



# Support to pre-feasibility assessment for the Test Research Centre for Offshore Wind Turbines at Dhanuskodi

Summary of key findings, recommendations and proposed next steps

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**Centre of Excellence**  
for Offshore Wind and Renewable Energy

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## Disclaimer

This document is intended to serve as an explanation of the process undertaken during the pre-feasibility assessment process for the Test Research Centre for Offshore Wind Turbines at Dhanuskodi. This report was jointly prepared by the Danish Energy Agency (DEA) and the Technical University of Denmark (DTU) and the National Institute Wind Energy (NIWE). The document is specifically focused on the support from DEA and DTU to the process including key findings, recommendations and the proposed next steps. This document does not have any legal status and is not an official and legally binding DEA document.

## Acknowledgements

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## Table of Contents

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1. Background and context .....	3
2. Site visit .....	5
3. Stakeholder analysis and stakeholder workshop.....	6
4. Inputs and recommendations.....	7
5. Next steps .....	9
6. Appendices .....	10

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## 1. Background and context

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Technical University of Denmark (DTU) and Danish Energy Agency (DEA) have been collaborating with the National Institute of Wind Energy (NIWE) during 2020-2022 to provide advisory, guidance and capacity-building in the area of standards and wind turbine testing. The aim was to reinforce NIWE competencies in the area in order to prepare NIWE to become a Renewable Energy Test Lab (RETL) under the international standards of IECRE. On this matter, NIWE expressed the strong need to receive advisory guidance and inspiration from Denmark based on the lessons learned and key features of the Danish offshore wind test centre at Østerild. Moreover, NIWE expressed the need to receive assistance in order to prepare themselves to become a RETL within IECRE.

In 2020, DTU reviewed selected NIWE reports according to IEC standards (IEC 61400-12-1 and IEC 61400-13) to assess NIWE's capability of conducting measurements and required analysis of data. Based on this evaluation, virtual training meetings were conducted. In order to share Danish experiences, DTU described the process and key elements leading to the establishment of the Østerild Test Centre in "*Lessons Learned in Setting up a Wind Test Center for Offshore Wind Energy in the Østerild, Denmark*". Further, DTU prepared an internal report of the wind resources at Dhanuskodi "*Assessment of site specific wind conditions Dhanuskodi test site – India*", May 2020. Based on this, the work in 2021 and 2022 have been divided into four work packages (WP) which is elaborated below.

During 2021 and 2022, DTU performed a well-executed series of virtual learning modules to deepen the technical capacity of NIWE in wind turbine testing. In 2021, the work focused on the application of IEC Classification at Dhanuskodi Wind turbines site as well as the standards IEC 61400-13, IEC 61400-12-1, QMS:ISO 17025 and IEC 61400-21 (WP1). In 2022, the skype training sessions finalized the support within application of standards of IEC 61400-13, IEA 61400-21, QMS:ISO 17025 and the micro-meteorology part of IEC 61400-1 (WP3).

As part of the preparation of a stakeholder workshop, a stakeholder analysis was conducted by NIWE to collect viewpoints regarding a Offshore Wind Test cum Research Centre (WP2). "National Offshore Test Centre Survey Questionnaire" was circulated to selected private sector stakeholders during 2021 with 13 responses and a subsequent interview with a survey respondent. The findings of the stakeholder analysis were presented at an internal workshop in March 2021.

Due to COVID-19 and lack of capacity at NIWE to organize and execute stakeholder consultations and consolidating this in a process with a roadmap, it was planned to further assist NIWE in screening of requirements and support preliminary roadmap activities in 2022. These included further in-depth interviews with industry and other stakeholders with interests in a national test

centre. From 10 – 14 October 2022, DEA and DTU preformed a mission to Chennai, India in order to support NIWE in preparation and completion of a stakeholder workshop to consolidate consultation and create the possibility of making a roadmap (WP4).

This report summarizes the main activities and findings related to the support provided for the pre-feasibility assessment for the Test Research Centre for Offshore Wind Turbines at Dhanuskodi (WP4):

- Outlining a preliminary roadmap to be used by NIWE in screening of requirements and support preliminary activities for development of the work plan to develop the Dhanuskodi Wind Test Centre.
- Summarizing the recommendations and inputs gathered at the workshop, including most suitable uses for the test centre based on the outcome of the survey, interviews and further inputs collected at the workshop.
- Identifying and consolidating a set of priorities for the next steps of the development of the National Test Research Centre for Offshore Wind Turbines at Dhanuskodi. This could include proposal for further support through INDEP (to be executed in 2023).

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## 2. Site visit

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A site visit to Dhanuskodi was foreseen ever since the initial support for the project, but due to COVID-19 this was not realised until October 2022 where a physical mission by DTU and DEA was organized together with an external stakeholder workshop at NIWE. On 11 October 2022, a site visit was organized to Dhanuskodi, in which DTU (Deputy Head of Department Mr. Peter Hjuler Jensen, Associate Professor Dr. Niels Erik Clausen, Senior Researcher Dr. Birte Holst Jorgensen), DEA (Country Team Leader Mr. Simon Engfred Schlichting and the Danish Embassy in India (Programme Officer Ms. Aishwarya Joshi) and NIWE (Shri. N. Rajkumar, Shri. Bhukya Ramdas, Shri. A. R. Hasan Ali, Shri. M. Karuppuchamy, Shri. Y. Packiyaraj) participated.

The visit allowed the participants to get impressions related to:

- The road infrastructure from Madurai via the Indira Gandhi Road Bridge (next to the Pamban Railway bridge) to the City of Rameswaram and to the very end of the peninsula Dhanuskodi.
- The expected test site including the previous mast measurement station, which provided the wind resource data (1st October 2013 - 15th December 2015) for the DTU wind resource assessment reported in accordance with the MEASNET, May 2020.
- The access to a fishing jetty on the Northern coast of the peninsula. A new jetty on the Southern coast will most likely be constructed to be used for unloading wind turbine and blade components (incl. the crane for assembly) from the VOC port at Tuticorin.
- The popularity of the pilgrimage site at the end of the bow of Dhanuskodi. Since the cyclone in 1964, there was no road access to the site until the met mast together with road access was installed in 2013.
- Possible placement of test pads based on the geographical characteristics, incl. prospects for adding more test pads.

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### 3. Stakeholder analysis and stakeholder workshop

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NIWE and DTU prepared and conducted a stakeholder analysis for the Dhanuskodi Test Centre and reached out to the users and beneficiaries of the test centre (the wind industry), but so far not to the local communities whose interests may be affected by the establishment of the test centre.

Therefore, the stakeholders of the Offshore Wind Test cum Research Centre are so far limited to the following customers, to whom the centre adds value:

- Wind turbine manufacturers (OEMs) that need to test proto-types at an Indian test site according to international test standards – domestic as well as international
- Developers that want to test their preferred/acquired wind turbine at an Indian test site before installation
- Wind turbine component manufacturers that want to test a specific component (e.g. blades) on a wind turbine.

The analysis consisted of a survey with a set of questions focusing on some background information of the company, its engagement in the offshore wind market and current use of test facilities, its interest in a new test facilities and specific requirements and also availability for a follow-up interview. The survey took place in the last quarter of 2020. A total of 13 responses were received. Afterwards in-depth follow up interviews were conducted with 6 companies in 2021 and 2022. The interviews were semi-structured with a set of open questions focusing on testing needs, expectation towards the proposed test centre, key criteria for the test centre, including the location and then also the willingness to participate in the workshop on 13 October 2022. All results from the survey and the in-depth interview were presented at the stakeholder workshop.

The stakeholder workshop took place on 13th October 2022 at NIWE with possibility also for online participation. A total of 46 participants from 24 different companies and institutions joined workshop at NIWE while 30 participated online. The stakeholders received very comprehensive information about the relevance of the Indian test centre, the finding from the power evacuation study, the feedback from survey and interviews with the industry and the lessons learned from Østerild Test Centre. There was a good dialogue at the work-shop and stakeholders looked forward to learn more about the preparation of the test centre. Programme, background information and presentations from the workshop are attached as annex to this report.

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## 4. Inputs and recommendations

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Based on background information and discussions between NIWE, DEA and DTU, impressions from DTU and DEA from the site visit to Dhanuskodi and stakeholder interaction can be summarized to the following::

- NIWE had developed a detailed Project Report for a commercial 20MW wind farm at the Dhanuskodi site, called the “*Greening of Rameswaram*” project. It will consist of two commercial wind turbines (each 8MW+) and a solar plant (1MW). The aim is to kick start the national test center by installing the 20MW wind farm and parallel to that start preparing the test center with two test pads with the capacity of 20MW each.
- Contrary to Østerild Test Centre, the Dhanuskodi test centre foresees to use monopiles as foundation for the test pads due to land constraints.
- A power evacuation analysis was made by NIWE in 2022 for a 20MW wind farm at Dhanuskodi. The project is planned in two phases: Phase 1 consisting of the two commercial wind turbines (each 8MW+) and 1MW solar plant, and Phase 2 consisting of two test pads (each 20MW).
- NIWE will conduct a HTL/LTL (high tide level / low tide level) demarcation study for the Dhanuskodi site according to the Coastal Regulation Zone (CRZ). The project lay out will be superimposed on the CRZ Map (1km x 1km) on the 1:4000 scale and CRZ Map (7km x 7km) on the 1:25000 scale indicating HTL and LTL with ecological features.
- The centre is expected to have multiple uses. It will be a demonstration site, which will allow NIWE to gain the necessary competences to be used also for the test centre. It will also be an educational and learning centre where the next generation of engineers can be trained. It will be visible to the general public and people visiting the pilgrimage site at the end of the peninsula and may influence the public acceptance of wind power.
- The Detailed Project Report for the proposed 20MW wind farm at Dhanuskodi site will be finalized before the end of fourth quarter of Financial Year 2022-23 and used in the further process to attract funding to the project, e.g. the storage part from agencies like the World Bank’s Energy Storage Programme.

Based on these impressions and inputs, the DEA and DTU recommendations can be summarized to the following:

- It is challenging to envision the size of the future wind turbines and thereby also the dimension of the test site. Therefore, it is important to design the test site for the future:
  - Design for scalability and adaption to be made for the future. The technology development is fast and the test centre should be designed in a way so that it can be upgraded or adapted to accommodate new wind turbine proto-types.



- Take the necessary precautions regarding access to the test site, both in terms of commercial confidentiality and requests for restrictions, safety issues especially during installation and radar control of overflying air-planes.
- Consider carefully the implications of the co-location with the pilgrimage site, both during installation time but also in operation. There may be both pros and cons. Pros as being highly visible to the general public and cons in terms of disturbing a holy site.
- Develop a sound business model:
  - Build on the good momentum of the stakeholder interactions and workshop to deepen the value proposition to the different customer groups, including further stakeholder interviews and consultations.
  - Create a business model where the roles and responsibilities allows NIWE to provide test services to the industry while also create the societal benefit of providing large wind turbines to the Indian market.
  - Plan a robust economic model for the test services to the industry, including stable and secured cash out- and inflows.
  - From the very beginning, make a robust and convincing plan for data management that takes notice of IPR and the request for academic publishing, all of which are important to gain the necessary trust from industry.
  - In case of an accident at the test centre, explore carefully what the insurance company cover and what not.
- Prepare a detailed project description document for the design and construction of the test centre, making use of the synergies and learnings from the demonstration project. It should include:
  - Detailed technical description and lay out plan
  - A solid Environmental, Social and Governance (ESG) assessment of the centre, making sure that the centre safeguards the environment, meets social criteria regarding relationships with employees, suppliers, customers and the communities where it operates, and that the Governance structure deals with the leadership, audits, internal controls and shareholder rights.
  - Detailed activity plan and timeline, including a set of measurable KPIs
  - A detailed budget for preparation and construction of the test centre.
  - An accountable, market-oriented governance model, which accommodates the viewpoints of the industry (group of the most influential industrial stakeholders) while meeting governmental obligations.

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## 5. Next steps

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### Next steps in the project development for Dhanuskodi (NIWE)

1. Formulation of a detailed project description plan that includes a detailed time line, activity list, and KPIs
2. Formulation of the detailed layout plan for the Offshore Wind Test cum Research Centre at Dhanuskodi
3. Finding out efficacy of Test Centre at Dhanuskodi based on Wind resources available at the site.
4. Micro siting of the Offshore Wind Test cum Research Centre at Dhanuskodi.
5. Development of a Public-Private Partnership and business model for the Offshore Wind Test cum Research Centre at Dhanuskodi.

Following the completion of the support to the pre-feasibility assessment for the Test Research Centre for Offshore Wind Turbines at Dhanuskodi, it has been agreed between NIWE, DEA and DTU that further support will be provided with a specific focus on inputs for the drafting of a detailed project description for the Dhanuskodi Test Centre. This will have three main focus areas:

1. To support NIWE's development of a detailed project description plan for the development of the Offshore Wind Test cum Research Centre at Dhanuskodi.
2. Support NIWE in the development of a Public-Private Partnership and business model for the Offshore Wind Test cum Research Centre at Dhanuskodi.
3. To share experiences from the layout plan of Østerild Test Centre and assist NIWE in the micro siting of the Dhanuskodi site based on Danish experiences.

The support and joint work will be continued under the framework of the joint Centre of Excellence for Offshore Wind and Renewable Energy between India and Denmark.

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## 6. Appendices

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1. Links for presentations from stakeholder workshop - <https://cloud.niwe.res.in/index.php/s/eYffafmDaE2dSoX>
2. Leaflet on the Dhanuskodi Test Site - <https://coe-osw.org/leaflet-about-test-centre-in-dhanuskodi/>