



**EVALUATION REPORT
SITE CONDITIONS -
METOCEAN CONDITIONS
PART B**

PREPARED FOR:

ENERGINET ELTRANSMISSION A/S

Order No.: 14772968

Report No.: R14772968-0-3, Rev. 0,
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Wind Farm: Energy Island Baltic Sea
Wind Farms

CLASSIFICATION
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DOCUMENT HISTORY

REVISION	RELEASE DATE	MODIFICATION
0	2024-03-19	Initial Document

1 DOCUMENTS

1.1 Examined Documents

- /1.1.1/ DHI: Report
"Energy Island Baltic Sea Metocean Assessment Part B: Data Analyses",
Doc. No. 4500092960, Rev. 1.2, 2024-02-22, 116 pages
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+036)
- /1.1.2/ DHI: Data Folder
"Digital_Appendices for Metocean Assessment Part B",
MD5 Checksum: A0C3C8EDC7E32FA37F015A350AB132A5, 2024-02-27, 12 files
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+037)

1.2 Noted Documents

- /1.2.1/ DHI: Report
"Energy Island Baltic Sea Metocean Assessment Part A: Description and Verification of Data Basis",
Doc. No. 4500092960, Rev. 1.1, 2023-12-20, 192 pages
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+031)
- /1.2.2/ DANAK: Certificate
"Accreditation for testing DS/EN ISO/IEC 17025:2017 DHI A/S",
2019-06-24, 2 pages
(DEWI-OCC Order-No.: 14772968 – Doc. No. -00+034)
- /1.2.3/ Fugro: Report
"SWLB measurements at Energy Islands Project Measurement Plan, All Lots",
Doc. No. C75486_Project_Measurement_Plan_All_Lots 09, Rev. 9, 2023-05-30, 56 pages
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+002)
- /1.2.4/ DNV GL: Report
"ZX898M Independent analysis and reporting of ZX Lidars performance verification executed by ZX Lidars at the UK Remote Sensing Test Site",
Doc. No. 10159431-R-11, Rev. A, 2019-08-02, 82 pages
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+024)
- /1.2.5/ DNV: Report
"WS199 Independent performance verification of Seawatch Wind Lidar Buoy at Frøya, Norway",
Doc. No. 10281716-R-11, Rev. A, 2021-11-03, 44 pages
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+025)
- /1.2.6/ DNV GL: Report
"ZX993 Independent analysis and reporting of ZX Lidars performance verification executed by ZX Lidars at the UK Remote Sensing Test Site",
Doc. No. 10189145-R-12, Rev. A, 2020-02-28, 90 pages
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+026)
- /1.2.7/ DNV: Report
"SWLB044 Independent performance verification of Seawatch Wind Lidar Buoy at Frøya, Norway",
Doc. No. 10281716-R-12, Rev. B, 2021-11-11, 44 pages
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+027)

- /1.2.8/ DNV GL: Report "TYPE ZX300 LIDAR Remote Sensing Device Type-specific Classification Summary", Doc. No. GLGH-4275 18 14741 258-R-0003, Rev. D, 2018-11-09, 21 pages
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+028)
- /1.2.9/ DNV GL: Certificate
"ISO 9001 Management System Certificate Fugro Norway AS",
Doc. No. 10000409040-MS-C-NA-NOR, 2020-12-16, 2 pages
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+001)
- /1.2.10/ Energinet: Excel-File
"Stations and deployment record - EIBS",
MD5 Checksum: D60CA60ED1EEF0DC6156D37CEEF9975D, 55 kB
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+039)
- /1.2.11/ Energinet: Folder
"Buoy predeployment validation reports",
MD5 Checksum: 31C235877CAA7B49E65ED01B63F81E11, 11 files
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+004)
- /1.2.12/ Energinet: Folder
"Instrument certificates and reports",
MD5 Checksum: 4E57DF8944CAB3F13F0B921B83C8A57E, 103 files
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+005)
- /1.2.13/ Energinet: Folder
"Service reports",
MD5 Checksum: BE9419A52E4F80B41BBFD5C3726D065D, 50 files
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+006)
- /1.2.14/ DEWI-OCC GmbH: Evaluation Report
Site Conditions – Measurement Campaign for Wind and Metocean Conditions
Doc. No. R14772968-0-5, Rev. 1, 2024-03-19, 7 pages

2 CERTIFICATION SCHEME

- /2.1/ IECRE OD-502: Operational Document, "Project Certification Scheme", Edition 1.0, 2018-10-11

3 STANDARDS AND GUIDELINES

The conformity evaluation was carried out based on the following standards and guidelines:

- /3.1/ IEC 61400-3-1: "Wind energy generation systems - Part 3-1: Design requirements for fixed offshore wind turbines", Edition 1.0, 2019-04
- /3.2/ IEC 61400-1: "Wind energy generation systems - Part 1: Design requirements", Edition 4.0, 2019-02

4 SCOPE OF EVALUATION

The metocean conditions data analysis (Metocean Conditions Assessment Part B) for the Energy Island Baltic Sea wind farms documented in chapter 1 shall be evaluated for conformity with IECRE OD-502 /2.1/ with consideration of the additional standards listed in chapter 3 with the purpose of use in the design basis for FEED design.

The documents in 1.1 shall be reviewed for completeness, correctness and consistency.

Measurement validation and the creation of a metocean data basis as well as presentation of design parameters for wind conditions, soil conditions and electrical conditions are not subject of this evaluation report.

5 REMARKS

5.1 General

The Energy Island Baltic Sea Wind Farm site is located in the Baltic Sea off the Coast of Bornholm, Denmark. The number and locations of wind turbines is not yet defined.

The documents listed in chapter 1 present the data analysis and determination of design values for the metocean conditions assessment for the Energy Island Baltic Sea wind farms. The documentation details the results of the assessment for water levels, current conditions, and waves climate as well as wind conditions for the purpose of correlation of wind and waves. Additionally, other atmospheric and oceanographic conditions are included. In /1.1.1/ and /1.1.2/, relevant input parameters to be used for the design basis for FEED design for the offshore wind farm area are presented.

The location of the planned wind farm and energy island area is given in /1.1.1/. The metocean assessment is established on the base of hindcast models which are compared against local and regional measurements. The responsible company "DHI" holds an accreditation for testing according to DS/EN ISO/IEC 17025 /1.2.2/.

Presentation of hindcast models, presentation of measurement data at the project site and validation of models and measurements are not part of the scope of the documents in chapter 1.

Wind conditions for design of wind turbine generators (WTG) at the site, results of the geophysical and geotechnical campaigns and electrical network conditions are not part of this report.

5.2 Site Conditions

5.2.1 Wind conditions

Wind conditions for the site of the Energy Island Baltic Sea wind farms are given in /1.1.1/ for correlation with hydrographical conditions only. Wind conditions for use in the design basis and design of the WTG are not part of this report.

5.2.2 Hydrographic conditions

Hydrographic conditions for the site of the Energy Island Baltic Sea wind farms are detailed in /1.1.1/ and /1.1.2/.

Results are presented for 6 analysis points spread over the project area. A justification is given for the choice of analysis points and their coordinates are included. The location "BHI-2" is chosen for the presentation of design values in /1.1.1/.

Measurements of wind conditions, water levels, wave data and current data at the project site were executed by the company "Fugro" /1.2.3/. Independent testing and verification of the utilized buoys are

documented in /1.2.4/ to /1.2.8/. The availability period of the different buoys and replacement of single buoys is presented in /1.2.10/.

The company "Fugro" is not recognized by IECRE as a testing laboratory for wind and metocean measurements. The qualification of the testing laboratory and the involved personnel as well as the quality of the measurement campaign were therefore confirmed by DEWI-OCC on the basis of the additional documentation /1.2.9/ to /1.2.13/. The evaluation of the measurement campaign is documented in /1.2.14/.

Hydrographic data was derived on the basis of hindcast modelling, correlated with on-site measurements and regional measurements.

Water levels, currents and waves for the wind farm area were determined from the hydrodynamic model described in /1.2.1/.

Tidal water levels are presented in /1.1.1/ with reference to mean sea level (MSL). Extreme water levels are given for various return periods including 1 year and 50 years.

Normal and extreme current conditions are presented. Current roses are given for total currents at different depths. Information on vertical profiles of current speed is included in /1.1.1/ as well as an overview of extreme current speeds at different depths for various return periods including 1 year and 50 years.

Wave characteristics are presented in /1.1.1/ for normal and extreme conditions. Wave roses are presented for total waves, wind sea and swell. Various scatter diagrams are given. An overview of the extreme significant wave height, the peak wave period, the maximum wave height and the maximum crest height for various return periods including 1 year and 50 years are included in /1.1.1/. Recommendations regarding breaking waves are presented.

Under consideration of all remarks hydrographic conditions as detailed in /1.1.1/ are suitable for application in the design basis for FEED design.

5.2.3 Other site conditions

Other site conditions for the Energy Island Baltic Sea wind farms are detailed in /1.1.1/. They are separated into other atmospheric conditions and other oceanographic conditions.

Given information for atmospheric conditions includes air temperature, humidity and solar radiation.

Given information for oceanographic conditions includes water temperature, salinity and marine growth.

Under consideration of all remarks, other site conditions as detailed in /1.1.1/ are suitable for application in the design basis for FEED design.

6 INTERFACE TO OTHER EVALUATION MODULES

- 6.1 The measurement campaign is evaluated in R14772968-0-5, Rev. 1
- 6.2 The wind conditions at the site are evaluated in R14772968-0-1, Rev. 1
- 6.3 The data basis for metocean conditions at the site (Metocean Assessment Part A) is evaluated in R14772968-0-2, Rev. 0
- 6.4 The ice conditions at the site are evaluated in R14772868-0-4, Rev. 0

7 CONDITIONS

- 7.1 Design parameters for wind conditions, soil conditions and electrical conditions shall be presented in additional expertises and will be evaluated separately.
- 7.2 When additional measurements are available, the results and validation, especially for the long-term site conditions, shall be reassessed and updated.

8 CONCLUSION

The metocean conditions data analysis (Metocean Conditions Assessment Part C) for the Energy Island Baltic Sea wind farms in /1.1.1/ and /1.1.2/ was found plausible and in conformity with IECRE OD-502 /2.1/ and the respective technical standards /3.1/ and /3.2/.

There are no objections against the application of the metocean conditions data analysis in the design basis for FEED design for the Energy Island Baltic Sea wind farms.

Changes in the metocean condition data analysis shall be approved by DEWI-OCC GmbH; otherwise this report loses its validity.

Bremen, 2024-03-19

Expert in Charge

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