22nd February 2023

Dear Sir/Madam,

Invitation to Tender for the Power Curve Validation for Floating Turbines [PCV] project for the Floating Wind Joint Industry Programme

You are invited to submit a proposal for the Power Curve Validation for Floating Turbines project which is part of the Floating Wind Joint Industry Programme. The key objective of this project is identify and understand which parameters are important for power curve validation of floating turbines, to draw conclusions on the likely uncertainties associated with commercial technologies.

Please be aware that this process is a non-mandatory procurement process, published for transparency and best practice. All timescales are based, as near as possible, to the Open Procedure. However, dates referred to below may be subject to change where this is necessary in the interests of the project (such changes will be notified in advance).

Should your proposal be successful an Award Letter, the Scope of Work, the Carbon Trust Conditions of Contract ("**Conditions**"), and any clarifications agreed in writing, will establish the Contract for the Power Curve Validation for Floating Turbines (the "**Contract**") between you and the Carbon Trust. The Conditions accompany this ITT for your prior review. Please note that in the interests of transparency and fairness, these Conditions are non-negotiable, although we will provide clarifications to any queries you may have prior to submitting your tender, answers to which will be distributed to all bidders as set out below. Bids that fail to accept the Conditions in their full un-amended form (other than changes explicitly accepted and agreed by the Carbon Trust on the clarifications page) at the time of submission will be considered to be non-compliant and may, at the Carbon Trust's discretion, be excluded from the procurement process.

Clarification questions must be emailed to Mary.Harvey@carbontrust.com and FloatingWind@carbontrust.com any time before 17:00 GMT 7th March 2023. Answers to clarification questions will be communicated by email by 10th March 2023. Answers can be found at: https://www.carbontrust.com/about-us/tenders.

Unless informed to the contrary, tenders and communications should be sent by e-mail to the following e-mail address: Mary.Harvey@carbontrust.com and FloatingWind@carbontrust.com.

Please submit your proposal by 17:00 GMT 31st March 2023.

The timeline of this procurement process is as follows:

Deadline for clarification questions	17:00 GMT 7th March 2023
Clarification response date	10th March 2023
Submission of full proposal	17:00 GMT 31st March 2023
Bidder interviews	April 2023
Project kick off	May 2023

If you have any questions about the timing, please let us know.

We look forward to receiving your tender.

Yours sincerely,

Mary Harvey
For and on behalf of
THE CARBON TRUST

IMPORTANT INFORMATION FOR BIDDERS

Neither this document, nor any part of it nor any other information supplied in connection with it may, except with the prior written consent of the Carbon Trust, be published, reproduced, copied, distributed or disclosed to any person for any purpose other than consideration by the recipient of whether or not to submit a Tender.

Bidders should note that the Scope of Work described in this Invitation to Tender (ITT) does not constitute an offer to contract with the Carbon Trust. It only represents a definition of specific requirements and an invitation to submit a tender proposal addressing these requirements. Issuance of this ITT and the subsequent receipt and evaluation of the tenders by the Carbon Trust does not commit the Carbon Trust to enter into a Contract with any bidder.

Bidders should also note that:

- depending on the progress and/or results of the project referred to in this Invitation to Tender and the views of the Carbon Trust and/or the Floating Wind JIP Partners as to whether additional analysis or more in-depth work in respect of any or all aspects relating to the project are desirable in order to achieve the objectives referred to in the ITT, the Carbon Trust may request such additional analysis or work. Any additional analysis or work agreed between the parties shall form part of Scope of Work and the Services to be provided by the selected Contractor under the Contract;
- the Carbon Trust reserves the right not to accept the lowest priced tender or any tender whatsoever;
- the Carbon Trust reserves the right to accept more than one tender;
- unless a bidder makes a formal statement to the contrary, the Carbon Trust reserves the right to accept any part of a bidder's tender without accepting the remainder;
- formal notification that a tender has been successful will be communicated in writing by the Carbon Trust;
- the costs of tendering are the full responsibility of the bidder; and,
- the pricing set by bidders shall be valid for a minimum of 90 days.

The information contained here, in the Scope of Work and in any documents or information it refers to or incorporates (the "**Disclosed Information**") has been prepared to assist interested parties in deciding whether to make a bid. The Disclosed Information is not a recommendation by the Carbon Trust. It does not purport to be all inclusive or include all the information that a bidder may require. Furthermore, the Carbon Trust does not warrant or provide any undertaking with respect to the fairness, accuracy, adequacy or completeness of the information provided. The bidder should conduct its own due diligence and seek its own professional, legal, financial and other advice as appropriate.

Neither the Carbon Trust nor any of its directors, employees, agents or advisers makes any representation or warranty (express or implied) as to the accuracy, reasonableness or completeness of the **Disclosed Information**. All such persons or entities expressly disclaim any and all liability (other than in respect of fraudulent misrepresentation) based on or relating to the Disclosed Information or any subsequent communication. The only information which will have any legal effect and/or upon which any person may rely will be such information (if any) as has been specifically and expressly represented and/or warranted in writing to the successful bidder in any written contract that may be entered into with the Carbon Trust.

Tenders and all supporting documentation must be written in English. This ITT, the Contract, its formation, interpretation and performance will be subject to and in accordance with the law of England and Wales.

Floating Wind Joint Industry Programme

Invitation to Tender for the "Power Curve Validation for Floating Turbines" Project

Description of Tender

Contents

1. Introduction to the Floating Wind Joint Industry Programme

1.1. The Floating Wind Joint Industry Programme ("**Floating Wind JIP**") is a collaborative R&D initiative between The Carbon Trust and participating industry partners bp, EDF Renouvelables, EnBW, Equinor, Kyuden Mirai Energy, Ocean Winds, Ørsted, Parkwind, RWE, ScottishPower Renewables, Shell, Skyborn Renewables, SSE Renewables, TEPCO, Tohoku EPCO, TotalEnergies and Vattenfall (the latter are collectively referred to in this document as "**Floating Wind JIP Partners**"), that aims to investigate the challenge and opportunities of developing commercial-scale floating wind farms.

1.2. The objective of the Floating Wind JIP is to overcome technological challenges and advance commercialisation of floating offshore wind.

1.3. Contractors receive technical direction and data from Floating Wind JIP Partners through the Carbon Trust management team.

1.4. Please note, the term "Contractor", where used within this document, refers only to successful bidders.

2. Objective of the Work

2.1. The Floating Wind JIP would like to improve the understanding power curve validation for floating turbines, with the main objectives to:

i) For floating turbines, determine the key parameters which need to be considered for power curve validation.

ii) Determine the uncertainty on each bin of the power curve when using different methods of wind resource assessment.

3. Pre-Conditions

3.1. Bidders should take the following pre-condition into account when preparing and submitting their tenders. The Carbon Trust may reject any non-compliant tenders without progressing such tenders through the evaluation phase. If the Carbon Trust, in its absolute discretion, considers that the bidder's response to the following pre-condition is not satisfactory, the bidder's tender will be non-compliant.

Description	Information required from Bidders
Conflict of interests	Bidders are required to state that they are free of any commercial interests, partnership arrangements or contracts underway or other matters which may present a conflict or potential conflict of interest in respect of the provision of these services. If a bidder thinks that they may have any conflict or potential conflict of interest, the bidder should describe the details of this conflict and provide details of whether and how it would propose to manage such a conflict in a satisfactory and robust manner. The Carbon Trust reserves the right to require the provision of further information in relation to the bidder's response to this pre-condition.
Conditions of Contract	The Carbon Trust Conditions of Contract for this project are attached. The Contract will be constituted by the Award Letter, the Carbon Trust Conditions of Contract and the Scope of Work (including any agreed clarifications to it). Failure to accept these documents in their unamended form or requesting amendments to them means that a bidder's tender is a non-compliant tender. Submission of a tender shall constitute unqualified acceptance of the Carbon Trust Conditions of Contract. Bidders are required to submit a signed Form of Tender when submitting their tenders. The Form of Tender forms part of this Invitation to Tender. The failure by a bidder to submit a signed Form of Tender when submitting its tender shall mean that such tender is a non-compliant tender. Non-compliant tenders may be rejected without further consideration. If any bidder wishes to request an amendment to any term or condition, such amendment must be clearly stated and the exact wording which the bidder is requesting must be set out. No material changes will be considered.
Further Conditions	All documentation and correspondences must be in English with costs given in GBP (£). Staff employment rates must be quoted as hourly rates in GBP (£). All additional expenses must be included under Work Package B: Costs and Expenses. Bidders are requested to input the man hours involved in the project for each work package in table 1, section 5.7. Any additional information (e.g. CVs or References) that Bidders wish to provide must be included in the main bid document (preferably in PDF) as an appendix.

4. Contractor Requirements

Contractor Responsibilities and Support of Carbon Trust Resources

4.1. Mary Harvey of the Carbon Trust will serve as overall Project Manager and also as the main point of contact for the Contractor. If the Project Manager becomes unavailable for any reason, the Carbon Trust shall make reasonable alternatives available.

4.2. The Contractor shall be responsible to the Carbon Trust for discharging its responsibilities under the Contract to deliver the Power Curve Validation for Floating Turbines project. The Contractor will also be responsible for the performance of all activities listed in this Scope of Work except where responsibility is allocated elsewhere in this document.

4.3. The Project Manager will be the Contractor's first point-of-contact for all matters concerning the Contract and shall be primarily responsible for providing the Contractor with all instructions, releases, approvals and the like. The Project Manager will review any project deliverables defined within this Scope or Work and will approve invoices accordingly if deliverables meet the agreed standard.

4.4. The Contractor shall, prior to commencement of the Contract, appoint a named person as the Contractor's Representative who shall be responsible for the overall quality and timeliness of the activities performed and deliverables created under this Scope of Work.

4.5. The Contractor engaged will manage and deliver the work packages as described in Annex A. This role will involve working closely with the designated Project Manager and the Floating Wind JIP Partners.

4.6. The Contractor will be required to provide services in the form of one or more lead consultants as required by the Carbon Trust to lead delivery of the project to the required scope, within the given budget and in the allocated time. The Contractor will need to be flexible to the requirements of the workload.

4.7. The Carbon Trust appreciates that due to the breadth of skills and experience required for this project a consortium may be required to successfully meet the objectives of the project.

4.8. The Contractor is expected to work at their own premises but also to meet regularly at the Carbon Trust's offices in London, probably around once a month, including attendance at Floating Wind JIP Partner meetings when required. In addition, a certain amount of travelling, both within the UK and overseas, may be required during the Contract in order to engage with relevant companies in the sector and to ensure the robust delivery of the project.

4.9. The core activity under the Contract is to manage and deliver the Scope of Work. The Contractor may be required to undertake a range of other tasks that fall within the scope of the Contract but that are not necessarily specified here, to enable the efficient and smooth operation of the Floating Wind JIP. The Contractor will be required to report regularly to the Steering Committee, complete schedule and budget reports each month (Flash Reports), convene the Floating Wind JIP Partners and draft a written report at the end of the different phases of the work, containing a detailed assessment of everything conducted and recommendations for future work. This report should be presented upon the completion of all activities as required by the Contract. Without limiting the reference in this paragraph to the range of other tasks falling within the scope of the Contract, the Contractor may also be requested by the Carbon Trust to provide additional services with respect to additional analysis or more in depth work on any or all aspects of the project referred to herein. Such additional analysis or more in depth work shall form part of the Services

defined in the Contract. The Contractor must be prepared to receive such requests(s) and provide such additional Services agreed between the parties.

4.10. The Contractor must appoint secondary "backup" resources in order for the Contractor to continue providing the services in the event that the primary consultant(s) is(are) unexpectedly unavailable for periods of more than 1 week (for instance, due to illness or vacation). The nominated primary consultant(s) must be available to work on the project for the expected duration of the Contract, and only in exceptional circumstances should a replacement be necessary.

Intellectual Property and Knowledge

4.11. All rights in and relating to pre-existing intellectual property and know how contributed by the Contractor, third parties or Floating Wind JIP Partners shall remain the exclusive property of the contributing party.

4.12. In the event that bidders plan to use or rely on pre-existing intellectual property and/or know how for the project, the Carbon Trust's expectation is that a premium will not be charged for leveraging this IP or know how.

4.13. Results of this project, which the Contractor will be expected to keep strictly confidential in addition to all other information disclosed to the Contractor during the project, will be owned by the Carbon Trust for the benefit of the Floating Wind JIP Partners, who will be entitled to commercially exploit the Results.

Management of Progress

4.14. Work and expenditure under the Scope of Work shall be monitored throughout the duration of the Contract by the Project Manager. Flash Reports are to be provided by the Contractor to the Project Manager at the end of each month after the start of the project. The Flash Report template will be provided to the Contractor at the beginning of the project.

4.15. The Carbon Trust will be entitled, at reasonable notice, from time to time during the term of the Scope of Work (and for a period of 2 years following its termination for any reason) to inspect all of the Contractor's book of accounts and records so far as they relate to the subject matter of the Contract.

4.16. Failure to submit deliverables in a timely manner at the end of a stage will be grounds for suspension or termination of the Contract as described in section 4.25. Any suspension, reinstatement or dismissal shall be solely at the discretion of the Programme Manager.

Contract Price & Commitments

4.17. The Contract price to be paid by the Carbon Trust to the Contractor under the Contract will be on a time and materials basis capped at the approved maximum cost specified in the Award Letter ("**Approved Maximum Cost**").

4.18. The total price and any expenses paid or payable under the Contract shall not in any circumstances exceed the Approved Maximum Cost. The Approved Maximum Cost shall be the maximum sum for which the Carbon Trust shall be liable under the Contract to pay the Contractor for all work and services. The Approved Maximum Cost may be revised by the Carbon Trust in

order to accommodate any adjustment necessary in relation to any additional services required by the Carbon Trust and agreed between the parties.

4.19. The Approved Maximum Cost for the Contract shall be equal to the Contract price. The Carbon Trust Project Manager reserves the right to vary the Approved Maximum Cost by informing the Contractor of the revised Approved Maximum Cost in writing at any time.

4.20. It shall be sufficient authority for the Contractor to undertake services or work in accordance with the Contract if it has received a purchase order from the Carbon Trust.

4.21. Notwithstanding any other term of the Contract:

i) the Carbon Trust shall not be liable to pay the Contractor for any service or work in connection with the Contract unless and until it is authorised in accordance with section 4.20; and

ii) the amount payable to the Contractor shall not exceed the amount stated in the purchase order; and

iii) in no circumstances shall the total amount payable by the Carbon Trust to the Contractor, for the work or services to be carried out under the Contract, including project expenses, exceed the Approved Maximum Cost.

4.22. If the Carbon Trust terminates or suspends the Contract under section 4.24 or 4.25 provided that such termination or suspension does not arise out of any default of the Contractor (or any of its employees, agents or sub-contractors) or any failure to perform to the Carbon Trust's satisfaction under the Contract, then subject to sections 4.21.iii) and 4.23, in such circumstances the Carbon Trust will pay the Contractor a proportion of the next instalment of the Contract price falling due for payment, pro rata to the proportion of the period that has elapsed at the date of the termination or suspension.

4.23. The Contractor shall, if requested by the Carbon Trust, deliver to it all work and deliverables (including work in progress and incomplete deliverables) that have been undertaken prior to the date of termination or suspension (as the case may be).

Contract Duration and Early Termination

4.24. The Contract will commence on the date specified in the Award Letter and shall continue until the project has been completed in accordance with the Contract, to the satisfaction of the Carbon Trust and subject to the rights of early termination and break under the Carbon Trust Conditions of Contract and under section 4.25 below, but in any case shall be subject to termination upon 30 calendar days' notice by the Carbon Trust at the discretion of the Project Manager.

4.25. In addition, the Carbon Trust will have the right to immediately suspend or terminate the Contract without liability either in whole or in part if:

i) satisfactory deliverables are not submitted in a timely manner; and/or

ii) activities agreed with the Project Manager are not being completed to the timescales and/or quality standards set out in the Contract or otherwise agreed between the Contractor and the Project Manager; and/or

iii) the work or service is not likely to be completed within the Approved Maximum Cost.

Judgement as to whether these conditions are met will be at the sole discretion of the Project Manager.

5. Invoicing & Payment

5.1. To provide bidders with greater clarity on the nature, level and type of work involved in the various Work Packages (WPs), the expected total budget is £60,000-£70,000 for the standard WPs, with an additional £35,000-£45,000 for the additional WP. The Contract Price submitted with the tender must be derived from the cost breakdown table requested in section 5.7, and must include the costs for optional work packages as well as all expenses. Suggestions (within budget) are welcomed. If the Contract Price exceeds the budget (including where the bid includes alternative suggestions), to avoid receiving a lower score for this criterion, please provide a clear and justified reason why the Contract Price exceeds the expected budget.

5.2. For the avoidance of doubt, 'suggestions' referred to in preceding paragraph means 'additional areas of work or alternative or substitute activities to those described in Annex A, that would further support the objective of the work (see description of criterion 1).

5.3. Payments for the Contract price to the Contractor will only be made upon presentation by the Contractor of a valid invoice stating:

i) The current purchase order number

ii) The Contract number

iii) The name of the Project Manager: Mary Harvey

iv) Description of work completed and account for resources expended

5.4. All invoices are to be issued electronically to accountspayable@carbontrust.com, with Mary Harvey (Mary.Harvey@carbontrust.com) on copy, or to another email address as advised in writing by the Carbon Trust to the Contractor.

5.5. The payment terms for this project will be within 30 days of the Carbon Trust's receipt of a valid and undisputed invoice from the Contractor. The Carbon Trust shall be under no obligation to make any payment whatsoever to the Contractor in respect of any work or services not completed in accordance with the Contract.

5.6. Payments will be made when a Work Package has been completed and the Deliverables accepted by the Steering Committee.

5.7. The Contractor is required to fill in the following staff rate and project cost breakdown table as part of their tender. For consortia, the time and budget allocation of each consortium partner should be clearly stated. The project is expected to take approximately 9-12 months, depending on go/no-go decision.

Table 1: Staff rates and project cost breakdown

Staff member	Time spent per work package (WP) in hours WP1	WP2	WP3	WP4	WPA: Project mgmt	Total time in hours	Staff rate (£)	Staff cost to project (£)
Name (Role/Title)	hr	hr	hr	hr	hr	hr	£	£
Name (Role/Title)	hr	hr	hr	hr	hr	hr	£	£
Name (Role/Title)	hr	hr	hr	hr	hr	hr	£	£
Etc.	hr	hr	hr	hr	hr	hr	£	£
Total Time In hours	hr	hr	hr	hr	hr		WPB: Expenses	**£**
Total cost of each WP	**£**	**£**	**£**	**£**	**£**		**Total Cost**	**£**

Note: Additional rows and columns should be added as appropriate for additional staff members and work packages.

5.8. All rates quoted in Table 1 must be in GBP (£) and represent the **Hourly Rate** for employment of staff members.

5.9. Bidders should be aware that the Carbon Trust and Floating Wind JIP Partners usually require at least 2 weeks for the review and feedback procedure after delivery of each WP. This should be taken into account when the project Gantt chart is completed.

5.10. Tender submissions should be limited to 15 pages of A4 in the main body of the proposal. Supporting information should be included in an Appendix.

6. Tender Evaluation Criteria

Bidders should take the following evaluation criteria into account when preparing and submitting their tenders.

CRITERION 1: APPROACH TO WORK (WEIGHTING: 40%)

Bidders are required to provide the evidence of the approach to work within the main body of the tender (not in a separate document).

Description	Information required from bidders
Proposed Approach [25%]	Bidders are required to provide a detailed description on how they plan to develop each work package described in Annex A. The description should include an initial overview on the approach followed by a description on how each Work Package and task will be delivered.

	Also, bidders need to justify how their proposed approach meets the project objectives.
Suggestions [5%]	Suggestions of additional areas of work to those described in Annex A of the ITT that the bidder proposes looking at as part of this study in order to achieve the required objectives, maintain an industry focus and provide valuable insights into the potential for reducing costs and risks floating wind projects. Bidders are required to differentiate which are their additional areas of work from the proposed approach. Besides, bidders should specify if the proposed additions affect to the total price and quote them separately.
Project management [10%]	Bidders are required to describe how they will manage the project utilising appropriate resources and describe how they will work with the various stakeholders to acquire information and manage potentially conflicting relationships.

CRITERION 2: EXPERIENCE & STAFF SKILLS (WEIGHTING: 40%)

Bidders are required to provide the experience and staff skills evidence as an appendix, at the end of the bid document (not in a separate document).

Description	Information required from Bidders
Experience in relevant projects and industries [20%]	Bidders should elaborate on experience of the criteria described. Explain how these past experiences are relevant for this tender. In addition, the bidder should provide at least two examples (with reference to specific roles, responsibilities and activities the bidder undertook) of previous work which illustrates the bidder's skills, capabilities, and experience in all of these areas (bidders may wish to make reference to submitted examples of previous work for other clients). Bidders are advised that experience is considered a key important criterion and partnerships with other companies to support certain areas of experience are welcomed. All experience / case studies should be attached as an appendix to the proposal, but a summary of each case should be listed in the proposal main text.
CVs/Resumes and applicable skills [10%]	Detailed CVs/Resumes for any staff who will be involved with this Contract together with proposed project structure, intended position of staff in the project, and main responsibilities. CVs should include professional memberships of proposed staff working on this project. Bidders should elaborate on the most relevant skills of the selected staff that will be applicable in the project.
Expert engagement [10%]	A close working relationship with key stakeholders, such as wind turbine OEMs and platform/substructure developers are seen as

	relevant to the success of this project. Please supply ideas of how these groups can be engaged and leveraged.

CRITERIA 3: PRICE (WEIGHTING: 20%)

In the event that tenderers plan to use or rely on pre-existing intellectual property or know how for the project (e.g. existing O&M modelling tools), the Carbon Trust's expectation is that a premium will not be charged for leveraging this intellectual property or knowhow.

Description	Information required from bidders
Day rates and man-hours for all staff grades [10%]	Bidders are required to provide day rates for all staff grades and to input the man-hours involved in each work package described in Annex A.
Fixed price for the project [10%]	Project cost breakdown by work package, time and rate of person completing the work as specified in Section 5.7. Bidders are required to specify expected expenses apart from the estimated budget for each work package. Carbon Trust will reimburse reasonable expenses at cost and receipts may be requested. Pre-approval will be required for travel costs over £150 per return journey and combined hotels & subsistence cost exceeding £200 per day. Bidders will be required to confirm or comment on their ability to carry out the activities detailed in the Scope of Work within the initial term of the Contract and provide an outline plan of work

Annex A - Scope of Work

Background – General

A key value driver for a wind project is the power curve. At present, there is no industry accepted approach of power curve validation after project construction, for floating wind. Best practices are currently based on the fixed bottom turbine approach, and floating specific aspects are currently not considered in standards. Having such a process would reduce yield uncertainties, improve the bankability of floating wind projects and reduce LCOE.

The recently released standard IEC 61400-50-3 describes using nacelle-mounter lidars (NML) for power curve validation, though it does not detail floating-specific aspects. In fact, there is little known about the effects of floating turbines on power curve validation and if NMLs are feasible and practical for use in floating turbine Power Curve Validation.

Work Packages

Work package	Description of work
WP1: Literature study	This work package will focus on an initial detailed literature review, identifying work that has been completed in relation to floating power curve validation from academia and industry. This literature review should include any mention of power curve validation with any methodology of wind assessment including Nacelle-Mounted LiDARs (NMLs), scanning LiDARs and floating LiDARs. It should identify the key risks and challenges associated with floating turbine power curve validation, including (but not limited to): turbine motion, sensor motion and the sensitivity of the true power output to metocean parameters. For NMLs, the review should explore the abilities of commercially-available systems to resolve the shear profile in the inflow and hence compensate for the motion of the turbine. Any validation of this motion compensation should be reviewed, highlighting (where possible) the effect on uncertainty in the horizontal wind speed and direction data. If possible, the impact on measurements of inflow turbulence and/or shear should also be assessed. The study should identify any uncertainty estimates for power curve validation of floating wind turbines For a typical site, it should infer the overall effect that these uncertainties and limitations have on yield uncertainty (e.g. P90/P50 ratio). If any datasets are available which could be used to test power curve validation methodologies, these should be identified along with the steps required to secure access to the data (e.g. NDAs).

<table>
<tr><td colspan="2">Project deliverables:
- D1.1: Literature review report with focus areas for WP2 and WP3;</td></tr>
<tr><td>WP2: Stakeholder engagement</td><td>With many unknowns for developers on the right approach to take for floating power curve validation, this topic requires input from a variety of stakeholders within the industry to gather the best information and approach.

The Carbon Trust Floating Wind JIP advisory network does have some contacts with turbine OEMs, however the contractor should endeavour to form their own stakeholder network, and existing contacts shall be looked upon favourably.

This group of stakeholders shall include:

• Turbine OEMs. This group of stakeholders is key to understand how the results of the project will dicate how power curves will be validated on floating turbines. OEMs will be engaged to try and establish which metocean parameters influence the power curve and to what degree and how floating foundations impact the static & dynamic turbine tilt. They should also be able to advise on the wind measurement techniques (and validation thereof) that would be acceptable for contractual power curve warranty.
• Floater Designers. Due to the dynamic nature of FOWTs, the design of each component will influence the dynamic behaviour of the overall system; this will in turn influence the design of the components. After engagement with the Turbine OEMs, it may also be necessary to engage with floater designers to determine the key parameters they understand will contribute or enhance system behaviours, including the effects of metocean conditions on tilt and roll of the floater.
• Project Developers. The contractor should aim to engage with the 17 Floating Wind JIP partners (and other developer contacts they have) to determine the important aspects and parameters from their experience or research. Contractors must adhere to the Carbon Trust Contractor conditions and ensure results are anonymised and data is not shared.
• Lenders' Technical Advisors. LTAs should be consulted to gather their views on the bankability of various power curve validation methodologies and the uncertainties that may be assigned.

• LiDAR Manufacturers. Manufacturers of nacelle-mounted LiDARs may be able to advise on the state-of-the-art in motion compensation, and hence the ability of nacelle LiDARs mounted</td></tr>
</table>

<table>
<tr><td></td><td>on floating platforms to characterise the inflow accurately from a moving platform.

• Financiers / Investors. The measurement campaign for power curve validation may be required by financers or investors in the wind farm, to understand payback periods.

The contractor should collate information from different stakeholder groups to present to the FLW JIP partners and inform the basis of WP2.</td></tr>
<tr><td colspan="2">Project deliverables:

- D2.1: List of engagement questions to FLW JIP partners prior to engagement;
- D2.2: Presentation to FLW JIP partners on the stakeholder feedback;
- D2.3: Detailed report with stakeholder feedback;
- D2.4: Revised workplan for WP3-WP4 based on stakeholder feedback.</td></tr>
<tr><td>WP3: Parameter identification, conclusions and recommendations.</td><td>Based on WP1 and WP2 the contractor should make a clear recommendation which LiDAR technology is suitable to measure floating power curves. The contractor should identify which factors play into a fixed bottom power curve and how applicable these are to the floating turbine power curve, i.e., how do relative motions effect this?

Factors such as tilt and various motions of the turbine should be considered to conclude the validity of the wind speed measurement with different methods:

• How do we measure the wind speed with different types of lidars? Correcting for motions?

• Are there any dependencies on the type of floater?

• How is the motion of floating foundation (consequently motion/velocity of nacelle) measured?

• Which parameters should be measured for motion?

• What are the key behaviour responses for these parameters?

• How should the uncertainty of these measurements be accounted for?

• How do environmental conditions impact floater motions? Turbine OEM/floater designer feedback should feed into this.

• How do the additional Nacelle LiDARS and the disparity between the power curve sent by turbine OEMs and the true floating power curve impact the cost of energy?

○ What is the required additional Instrumentation?</td></tr>
</table>

	○ What is the cost of the LIDAR ? The report should draw conclusions on the likely uncertainties that would be associated with commercially-available nacelle-mounted LIDAR technologies (if this is the best technology) on floating wind turbines of various floater types in at least two representative sets of metocean conditions. Estimated uncertainty ranges associated with NML should be compared with similar uncertainties that could be expected from other potential solutions to measure the power curve of floating turbines (e.g. Floating LIDAR). The report should also make detailed recommendations for next steps towards a standardised, bankable approach to power curve validation for floating wind turbines, including approximate costs and timescales. This could include: • Modelling approach of turbine motions and LiDAR responses to validate the uncertainty assessments produced in this study ○ Choose the hydro-servo-elastic software ○ Emulate a nacelle-mounted LiDAR ○ Definition of the load cases; production, severe cases, idling etc ○ Simulations for a bottom-fixed wind turbine without a NML ○ Simulations for a floating wind turbine with a NML ○ Comparison of the load case results and the power curve • Experimental studies to validate the performance of floating LiDAR systems and motion compensation algorithms under motions typical of floating wind turbines • Drafting of best practice guidelines for floating wind turbine power curve validation • Other activities deemed necessary by the contractor Depending on the nature and cost of these proposed steps, the FLW JIP partners could choose to execute on or more tasks as enhancements to this Scope of Work, to tender the work publicly or to lobby other organisations to fund and/or perform these activities.

<table>
<tr><td colspan="2">Project deliverables:

- D3.1: Report summarising the outcomes of the work and making clear, actionable recommendations for next steps towards a standardised, bankable approach to power curve validation for floating wind turbines;
- D3.2: DLC matrix definition, Load cases report, chosen turbines / floaters models, power curve comparison/analysis;
- D3.3: Presentation to the FLW JIP partners.</td></tr>
<tr><td>WP4: Modelling/simulation.</td><td>GO/NO-GO decision.

The contractor will present current findings and proposed approach for modelling of WP4 at this stage to the Floating Wind JIP partners for approval.

This work package will aim to further understand the impact of identified parameters upon the power curve.

The contractor should propose their approach to model turbine motions and LiDAR responses to validate the uncertainty assessments produced in WP3.

The approach should use a tool with a certain level of accuracy, rather than an assumption-based solution, to provide quantifiable outputs of the uncertainties.

The modelling tasks should include a commercially-available nacelle mounted LIDAR technology on a floating wind turbine of various floater types in at least two representative sets of metocean conditions.

If any datasets are available, the proposed model could also be verified.</td></tr>
<tr><td colspan="2">Project deliverables:

- D4.1: Detailed report concerning the impact of various parameters and the uncertainties associated with the power curve. Report should also list next steps and considerations including scenarios which weren’t covered as part of the project and follow on work, perhaps including measurement campaign to address unanswered questions.
- D4.2: Model made available to FLW JIP partners.
- D4.3: Presentation to FLW JIP partners.</td></tr>
<tr><td>WPA: Project management</td><td>The contractor should stipulate how they will manage the project efficiently and effectively. This should include specific costs for project management time, to include update calls with the Carbon Trust Project Manager as required.

This should also include production of an executive summary for the whole project, for internal dissemination. Carbon Trust will provide the template for this. The budget should also accommodate production of a final presentation and time dedicated to presenting this in the form of a short webinar to invitees from the developers of the Floating Wind JIP.</td></tr>
</table>

	Finally, if appropriate, resource should also be allocated to provide inputs into the 'Floating Wind JIP Cost Model'. The contractor is not expected to produce a cost model of its own, but rather provide guidance on the effect of the research on inputs to the 'Floating Wind JIP Cost Model'.
Project deliverables: - **DA.1: Monthly flash reports** - **DA.2: Project executive summary** - **DA.3: Delivery of webinar** - **DA.4: Inputs to Floating Wind JIP Cost Model**	
WPB. Expenses	The contractor should detail the capped amount of expenses it expects to incur throughout the project. Expenses will be paid as incurred and any unused balance will not be paid.

Note on deliverables:
All written deliverables should include a short Executive Summary (~2-5 pages) and larger deliverables should also include an extended Synthesis (~10-20 pages) of the key findings from the work undertaken.