshore Wind Leasing Round 5. RPS had previously been commissioned to provide a peer review of the Round 4 leasing process (The Crown Estate, 2019). For that peer review, RPS undertook a Phase 1 data audit (of the data used in the constraints mapping), review of the tier structuring (theme and sub-theme structure of constraint categories) and review of the Analytic Hierarchy Process (AHP) scoring and normalisation (the algorithm used to calculate the pairwise scoring of constraints). We also undertook a Phase 2 internal constraints workshop to score the constraints and compare these to the scoring undertaken by The Crown Estate and a peer review of The Crown Estate methodology report. The same approach has been utilised for the Celtic Sea Floating Wind Programme, although with stakeholders engaged earlier in the process. Therefore, this level of peer review has not been repeated here. However, this previous work on Round 4 has helped to inform the peer review for this Offshore Wind Leasing Round 5.

1.4 Materials Reviewed

The peer review has considered the “Draft Methodology Report” published in July 2022 (The Crown Estate, 2022). RPS also conducted a separate interview with staff at The Crown Estate to discuss queries on the approach to the spatial constraints analysis (the ‘Spatial Constraints Interview’), The peer review was further supported by information relayed at a webinar hosted by The Crown Estate.[2]

Reference has also been made to the following reports and online resources:

- Everoze for The Crown Estate, 2020: Broad Horizon: Key resource areas for offshore wind (Everoze Partners Limited, 2020).

[2] The Crown Estate’s Stakeholder Webinar: Floating Offshore Wind in the Celtic Sea – hosted 7 July 2022. See https://www.thecrownestate.co.uk/media/4173/celtic-sea-floating-offshore-wind-marine-stakeholder-webinar-july-2022.pdf

- The Crown Estate's Celtic Sea Floating Offshore Wind Document Library.[3]

A number of confidential documents (unpublished at the time the Peer Review were completed) were also provided to RPS to support the review.

[3] The Crown Estate's Document library https://www.thecrownestate.co.uk/our-business/marine/round-5-document-library [Accessed 20 December 2023]. .

2 REVIEW METHODOLOGY

RPS has undertaken a high-level peer review of the Draft Methodology Report (The Crown Estate, 2022) and process that The Crown Estate has drafted on the constraints analysis process and outcomes. The focus of this peer review was to assess and validate the approach taken to spatial design of the Floating Offshore Wind Programme in the Celtic Sea. Once the methodology report had been reviewed, RPS undertook interviews with The Crown Estate staff to discuss any queries on the process followed. This report summarises our consideration of the process followed by The Crown Estate and the robustness of this approach. RPS's review also included any recommendations for updates to The Crown Estate methodology report to ensure clear messaging/explanation.

The peer review provides expert opinion on key stages of the spatial constraints approach to date, including:

- Overview of the approach taken to provide a robust appraisal and objectives of the study;
- Review of the appropriateness of the data used;
- Consultation stages and suitability of stakeholder involvement at appropriate stages in the methodology; and
- Evidence that the approach to the study was followed, and that an iterative, auditable and transparent assessment process was undertaken;

3 OVERVIEW OF THE CROWN ESTATE APPRAISALS FOR THE CELTIC SEA

3.1 The Crown Estate Approach to Spatial Constraints Analysis

The purpose of the AoS selection methodology is to refine areas where floating offshore wind farms could be located in the Celtic Sea. The aim is to "characterise opportunities and risks, with the purpose of identifying economically viable AoS that also minimise as much as possible the impact to other users and interests within the marine environment" (page 4, The Crown Estate, 2022a).

The approach taken by The Crown Estate was to develop from an Area of Interest in the Celtic Sea down to the AoS (Figure 1), which will then develop further to Project Development Areas (PDAs). The five-step process refines the Area of Interest to the PDA, with the first step being identification of Key Resource Areas, which was produced as part of the Broad Horizons study (Everoze Partners Limited, 2020). This study considered the technological feasibility of different wind technologies, driven by water depth, metocean conditions and geology parameters.

The second step in the modelling was the Exclusion Model, where hard constraints were identified and removed from the model. The parameters, including buffer zones, were agreed with stakeholders at a workshop in February 2022. The full list of exclusions can be found in the Draft Methodology Report.

The third step was the Restrictions Model, which identified soft constraints, which were structured and weighted in terms of their risk to the development in that area. The Crown Estate's GIS decision making tool, MaRS, applies weightings to the datasets to carry out analyses. The datasets used included environmental designations, navigation, fisheries and visibility from landscape designations (on land). The full list of soft constraints can be found in the Draft Methodology Report. Again, buffers were applied where appropriate. The datasets and buffers were discussed and agreed upon in the stakeholder workshop in February 2022. AHP and pairwise comparisons have been used to identify the relevant constraints across the Area of Interest. This was achieved using the AHP visualisation software Spice Logic.

The approach used by The Crown Estate to score each constraint layer prior to inputting into the GIS model placed the data into a series of tiered themes, Tier 1 being the coarsest ('Environmental', 'Social' and 'Economic') and Tiers 3 and 4 the more detailed (focusing on specific datasets). Under Tier 1 Economic, the Tier 2 sub themes of shipping and navigation, subsurface activity fishing activity and infrastructure were included to accommodate the large number of criteria under this theme. Subsequent tiers were used to house the data layers for discreet data i.e. polygons and lines (Tier 3) and for continuous data layers i.e. data with full coverage over an area (Tier 4). Each of these themes and subthemes were then scored against each other (pairwise comparison) (see the Draft Methodology Report for a more detailed explanation). Note that whilst The Crown Estate's GIS decision making tool, MaRS tool has four tiers, the workshop in February 2022 only considered Tiers 1, 2 and 3, i.e., excluded the Tier 4 continuous data layers, due to the level of granularity and how the weightings were applied (linearly) in the datasets in this tier.

These weightings were then normalised and applied through an algorithm to the data layers and then inputted to MaRS. The output of the Restrictions Model together with the Exclusion Model was split into equal number of features representing the suitability of the area of search as ten groups containing equal areas of seabed which represent the range in suitability for floating offshore wind development within the Celtic Sea. The next stage showed the top 50% of the most favourable areas, which were taken forward to identify the AoS (Figure 1).

The AoS were then developed using the GIS model output, further consideration of environmental designation risk, the Levelised Cost of Energy assessment, and further bilateral engagement between February and July 2022. The bilateral consultations included refinements to the AoS based on defence, navigation, civil aviation, fisheries, environmental and telecoms cables.

The final step will be the refinement of the AoS to develop the PDAs (not completed at the time of drafting this peer review). This will continue to be an iterative process and include engagement with marine and market stakeholders.

3.2 Stakeholder Consultation

The review of the Celtic Sea began in 2021, with informal bilateral consultations leading to a stakeholder questionnaire issued to over 150 stakeholders requesting input to the spatial design, including requests for datasets to support the spatial modelling. A stakeholder workshop was held online in February 2022 to explore datasets, exclusions and specific weightings to be used in the spatial modelling. Additional engagement was undertaken between February and July 2022 on a series of targeted topics to identify any other significant factors relevant to the spatial design, including Navigation, Telecoms, Grid, Defence, Civil Aviation, Fisheries, and Environmental. I In July 2022, the final Areas of Search (AoS) were published by The Crown Estate[4].

[4] https://opendata-thecrownestate.opendata.arcgis.com/search?groupIds=137693d44b734b9b9118ea14d527e2cf [Accessed 20 December 2023]

4 RPS REVIEW

4.1 Constraints Methodology

Analytic Hierarchy Processing (AHP) is a structured technique for dealing with complex decisions developed by mathematician Thomas L. Saaty in 1977 (Saaty, 1997). AHP provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals and for evaluating alternative solutions.

It was decided that it was appropriate to use AHP to develop the input structure and define weights for processing constraints models in MaRS. The methodology ensures that a robust, traceable, repeatable and defendable weighting and scoring process can be implemented.

The theory behind AHP states that it is generally only possible to compare the significance of inputs across 7 criteria at a time. AHP uses a tree structure to define mini multi criteria analysis calculations that feed up into a more complex analysis. This was used in The Crown Estate approach, as described in Section 2.1.

In the opinion of RPS, this is an effective technique for The Crown Estate to use, and ideal for the scale and nature of this exercise. Following the peer review interview, RPS is confident that the process in itself was followed appropriately.

The approach to the AHP and tiers is also consistent with that used in the previous Round 4 Leasing exercise (The Crown Estate, 2019), and therefore, as this approach to the constraints modelling was previously demonstrated as being robust through the RPS peer review undertaken in 2019, this approach is considered to be equally robust in this study.

4.2 Dataset Review

The characterisation method relies on the output of the spatial modelling, and therefore in turn is dependent on the datasets that are used in the modelling. It is key however to make sure the datasets used are fit for purpose. The quality of data and date it was produced will have an effect on the reliability of the final modelled solutions. The process has been supported by the work of technical advisors in identifying relevant datasets and assessing their quality prior to running the spatial modelling. The dataset review process has included a review of data quality and input prior to the model being run.

The Draft Methodology Report lists the datasets used in Appendix 2. The datasets were consistent with those used in the Round 4 Peer Review (The Crown Estate, 2019). In addition, from the interview, it was understood that consideration was made to include or exclude datasets during the workshop stages, and clarification was obtained if necessary, during the following bilateral engagement phase.

The Draft Methodology Report does not list the datasets used to define the maritime jurisdiction boundaries: this is not a major omission, but these should be included for completeness. Proximity to the Exclusive Economic Zone (EEZ) boundary is noted as a specific interaction for the AoS. The digital terrain model datasets and a Digital Elevation Model (DEM) used in the visibility analysis is also not listed.

The quality of data does not appear to have been discussed as part of the February 2022 workshop, however, the attendees have had the opportunity to comment on the types of datasets used and many opportunities to provide data into the spatial modelling process.

It is noted that recommendations on datasets made during RPS's Round 4 Peer Review (The Crown Estate, 2019) have been implemented in the Celtic Sea Floating Offshore Wind spatial design. For example, the Round 4 recommendation regarding shipping routes and traffic separation schemes was that The Crown Estate should consult with the Maritime and Coastguard Agency (MCA). The Crown Estate included bilateral consultation with the MCA, and this resulted in the AoS being refined to take account of navigation channels.

Notwithstanding the above comments on data requirements, the process for identifying the AoS is not only consistent with the methodology for undertaking previous site selection processes but has also taken on learnings from those previous programmes, namely in including stakeholder engagement. The process is more robust through the incorporation of stakeholder engagement throughout the programme, with

discussions held on relevant datasets, criteria, weightings and results. Additional recommendations to improve the openness of the process are included in Section **Error! Reference source not found.** below.

4.3 Stakeholder Consultation

The positive participation of stakeholders is important to make the project accountable and ensures a true reflection of the needs and priorities of the area being assessed. Involving stakeholders who are experts in the location or specialist topics ensures that there is an accurate portrayal of the nature and value of the activity during the characterisation phase of work. It is also important to engage with end-user subgroups which have an interest. It helps to familiarise groups to the project and for them to positively contribute to the end solutions.

However, it can be difficult to explain complex processes such as AHP to stakeholders through documentation alone, and even seminars and presentations will have difficulties. The workshop approach is the best forum to be able to explain the process, and allow questions to be asked, and to also obtain additional information and identify gaps.

Stakeholder engagement was undertaken throughout the development of the programme, as detailed in the Draft Methodology Report. At the interview, the stages prior to the publication of the AoS were clarified (as detailed in Section 3.1.1), and in summary, this involved:

1. Initial invitation to the Market sector for views on implementing floating offshore wind in the UK;
2. Bilateral engagement with market and other marine stakeholders to shape plans;
3. Spatial design and data questionnaires to over 150 stakeholders;
4. A marine stakeholder workshop with over 70 individuals from 30 organisations taking part (although more organisations were invited), where the data modelling approach was discussed, data weightings explored, and the opportunity given for feedback;
5. Further bilateral engagement to inform the spatial design; and
6. Pre-consent engagement with over 50 developers to share their views on the datasets, methods, standards and areas of focus.

Further engagement is expected to be held as part of the development of the PDAs, as detailed in the Draft Methodology Report.

As clarified in the interview, the stakeholder engagement has been recorded throughout.. The Crown Estate employed external advisors to support development of the initial questionnaire. It was understood from the interview that any gaps in the questionnaire were then closed off through the workshops and the following bilateral consultations.

From the initial review and the interview, there were no significant gaps identified in the stakeholder consultation input to the constraints analysis. It was clear attempts were made to reach a wide range of stakeholders to participate in each stage of the assessment above, including reaching out to organisations that potentially had an interest in floating offshore wind, but were not part of the existing stakeholder network. In particular, the post-workshop stage allowed The Crown Estate to contact any stakeholders who had not participated in the workshops, and obtain clarifications on weightings and constraints, which strengthened the application of the AHP approach.

During the interview with The Crown Estate for this peer review, it was confirmed that there was an intention to publish more details of the stakeholder consultation at the same time as the publication of the PDAs. Recommendations to improve the openness of the process are included in Section **Error! Reference source not found.** below.

4.4 Summary of Draft Methodology Report

In view of the commitment by The Crown Estate to further engage on the next stages, RPS is satisfied that the constraints appraisal detailed in the Draft Methodology Report followed by The Crown Estate has been robust, and will deliver considerable benefits to developers within the planning process in ensuring the final PDAs are chosen with rational contexts. The consultation with stakeholders has supported the review of key risk areas such as Environment, Navigation, Defence, Grid, Subsea Cables, Civil Aviation and Fisheries, which should give confidence that the final PDAs have been developed in a considered and logical approach, reducing risk as far as practical at this stage in the development process.

In summary, RPS believes that a coordinated and principled process will be implemented involving ongoing stakeholder engagement to agree environmental sensitivities. During the development of the PDAs, the evidence gaps and future information requirements will be identified. The Crown Estate's approach shows a thorough understanding of the requirements, and it is believed that a thorough and evidence-based assessment and stakeholder participation in the process will be enabled and reported transparently.

5 RPS RECOMMENDATIONS

The following recommendations are made to strengthen the robustness of the Methodology Report.

1. RPS recommends that details of the quality of the datasets used, including the date they were last updated and accessed prior to being input to the modelling, is reported in the Methodology Report.

2. RPS recommends that any amendments to data used from the next stage of the process, refinement to the PDAs, that the quality of the data is continually reviewed, and if necessary, qualifications made to the assessment where there may be gaps or uncertainties.

3. RPS recommends that stakeholder consultation to date or a summary thereof is also published in a timely manner. This will improve the transparency of the process undertaken to date.

4. RPS suggests that further detail is provided on the proposed methodology for the next stage of the programme, i.e., refinement from AoS to PDAs is summarised in the Methodology Report to inform and reassure stakeholders on what the process is to develop the PDAs and what sort of information will be considered.

5. RPS recommends that future consultation continues to aim to engage a wide range of stakeholders.

6 REFERENCES

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