



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

PREPARED FOR:

**ENERGINET ELTRANSMISSION A/S**

Order No.: 14772968

Report No.: *R14772968-0-2, Rev. 0,  
2024-03-19*

Wind Farm: Energy Island Baltic Sea  
Wind Farms

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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 A: Description and Verification of Data Basis",  
Doc. No. 4500092960, Rev. 1.2, 2024-02-07, 195 pages  
(DEWI-OCC Order-No.: 14772968 – Doc. No. -00+035)

## 1.2 Noted Documents

- /1.2.1/ 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)
- /1.2.2/ 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)
- /1.2.3/ 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)
- /1.2.4/ 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)
- /1.2.5/ 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)
- /1.2.6/ 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)
- /1.2.7/ 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)

- /1.2.8/ DNV GL: Certificate  
"ISO 9001 Management System Certificate Fugro Norway AS",  
Doc. No. 10000409040-MSC-NA-NOR, 2020-12-16, 2 pages  
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+001)
- /1.2.9/ Energinet: Excel-File  
"Stations and deployment record - EIBS",  
MD5 checksum: D60CA60ED1EEF0DC6156D37CEEF9975D, 55 kB  
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+039)
- /1.2.10/ Energinet: Folder  
"Buoy predeployment validation reports",  
MD5 checksum: 31C235877CAA7B49E65ED01B63F81E11, 11 files  
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+004)
- /1.2.11/ Energinet: Folder  
"Instrument certificates and reports", Doc. No.  
MD5 checksum: 4E57DF8944CAB3F13F0B921B83C8A57E, 103 files  
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+005)
- /1.2.12/ Energinet: Folder  
"Service reports",  
MD5 checksum: BE9419A52E4F80B41BBFD5C3726D065D, 50 files  
(DEWI-OCC Order-No.: 14772968 - Doc. No. -00+006)
- /1.2.13/ 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 basis (Metocean Assessment Part A) 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.

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

The analysis and interpretation as well as presentation of design parameters for marine conditions, 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 sites are 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 basis for the metocean conditions assessment for the Energy Island Baltic Sea wind farms. The documentation details the site bathymetry, the data basis for the analysis of water levels, current conditions, and waves as well as wind conditions for the purpose of correlation of wind and waves. Additionally, other atmospheric and oceanographic conditions and information on expected climate change and sea level rise is included.

The location of the planned wind farm areas is given in /1.1.1/. The metocean data base is established on the base of a hindcast model which is compared against local buoy measurements and existing regional measurements. The responsible company "DHI" holds an accreditation for testing according to DS/EN ISO/IEC 17025 /1.2.1/.

Measurements and models are presented in /1.1.1/.

An analysis and interpretation of metocean conditions at the project site and determination of design values 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 farm areas 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

The data basis for hydrographic conditions for the site of the Energy Island Baltic Sea wind farm areas is detailed in /1.1.1/.

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

Measurements of wind conditions, water levels, wave data and current data at the project site were executed by the company “Fugro” /1.2.2/. Independent testing and verification of the utilized buoys is documented in /1.2.3/ to /1.2.7/. The availability period of the different buoys and replacement of single buoys is presented in /1.2.9/. Measurement positions are listed in /1.1.1/

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 /1.2.2/ and /1.2.8/ to /1.2.12/. The evaluation of the measurement campaign is documented in /1.2.13/.

A description of the bathymetry at the sites is included based on a survey executed at the site during 2022, using a multi-beam echosounder, data has a resolution of 5 m. A map of the bathymetry is included in /1.1.1/.

Water levels were derived from a regional hydrodynamic model. Tidal ranges are found to be very small. According to /1.1.1/, low pressure storm systems travelling eastward can create high surges. This shall be considered for the further project progress.

The applied model is described and according to /1.1.1/, it is validated against selected measurement locations around the Baltic Sea. Measurement positions are given.

Current conditions at the sites are based on a hindcast model and local and regional measurements.

Local and regional locations of current measurements are given.

The validation of the local and the regional hindcast model against measurement data is included in /1.1.1/.

Current profile statistics are presented and multiplication factors for current speeds at different depth are given.

Wave characteristics are derived based on a local spectral wave model calibrated on local measurements according to /1.1.1/.

Locations of local and regional wave climate measurements are given.

General information on the applied wave model, a sensitivity study for the model, the model setup and a validation of wave parameters are presented. Possible wave spectra are discussed and a recommendation for an appropriate wave spectrum is given in /1.1.1/.

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

### 5.2.3 Other site conditions

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

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

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

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

### 5.2.4 Climate change

The Metocean Assessment Part A /1.1.1/ includes information on how to address climate change and sea level rise at the Energy Island Baltic Sea wind farms site for the project lifetime. Information is based on a literature study.

According to /1.1.1/ a sea level rise between 0 m and 0.5 m with a median of 0.25 m by the year 2055 is expected.

Under consideration of all remarks information on climate change is suitable for application in the design basis.

## 6 INTERFACE TO OTHER EVALUATION MODULES

- 6.1 The measurement campaign is evaluated in R14772868-0-5, Rev. 1
- 6.2 The wind conditions at the site are evaluated in R14772868-0-1, Rev. 1
- 6.3 The analysis of metocean conditions at the site (Metocean Assessment Part B) is evaluated in R14772868-0-3, 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 marine conditions, 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.
- 7.3 The effect of possible high surges caused by low pressure storm systems shall be considered for further project progress.

## 8 CONCLUSION

The metocean conditions data basis (Metocean Conditions Assessment Part A) for the Energy Island Baltic Sea wind farms documented in /1.1.1/ 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 basis in the design basis for the Energy Island Baltic Sea Wind Farms.

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

Bremen, 2024-03-19

Expert in Charge

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