Project Information Sheet

Appendix 1 to the application

for the decision on environmental conditions

Offshore Wind Farm located in 14.E.1 area


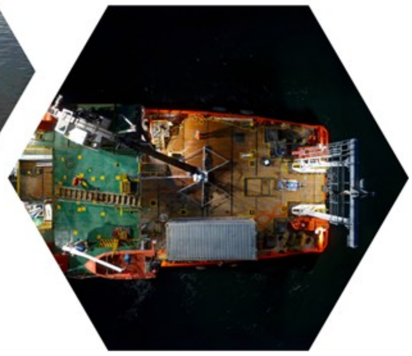

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Table 1.1 List of abbreviations and symbols

ABBREVIATION	EXPLANATION
AIS	Automatic Identification System
BBC	Big Bubble Curtain – a technology aimed at limiting the spread of underwater sound
CTV	wind farm crew transport vessel
DBBC	double big bubble curtain
phytobenthos	hydrophytes, which include vascular plants rooted in the seabed (e.g. sea grass) and macroalgae, which attach themselves to a hard surface (cobbles, wrecks, structures) or lie freely on the seabed
HLJV	heavy lift jack-up vessel
HVDC	high voltage direct current technology of power output from the OWF
HVAC	high voltage alternating current technology of power output from the OWF
GCI	Grid connection infrastructure
NPS	National Power System
macrozoobenthos	a complex of invertebrate organisms living on the surface of bottom sediments (epifauna) or inside the sediment, remaining during the sediment flushing on a screen with a mesh size of 1 mm
OWT	Offshore Wind Turbine
OWF	Offshore Wind Farm
14.E.1 OWF	14.E.1 Offshore Wind Farm
OS	Offshore Substation
MW	megawatt – SI power unit
Project	construction, operation, and decommissioning of the Offshore Wind Farm in 14.E.1 area, including accompanying infrastructure
POM	Polish maritime areas within the meaning of the Act of March 21, 1991 on maritime areas of the Republic of Poland and maritime administration (consolidated text, Journal of Laws of 2022, item 457, as amended)
Permit for erection and use of artificial islands	Permit for erection and use of artificial islands, structures and devices in the Polish maritime areas within the meaning of the Act of March 21, 1991 on maritime areas of the Republic of Poland and maritime administration (consolidated text, Journal of Laws of 2022, item 457, as amended)
MSP-POM	Maritime Spatial Plan of Polish Marine Areas was introduced by the Regulation of the Council of Ministers of April 14, 2021 on the adoption of the spatial development plan for internal sea waters, the territorial sea and the exclusive economic zone at a scale of 1:200,000 (Journal of Laws of 2021, item 935, as amended)
RAO	Reasonable alternative option
SIPAM	Maritime Administration Geographic Information System
SOV	OWF service operation vessel
UXO	explosive and dangerous object
VMS	Vessel Monitoring System
OPA	Option proposed by the Applicant

1 INTRODUCTION

Proposed Project – Offshore Wind Farm in the 14.E.1 area (hereinafter: 14.E.1 OWF) will consist in the construction, operation and decommissioning of the Offshore Wind Farm in the 14.E.1 area, along with the necessary infrastructure. The maximum installed capacity of the 14.E.1 OWF will be 812 MW.

1.1 Subject and objective of the study

The subject of this study is the Project Information Sheet (hereinafter: PIS) which constitutes an appendix to the application for the decision on environmental conditions for the above-mentioned Project. The purpose of this study is to present the key parameters of the proposed Project and analyze the related environmental aspects.

1.2 Formal qualification of the Project

In accordance with the Regulation of the Council of Ministers of September 10, 2019 *on projects which may have a significant environmental impact* (Journal of Laws of 2019, item 1839, as amended), the Project qualifies as a project that may always have a significant environmental impact:

- according to § 2 section 1 point 5 letter b., plants using wind energy for electricity generation located in maritime areas of the Republic of Poland.

The Applicant also allows for the construction of a helideck on OWF structures, which was qualified in accordance with § 3 section 1 point 61) of the above-mentioned Regulation as projects that may have a significant environmental impact:

- airports other than mentioned in § 2 section 1 point 30 or landing fields, except for landing fields mentioned in the Regulation of the Minister of Health of June 27, 2019 *on the hospital emergency department* (Journal of Laws, item 1213).

Other infrastructure, such as offshore substations or offshore power lines located in the OWF area, have not been qualified in the above-mentioned Regulation as projects that may have a significant or potentially significant environmental impact, but will be assessed as an element of the Project.

Table 1.1. Geocentric geodetic coordinates of the boundary turn points of the 14.E.1 OWF area (source: Appendix No. 2 to the Act of December 17, 2020 on promoting electricity generation in offshore wind farms (consolidated text, Journal of Laws of 2022, item 1050))

BOUNDARY TURN POINT	GEOCENTRIC GEODETIC COORDINATE SYSTEM GRS80H	
	Latitude	Longitude
	[DD° MM' SS, SSS"]	
1	54° 25' 04.473" N	15° 17' 22.724" E
2	54° 22' 35.969" N	15° 10' 01.757" E
3	54° 22' 35.887" N	15° 10' 01.514" E
4	54° 22' 18.852" N	15° 09' 10.930" E
5	54° 22' 18.766" N	15° 09' 10.674" E
6	54° 21' 46.994" N	15° 07' 36.331" E
7	54° 24' 09.333" N	15° 02' 43.279" E
8	54° 27' 23.856" N	15° 07' 48.495" E

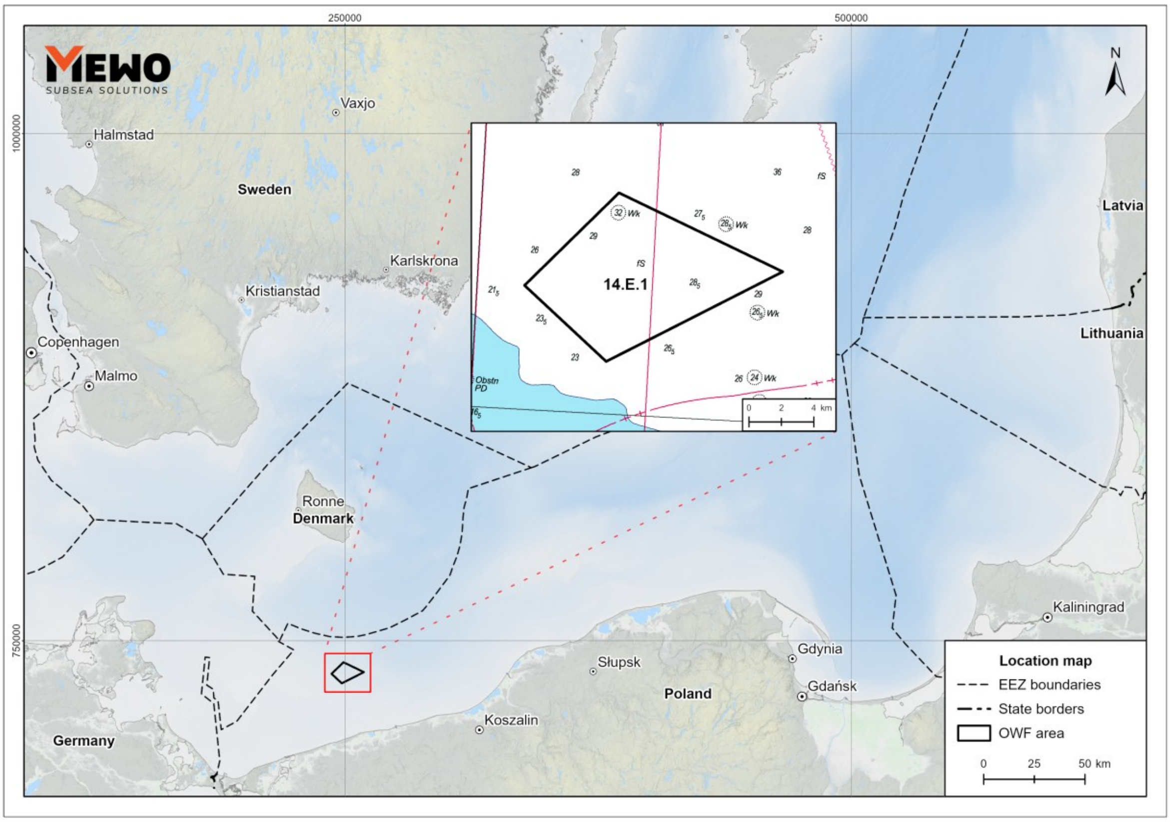

Figure 1.1. Location of the 14.E.1 OWF area in the Polish maritime areas (source: own study)

1.3 Location of the Project against the Spatial Development Plan for the Polish maritime areas

The 14.E.1 OWF area is located within the boundaries of the POM.14.E water region, the boundary of which is defined in Appendix No. 1 to the Regulation of the Council of Ministers of April 14, 2021 *on the adoption of a spatial development plan for internal sea waters, territorial sea and exclusive economic zone at a scale of 1:200,000* (Journal of Laws of 2021, item 935, as amended), (Figure 1.2).

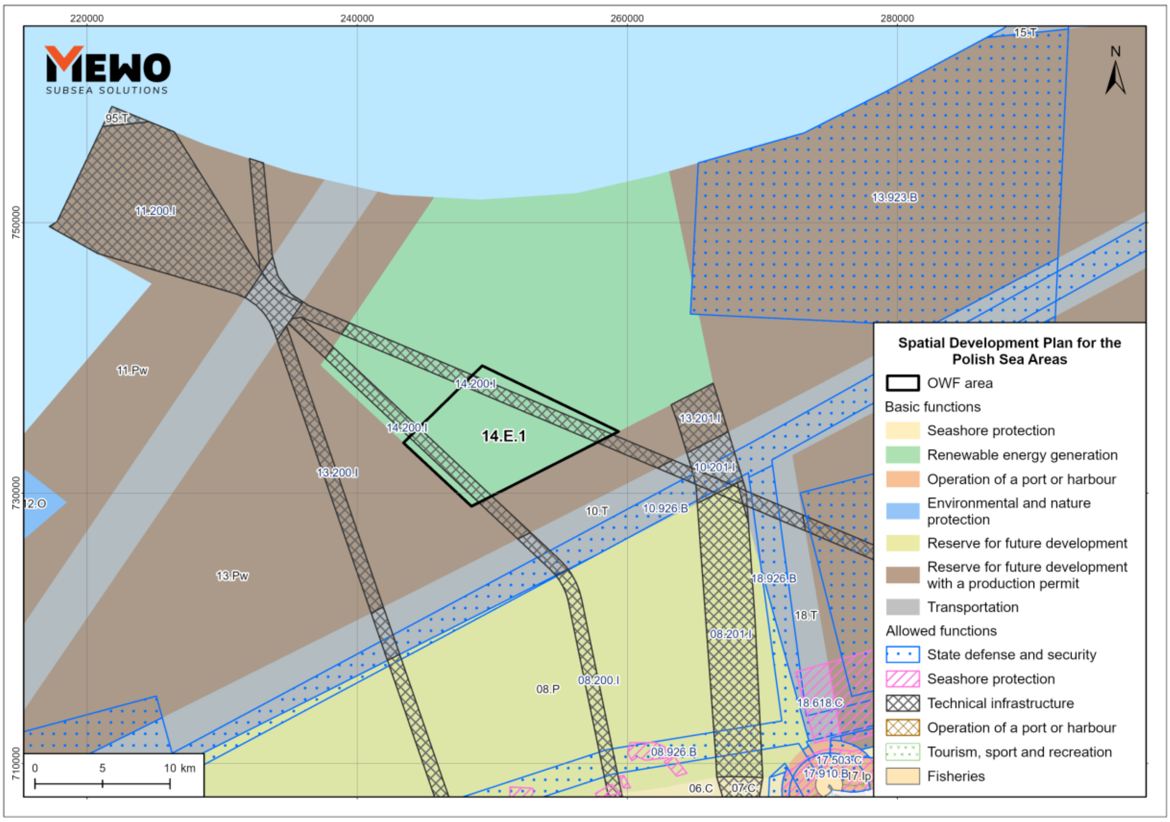

Figure 1.2. Location of the 14.E.1 OWF area in relation to water regions and sub-regions resulting from the Spatial Development Plan for the Polish maritime areas (source: own study based on spatial data of the Maritime Administration Geographic Information System (SIPAM))

The offshore area where the proposed Project will be located performs various functions resulting from the existing human activity and natural resources present there. Appendix No. 2 to the above-mentioned Regulation indicates that the basic function in the POM.14.E water region is the renewable energy generation. Additionally, the Appendix indicates a set of functions permitted to be performed in the water region:

1) aquaculture,
2) scientific research,
3) cultural heritage,
4) technical infrastructure,
5) prospecting, exploration of mineral deposits and extraction of minerals from deposits,
6) fishing,
7) artificial islands and structures,
8) transportation,
9) tourism, sport and recreation.

The basic and permitted functions take into account the conditions of the water region resulting from the previous and planned methods of its use.

The POM.14.E water region sheet contains a series of prohibitions or limitations which regulate the possibility of performing the permitted functions in order to subordinate them to the basic function:

1) aquaculture:
   - the function shall be limited to projects agreed upon with the relevant investor of offshore wind farms;
2) scientific research:
   - scientific research shall be limited to ways that do not interfere with the linear facilities of the technical infrastructure;
3) technical infrastructure:
   - it is required to install linear elements of technical infrastructure in such a manner as to ensure economical use of space under the seabed surface, and if it is impossible due to environmental or process reasons, other permanent protections shall be used to enable the safe use of set anchored gillnets;
4) prospecting, exploration of mineral deposits and extraction of minerals from deposits:
   - the function shall be limited to ways that do not interfere with the linear facilities of the technical infrastructure;
   - the extraction of minerals from deposits shall be limited to projects agreed upon with the relevant investor of offshore wind farms;

5) fishing:
   - during the operation of offshore wind turbines, until rules for fishing in the water region are developed, it is forbidden to fish in safety zones of each structure and in places endangering the safety of the internal connection infrastructure;
6) artificial islands and structures:
   - it is prohibited to erect artificial islands, structures and equipment for the extraction of hydrocarbons throughout the water region;
   - the erection of structures for aquaculture purposes shall be limited to locations that do not interfere with the linear facilities of the technical infrastructure;
7) transportation:
   - during the operation of the offshore wind turbines, navigation shall be limited to vessels of less than 50 meters in length until the conditions for the safety of navigation are established by decision of a locally competent director of the maritime office, with the exception of the navigation of vessels connected with the operation and maintenance of structures and devices of offshore wind farms;
8) other:
   - after project completion, in the water sub-regions intended for the installation and maintenance of linear facilities of technical infrastructure, it is required to have a safety zone around them established by a locally competent director of the maritime office, in which anchoring shall be prohibited, excluding emergency anchoring and anchoring related to installation and service works.

In the case of the “artificial islands and structures” and “technical infrastructure” functions, which directly refer to offshore wind farms and their accompanying infrastructure, it is indicated that their implementation shall be limited to methods that do not threaten the ecological function of spawning grounds and the survivability of fish (hard roe and larvae) of commercial species at early stages of development.

No prohibitions or limitations have been established for the performance of the “environmental protection”, “state defense and security” and “protection of cultural heritage” functions, which are entirely governed by separate regulations. There are also no prohibitions or limitations on the “tourism, sport and recreation” function.

1.4 Project characteristics

An offshore wind farm is a set of devices used to generate renewable energy by converting kinetic wind energy into electricity.

The main components of the 14.E.1 OWF will be:

- offshore wind turbines – rotor nacelle and support structure (surface part, transition pieces and underwater part);
- offshore substation or offshore substations consisting of offshore transformer stations and, in the case of direct current electricity output to land, offshore converter stations;
- medium or high voltage power cables for the transmission of electricity from wind turbines to offshore substations and between offshore substations with accessories;
- service and accommodation station (optional);
- metering and research station (optional);
- helideck located on OWF structures (optional).

The power generated by the 14.E.1 OWF will be transmitted to the NPS via a power connection, which will be a separate project. The Investor shall submit a separate application for the decision on environmental conditions for the connection infrastructure used to output power produced by the OWF.

As per the Act of December 17, 2020 *on promoting electricity generation in offshore wind farms* (consolidated text, Journal of Laws of 2025, item 498), the division point between the OWF and the grid connection infrastructure is the terminals of the high voltage side of the transformer or transformers located at the substation or substations, i.e. the points of connection of the offshore substation or offshore substations with power cables exporting electricity generated by 14.E.1 OWF towards the land.

The assumed maximum electric power that may be output from the 14.E.1 OWF will amount to 812 MW.

Since the development of technology in the field of offshore wind energy is very fast and the process related to the preparation of the project for implementation is a long-term process (requires the performance of detailed environmental surveys, geotechnical substrate investigation, conducting environmental procedures, obtaining necessary decisions, preparing design documentation and obtaining permits), it is assumed that the wind turbines used to generate electricity will have power output from at least 15 MW to 25 MW. As an example of other offshore wind farms implemented in Europe, it can be assumed that the construction time of the 14.E.1 OWF will be approx. three years.

The project – an offshore wind farm – will consist of up to 54 wind turbines, with the final number of turbines depending, among others, on the unit capacity of the turbines available on the market at the time of their contracting.

The Investor will be able to decide on the final number, capacity, and location of individual turbines at later stages of the project development based on the results of environmental surveys, environmental impact analysis, and economic analysis, taking into account the technology of construction and operation of wind turbines and the availability of equipment at the contracting stage. After the completion of design works, the Investor will be able to present the final number of wind turbines and their locations in the 14.E.1 OWF development area.

The applied approach assumes that not all maximum values (power output, number of turbines, rotor diameter) will occur simultaneously. For example, if turbines with a unit capacity close to the upper range limit (e.g. 22–25 MW) are used, the number of turbines necessary to achieve a total capacity of 812 MW will be reduced accordingly, as per the power balance principle. The IEA Wind 22-MW[1] reference turbine, developed in 2024 by the Technical University of Denmark and the International Energy Agency, is an example of a technology that can be commercially available over the time horizon of the planned project (DTU Wind Report E-0243). Like the IEA Wind 15-MW[2] model, this turbine has been developed as a reference tool for industry and academia environments to test future design concepts and optimize wind farm designs.

Considering the above, the assumed parametric values are within the range of expected technical solutions, and their application is aimed at ensuring compliance of the project with environmental requirements while maintaining the flexibility necessary for an efficient design process.

Depending on the development of technology in offshore substations (hereinafter: OS) the Applicant assumes that up to two OS will be implemented. The location of the OS will depend on the location

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[1] *Definition of the IEA Wind 22-Megawatt Offshore Reference Wind Turbine* (DTU Wind Report E-0243, 2024), https://doi.org/10.11581/DTU.00000317

[2] Barter, G., Sethuraman, L., Bortolotti, P., et al. (2020). *IEA Wind 15-Megawatt Offshore Reference Wind Turbine*;

of offshore wind turbines (hereinafter: OWT) and the possibility of their connection to the internal network of OWF power connections.

Table 1.2. Technical parameters of the Option Proposed by the Applicant

PARAMETER	UNIT	OPA	
Maximum nominal capacity of the OWF	MW	812	
Capacity of an individual wind turbine	MW	15	25
Maximum number of wind turbines	pcs	54	
Maximum rotor diameter	m	310	
Minimum clearance between the rotor operating area and sea surface	m	20	
Maximum height of the OWT	m	350	
Maximum number of the OWT support structures	pcs	56	
Maximum length of cable lines	km	210	
Maximum number of OS	pcs	2	
Maximum sweep area of a single rotor	m^2	43 744	75 477
Maximum total rotor sweep area	m^2	2 415 256	
Maximum seabed occupancy	%	5	

2 THE AREA OF THE OCCUPIED REAL PROPERTY, AS WELL AS CIVIL STRUCTURE AND THE EXISTING MANNER OF THEIR USE, VEGETATIVE COVER OF THE REAL PROPERTY, AND WILD ANIMALS ON THE REAL PROPERTY

2.1 Area of the 14.E.1 Offshore Wind Farm

The area of the 14.E.1 OWF, within the boundaries of which the OWT with accompanying infrastructure will be installed, is 82.44 km^2.

It will be possible to indicate the detailed location of the planned OWT and accompanying infrastructure after completing the design process based on detailed geotechnical surveys determining the possibility of locating the 14.E.1 OWF components in individual locations, as well as surveys aimed at determining environmental conditions.

The OWT and the entire accompanying infrastructure will be located in the area covered by the permit for erection and use of artificial islands, structures and devices for the Project in question. The implementation of the 14.E.1 OWF will include limitations resulting from the provisions of the Regulation of the Council of Ministers of April 14, 2021 *on the adoption of the spatial development plan for internal sea waters, the territorial sea and the exclusive economic zone to a scale of 1:200,000* (Journal of Laws of 2021, item 935, as amended).

2.2 Existing manner of using the area of the 14.E.1 Offshore Wind Farm

Based on the information taken from the Regulation of the Council of Ministers of April 14, 2021 *on the adoption of the spatial development plan for internal sea waters, the territorial sea and the exclusive economic zone to a scale of 1:200,000* (Journal of Laws of 2021, item 935, as amended), the most important forms of use of the maritime space in the area of 14.E.1 OWF are described below.

2.2.1 Technical and linear infrastructure

A fragment of the southern part of the 14.E.1 OWF area coincides with the boundary with a part of the area intended for the construction of an offshore wind farm with an area of 0.239 km^2 (Figure 2.1), for which the Minister of Infrastructure issued a permit for erection and use of artificial islands, structures and devices on January 30, 2021 for the project entitled “Offshore Wind Farm with a maximum capacity of 14 MW with technical, measurement, research, and service infrastructure related to the preparation, execution, and operation stages” (ref. No.: DGM.WZRMPP.3.430.17.2020.KW). The permit was issued for Energa OZE S.A. The permit is valid until January 30, 2056.

The 14.E.1 OWF is also adjacent to the areas intended for the construction of offshore wind farms in 14.E.2, 14.E.3, and 14.E.4 areas (Figure 2.1), for which the Minister of Infrastructure issued the permit for erection and use of artificial islands, structures and devices in 2023. The permits are valid until 2099.

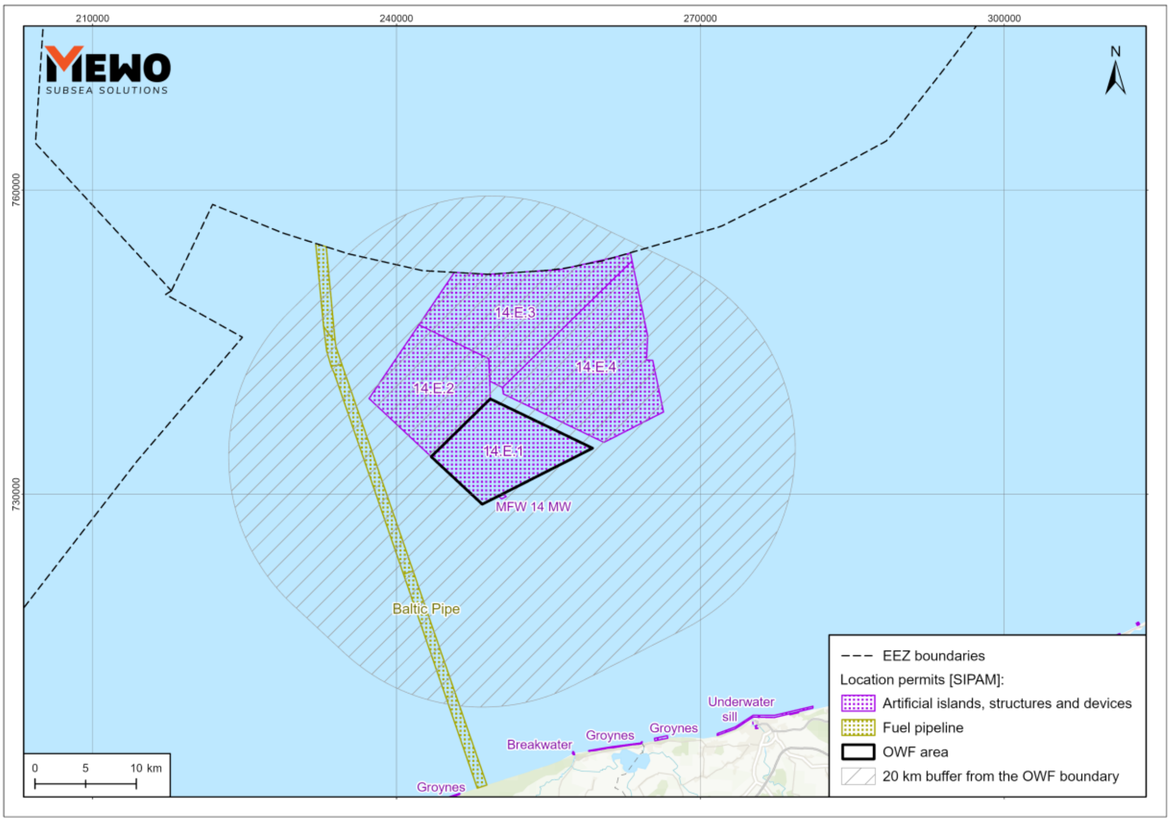


Figure 2.1. Location of the 14.E.1 OWF area and adjacent OWF areas covered by permits for erection and use of artificial islands, structures and devices issued by the Minister of Infrastructure (source: own study based on the SIPAM data)

In the POM.14.E water region, including the part occupied by the 14.E.1 OWF area, 14.200.I sub-basin was designated for laying and maintaining linear elements of the technical infrastructure – the second and third option of the Baltic Pipe Gas Pipeline route (Figure 1.2, Figure 2.1). These options will not be proceeded because, in accordance with decision No. 12/2020 of the Governor of Zachodniopomorskie Voivodship of April 23, 2020, the undersea part of the gas pipeline was constructed in the first option, i.e. outside the POM.14.E water region at a distance of approx. 5.3 km from the boundary of the 14.E.1 OWF area.

2.2.2 Fishery

The 14.E.1 OWF area is located entirely in the F4 fishing square and occupies 20.5% of its area (Figure 2.2).

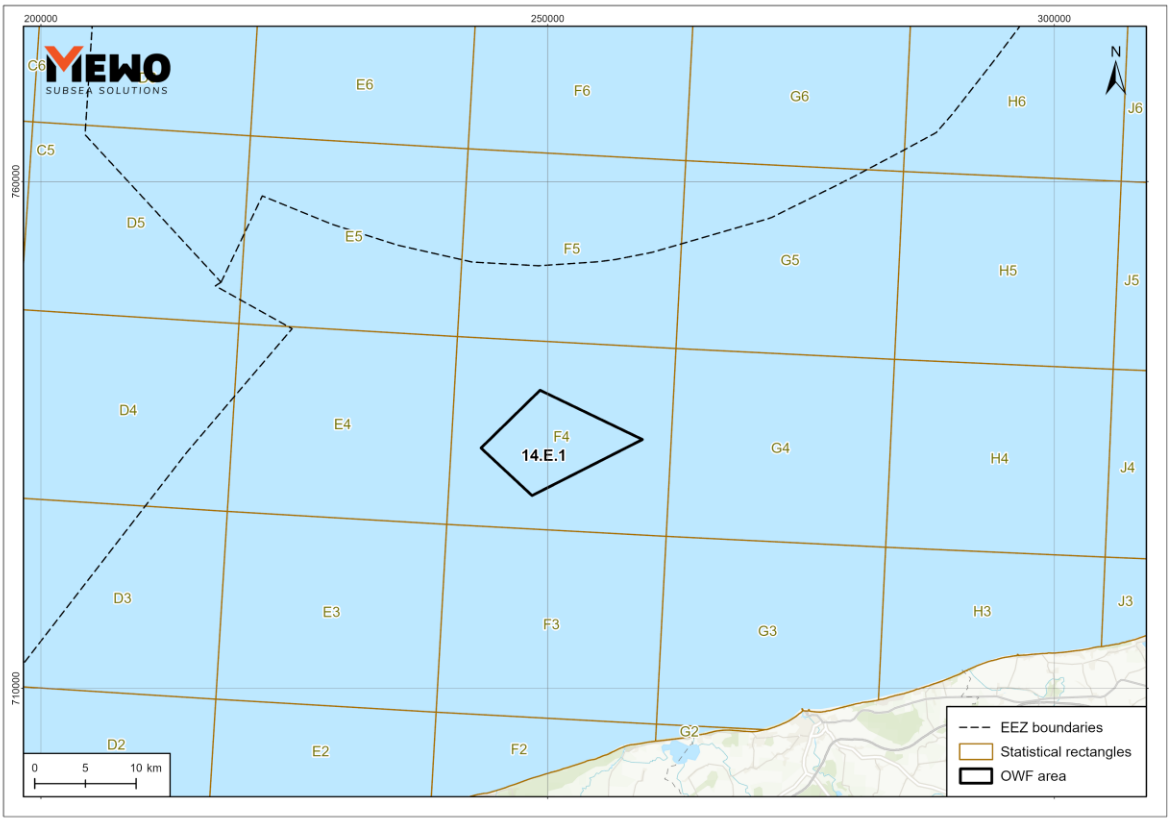


Figure 2.2. Location of the 14.E.1 OWF area against the background of fishing squares (source: own study based on data from the Fisheries Monitoring Center of the Fisheries Department of the Ministry of Agriculture and Rural Development)

Table (Table 2.1) contains data specifying the volume of fish catches in the F4 fishing square in 2019–2024, including for catches in the entire Polish maritime areas.

Table 2.1. Volume of fishing catches [kg] (Atlantic salmon in pieces) in F4 fishing square in 2019–2024 in relation to catches in the entire Polish maritime areas [%] (source: own study based on data from the Fisheries Monitoring Center of the Fisheries Department of the Ministry of Agriculture and Rural Development)

TAXON	CATCH VOLUME [kg, (salmon and trout in pieces)]						SHARE OF CATCHES IN RELATION TO THE ENTIRE POM [%]					
	2019	2020	2021	2022	2023	2024	2019	2020	2021	2022	2023	2024
Three-spined stickleback	-	-	-	-	30	-	-	-	-	-	<0,1	-
Great sand eel	5500	23930	47460	-	5403	-	5,3	0,8	3,7	-	4,8	-
Great sand eels (not marked for the species)	-	120	1700	-	3001	-	-	<0,1	3,7	-	4,8	-
Cod	42078	17039	1954	3455	7295	6488	1,0	3,8	1,2	2,8	5,0	6,6
Plaice	15291	13665	8872	6742	7658	7172	2,1	6	5,1	5,2	5,6	8,7
Atlantic salmon	1	1	-	-	7 (3)	-	<0,1	<0,1	-	-	4,9	-
Mackerel	-	-	100	-	837	-	-	-	1,4	-	3,2	-
Perch	-	-	26	-	-	150	-	-	<0,1	-	-	0,2
Sea fish not elsewhere specified	-	1500	10 120	135	1	-	-	1,2	3,6	0,1	0,1	-
European flounder	258238	270107	138190	128845	118752	133126	2,0	2,8	1,6	1,8	2,4	3,9
Sprat	382435	343064	366713	53445	141577	12815	0,5	0,6	0,6	0,1	0,3	<0,1
Herring	1737290	1068136	1527444	452640	747793	225549	4,5	3,9	8,1	3,8	5,2	2,5
Lumpfish	-	-	-	1	1	-	-	-	-	33,3	41,7	-
Lesser sand eel	16600	32783	32770	-	23400	3000	5,9	0,9	2,4	-	4,0	3,5
Sea trout	-	-	-	(17)	-	23 (5)				<0,1	-	0,1
Turbot	448	1203	1275	280	110	24	0,8	3,1	1,8	0,8	0,2	<0,1
Eel	-	-	4	-	-	-	-	-	<0,1	-	-	-
Whiting	15383	15090	25042	3 080	7 415	100	1,9	1,6	6,8	4,3	6,4	1,4

Herring, sprat and European flounder were the most frequently caught fish in the F4 fishing square in the period 2019-2024. Other species were caught in much smaller quantities, in some cases occasionally – mackerel, perch, lumpfish, three-spined stickleback, eel and Atlantic salmon. It should be noted that catches of sandeel fish (mainly greater sand eel and lesser sand eel) increased from a total of approx. 22 tons in 2019 to almost 82 tons in 2021. This was influenced by the intensification of feed fishing targeted at these species, among others. However, in subsequent years, the volume of catches of sandeel fish decreased significantly: no catches were recorded in 2022, in 2023 it was less than 32 tons and 3 tons in 2024. There is also a noticeable decrease in cod catch from approx. 42 tons in 2019 to less than 2 tons in 2021 and remaining below 7 tons in subsequent years. The total catch volume in the F4 fishing square in subsequent years decreased from over 100,000 tons in 2019 to 50 tons in 2024.

High catches of sprat, herring and European flounder did not translate into a high share of their catches in the F4 square for general fishing in Polish maritime areas. For sprat the share did not exceed 0.7% and for European flounder it did not exceed 4%. The volume of herring catches had a slightly higher share of the entire Polish maritime areas – on average 4.7% of the share of catches of the entire Polish maritime areas in 2019–2024, up to a maximum of 8.1% in 2021. Catches of lumpfish were also recorded in 2022 and 2023, which, due to their small total catches in the Polish maritime areas, accounted for a high percentage of catches: 33.3 and 41.7%. An increase in the share of the plaice catches value can be noted (up to 8.7% of the share of catches) despite a constant decrease in the volume of catches in the square: from more than 15 tonnes in 2019 to about 7 tonnes in 2024. A similar pattern can also be seen in the case of cod, the share of catches in the Polish maritime areas increased, but at the same time, as a result of introducing catch limits, the volume of catches decreased significantly: 42 tonnes/1% of catches in the Polish maritime areas in 2019 to 6.5 tonne/6.6% in 2024. The share of catches of other species usually did not exceed 7%.

2.2.3 Navigation

The 14.E.1 OWF area is located outside the main Baltic Sea shipping routes. Analysis of AIS (Automatic Identification System) data (i.a. dynamic information on vessel position, course and speed) showed that most vessel traffic in this area in 2023 was generated by fishing vessels from the Kołobrzeg port (source: AIS data made available by EMODnet), (Figure 2.3 and Figure 2.4).

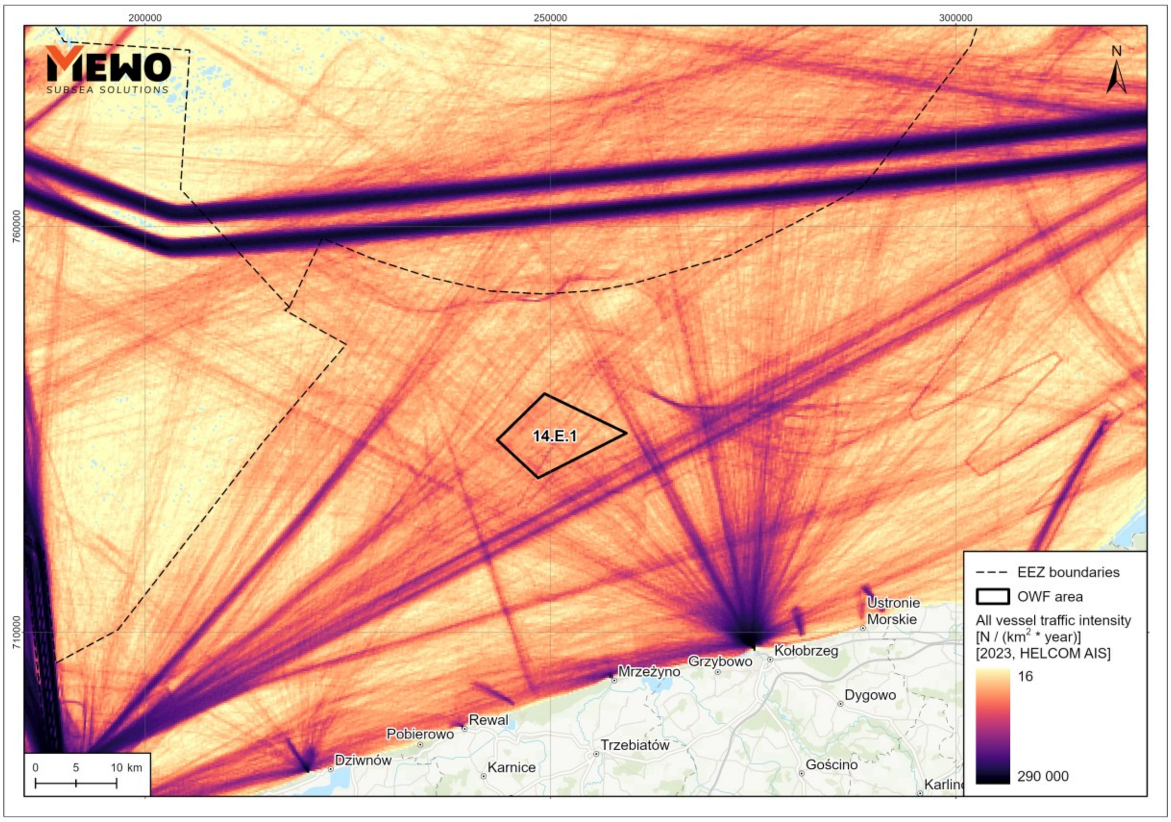


Figure 2.3. Location of the 14.E.1 OWF area in relation to the use of the maritime space by all vessels. AIS data – average for 2023 (source: own study based on EMODnet data)

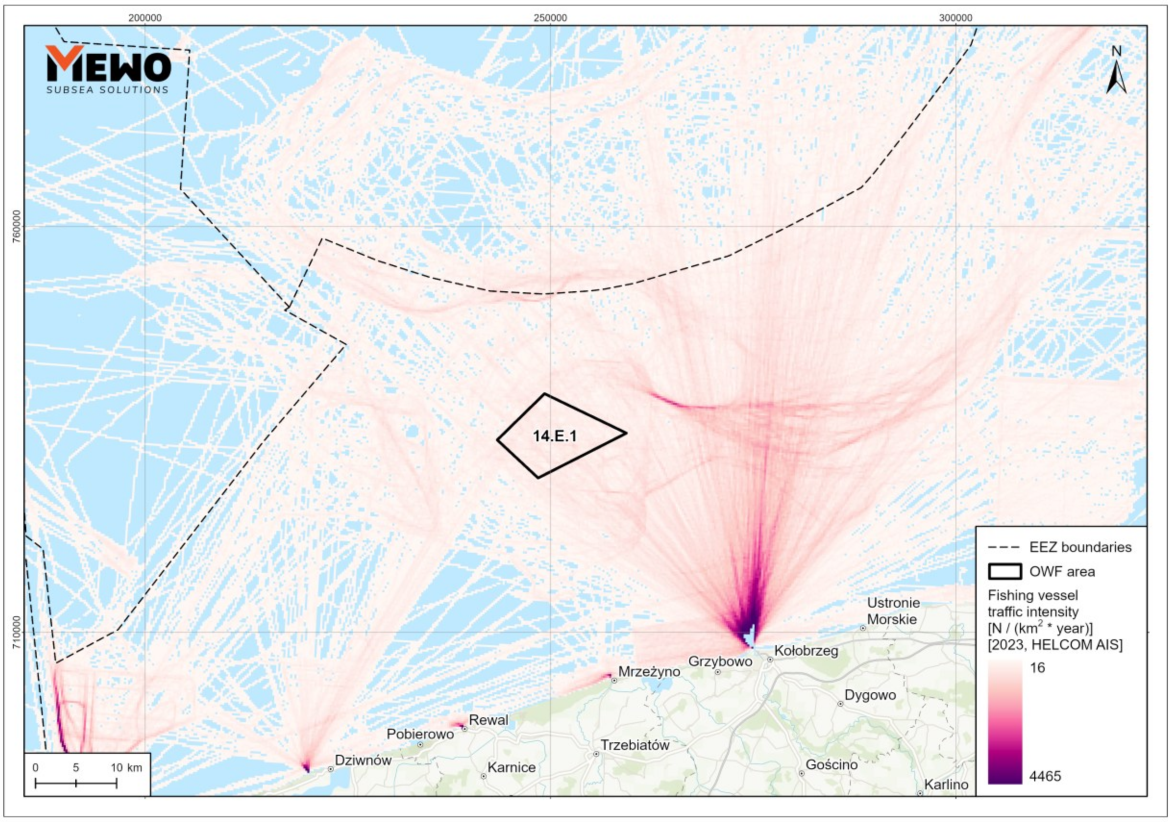


Figure 2.4. Location of the 14.E.1 OWF area in relation to the use of the maritime space by fishing vessels. AIS data – average for 2023 (source: own study based on EMODnet data)

2.2.4 Cultural heritage and other objects of anthropogenic origin

In the northern part of the 14.E.1 OWF area, there is an unspecified shipwreck marked as WK-0288, classified as a non-cultural heritage object (SIPAM). This is the only anthropogenic object identified so far in this water region.

In the 14.E.1 OWF area, no conventional combat assets from the period of both World Wars were found. However, their presence on the seabed of the analyzed area cannot be excluded. Similarly, it is necessary to take into account the potential presence of chemical weapons containers which, after the Second World War, were dumped mainly in deep waters of the Baltic – Gotland Deep and Bornholm Deep, as well as in Skagerrak, the Little Belt and the Gdańsk Deep (Knobloch *et al*. 2013, Bełdowski *et al*. 2014) (Figure 2.5). In the light of current results of analyses and accidental discoveries, it is known that some chemical warfare agents were dumped from vessels into the sea during transport to their final storage locations (Knobloch *et al*. 2013). Therefore, while maintaining the precautionary approach, it should be assumed that conventional and unconventional combat assets from the war periods may also remain on the seabed in the 14.E.1 OWF area and pose a potential threat to safety during the construction of the Project. Prior to the commencement of construction, the Applicant will conduct detailed surveys for the presence of unexploded ordnance (UXO) on the seabed. If combat agents/unexploded ordnance are found during these surveys, the applicant shall inform the relevant authorities and institutions and shall follow the recommendations issued by them.

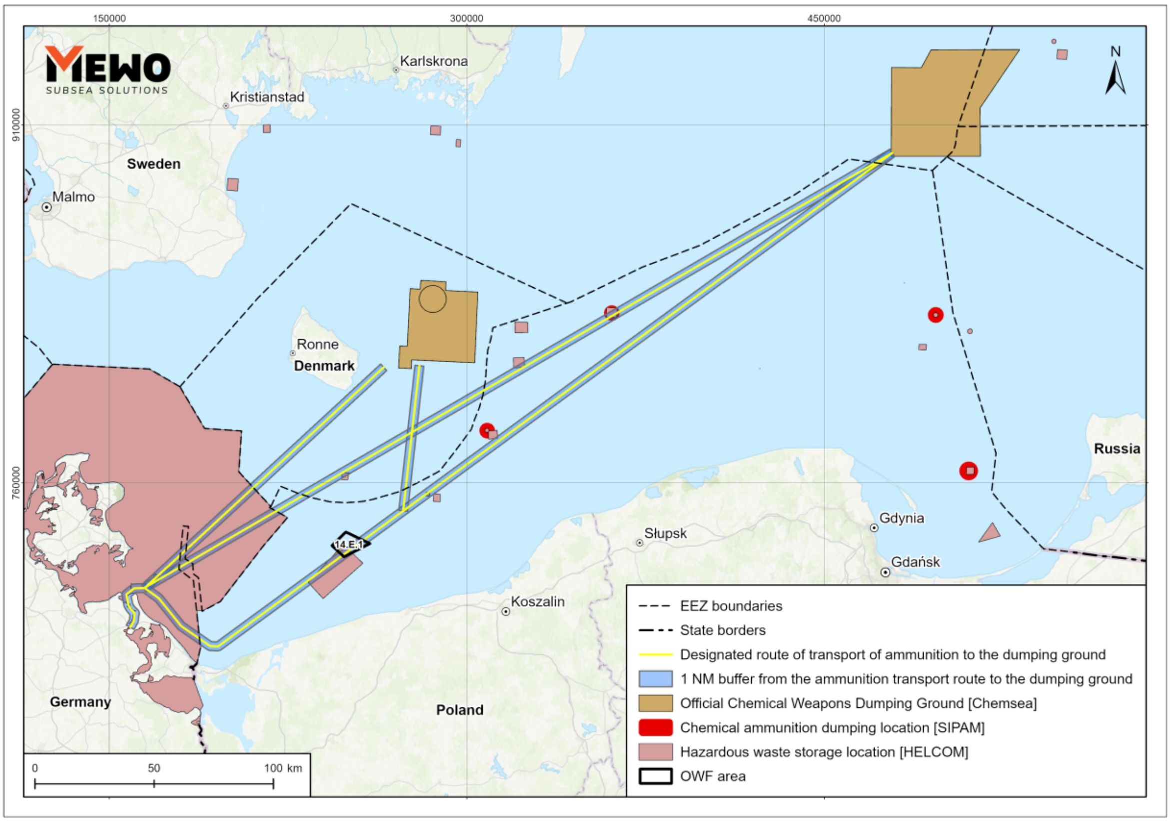


Figure 2.5. Location of the 14.E.1 OWF area in relation to transport routes and areas where chemical weapons were deposited in the Baltic Sea (source: own study based on: Bełdowski et al. 2014)

2.2.5 State defense

The area of the planned Project is not located within zones permanently or periodically closed to navigation and fisheries, established by the Minister of National Defense by virtue of a regulation in accordance with the Act of March 21, 1991 *on maritime areas of the Republic of Poland and maritime administration* (consolidated text, Journal of Laws of 2022, item 457, as amended). The area does not cross the fairways of the Polish Navy either.

2.2.6 Exploration, survey and extraction of mineral resources

An analysis of the data made available in the Central Geological Database showed that within the boundaries of the area of the planned Project or in its vicinity there are no mining areas and sites. At a distance of 167 m from the limits of the 14.E.1 OWF area, there is an "Ustronie N" tender area for exploration and production of hydrocarbons, which has not been developed so far and for which no entity holds an operating license (Figure 2.6). In the vicinity of the 14.E.1 OWF area, there are no areas indicated for exploration for the presence of sand for artificial feeding of the seashore.

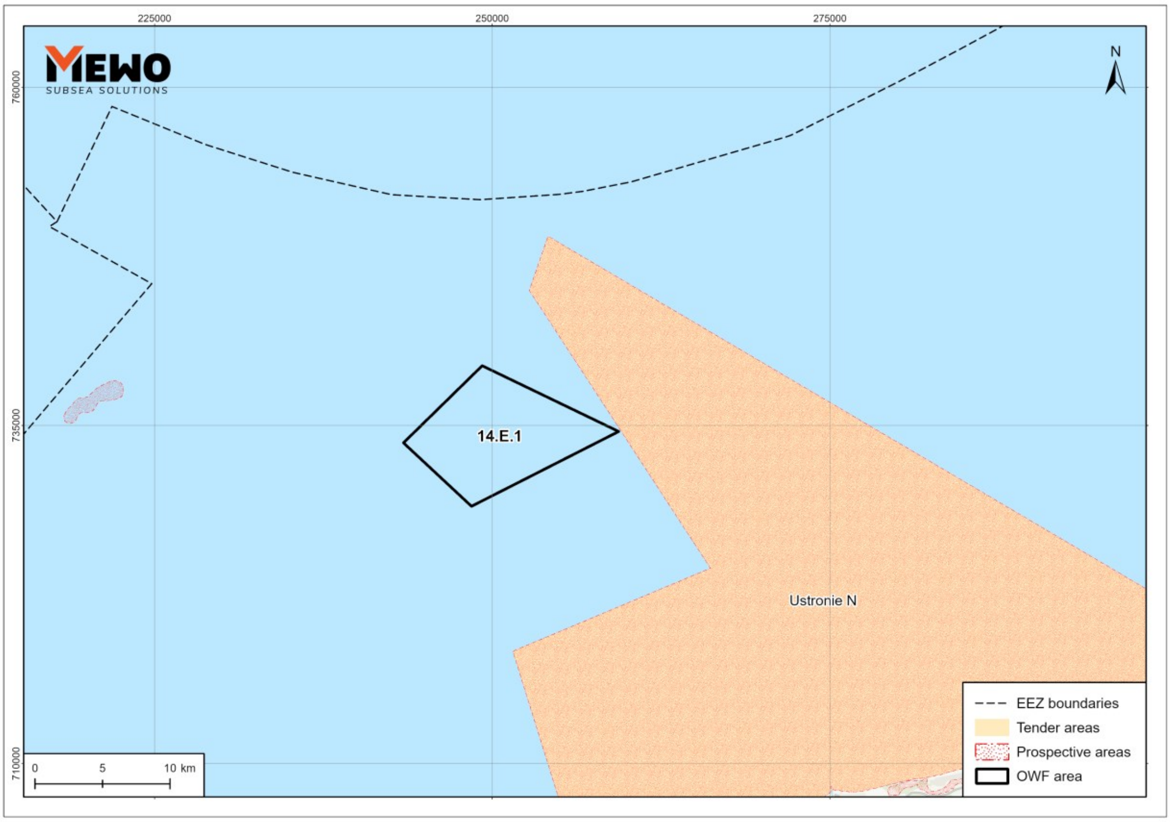


Figure 2.6. Location of the 14.E.1 OWF area in relation to tender and prospective areas (source: own study based on information from the Central Geological Database)

2.3 Vegetation cover over the real property

The area of the planned Project has not been surveyed so far for the presence of aquatic plants – macrophytobenthos. So far, the results of macrophytobenthos surveys in Polish maritime areas have allowed the determination of general principles characterizing its spatial range, i.e.:

- plants rooted in the bottom sediment occur down to a depth of approx. 10 m (Błeńska 2014, Błeńska 2015a and b, Kautsky 2017, Pliński and Jóźwiak 2004, Schiewer 2008);

- periphyton plants (macroalgae) occur on hard surfaces (e.g. boulders, pebbles, shells and objects of anthropogenic origin) down to a depth of approx. 20 m and occasionally down to a depth of 25 m (ibidem).

The minimum depth of the seabed in the area is approx. 21 m, so the entire 14.E.1 OWF area is outside the range of occurrence of rooted plants and at the limit of occurrence of macroalgae. It can be assumed that the occurrence of macrophytobenthos in the area will be at most occasional, in the form of individual macroalgae thalli attached to stones or mussel shells deposited on the seabed. In the process of carrying out environmental surveys in the project area for the purpose of preparing the environmental impact assessment report, the applicant shall verify the presence of macrophytes in the area in question.

2.4 Wild animals present on the real property

2.4.1 Macrozoobenthos

Macrozoobenthos organisms commonly inhabit the seabed. There are no data available on macrozoobenthos communities in the OWF area. The measurement and research stations (M3 and K6, located respectively: approx. 45 km to the east at a depth below 20 m and approx. 23 km to the south-east of the 14.E.1 OWF area at a depth of more than 30 m) within which the State Environmental Monitoring is carried out are the closest locations surveyed for the presence of macrozoobenthos. Up to 15 taxons were recorded at these stations (Osowiecki and Kraśniewski 2020), including:

- **Hydrozoa***: Gonothyraea loveni*;
- **Priapulida:** *Halicryptus spinulosus*;
- **Polychaeta:** *Hediste diversicolor, Marenzelleria sp., Pygospio elegans*;
- **Oligochaeta:** *Oligochaeta non det*.;
- **Malacostraca:** *Monoporeia affinis, Corophium volutator, Diastylis rathkei*;
- **Gastropoda:** *Hydrobiidae*;
- **Bivalvia:** *Mytilus sp, Limecola balthica, Cerastoderma glaucum, Mya arenaria'*
- **Gymnolaemata:** *Einhornia crustulenta*.

In terms of population size, Polychaeta dominated in this area (approx. 85%), whereas Bivalvia dominated in terms of biomass (approx. 75%). A similar taxonomic composition and structure of abundance and biomass may occur within the OWF area.

2.4.2 Ichthyofauna

In the case of ichthyofauna, apart from commercial fish species (Chapter 2.2.2.) in the OWF area there may be protected species subject to protection of the nearest Natura 2000 site, i.e. Refuge in the Pomeranian Bay (PLH990002) and other protected species for which favorable environmental conditions prevail in this area. These species are: sea lamprey *Petromyzon marinus,* allis shad *Alosa alosa,* twait shad *Alosa fallax,* common goby *Pomatoschistus microps,* sand goby *Pomatoschistus minutus,* snake blenny *Lumpenus lampretaeformis,* fourhorn sculpin *Myoxocephalus quadricornis* and common seasnail *Liparis liparis.*

2.4.3 Avifauna

Bird species that may be present in the vicinity of the planned Project include first and foremost all species subject to protection of two Natura 2000 sites closest to the OWF area, i.e. the Pomeranian Bay (PLB990003) and the Coastal Waters of the Baltic Sea (PLB990002). The species of protected birds recorded within the Natura 2000 site – the Słupsk Bank (PLC990001) – which may fly during migration and local flights during wintering between Natura 2000 sites, were also indicated. These species are: long-tailed duck *Clangula hyemalis*, velvet scoter *Melanitta fusca*, European herring gull *Larus argentatus*, common scoter *Melanitta nigra*, razorbil *Alca torda*, common guillemot *Uria aalge*, black guillemot *Cepphus grylle*, mute swan *Cygnus olor*, black-throated diver *Gavia arctica*, red-breasted merganser *Mergus serrator*, horned grebe *Podiceps auritus*, great crested grebe *Podiceps cristatus*, red-necked grebe *Podiceps grisegena*, common gull *Larus canus*, widgeon *Anas penelope*, lesser black-backed gull *Larus fuscus*, great black-backed gull *Larus marinus*, little gull *Hydrocoloeus minutus*, and red-throated diver *Gavia stellata*.

2.4.4 Marine mammals

Four species of mammals are recorded in the Polish maritime areas, i.e.: one species of whales – harbor porpoise *Phocoena phocoena* and three species of seals: gray seal *Halichoerus grypus*, ringed seal *Phoca hispida* and harbor seal *Phoca vitulina* (IO PAN 2009, Barańska et al. 2018).

Porpoises move within the entire Baltic Sea area, but they prefer shallower water regions where they may feed. Results of the SAMBAH project (2017) indicate porpoise sites within the Baltic Sea. This species prefers its western and central part, including the South Middle Bank area. The results of modeling the porpoise distribution indicate that their presence is possible in the area of the planned construction and operation of the offshore wind farm, both in the winter and summer seasons. However, the largest number of porpoises, regardless of the season, is recorded in the area of the Danish Straits.

Like porpoises, seals also stay mainly in the coastal zone. The population of the most numerous gray seal in the Baltic Sea is estimated at approx. 60,000 individuals, however, in the southern Baltic Sea, there are only about several hundred individuals (HELCOM 2023). This is the most common seal in the Polish maritime areas, especially in the coastal zone. The only place of their permanent presence in the Polish maritime areas is the foreland of the mouth of the Vistula River, a cut through the Gdańsk Bay (Barańska et al., 2018).

The size of the ringed seal population in the Baltic Sea is approx. 7,000 individuals. It occurs almost exclusively in the Gulf of Bothnia, Riga, Finland and in waters around the Åland Islands (HELCOM 2018). The population of the rarest harbor seal in the Baltic Sea is approx. 20,000 individuals (ibidem). Harbor seal and ringed seal are recorded in Polish maritime areas extremely rarely, and observations usually refer to single individuals (Barańska et al., 2018).

Due to their presence in coastal waters and low population, the occurrence of porpoises and seals in the OWF area will be only occasional.

2.4.5 Chiropterofauna

24 species of bats have been recorded in Poland, all of them under strict species protection (Sachanowicz and Ciechanowski, 2005, Sachanowicz et al. 2006). 18 species of these mammals are present in the Baltic Sea coastal area (Sachanowicz et al., 2006). Bats may fly over maritime areas during feeding and during seasonal migrations. However, due to the location of the OWF area at a distance of more than 25 km from the shore, their occurrence in this area will be occasional. Detailed data on the presence of bats in the OWF area will be gained during the surveys carried out to obtain the decision on environmental conditions for the planned Project.

3 TECHNOLOGY TYPE

Offshore wind turbines are devices used to generate renewable energy by converting kinetic wind energy into electricity. The electricity production process starts in the wind turbine, where the kinetic energy of the wind flowing through its blades is transformed into the rotational motion of the rotor (conversion of kinetic energy into mechanical energy). This motion is then transferred to the generator, where it is transformed into current (conversion of mechanical energy into electricity). The electricity generated after being transformed to high voltage at the offshore substation (OS) is then transferred to the onshore power grid.

In terms of definitions, an offshore wind farm is a plant constituting a separate set of equipment used for energy generation, consisting of **one or more offshore wind turbines**, a medium or high voltage network with offshore substations, **excluding equipment on the high voltage side of the transformer or transformers located in that substation.**

Due to the conditions of their location (in offshore areas), offshore wind farms are built comprehensively as complexes of individual wind turbines together with a set of power output equipment. The purpose of this infrastructure is to deliver electricity generated at sea to the onshore substation and to supervise the availability and productivity of the OWF [Figure 3.1].

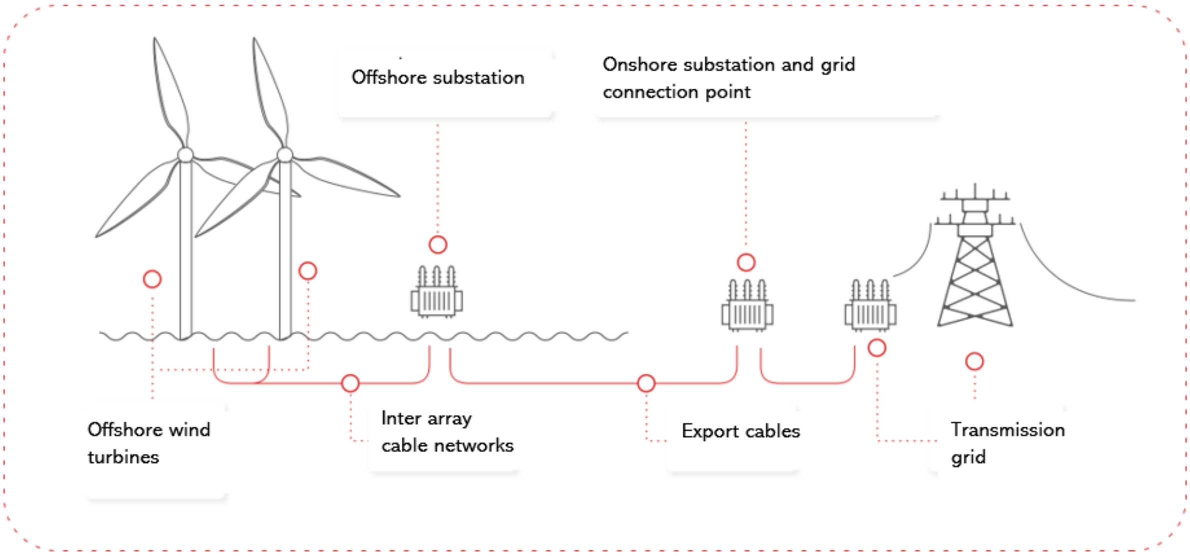


Figure 3.1 Basic elements of the offshore wind farm together with transmission infrastructure [Source: Orsted, 2021]

Wind turbines are only used to generate electricity and, importantly, do not require the supply of other fuels and raw materials in the operation phase. Only in case of wind-free weather they are characterized by low electricity demand. The demand for raw materials and energy is generated during the OWF execution phase, when structural components of individual wind farm elements (i.e., materials used for production, fuels, and other materials necessary in the construction phase) are constructed and installed. During the operation phase, fuels and materials are normally used as part of maintenance and decommissioning activities. Moreover, the proper operation of the OWT does not cause pollution of the natural environment.

The results of environmental surveys, including detailed geophysical and geotechnical surveys, environmental impact analysis, economic analysis of the Project implementation, and the possibility of contracting materials and services for the period of construction commencement, will be the basis for selecting appropriate process solutions.

It should be noted that in recent years, there has been a significant development and technological progress of wind energy generation, especially the increase in the capacity of offshore wind turbines, resulting from the development of ever larger structures and more efficient equipment. In the coming years, it is planned to disseminate wind turbines with capacity exceeding 15 MW and implement units with capacity of 20 MW and higher.

The offshore wind farm consists of four main components that are functionally and structurally connected:

- wind turbines with support structures;
- inter array cables (IAC);
- offshore substations (OS).

Below is a description of the currently commonly used OWF implementation technologies – a description of wind turbines, types of support structures, implementation methods of submarine cable lines and transformation of the transmission of electricity generated by the OWT in the OS.

3.1 Components of the offshore wind farm

3.1.1 Offshore wind turbines

3.1.1.1 Wind turbine

The figure below shows the wind turbine diagram [Figure 3.2].

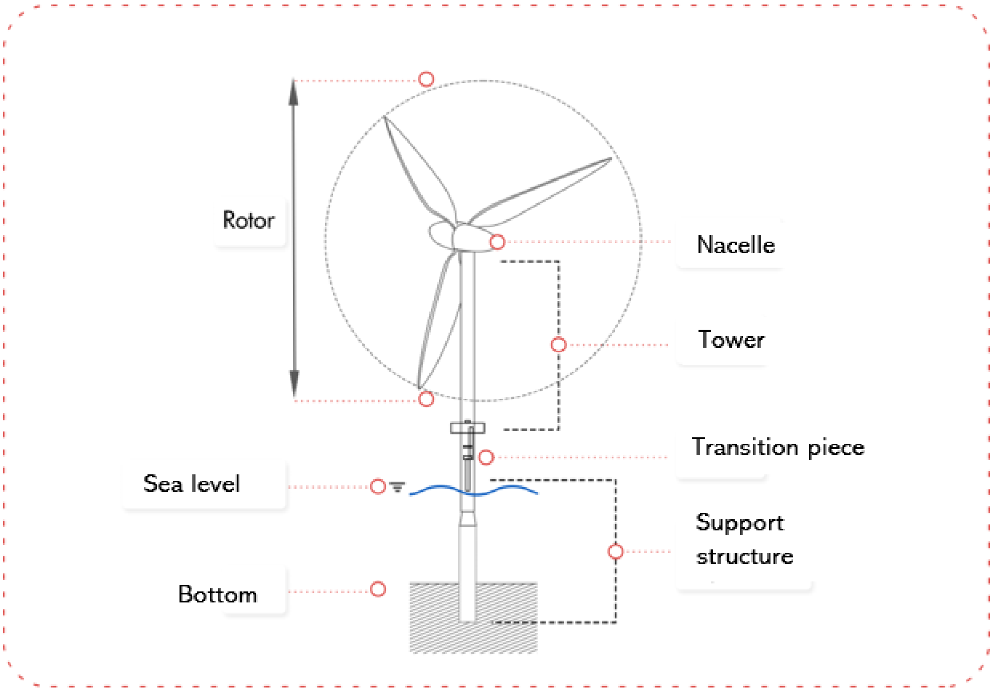


Figure 3.2 Offshore wind turbine diagram with support structure [source: own study]

The **nacelle** is a critical component of the wind turbine. It is entirely assembled onshore and transported and installed on the wind turbine tower. It consists of the drive train equipment and a casing protecting it against weather conditions [Figure 3.3]. The drive train is responsible for converting the energy of the rotating rotor into three-phase alternating current. Its components include a rotor, rotating shaft with or without a gearbox, and generator.

A ladder and manhole located inside the nacelle provide access to the top part (roof) of the nacelle. This provides access to the cooler, wind sensors, as well as aviation marking equipment.

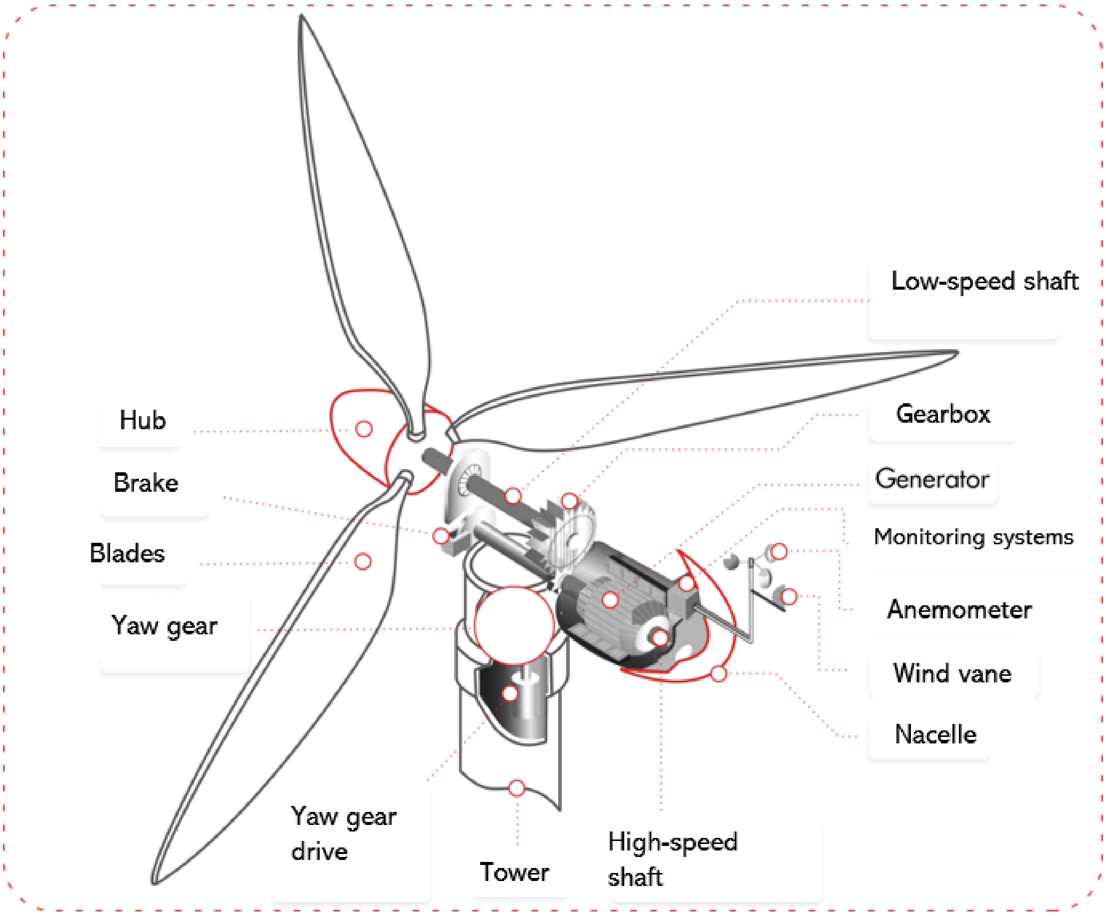


Figure 3.3 Schematic diagram of the nacelle with a gear drive system [Source: Areva]

The **rotor** is another essential component of the wind turbine, consisting of three blades and a hub. The wind impact causes the rotor to move rotationally and transfer kinetic energy to other elements of the nacelle. The rotor is automatically set against the wind. To optimize the operation, the rotor is equipped with aerodynamic brakes and the pitch angle of the blades is set on an ongoing basis depending on the current wind conditions. The rotor plays a key role in turbine operation and its size (diameter) affects its capacity. Generator is responsible for converting the mechanical energy of the shaft into electricity.

The wind turbine is equipped with systems continuously monitoring and protecting its operation. Two main systems that ensure safe operation of the turbine comprise the overspeed protection system and the lightning protection system.

The **tower** is a structural element connecting the nacelle with the foundation. The tower is structurally a steel pipe tapered upwards, consisting of sections connected by flanged connections with the use of bolts. The tower serves as a support structure for the wind turbine and provides the basis for routing the necessary cabling, i.e. control cables, power cables and other systems and equipment important for the operation of the entire plant. The internal and external equipment of the tower includes platforms, supports, elevator, etc., owing to which the service teams have access to the nacelle and elements of the tower itself.

The wind turbine is permanently connected to the seabed by means of a steel or concrete **support structure** (of single or multi-support type). The selection of an appropriate support structure depends on the size and weight of the wind turbine and on the environmental conditions prevailing in the OWF location, i.a.: the depth of the water region, geological conditions of the seabed and other environmental conditions, i.e.: wave motion, currents, icing, biotic values, the economic aspect is also an important factor. The support structure performs the following functions:

- ensures adequate stiffness and strength of the wind turbine;
- supports cable systems;
- is a connection between the wind turbine and the seabed;
- ensures efficient erection of the wind turbine.

In the process of erection of an offshore wind turbine, a support structure is installed first, followed by subsequent elements of the wind turbine.

The access to the OWT and to the OS at the construction, operation and decommissioning stages shall be provided by means of vessels performing civil and erection works, SOVs, CTVs or, in exceptional situations, by means of helicopters which will land on helidecks located at offshore substations.

3.1.1.2 Foundations and support structures

On the basis of offshore wind farms already completed, it should be stated that most of the structures included in the offshore wind farm are provided with foundations embedded in the seabed, which is associated with the transfer of the load/weight of wind turbine equipment, offshore substations to the seabed. The foundation structures, regardless of their type, are designed in a manner enabling the transfer of loads exerted by turbines, extraordinary loads, loads exerted on OWF facilities by the environment (increased wind speed, movement of water masses and currents) throughout the Project operation period. Currently, depending on local conditions, investors use the following types of concrete for steel foundations for construction:

- gravity-base foundations;
- monopiles;

- jacket foundations;
- floating foundations.

Permanent support structures, which may be used in the implementation of the 14.E.1 OWF, are gravity-base foundations, monopiles and jacket systems (Figure 3.4).

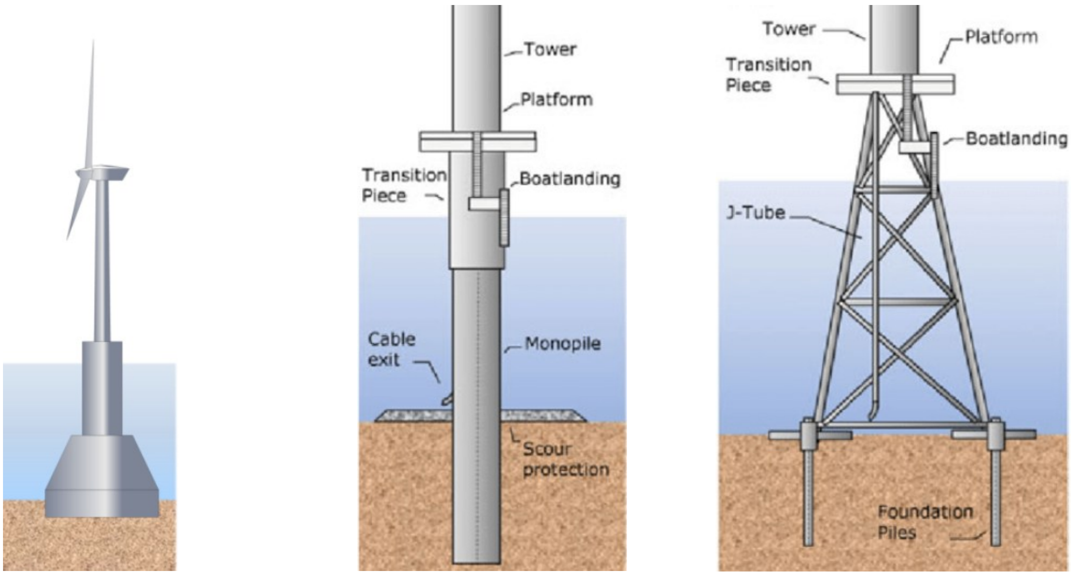


Figure 3.4. General arrangement drawings of individual foundation types (left): gravity-base foundation; monopile; jacket foundation (source: https://www.obayashi.co.jp/chronicle/130th/en/archives/chapter4_1_5.html# and: https://www.researchgate.net/figure/Three-types-of-turbine-foundations-Monopile-a-jacket-b-and-gravity-based-c_fig2_315874967)

For the placement of foundations of substations on the seabed, it is planned to use foundations of the same types as for offshore wind turbines.

The characteristics of individual types of foundations that may be used as part of the planned Project are presented below.

3.1.1.2.1 Gravity-base foundations

Gravity-base foundations are typically concrete or steel structures that can be additionally loaded with natural aggregate (Figure 3.4). They consist of a massive base and a shaft. They are usually used in relatively shallow water regions with a depth of up to 30 m, characterized by a flat seabed surface. They usually require proper preparation of the ground before erection – cleaning the removal from the seabed of obstacles, unevenness, boulders and stones, as well as leveling it. The excavated material generated during seabed preparatory works is surfaced in the OWF area or transported to the damping site after completion of the necessary surveys and obtaining the necessary administrative permits. The size and weight of gravity-base foundations provide stable support for the emerged parts of wind turbines. For gravity-base foundations, concrete with high cement content and increased strength parameters for environmental conditions, in particular salt seawater, is used. Often after foundation, gravity-base foundations are covered with rock aggregate to prevent the scouring of bottom sediments as a result of hydrodynamic processes. The advantage of using gravity-base foundations is their relatively low production cost and easy transport – towing to the place of foundation, while the disadvantage – occupation of a large area of the water region seabed and negative impact on benthic organism communities, the largest from among other solutions.

3.1.1.2.2 Monopile foundations

The monopile foundation (large-diameter pile) is a steel structure consisting of welded cylinders. Depending on the foundation conditions of a specific wind turbine, the monopile length will be maximum approx. 120 m. The installation of monopiles consists in driving them (or partial drilling in the case of difficult geological conditions) into the seabed to an appropriate depth, and installation of a transition piece on the part of the large-diameter pile protruding above the sea level, on which the wind turbine tower is installed. The available process solutions also allow for direct erection of the tower to the foundation with an integrated transition piece (TP-*less)*.

The advantage of using monopiles includes a simple design and universal application. However, the disadvantages comprise limited possibilities of complete removal from the seabed in the decommissioning phase of the wind farm, whereas in the construction phase, during driving of the structure into the seabed, underwater noise affecting marine animals is generated. The possible necessity to drill in the case the pile installation is hindered due to difficult soil conditions should also be noted. In the operation phase, in the immediate vicinity of large-diameter piles, sea currents are modified, which affects the sediment displacement on the water region seabed. The choice of foundation type will depend on geotechnical conditions and depth at specific locations. Moreover, depending on the depth of the water region and expected weather conditions, it may be necessary to provide erosion protection of the seabed.

Additionally, in places where the seabed is subject to hydrodynamic processes, it may be necessary to protect the seabed surface around the pile with a protective layer, e.g. with scour protection.

3.1.1.2.3 Jacket foundations

The jacket structure consists of a series of pipe elements connected with each other in K, X or Y type nodes. The entire structure is braced with tubular elements with the diameter of approx. 1 m. The jacket itself will be placed indirectly on the water region seabed. Clamps of the main girders are rigidly connected to piles driven into the seabed substrate.

The advantage of using jackets includes a simple design and universal application. However, the disadvantages comprise limited possibilities of complete removal from the seabed in the decommissioning phase of the wind farm, whereas in the construction phase, during driving of the structure into the seabed, underwater noise affecting marine animals is generated. The possible necessity to drill in the case the pile installation is hindered due to difficult soil conditions should also be noted. In the operation phase, in the immediate vicinity of large-diameter piles, sea currents are modified, which affects the sediment displacement on the water region seabed. The advantages of the jacket solution result mainly from the method of transferring loads to the ground by the structure, i.e. by the distribution of forces within the support structure into 3 or 4 independent pile supports, better operating characteristics are obtained. This type of support structure is more stable and less susceptible to the bending moment generated by horizontal forces than monopiles. The support surface for the process load-bearing capacity of the structure is also larger.

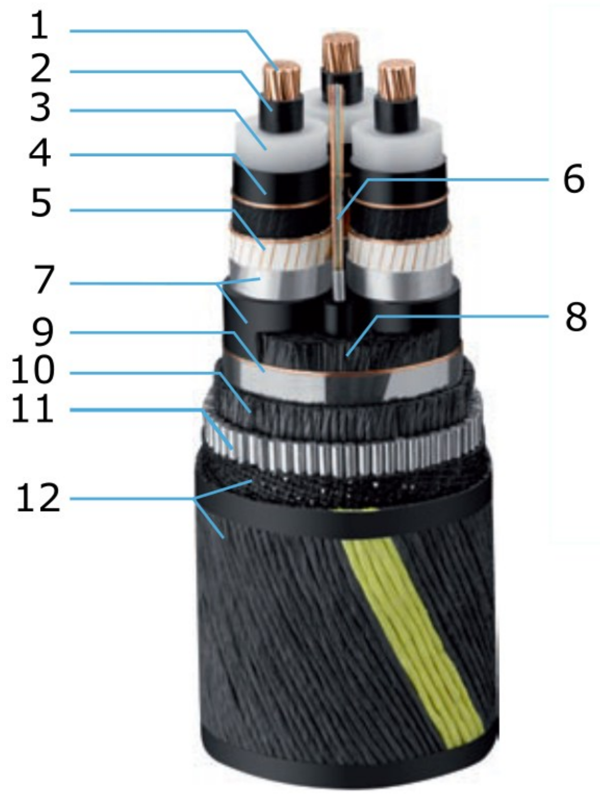
3.1.2 Inter array cables

Inter array cables (IAC) of the OWF connect wind turbines with substations located within the wind farm.

Electricity from wind turbines to substations is transmitted via medium- or high-voltage AC power cables. A typical submarine medium or high voltage inter array power cable consists of three conductors made of copper or aluminum, properly insulated and screened, reinforced, covered with a durable plastic sheath (Figure 3.5). Inside the cable, a fiber is placed that enables communication between the wind farm infrastructure and the onshore substation or the OWF operational management center, and the measurement of cable temperature.

1 – copper/aluminum conductor

2 – extruded shield
3 -–XLPE insulation (cross-linked polyethylene)
4 – semi-conductive screen



5 – screen made of copper wire with water swelling powders (to prevent the spread of moisture along the cable in case of local damage)

6 – fiber optic cable

7 – laminated cover: aluminum tape glued to the polyethylene coating plus conductive coating

8 – filler: polypropylene fibers

9 – binder tapes

10 – bedding: polypropylene or polyester tape

11 – armor made of galvanized steel wire braid used for protection against mechanical damage

12 – outer shield: bituminous bundles, jute bands, polypropylene fiber braid

Figure 3.5. Design of an example of an extra high voltage submarine power cable (source: own study based on nexans.com)

The power cables used within the area of 14.E.1 OWF will be provided with the necessary certificates confirming their applicability and will meet the standards and technical requirements for offshore power cables.

3.1.3 Offshore substations

The offshore substation (OS) [Figure 3.6] is one of the main elements of the offshore wind farm. The basic function of offshore substations is to receive electricity generated by offshore wind turbines through inter array cable lines and to transmit electricity to the shore by means of (offshore and onshore) export cables, while maintaining voltage stability and minimizing transmission losses. The offshore substation converts alternating current with lower voltage (e.g. 66 kV) which is not suitable for long-distance transmission, into alternating current with higher voltage (e.g. 220 kV or more) in order to reduce transmission losses.

The substations will consist of the following basic elements:

1. support structure used for the foundation of the offshore substation and the transfer of loads generated during its operation to the seabed,

2. topside structure – located on top of the support structure, containing, i.a., the following components:

- transformers – used for voltage level transformation;
- auxiliary transformers – used to ensure power for substation equipment;
- earthing transformers – used to obtain an artificial neutral point;
- high and medium voltage switchgears – used to connect, interrupt and distribute electrical circuits;
- redundant generators – ensuring power supply in case of an emergency;
- reactors – used to compensate reactive power;
- AC filters – used to eliminate higher harmonics.

Figure 3.6 Example of an offshore substation

[source: https://www.flickr.com/photos/pshab/27738985766]

No permanent stay of people is planned at offshore substations.

The individual stages relating to the implementation of the OS are as follows:

- preparation of the seabed ground for the OS erection;
- transport of foundations from installation ports to the OWF location by vessels or barges adapted to such works;
- with the use of heavy lift crane vessels (HLCV), installation of foundations at previously prepared locations;
- erection with the use of HLVCs of the offshore transformer station on a pre-prepared foundation;
- connection to the OS of cable lines for power output from the OWT and connection of cable lines for power output from the OS towards onshore transformer stations;
- commissioning.

3.2 Auxiliary infrastructure

Within the area of 14.E.1 OWF, it is possible to construct additional facilities to support the farm operation. Most often these are: a research and measurement platform and an accommodation and service platform.

Instruments for maintenance-free measurements of meteorological and hydrological conditions, as well as data recording and transmission systems may be installed on the research and measurement platform.

The accommodation and service platforms operate as a local, ad hoc base for all service and maintenance activities in the operation phase. In addition to their basic functions, they may also include additional systems, including electrical systems. Platforms of this type can vary significantly in size and capabilities. The construction of accommodation and service platforms is becoming increasingly rare. The planned service and maintenance works of the OWF are currently carried out most frequently with the use of specialized CTVs and SOVs. In some cases helicopter helidecks are installed on platforms to enable personnel transport.

3.3 Work execution technologies

3.3.1 Preparatory works stage, cleaning, dredging and leveling of the seabed surface for the OWF structure

On the basis of the experience relating to the implementation of projects of similar scope, the applicant identified works that may need to be carried out at the preparatory stage prior to the commencement of the relevant construction works in the 14.E.1 OWF area.

The preliminary and preparatory works in question include:

- survey of seabed morphology necessary for the planning and design works of the 14.E.1 OWF structure and systems;
- soil survey aimed at determination of its parameters, important from the point of view of foundation of the 14.E.1 OWF structure, laying of systems and performance of construction works;
- seabed survey aimed at identifying non-standard facilities of anthropogenic origin, e.g. UXO, wrecks, nets, unidentified objects remaining on the seabed;
- boulder clearance/relocation from inter array cable routes and installation zone of turbine foundations and offshore substations;
- removal/displacement of other obstacles, e.g. fishing ropes, cables and nets;
- preparation of places of possible crossing of cables with external infrastructure consisting in reinforcement and appropriate protection;
- stabilization of the ground by means of rip-raps, e.g. for foundations (e.g. scour protection*)* and cable route;
- preparation of embankments/gravel pads for Heavy Lift Jack up Vessels;
- Pre-Lay Grapnel Run (PLGR);
- preparation of the seabed for foundations if unfavorable soil conditions are found;
- displacing of bottom sediment layers;
- other works related to sediments.

The preparatory works relating to preparation of the seabed for proper construction works shall be performed with the use of, i.a.:

- a dredger for displacement of bottom sediments, as well as preparation of seabed ground for installation vessel supports or OWT and OS foundation structures (e.g. for gravity-base foundations) (Figure 3.7);

Figure 3.7 Example of a trailing suction hopper dredger (source: https://www.jandenul.com/sites/default/files/2020-05/Leiv%20Eiriksson%20%28EN%29.pdf)

- fallpipe vessels that will deliver rock material in place of dredging in order to reinforce the ground for installation vessels and OWF structures (Figure 3.8);

Figure 3.8 Example of a fallpipe vessel (source: https://www.portalmorski.pl/zegluga/53382-nowy-podsypkowiec-boskalisa)

- plows used to clean the seabed of stones on the route of power lines in the seabed (Figure 3.9);

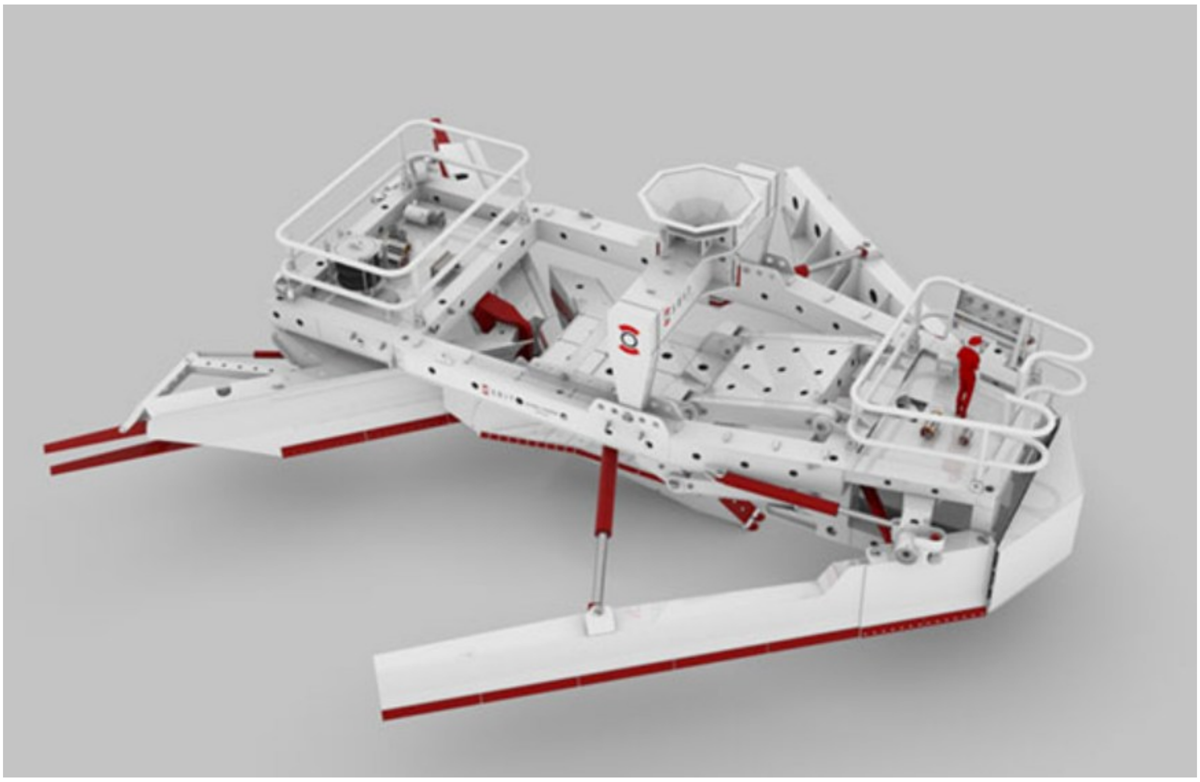


Figure 3.9 Multi-function pre-lay and backfill subsea plough Scion 240

(source: https://globalmarine.co.uk/osbit-to-deliver-next-generation-subsea-plough-to-global-marine-group/)

- grab buckets used to clean the seabed of stones and boulders and other objects that prevent the performance of works specific to the seabed area (Figure 3.10);

Figure 3.10 AssoGrapple II – a multi-purpose tool designed for seabed intervention (source: https://www.assogroup.com/equipment/seabed-preparation-equipment/pre-trenching-boulder-clearance/assograpple-ii/)

- anchors and hooks for removal of fishing lines, cables and nets from the seabed, which enable interference with the seabed to a depth of approx. 0.5 m.

3.3.2 Piling

The OWF monopiles are driven into the seabed by means of special equipment (surface pile drivers with weight and impact energy appropriate to the size of driven piles) from the deck of vessels adapted to these works (jacking platforms, vessels or other solutions available during construction). A vessel installing foundations of the jack-up type is placed on the seabed in a position which enables piling to be commenced in a given location. Such vessels may have 6 or 4 jack-up legs with spudcans. Frequently, the seabed shall be prepared prior to the foundation of the vessel (leveling and/or increasing its load-bearing capacity) by building the so-called gravel pads.

The method using pile drivers is a universal method, as it can be applied in almost all soil conditions. At the same time, it is a method ensuring quick placement of piles in the ground. The installation of the project structural elements (foundations) in the seabed is accompanied by the generation of significant underwater noise. Driving, vibrating or screwing monopiles causes underwater noise, which may reach momentary SPL values above 230 dB re 1 µPa at a distance of 1 m.

In order to minimize underwater noise during the installation of foundations, various noise reduction systems (NRS) are used. They constitute a set of noise reduction solutions selected taking into account, e.g., the type of foundation and geological conditions for the location of wind turbines and substations or seasonal variability of environmental conditions.

The adopted underwater Noise Reduction System should take into account, among other things:

- work schedule, including works performed in other projects in the Polish EEZ;
- piling locations, including the locations of piling in adjacent projects,
- parameters of the pile driver (type, maximum energy and values during the life cycle, frequency and number of impacts) or other applied technical solution used for driving the pile in the seabed,
- parameters of driven piles (geometry and materials),
- geotechnical parameters of sediments,
- seasonal variability of environmental conditions (including parameters of underwater noise propagation).

Depending on the above conditions, the composition of the Noise Reduction System may include:

- visual and acoustic observations, including deterrence systems and pile driver soft-start system;
- passive noise reduction systems with appropriate noise mitigation parameters, e.g., air curtains, cofferdam, sound insulation or other similar technologies available during the implementation of the Project;
- organization of the performance of works taking into account the schedules of works in other projects.

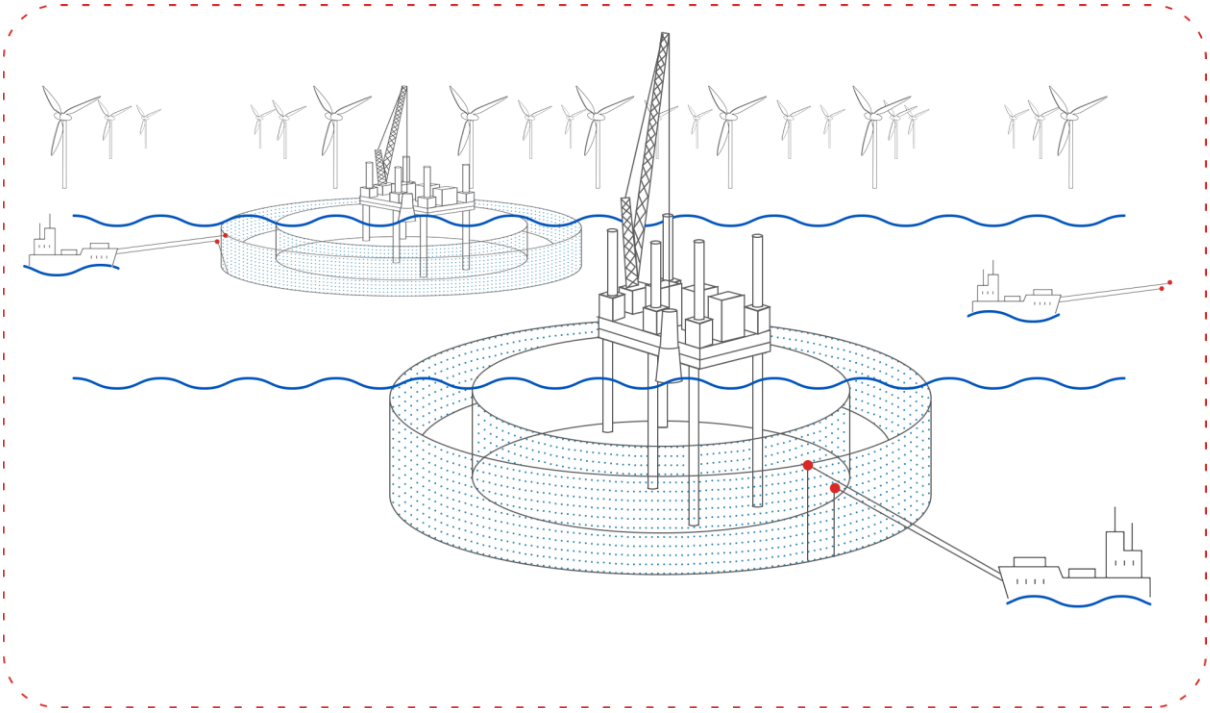


Figure 3.11 Example bubble/air curtain of the BBC type

[source: https://www.grow-offshorewind.nl/project/bubbles-jip#modalDialog1]

3.3.3 Technology of construction of cable lines in the OWF area

Power cables with a cross-section of up to 1,600 mm^2 and with a rated voltage of up to 132 kV may be used in the 14.E.1 OWF. It is assumed that most cable routes in the OWF area are laid at a depth of up to 3 m below seabed level and, in some places, it is allowed to lay power cables at a depth of up to 5 m below seabed level if particularly complex soil conditions are encountered. If rock substrate is encountered or if it is necessary for technical infrastructure to cross on the seabed, it is allowed to lay power cables on the seabed surface with the use of measures protecting against cable damage in the form of a rip-rap, gabion baskets and other technical solutions.

In most cases, cable routes will be performed by using equipment for liquefying the seabed, chasing with simultaneous backfilling of the cable with excavated material generated during the works, ploughs for burying the cable and other solutions described in the next chapter.

Electricity processed by substations will be output from the 14.E.1 OWF using export cables which are not included in the planned Project. The grid connection infrastructure from the OWF to the NPS will be covered by a separate environmental impact assessment procedure.

The commencement of construction works related to internal offshore power cable laying starts after the completion of works related to the installation of foundations for offshore wind turbines and OPSs.

Works related to power cable laying are performed using a cable transport vessel, as well as equipment performing works in the seabed related to the execution of the excavation for the power cable.

3.3.3.1 Cable laying equipment

The equipment used for the execution of excavations in the seabed includes blast equipment with pressure systems using seawater to flush the seabed under its pressure. The water is pumped into the sediment, which flushes the sediment to the sides and thus shapes the cable trench in which the power cable is placed. Blast equipment is used in the soft seabed where silt or fine and medium-grained sands occur. Blast equipment is installed on vehicles equipped with a drive train which transfers the drive to caterpillars, on the sleds towed by an installation vessel (Figure 3.12, Figure 3.13).

Figure 3.12 Sleds for power cable laying for the Mod-Jet/Sea Venture (source: https://eta-ltd.com/jetting-sleds-for-subsea-power-cable-laying/)

Figure 3.13 Shallow water trencher (source: https://www.smd.co.uk/blog/may-2023-smds-shallow-water-trencher-the-story-so-far/)

Another method applied is the use of equipment which mechanically performs dredging of trenches in the seabed by means of cutting chains which cut out a narrow trench where a power cable is installed immediately after the cutting chain goes through. This equipment is used in the seabed with harder sediments, such as clay or fine-grained sand (Figure 3.14). If works are performed in a substrate with more difficult conditions (rocky seabed or boulder areas), the equipment uses a cutting wheel instead of a cutting chain, which is characterized by higher strength in the hard seabed work.

Figure 3.14 Equipment for burying cables in the seabed. Source: https://www.barthhollanddrain.nl/page/161

Another method for burying cables is to use cable ploughs for this purpose. Cable ploughs are equipment towed by an installation vessel (Figure 3.15). Cable ploughs have the possibility of executing a cable trench and placing a power cable in it simultaneously and then backfilling the trench with seabed material in order to protect the cable against mechanical damage. Cable ploughs are commonly used due to optimization of costs and operating times.

Figure 3.15 AMP500 advanced multi-pass plough. Source: https://www.subsea-rov.com/services-assets/trenchers-ploughs/item/74-amp500

The solutions to be applied in the processes of internal offshore power cable laying within the 14.E.1 OWF will depend on the parameters and topology of the cable route as well as environmental, geotechnical and geophysical conditions of the seabed in the area of the offshore wind farm.

The applicant will make a decision on the applied technology to be contracted for the performance of works at the building permit design stage.

3.3.4 Collisions with external infrastructure – technical solutions

If works related to burying power cables in the seabed are performed, there may be a collision with external infrastructure which has been laid or buried in the seabed by other users. If it is not possible to lay cable infrastructure in a way bypassing external infrastructure, solutions which enable safe crossing of the infrastructure on the seabed surface with its proper protection will be applied.

Several types of solutions are used to enable the protection of power lines laid on the seabed surface:

- casing pipes made of reinforced concrete or HDPE;
- specially designed and prepared concrete mattresses protecting cables;
- gabions with rip-rap;
- rip-rap laid on the seabed surface on the power cable.

Detailed solutions used in the implementation of collisions with external infrastructure will be discussed at the stage of the environmental report for the 14.E.1 OWF.

3.4 Parameters of vessels performing works within the OWF

Most of the works carried out at sea during the construction of the offshore wind farm will be performed with the use of specialized vessels dedicated to the implementation of projects of similar scope. The most important vessels whose participation may be planned during the performance of works are listed below:

- installation vessels for the installation of foundations and elements of offshore wind turbines, such as: HLCVs, HLJVs, jack-ups, transportation barges;
- vessels involved in the seabed preparation for the installation and protection of foundations, as well as for the seabed preparation for spudcans – rock dumping vessels, dredgers;
- vessels for the execution of cable infrastructure – cable-laying vessels, specialized vessels;
- vessels supporting the execution of foundation works – e.g., vessels securing the execution of DBBCs or BBCs and other noise reduction systems;
- support vessels, guard vessels, towing tugs, CTVs and others;
- vessels carrying out monitoring related to the implementation of the OWF construction stage.

Installation vessels currently used for operations related to the execution of foundation works and OWE and OG installations are characterized by:

- approx. 270 m length;
- approx. 7,000 tons lifting capacity;

- approx. 200 persons accommodation capacity;
- a dynamic positioning system.

The dynamic development of the sector and services related to the execution of works on offshore wind farms results in specialist construction services companies racing internally to optimize the costs and time necessary to execute a complete single offshore wind turbine installation. In the future, the vessels may be used which are now only in the design phase and will be able to combine the functions of certain separate vessels, e.g. installing foundations and offshore wind turbines.

Depending on the logistics adopted by the Contractor of works in the OWF area, there may be also used vessels for preparing the subbase for foundations and cable lines. These vessels may perform works related to the removal of boulder fields preventing the commencement of foundation works or the necessity to remove boulders in places where spudcans are placed. The vessels for such works must be equipped with grabs allowing for moving of boulders identified during geophysical surveys of the seabed. In order to prepare the area for spudcans, it may also be necessary to remove soils not providing sufficient load-bearing capacity parameters in these areas. Such works will be performed by various types of dredgers. In place of selected non-bearing or low-bearing soils, it may be necessary to place a thin layer of rock material on the seabed to ensure proper subbase parameters for the assumed load related to the foundation of the spudcans. These rock layers will be executed by fallpipe vessels.

For executing works related to the construction of foundations there are used vessels specialized in this type of works, referred to as installation vessels. The Contractor will also be able to use barges and tug boats to transport ready-made foundation elements from installation ports to the site of their placement by installation vessels.

To perform works related to the installation of towers, nacelles and blades HLJV vessels are used, which currently allow for loading in the installation port several complete sets to be installed within the OWF. In order to support the above-mentioned works within the OWF it is necessary to use surveillance vessels and vessels for transporting personnel between service ports and the OWF area, where construction and erection works are being performed.

When planning offshore works, the Contractor shall take into account meteorological and hydrological conditions that may affect downtime and delays related to the performance of all planned works.

The vessels planned for use will perform tasks at the stage of construction and decommissioning of the OWF, whereas in the operation stage large vessels may be used only in emergency situations which require interference with the seabed or works related to repairs of the damaged OWF components.

4 POSSIBLE PROJECT OPTIONS

Taking into account the restriction of the construction area within the boundaries of the water region covered by the permit for erection and use of artificial islands, structures and devices, it should be concluded that any options of the planned Project will depend upon technical parameters and the number of offshore wind turbines, as well as any derivative aspects resulting from the scale of performed activities. The equipment available on the market varies significantly in terms of its rated capacity and overall dimensions. The development of offshore wind energy over the last decade has contributed to the development of new wind turbine structures and a significant increase in their unit capacities. Currently installed offshore wind turbines have a capacity of 14-15 MW or more, but in the coming years it is planned to construct offshore wind farms using wind turbines of up to 25 MW and in the future also above 25 MW. Increasing the capacity of wind turbines entails increasing their size. The largest turbine models currently built are DEW-26 MW-310 with a capacity of 26 MW, 340 meters height and 310 m rotor diameter, produced by Dongfang Electric Corporation (DEC), and MySE 16.0-242 produced by MingYang with a capacity of 22 MW, equipped with a 310 m diameter rotor.

The maximum total installed capacity of the 14.E.1 OWF was defined as 812 MW. The selection of the wind turbine model, dictated by economic and environmental factors and the availability of appropriate structures, will be decided at the stage of designing and contracting deliveries, and only then it will be possible to determine the final number of wind turbines, their arrangement and thus technical parameters to be used in the 14.E.1 OWF.

Based on the held permit for erection and use of artificial islands, structures and devices, and taking into account the MSP-POM statements determining the locations intended for the acquisition of wind energy within the Polish maritime areas, it is not possible to execute any location options of the Project in question.

The options presented by the Applicant are based on technological variants related to the availability of different technical solutions of possible foundations (their types), wind turbine towers, wind turbine capacity and possible diameters of wind turbine rotors.

The permit for erection and use of artificial islands, structures and devices for the 14.E.1 area specifies the following parameters for the 14.E.1 OWF:

- the total power output from the 14.E.1 area shall not exceed 812 MW;
- the maximum number of wind turbines is 54 pcs.;
- the maximum total height of a wind turbine including the rotor is 350 m a.s.l.;
- the maximum diameter of a wind turbine rotor shall not exceed 310 m;
- the maximum number of OPSs will be 2.

The Applicant shall develop options depending on:

- the wind turbine rotor diameter;
- the wind turbine rotor swept area;
- the maximum number of wind turbines;
- the wind turbine height;
- the number of supporting structures and the area occupied by them in the 14.E.1 area;
- the maximum length of cable lines in the 14.E.1 area;
- the maximum number of OPSs to be constructed in the 14.E.1 area;

4.1 Option Proposed by the Applicant

Option proposed by the Applicant (hereinafter: OPA) will be based on technical solutions which will be available in the future. Such an approach is based on the Applicant's experience, and is conditioned by a very long investment process related to obtaining an environmental decision, conducting a possible cross-border impact procedure, ordering and performing detailed environmental surveys, including seabed surveys allowing to identify soil conditions which will enable the selection of appropriate technical solutions for offshore wind turbine foundations, as well as the selection of foundations for OPSs. Also obtaining financing ensuring funds necessary for the implementation of the Project is a long-term process.

The estimated planning period was defined by the Applicant as approx. 6 years from the moment of submission of the application for the decision on environmental constraints to the moment of obtaining the Building Permit.

The OPA assumes a capacity range for a single wind turbine from 15 to 25 MW. In 2024, the Technical University of Denmark and the International Energy Agency developed the IEA Wind 22-MW reference turbine, which is an example of a technology that may be commercially available in the time horizon of the planned Project (DTU Wind Report E-0243). This turbine, like the IEA Wind

15 MW model, has been developed as a reference tool for industry and academia to test future design concepts and optimize wind farm designs. Its existence and parameters confirm that adopting values such as 310 m rotor and unit capacity of up to 25 MW lies within a realistic, technologically justified framework.

The Applicant assumes that the continuously developing sector related to the construction of offshore wind farms will strive to increase the capacity of the OWE as well as to optimize the costs related to the involved construction process and logistics.

The above assumption will allow for the implementation of the Project while minimizing its environmental impact by means of:

- using wind turbines with higher unit capacity, which will result in smaller number of those turbines;
- reducing the number of OWEs, which will result in reducing the seabed surface occupancy for structures in the OWF area and may result in shortening the construction time;
- reducing cable lines interference with the seabed by shortening their length related to the reduction of the number of OWEs and OPSs.

With the assumptions adopted in the OPA, it may be assumed that the implementation of the OWF in this option will be carried out in a shorter period of time, with a lower equipment deployment and, consequently, lower consumption of raw materials and fuel. The Applicant assumed that within the OPA maximum 2 OPSs will be built. The number of OPSs will depend on the selected technology for electricity transmission to the NPS.

4.2 Reasonable alternative option

When developing a reasonable alternative option (hereinafter referred to as RAO), the applicant adopted technical and technological solutions existing on the offshore market, enabling the construction of offshore wind farms. It was assumed to use a 14 MW wind turbine with a rotor diameter of 236 m. In accordance with the issued permit for erection and use of artificial islands, structures and devices, a maximum capacity of 812 MW was allocated to 14.E.1 area. When using 14 MW wind turbines, it can be assumed that the installed number of wind turbines in this area will be 58.

The reasonable alternative option assumes the construction of more wind turbines due to the fact that it is based on the currently available technical solutions. Such an approach also results in the necessity to construct more structures founded on the seabed in 14.E.1 area.

The RAO assumes a feasible maximum of 2 OSs ensuring the offtake of generated energy from offshore wind turbines. The applied logistic and technical solutions for the construction of the OWF in the OPA and RAO are described in Chapter 3 (Type of technology).

4.3 Technical parameters of options

Table (Table 4.1) summarizes parameters for the analyzed options.

Table 4.1 Technical parameters for the analyzed options

PARAMETER	UNIT	OPA		RAO
Available capacity for the OWF area based on the permit for erection and use of artificial islands, structures and devices	MW	812		812
Maximum power output of a single wind turbine	MW	15	25	14
Maximum number of wind turbines	pcs	54		58
Maximum rotor diameter	m	310		236
Maximum height of the OWT	m	350		265
Minimum clearance between the rotor operating area and sea surface	m	20		20
Maximum number of support structures	pcs	56		60
Maximum length of cable lines	km	210		225
Number of OSs	pcs	2		2
Maximum sweep area of a single rotor	m^2	75 477		43 743
Maximum total rotor sweep area	m^2	2 415 256		2 537 125
Maximum seabed occupancy	%	5		

5 EXPECTED QUANTITY OF WATER, RAW MATERIALS, MATERIALS, FUELS AND ENERGY USED

5.1 Water use

Water will be used mainly for domestic purposes and technological processes. At this stage of the Project progress, it is not possible to determine exactly which vessels and their number will support its implementation. Therefore, it is not known what number of people will be involved in the works resulting from the implementation of each phase of the 14.E.1 OWF, nor what will be the time of these works. Therefore, it is not possible to estimate the amount of water used for domestic purposes, which would not be burdened with an unknown, although certainly a large error of this estimation.

With the theoretical assumption of maximum simultaneous involvement of 1,000 persons in the works of the construction or decommissioning phase (operation of the offshore wind farm in the operation phase requires involvement of a significantly smaller number of people) and assuming 100 liters as the daily demand for fresh water for one person, the value of 100 m^3 can be calculated as the maximum total demand of 1,000 persons for fresh water per day.

Sea water will be used to bury power cables in the bottom sediment by various types of equipment operating on the seabed. Such equipment will draw water from the environment and then pump it under pressure into the surface layer of bottom sediment to loosen its structure, which will enable laying the cable in it. During this process, the chemical composition of the water and its temperature will not change. All water used will be returned to the environment. Depending on the equipment used, it is expected that the water flow may range from approx. 800 to approx. 5,000 m^3/h. There will be no phenomenon related to non-returnable seawater consumption.

At the operation stage, the water demand is related to ensuring welfare and living conditions of the onshore and offshore crew, and its amount will depend on the number of individuals involved.

5.2 Use of raw materials and materials

Regardless of the adopted construction technology for the construction of the 14.E.1 OWF, mainly elements made in onshore production facilities and delivered to the construction area by sea will be used. In material terms, rotor blades are made of composites (glass fiber, carbon fiber, epoxy or polyester resins). The power plant tower and monopile and jacket foundations are steel structures. Gravity-base foundations are made of concrete. Typical submarine power cables consist of:

- core made of copper or aluminum with high electrical conductivity,
- electrical core insulation made of cross-linked polyethylene (XLPE) or paper impregnated with insulating oil (mass impregnated, MI),
- conductive screen made of a semi-conductive polymer or metal layer (e.g. lead),
- interference protection shield made of copper or aluminum braid,
- protective layer (polymer high density polyethylene (HDPE) or PVC shield with possible additional steel reinforcement),
- mechanical reinforcement made of high strength steel or composite wire,
- external sheath made of materials resistant to corrosion, seawater and UV radiation.

Natural aggregate may be used to protect the support structures of wind turbines and OS and to protect power cables, if laid on the seabed surface. Due to the fact that at this stage detailed parameters of the seabed and, consequently, the method of foundation of wind turbines and the OS are not known, it is also not possible to determine in detail the amount of natural aggregates to be used in the construction phase.

At the operation stage, the demand for basic raw materials and materials will take place only if it is necessary to perform service and overhaul works. At present, the quantities cannot be predicted, however, they will be negligible in comparison to the construction stage.

5.3 Use of fuels and energy

Fuels will be used mainly by vessels involved in construction and disassembly works and vessels performing service works in the operation phase.

The equipment used during construction and overhaul works at sea will consume electricity generated from combustion of fuel – diesel oil with low sulfur content (< 0.1%). The amount of fuel consumption will result from the impact of various factors, the most important of which are the type and intensity of works, and thus the type and number of vessels used and weather conditions prevailing during their performance: wave motion magnitude and wind force and direction, which largely determine the manner of maneuvering the vessel and load of propulsion engines (including by dynamic positioning systems).

5.3.1 Estimated fuel consumption in the construction phase

Due to the fact that at this stage the vessels that will participate in the Project implementation and weather conditions in which the marine operations will be performed are not known yet, it is also not possible to precisely estimate the amount of fuel that will be used by the vessels. Table (Table 5.1) provides information on average quantities of fuel consumed per operating hour by vessels of different sizes.

Table 5.1. Average fuel consumption for different types of vessels [source: own study based on Borkowski, 2009]

VESSEL SIZE	INTENDED USE	AVERAGE FUEL CONSUMPTION (DIESEL OIL) [kg·h^{-1}]*	NOMINAL DAILY OPERATION TIME [h]	ESTIMATED NUMBER OF VESSELS SUPPORTING THE OWF IN ONE ANNUAL CYCLE	ESTIMATED FUEL CONSUMPTION PER DAY [mg]
Small	Minor supplies, security vessels, personnel transport, one-day service, emergency operations	50–200	12–24	10	6–48
Medium	Supply, construction works and support for construction works, towing works, stationary multi-day service – for each phase	500–2000	12–24	5	30–240
Large	Construction works, storing – construction and decommissioning phase	2500–5000	12–24	7	210–840

* fuel consumption was determined on the basis of catalog cards of sample vessels

Fuel consumption shall also be taken into account when used as an ad hoc means of air transport – a helicopter whose fuel consumption is determined at 500 kg per flight hour.

5.3.2 Estimated fuel consumption in the operation phase

It is assumed that at the operation phase, mainly small and medium-sized service vessels will be responsible for fuel consumption, and in exceptional cases larger vessels may be involved in order to eliminate a failure.

Table (Table 5.2) provides information on average quantities of fuel consumed during one year of operation of vessels of different sizes in the operation phase.

Table 5.2. Average fuel consumption for different types of vessels [source: own study based on Borkowski, 2009]

VESSEL SIZE	INTENDED USE	AVERAGE FUEL CONSUMPTION (DIESEL OIL) [$kg \cdot h^{-1}$]*	NOMINAL ANNUAL OPERATION TIME [h]	ESTIMATED NUMBER OF VESSELS SUPPORTING THE OWF IN ONE ANNUAL CYCLE	ESTIMATED ANNUAL FUEL CONSUMPTION [mg]
Small	Minor supplies, security vessels, personnel transport, one-day service, emergency operations	50–200	8000	2	400–1600
Medium	Supply, construction works and support for construction works, towing works, stationary multi-day service – for each phase	500–2000	3500	2	1750–7000
Large	Construction works, storing – construction and decommissioning phase	2500–5000	240	1	600–1200

* fuel consumption was determined on the basis of catalog cards of sample vessels

Fuel consumption shall also be taken into account when used as an ad hoc means of air transport – a helicopter whose fuel consumption is determined at 500 kg per flight hour. It was assumed that the use of the helicopter during the year would be up to 400 flight hours, the fuel consumption was determined at 200 Mg.

5.3.3 Estimated fuel consumption in the decommissioning phase

Fuel consumption in the decommissioning phase will depend on the issues related to the decision to leave the foundation structure in the seabed, and recover only the part above the seabed, as well as the decision whether the cable infrastructure will be left in the seabed or, for financial reasons, it will be beneficial to make a decision on its removal. The total number of vessels in the decommissioning phase will be similar to the number of vessels performing construction works in the construction phase of 14.E.1 OWF.

Table (Table 5.3) provides information on average quantities of fuel consumed during one year of operation of vessels of different sizes in the decommissioning phase.

Table 5.3 Average fuel consumption for different types of vessels [source: own study based on Borkowski, 2009]

VESSEL SIZE	INTENDED USE	AVERAGE FUEL CONSUMPTION (DIESEL OIL) [$kg \cdot h^{-1}$]*	NOMINAL DAILY OPERATION TIME [h]	ESTIMATED NUMBER OF VESSELS SUPPORTING THE OWF IN ONE ANNUAL CYCLE	ESTIMATED FUEL CONSUMPTION PER DAY [mg]
Small	Minor supplies, security vessels, personnel transport, one-day service, emergency operations	50–200	12–24	7	4,2–33,6
Medium	Supply, construction works and support for construction works, towing works, stationary multi-day service – for each phase	500–2000	12–24	3	18–144
Large	Construction works, storing – construction and decommissioning phase	2500–5000	12–24	2	60–240

* fuel consumption was determined on the basis of catalog cards of sample vessels

Fuel consumption shall also be taken into account when used as an ad hoc means of air transport – a helicopter whose fuel consumption is determined at 500 kg per flight hour.

Taking into account the general information on the number and size of vessels involved in the works at each milestone of the offshore wind farm, it can be assumed that the highest fuel and energy consumption will occur in the construction and decommissioning phase, and much lower in the operation phase.

5.3.4 Electricity demand

The electricity demand of 14.E.1 OWF will occur only in the operation phase:

- within 1% of the total OWF power output for auxiliaries related to operation;
- up to a maximum of 3% of the total annual production during the operation phase during the year.

6 ENVIRONMENTAL PROTECTION SOLUTIONS

The basic solution protecting the environment will be such design and implementation of the Project that will minimize the number and magnitude of generated negative impacts. In the case of the construction and decommissioning phase, which in such projects have the greatest negative environmental impact, the applicant assumes the use of technologies that will cause the least environmental impact for their implementation. At each milestone of the Project, the applicant shall use vessels and equipment meeting the applicable environmental standards. All activities shall be monitored for possible leakages of hazardous substances, emissions and other failures that may lead to deterioration of the environment. A plan for prevention of oil hazards and pollution by vessels participating in all phases of the 14.E.1 OWF implementation shall be prepared and implemented.

The design of protection activities will be based on the results of environmental surveys carried out for the purpose of preparing the EIA Report and analyses of environmental impacts.

Examples of detailed solutions protecting the environment, which are commonly used in the implementation of offshore wind farms and which are planned to be taken into account in the 14.E.1 OWF project include, among others:

- Noise reduction system at the construction stage, including e.g. the use of the so-called “soft-start” procedure for piling during the construction of support structures of wind turbines – slowly increasing sound level in water will disperse fish and marine mammals from the area of its strongest impact in order to protect them against damage to hearing organs and echolocation of marine mammals and swim bladders of fish; use of noise abatement systems in the form of e.g. air curtains (Big Bubble Curtain) and dampers reducing the spread of underwater noise (e.g. NMC and HSD systems);
- limitation of light emission at night to the necessary minimum ensuring safe performance of works in accordance with relevant regulations, especially during bird migration;
- warning lighting system identifying aviation obstacles;
- application of systems allowing for temporary slowdown of wind turbines during periods of bird migration at a height colliding with turbines.

7 TYPES AND ANTICIPATED AMOUNTS OF SUBSTANCES OR ENERGY INTRODUCED INTO THE ENVIRONMENT USING SOLUTIONS TO PROTECT THE ENVIRONMENT

The main source of substances introduced into the environment will be the emission of flue gas from the engines of vessels involved in the construction and decommissioning of the offshore wind farm, as well as, to a lesser extent, vessels supporting the operation phase of the farm. In the case of energy emission, the underwater sound generated during piling of support structures and operation of vessels shall be considered the most important.

7.1 Flue gas emissions to air

In the construction and decommissioning phase of 14.E.1 OWF, vessels will generate flue gases that will be emitted to the atmosphere. High-efficiency engines of vessels produce significant quantities of flue gas, the quality of which results from the quality of fuel. Fuel and flue gas quality standards are determined by the "International Convention for the Prevention of Pollution from Ships" (MARPOL Convention) and "Directive (EU) 2016/802 of the European Parliament and of the Council of 11 May 2016 relating to a reduction in the sulphur content of certain liquid fuels" (the so-called Sulphur Directive). The records of these documents were implemented in the national law by the Act of March 16, 1995 on the *prevention of pollution of the sea by vessels (*consolidated text, Journal of Laws of 2020, item 1955, as amended). Flue gas quality from vessels has improved significantly in the last decade. The European Commission report on the results of the implementation of the Sulphur Directive indicates that the reduction of sulphur content in marine fuels has resulted in a drop in concentration of sulphur oxides in the air in harbor areas or intensive navigation routes by several dozen percent, significantly improving air quality (Commission Report 2018). Flue gases of vessels will not be concentrated due to favorable wind conditions prevailing in the open sea, which will disperse flue gases in a short period of time.

Additionally, the source of emissions may be power generator sets used to generate electricity to supply machines and equipment at the construction stage.

The amount of flue gas emitted to the air will result from the number and types of vessels involved in individual milestones of the Project and the duration of the planned offshore works. Due to the fact that the Project is in the early pre-execution phase, i.e. before preparation of a detailed schedule of works and before selection and contracting of appropriate vessels, it is currently not possible to determine and specify the flue gas emission values from the moment of commencement of the construction phase.

If the decommissioning phase involves leaving fragments of support structures of wind turbines and accompanying infrastructure as well as power cables in the seabed, the materials used for their construction shall be considered as substances permanently introduced into the environment. Also in this case, it will be possible to estimate the amount of these substances only at later milestones of the Project implementation, including after selecting the type of support structures and the type of power cables.

7.2 Noise emission

During construction and disassembly works of 14.E.1 OWF, noise will be generated to the atmosphere and water column. Noise emitted to the atmosphere will not involve noise levels that could have a negative impact on the environment, so it is not planned to apply measures limiting this emission. Operating vessels also emit underwater noise, the parameters of which correspond to the type of maneuvers performed. Frequency of this sound is usually 63 and 125 Hz. Sounds in these frequency bands are detected by fish and marine mammals, and at high intensities, they may trigger a behavioral response – fleeing the emission area. Noise emission by vessels will be minimized by limiting the number of vessels to the necessary one ensuring the possibility of efficient and safe performance of works. This is the only assumed way to minimize this impact.

The greatest negative impact on the marine environment is characterized by noise generated during piling of the support structures of wind turbines and the OS. The analysis of the range of underwater noise on marine mammals and fish and the theoretical efficiency of noise reduction after the use of an air curtain was carried out for the EIA Report of all OWFs planned to be implemented in the Polish EEZ. For example, the analysis performed for the Baltic Power OWF (Sarnocińska et al., 2020) showed that piling noise (multiple piling) emitted without the application of mitigation measures may cause permanent threshold shift (PTS) of porpoises and seals at a distance of 42.4 km and 13.1 km from the Baltic Power OWF area, respectively, and temporary threshold shift (TTS) at a distance of 129.1 km and 59.2 km. When using an air curtain protecting the piling site, the PTS range will not occur at a distance of more than 9.1 km for porpoises and 0.8 km for seals, and the TTS at a distance of 20.0 km and 6.1 km, respectively. Therefore, it was assumed that for the Project being the subject of this PIS, a noise reduction system will be implemented, the required efficiency of which will be determined at the stage of noise modeling and environmental impact assessment.

8 POSSIBLE CROSS-BORDER ENVIRONMENTAL IMPACTS

The area of the planned Project is located in the Exclusive Economic Zone of the Republic of Poland at a distance of approx.:

- 12.3 km from the limit of the EEZ of Denmark,
- 13.9 km from the limit of the EEZ of Germany,
- 130.3 km from the limit of the EEZ of Sweden.

Location of the 14.E.1 OWF at a distance from the borders of other countries does not exclude the occurrence of cross-border environmental impacts in connection with its construction, operation and decommissioning. The initially identified potential cross-border impacts and a description of their environmental impact are included in Table (Table 8.1).

Table 8.1. Impacts with a potential cross-border reach resulting from the construction of 14.E.1 OWF (study: own source)

ENVIRONMENT OR HUMAN ACTIVITY SUBJECT TO CROSS-BORDER IMPACT	EFFECT OF THE IMPACT
Birds and bats	The complex of wind turbines, the structures of which will rise to a height of more than 350 m above sea level, may constitute a permanent migration obstacle for birds and bats.
Marine mammals and fish	Underwater works related mainly to the construction of supporting structures of wind turbines generate noise, the spatial reach of which may cover maritime areas beyond the EEZ of the Republic of Poland. The negative impact of underwater noise will be particularly important for marine mammals and fish with swim bladder.
Vessel traffic	The 14.E.1 OWF area will constitute a navigation obstacle and cause a permanent change in the customary navigation routes of vessels. Due to the low traffic volume in this area of the Baltic Sea and the lack of permanent shipping routes in the area of 14.E.1 OWF, this hindrance is not expected to be of great importance for navigation.
Fishing	The 14.E.1 OWF area may be excluded in whole or in part from commercial fishing, which may cause a need to change the location of fisheries in this area of the Baltic Sea.

9 AREAS SUBJECT TO PROTECTION UNDER THE ACT OF APRIL 16, 2004 ON NATURE CONSERVATION AND ECOLOGICAL CORRIDORS LOCATED WITHIN THE SIGNIFICANT IMPACT AREA OF THE PROJECT

9.1 Protected areas

The 14.E.1 OWF area is not located within the boundaries of the area subject to protection under the Act of April 16, 2004 *on nature conservation (*consolidated text, Journal of Laws of 2022, item 916, as amended). An analysis of the results of an Environmental Impact Assessment of projects consisting in the construction of OWFs in Polish maritime areas demonstrated that the impact of underwater noise generated during piling in the construction phase has the greatest spatial coverage. They are most perceived in the nearest area of these works, but their significant impact on marine mammals and fish (especially species with swim bladders) may occur in an area even more than one hundred kilometers away from the source of emitted noise (if no noise reduction systems are applied). In order to determine Natura 2000 sites that may be affected by significant impacts, the results were used of modeling of underwater noise propagation, which were performed for the Baltic Power Offshore Wind Farm and are included in the study entitled: "Results of model calculations of underwater noise propagation during piling" constituting Appendix No. 3 to the EIA Report of the Baltic Power OWF (Sarnocińska *et al*. 2020). The study indicates that the maximum range of significant impacts on fish and marine mammals – permanent and temporary shift of the hearing threshold, using standard mitigation measures, i.e. air curtains and noise reduction screens, will amount to 20 km (see: chapter 7.2). Assuming this value, it was determined that protected areas located at a distance of up to 20 km from the limit of the 14.E.1 OWF area may be subject to significant impacts. Two Natura 2000 sites are located at this distance: Refuge in the Pomeranian Bay PLH990002 and Pomeranian Bay PLB990003 (Figure 9.1).

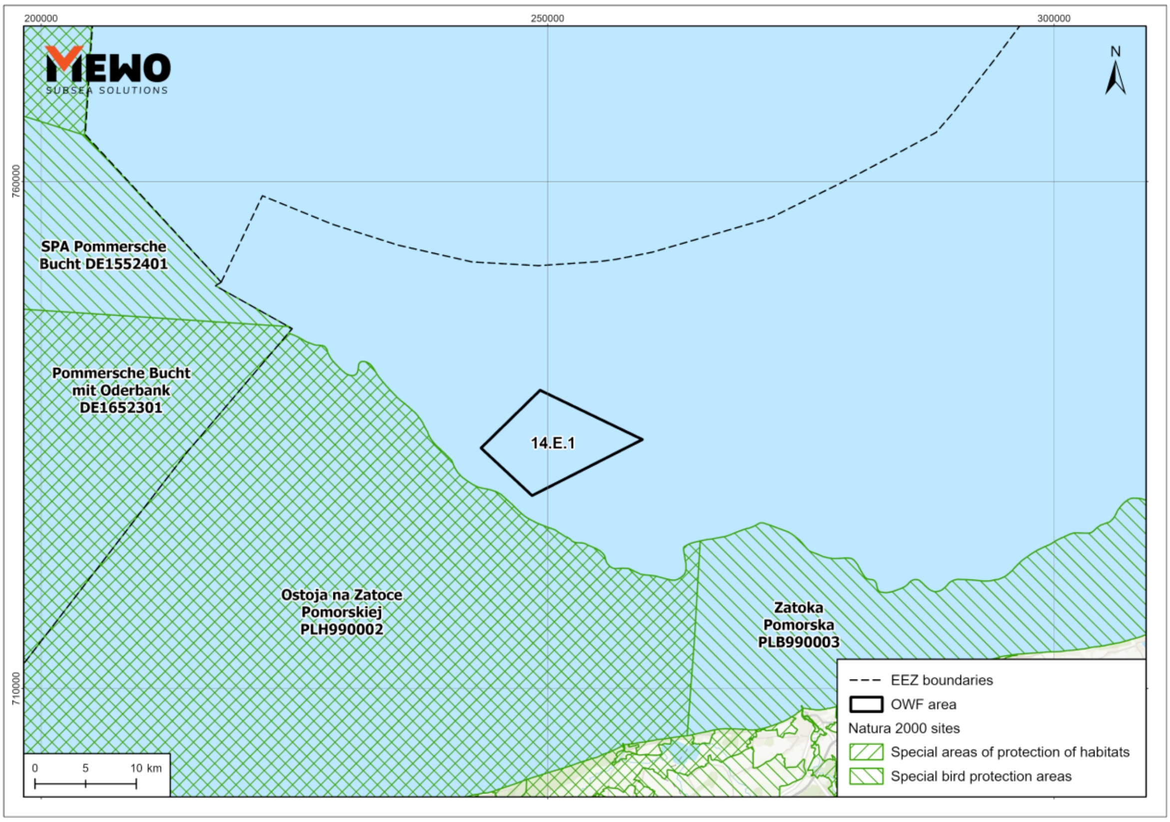


Figure 9.1. Location of the 14.E.1 OWF area in relation to the areas subject to protection under the Act of April 16, 2004 on nature conservation (consolidated text, Journal of Laws of 2022, item 916, as amended) (source: own study)

At this stage, it cannot be determined whether the 14.E.1 OWF will be a source of significant impacts on migratory seabirds, for which offshore wind farms are listed as potential obstacles preventing or limiting migrations. This analysis will be carried out after conducting targeted environmental surveys at the stage of the environmental impact analysis.

Refuge in the Pomeranian Bay PLH990002

The area was designated for the protection of a natural habitat of S*ubmarine sandbanks permanently covered with low-depth water* (code: 1110) for two fish species: twait shad (*Alosa fallax*) and sea lamprey (*Petromyzon marinus*) and two species of marine mammals: gray seal (*Halichoerus grypus*) and porpoise (*Phocoena phocoena*). The Pomeranian Bay is a key protection area for habitat 1110 and a place of regular observations of the porpoise. Four threats were identified for the area: extraction of sand and gravel (code: C01.01), pelagic trawling (code: F02.02.02), leisure fishing (code: F02.03), oil spills in the sea (code: H03.01) and toxic chemical discharge from material dumped at sea (code: H03.02), (SDF 2025a).

Pomerania Bay PLB990003

The area was designated for the protection of 11 bird species: razorbill (*Alca torda*), black guillemot (*Cepphus grylle*), long-tailed duck (*Clangula hyemalis*), black-throated diver (*Gavia arctica*), red-throated diver (*Gavia stellata*), velvet scoter (*Melanitta fusca*), common scoter (*Melanitta nigra*), red-breasted merganser (*Mergus serrator*), great crested grebe (*Podiceps cristatus*) and red-necked grebe (*Podiceps grisegena*). The Pomeranian Bay is an important bird refuge with the E82 international rank. There are at least 3 bird species listed in Annex I to the Birds Directive present in the area. During migration and winter, at least 1% of the population of the migratory route (C2 and C3) of the following species is present here: great crested grebe, red-necked grebe, horned grebe, smew, long-tailed duck, common scoter, black guillemot, red-breasted merganser and velvet scoter. Relatively high numbers (C7) of black-throated diver and red-throated diver are observed. Wetland birds occur in concentrations of more than 20,000 individuals (C4) – in the winter, more than 100,000 individuals. One hazard was identified for the area: other urbanisation, industrial and similar activities (code: E06), (SDF 2025b).

9.2 Wildlife corridors

A wildlife corridor, in accordance with the Act of 16 April 2004 *on nature conservation* (consolidated text: Journal of Laws 2022, item 916) is an area enabling the migration of plants, animals or fungi. The network of ecological corridors connecting the European Ecological Network Natura 2000 in Poland was developed in 2011 (Jędrzejewski *et al*., 2011), however, it does not indicate ecological corridors in Polish maritime areas.

According to the general classification of the migration system of wetland birds in Eurasia, Poland with its offshore areas is located within two large migration corridors: East Atlantic and Mediterranean – Black Sea corridors. The migration strategy and migration corridors of seabirds in the Baltic Sea area are very poorly understood. In summer, in July and August, sea ducks (mainly male common scoters) are observed flying from the Gulf of Finland toward the moulting areas located in the Danish Straits. They are accompanied by common eiders and velvet scoters, but the abundance of both species is much lower than that of common scoters. Those birds only exceptionally stop in sea basins in the Southern Baltic. The autumn migration period of seabirds extends over a very long time. Already in August, a number of waterbird species can be found within Polish maritime areas. Some of them only fly through and do not stay for winter (e.g. terns of the *Sterna* and *Chlidonias* genera), while others are observed throughout their migration and wintering period (sea ducks, razorbills, loons, grebes). In spring, large flocks of sea ducks (long-tailed ducks, velvet scoters, common scoters) are observed, which, while moving towards breeding sites, stop in the Polish Baltic Sea zone (Sikora *et al.*, 2011).

Krost *et al*. (2017) indicate the need to designate ecological corridors for benthic organisms. However, it is a relatively poorly identified issue. There are also no relevant studies in this respect concerning the southern Baltic Sea. Also, for marine mammals found in the southern Baltic Sea, no areas can be identified that can meet the criteria for ecological corridors. Both seals and porpoises go after food, without preferring specific routes.

10 PROJECTS BEING IMPLEMENTED AND COMPLETED IN THE AREA WHERE THE PROJECT IS PLANNED TO BE EXECUTED, AND IN THE AREA OF PROJECT IMPACT, OR WHOSE IMPACT FALLS WITHIN THE AREA OF IMPACT OF THE PLANNED PROJECT – TO THE EXTENT THAT THEIR IMPACT MAY LEAD TO CUMULATION OF EFFECTS WITH THE PLANNED PROJECT

According to the data and information included in the Maritime Administration Spatial Information System (SIPAM), there are no other projects completed or under implementation in the 14.E.1 OWF area.

In order to select projects whose impacts may overlap with the range of impacts of the Project in question, it was first identified what types of projects are located in the 14.E.1 OWF area. Based on the available information on the type and range of actual and theoretical impacts generated by various types of offshore projects, the projects whose implementation may very likely lead to cumulation with the impacts of the 14.E.1 OWF were selected – these were projects consisting in the construction of offshore wind farms and power cables infrastructure. In the next step, it was necessary to determine the maximum distance from the boundaries of the 14.E.1 OWF area, in which the areas of impacts of other projects might be located, which might cumulate with the impacts of the 14.E.1 OWF, leading to the occurrence of strong accumulated impacts. From the analysis of available EIRs for similar projects and data from monitoring performed during the construction of the OWF in Denmark and Germany (Brandt et al. 2011, Tougaard et al. 2016, Dähne et al. 2014) it may be concluded that the largest spatial range with a strong impact on the environment relates to the spread of underwater noise resulting from underwater works – in particular piling during the construction of OWF infrastructure foundations. Taking into account the fact that with the use of standard underwater noise suppression measures the range of strong impact of this type for a single OWF is 20 km, it was assumed that projects involving the construction of offshore wind farms at a distance of up to 40 km from the 14.E.1 OWF boundary will be considered (the distance of potential overlapping of the range of impacts from two OWFs).

Table (Table 10.1) contains information on current investment projects in the area of the planned Project and outside its limits, the area of which may be affected by impacts generated by the 14.E.1

OWF or whose impacts may cumulate with the planned Project impacts. The location of such projects in relation to the 14.E.1 OWF area is presented in Figure (Figure 10.1).

Table 10.1. Projects implemented in the 14.E.1 OWF area and projects planned to be implemented outside its area, which may be within the range of project impacts or whose impacts may cumulate with the 14.E.1 OWF impacts (source: own Study based on the data from the Maritime Administration Spatial Information System)

PROJECT TYPE / NAME	DESCRIPTION
Projects planned to be implemented within the 14.E.1 OWF boundaries	
Offshore Wind Farm with a maximum total capacity of 14 MW together with technical, measurement, research and service infrastructure related to the preparation, execution and operation stages	A fragment of the southern part of the 14.E.1 OWF area overlaps with a part of the area for which the Minister of Infrastructure issued on 01-30-2021 a permit for erection and use of artificial islands, structures and devices for the project named “Offshore Wind Farm with a maximum power output of 14 MW and technical, measurement, research and service infrastructure related to the preparatory, execution and operation stages”. Investor: Energa OZE S.A. Permit expiry date: 01-30-2056
Projects planned to be implemented outside the 14.E.1 OWF area, which may be within the range of impacts of the Project or whose impacts may cumulate with the 14.E.1 OWF impacts.	
“Baltic Pipe” Gas Pipeline	Permit decisions for laying and maintaining cables or pipework for the project: a) “Baltic Pipe Pipeline north section 2 BP “N2” within EEZ PL”. Permit expiry date: 08-07-2054 b) “Baltic Pipe Pipeline north section BP “N” within EEZ PL”. Permit expiry date: 08-07-2054 c) “Baltic Pipe Pipeline – western section BP “W” within EEZ PL”. Permit expiry date: 06-12-2053 d) “Baltic Pipe High Pressure Gas Pipeline – western section BP “W” within TW PL”. Investor: Operator of Industrial Gas Pipelines GAZ-SYSTEM S.A. Permit expiry date: 07-04-2053
Offshore wind farms in areas designated as: 14.E.2, 14.E.3 and 14.E.4	Permit for erection and use of artificial islands, structures and devices in the areas: 14.E.2: Investor: ENERGA MFW 2 sp. z o.o., permit expiry date: 01-01-2099; 14.E.3: Investor: ORLEN Neptun III sp. z o.o., permit expiry date: 01-01-2099; 14.E.4: Investor: ORLEN Neptun IV sp. z o.o., permit expiry date: 01-01-2099.
Connection infrastructure of offshore wind farms to the NPS	No permits issued for laying and maintaining cables or pipework.

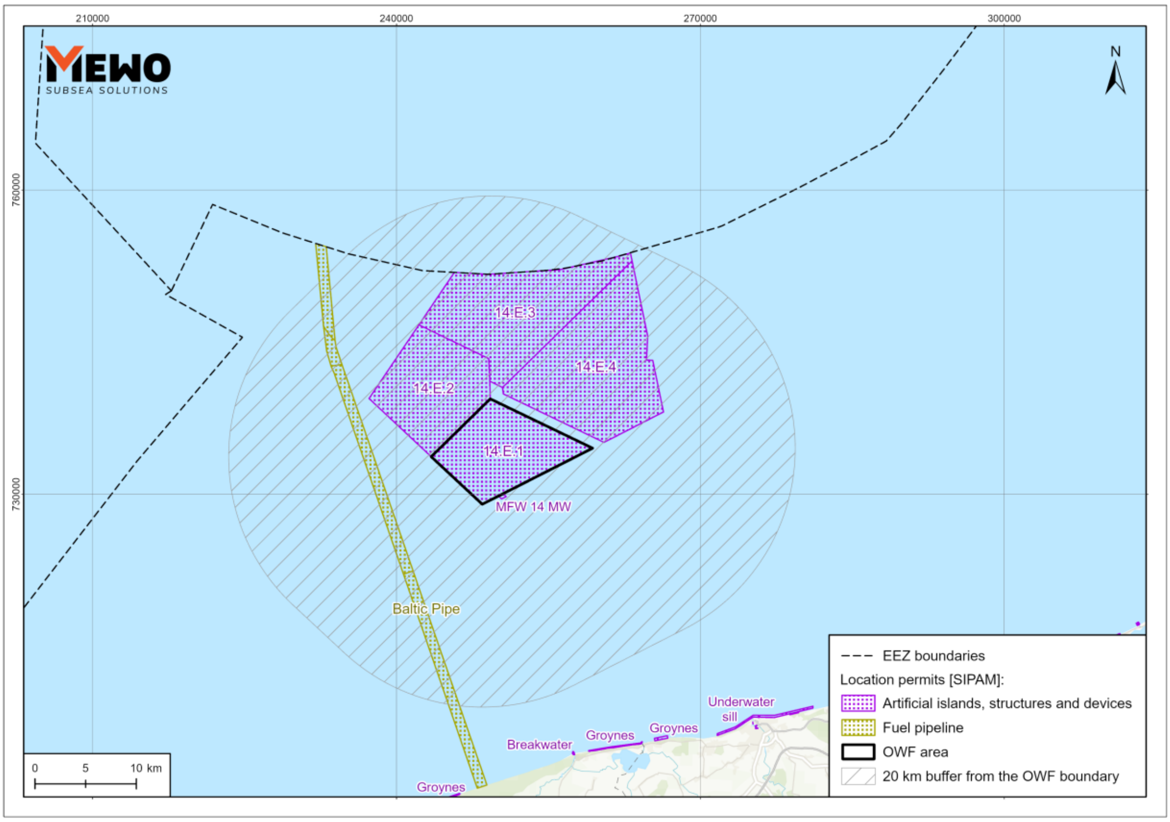


Figure 10.1. Location of projects planned to be implemented outside the 14.E.1 OWF area, which may be within the range of impacts of the Project or whose impacts may cumulate with the 14.E.1 OWF impacts (source: own Study based on the data from the Maritime Administration Spatial Information System)

11 RISK OF A SERIOUS FAILURE OR NATURAL AND CONSTRUCTION DISASTER

11.1 Risk of a serious failure

In accordance with Article 3 point 23 of the Act of April 27, 2001 - Environmental Protection Law (Journal of Laws of 2021 item 1973, as amended) a major failure shall mean "*an event, in particular emission, fire or explosion, occurring during an industrial process, storage or transportation, in which one or more hazardous substances are used, leading to the immediate hazard to life or health of people or to the environment or the delayed occurrence of such a hazard.*"

The planned Project will not be a site of storage of substances determining the classification of the project as a plant of increased or high risk of occurrence of a major industrial failure in accordance with the Regulation of the Minister of Development of January 29, 2016 *on types and volumes of hazardous substances present in the plant, which decide on classification of the plant as the plant of increased or high risk of major industrial failure* (Journal of Laws of 2016, item 138).

In the case of the 14.E.1 OWF, it is expected that the highest risk of a major failure will relate to the construction and decommissioning phases, in which the highest intensity of works and the largest deployment of vessels in the Project will occur. The highest risk of a major failure should be the leakage of oil derivative substances - mainly diesel oil from vessels to the environment, as a result of a collision with another vessel or elements of the offshore wind farm. Although the risk of such an event is very low, it cannot be completely excluded.

Another cause of a major accident may be the release of hazardous substances from anthropogenic facilities located on the seabed surface or deposited in the seabed sediments. It cannot be excluded that during the preparatory works for the construction process of the 14.E1. OWF, including, in particular, the surveys of the seabed cleanliness for the presence of unexploded ordnance and chemical weapons, anthropogenic objects may be revealed, the violation of which would result in the release of pollutants contained therein (e.g. containers with chemical substances or unexploded ordnance, see: Chapter 2.2). Prior to the commencement of construction works, the Investor will conduct surveys for the presence of unexploded ordnance (UXO) on the seabed. If combat assets/unexploded ordnance are found during these surveys, the Investor shall inform relevant authorities and institutions and comply with the instructions issued by them. In order to determine how to deal with such finds, the Investor shall prepare a plan for dealing with hazardous objects, both from the point of view of operations at sea (e.g., rules for conducting work in the vicinity of potentially hazardous objects) and from the point of view of possible removal or avoidance of the sites where such objects are present. The fundamental assumption of the plan for handling hazardous objects is to avoid hazards to human life and health and to avoid any spread of pollutants from such objects.

11.2 Prevention of failures

The prevention of failures is a set of activities related to the protection of human health and life, the environment and property, as well as reputation of all participants of the processes related to the construction, operation and decommissioning of the 14.E.1 OWF. The highest risk of a failure resulting in a serious threat to the environment concerns the works carried out in the maritime area. To eliminate or minimize it, various measures will be taken which include but are not limited to:

- the preparation of plans for safe construction, operation and decommissioning of the 14.E.1 OWF in accordance with the applicable provisions of law, guidelines and safe work execution instructions;
- the development of rescue plans and trainings for crews and personnel, including rules for updating and verification through regular drills, in particular the determination of procedures for the use of own rescue units, external units, including helicopters;
- the preparation of the plan for the prevention of hazards and pollution generated during the construction and operation of the 14.E.1 OWF;
- the selection of suppliers and certified materials and components of the OWF;
- the precise marking of the OWF area, its facilities and vessels moving within its area;
- the planning of maritime operations;
- the application of the standards and guidelines of the International Maritime Organization (IMO), recognized classification societies, and recommendations of the maritime administration;
- the development of safe navigation plans, with particular emphasis on the construction and decommissioning phases when the intensity of works is the highest;
- the provision of adequate navigation support in the form of valid navigation maps and warnings;

- the provision of direct or indirect navigation surveillance using a surveillance vessel or remote radar surveillance and Automatic Identification System (AIS);
- continuous monitoring of the traffic of service vessels operating during the construction, operation and decommissioning phases;
- creation of a coordination center to supervise the individual project implementation phases;
- the maintenance of permanent communication lines between the coordination center and the coordinator of offshore works and other coordination centers (Maritime Auxiliary Coordination Center in Świnoujście, maritime administration).

Design, process and organizational protections mainly consist in carrying out navigation risk assessments and developing plans to prevent:

- hazards to human life – evacuation plans, search and rescue plans;
- fire hazards;
- hazards of pollution of the natural environment – plan for prevention of hazards and oil pollution. The principle of the obligation to have a plan in place shall apply not only to the facility, but also to all large and medium-sized vessels participating in the process of construction, operation and decommissioning of the OWF;
- risks of construction disasters – all structures are designed taking into account possible extreme conditions, including the appropriate safety factors.

11.3 Risk of a natural disaster

Pursuant to Article 3 section 1 point 1 of the Act of April 18, 2002 on the state of natural disaster (consolidated text, Journal of Laws of 2017, item 1897), a natural disaster is "an event related to the impact of forces of nature, in particular atmospheric discharges, seismic shocks, strong winds, heavy atmospheric precipitation, prolonged occurrence of extreme temperatures, landslides, fires, droughts, floods, ice phenomena on rivers and the sea, lakes and reservoirs, mass occurrence of pests, diseases of plants or animals or infectious diseases of people or the impact of other elements."

In the area of the planned project – the sea area of the Republic of Poland, electric discharges, strong winds and intensive atmospheric precipitation (from among those listed in the quoted definition) may contribute to the occurrence of a natural disaster. The other relate to onshore areas or are not associated with the project. Ice phenomena at sea were also rejected as open waters of this part of the Baltic Sea do not freeze and there is no ice floe drift. The design of wind turbines and the accompanying infrastructure takes into account the need to resist extreme weather phenomena in the period of up to several dozen years of operation. In order to provide protection against discharges, wind turbines are equipped with lightning arresters and overvoltage protection systems (compliant with the international standard IEC 61400-24). Wind turbines have a certain wind performance. In the case of excessively strong winds, the rotor is automatically locked and its blades are set in such a way that the pitch angle is as small as possible – it has the smallest resistance. The structure of wind turbines and systems that provide protection against the impact of extreme weather phenomena almost completely exclude the possibility of occurrence of a natural disaster which would result in destruction of OWF elements.

It is also not expected that the impact of extreme weather phenomena could lead to damage to or destruction of vessels serving the construction, operation and decommissioning of the 14.E.1 OWF. All works performed at sea shall be carried out under the conditions specified in the work plan and immediately interrupted when they are exceeded.

11.4 Risk of a construction disaster

Pursuant to Article 73 section 1 of the Act of July 7, 1994 – *Construction Law* (consolidated text, Journal of Laws of 2021, item 2351, as amended), a construction disaster *"is an unintentional, violent destruction of a civil structure or part thereof, as well as structural elements of scaffolding, elements of forming devices, sheet piling and excavation support*." In the case of the 14.E.1 OWF, a construction disaster – destruction of wind turbines and/or the accompanying infrastructure – could result from the occurrence of an emergency situation, in this case due to collisions with a vessel or extreme weather phenomena. The probability of occurrence of such situations will be very low, additionally eliminated and minimized by design and organizational solutions developed for safe performance of works at sea.

11.5 Other releases and emissions

Vessels that participate in the construction, operation and decommissioning of the OWF will be the place of storage of various substances and materials, including municipal waste and wastewater. Their possible release into the sea may result in sea pollution and deterioration of the state of the environment. The strength and spatial extent of the negative environmental impact depend on the type of substances or materials released and the size of the release. A release of small amounts of oils and lubricants during normal operation of vessels is also possible. In order to protect the marine environment against pollution, the vessels involved in the implementation of the project will meet the requirements and will be subject to the provisions of the "MARPOL Convention and national regulations prepared by Polski Rejestr Statków S.A. (Rules for Statutory Survey of Sea-going Ships. Part 9, Environmental Protection), in particular procedures resulting from waste management plans, oil spill prevention plans and sea pollution prevention plans.

12 ANTICIPATED AMOUNTS AND TYPES OF WASTE GENERATED AND THEIR IMPACT ON THE ENVIRONMENT

In the construction and decommissioning phase of the 14.E.1 OWF, various types of waste related to the operation of vessels and equipment used for the construction of the offshore wind farm will be generated, and in the operation phase, waste generated by vessels performing inspections and service works will be generated. The anticipated types and amounts of generated waste are presented in the tables (Table 12.1 and Table 12.2). Waste names and codes comply with the Regulation of the Minister of Climate of January 2, 2020 *on the waste catalog* (Journal of Laws of 2020, item 10). At this stage of project development, it is not possible to precisely determine the types and quantities of generated waste, therefore, the tables include all theoretically possible types of waste and estimates of their maximum expected amounts, on the basis of information on the assumed technology and the longest assumed time of works in the maritime area.

Table 12.1. List of maximum estimated amounts of waste generated during the construction and decommissioning phase of the 14.E.1 OWF. The types and amounts of waste listed refer separately to each phase and their entire expected duration. (source: own study)

WASTE CODE (*hazardous waste)	WASTE TYPE	ESTIMATED MAXIMUM QUANTITY [kg]
13	**Waste oils and liquid fuel waste (except for edible oils and groups 05, 12, and 19)**	
13 01	**Waste hydraulic oils**	
13 01 09*	Mineral-based chlorinated hydraulic oils	200
13 01 10*	Mineral-based non-chlorinated hydraulic oils	200
13 01 11*	Synthetic hydraulic oils	200
13 02	**Waste engine, gear and lubricating oils**	
13 02 04*	Mineral-based chlorinated engine, gear and lubricating oils	200
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	200
13 02 06*	Synthetic engine, gear and lubricating oils	200
13 02 07*	Readily biodegradable engine, gear and lubricating oils	200
13 02 08*	Other engine, gear and lubricating oils	200
13 04	**Bilge oils**	
13 04 03*	Bilge oils from seagoing vessels	500
13 05	**Oil/water separator contents**	
13 05 02*	Sludge from oil/water separators	200
13 05 06*	Oil from oil/water separators	200

WASTE CODE (*hazardous waste)	WASTE TYPE	ESTIMATED MAXIMUM QUANTITY [kg]
13 05 07*	Oily water from oil/water separators	200
13 07	**Liquid fuel waste**	
13 07 01*	Fuel oil and diesel oil	200
13 07 02*	Petrol	200
13 08	**Waste not included in other subgroups**	
13 08 80	Oily solid waste from ships	200
14	**Waste organic solvents, refrigerants and propellents (excluding groups 07 and 08)**	
14 06	**Waste organic solvents, refrigerants and foam/aerosol propellents**	
14 06 02*	Other chlorinated solvents and solvent mixtures	200
14 06 03*	Other solvents and solvent mixtures	200
15	**Packaging waste; sorbents, wiping cloths, filter materials and protective clothing not specified in other groups**	
15 01	**Packaging waste (including separately collected municipal packaging waste)**	
15 01 01	Paper and cardboard packaging	1000
15 01 02	Plastics packaging	1000
15 01 03	Wooden packaging	1000
15 01 04	Metal packaging	1000
15 01 05	Multi-material packaging	1000
15 01 06	Mixed packaging waste	1000
15 01 07	Glass packaging	1000
15 01 09	Textile packaging	1000
15 02	**Sorbents, filter materials, wiping cloths and protective clothing**	
15 02 02*	Sorbents, filtering materials (together with oil filters not included in other groups), wiping fabrics (e.g. rags and cloths) and protective clothing contaminated with hazardous substances (e.g. PCBs)	500
15 02 03*	Absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02	500
16	**Waste not included in other groups**	
16 06	**Batteries and accumulators**	
16 06 01*	Batteries and rechargeable batteries containing lead	500
16 06 02*	Nickel–cadmium batteries and rechargeable batteries	500
16 06 04	Alkaline batteries (excluding 16 06 03)	500
16 06 05	Other batteries and accumulators	500
16 81	**Waste generated in consequence of accidents and force majeure events**	
16 81 01*	Waste displaying hazardous properties	50
16 81 02	Waste other than that mentioned under 16 81 01	50

WASTE CODE (*hazardous waste)	WASTE TYPE	ESTIMATED MAXIMUM QUANTITY [kg]
17	**Wastes from the construction and renovation of buildings**	
17 04	**Metallic and metal alloy waste and scrap**	
17 04 11	Cables other than those mentioned in 17 04 10	5000
17 09	**Other construction and demolition wastes**	
17 09 03*	Other construction and demolition wastes (including mixed wastes) containing hazardous substances	2000
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	2000
19	**Waste from systems and equipment used for waste management, water treatment plants and treatment of potable water and water for industrial purposes**	
19 08	**Waste from wastewater treatment plants not included in other groups**	
19 08 05	Stabilized municipal wastewater sludges	5000
20	**Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions**	
20 01	**Municipal waste sorted and selectively collected (except for 15 01)**	
20 01 01	Paper and cardboard	500
20 01 02	Glass	500
20 01 08	Biodegradable kitchen waste	500
20 01 29*	Detergents containing hazardous substances	500
20 01 30	Detergents other than those mentioned in 20 01 29	500
20 01 33*	Batteries and accumulators including those mentioned in 16 06 01, 16 06 02, or 16 06 03, and unsorted batteries and accumulators containing these batteries	100
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	100
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components (1)	500
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	500
20 03	**Other municipal waste**	
20 03 01	Mixed municipal waste	2000

Table 12.2. List of maximum estimated amounts of waste generated in each year of the 14.E.1 OWF operation phase (source: own study)

WASTE CODE (*hazardous waste)	WASTE TYPE	ESTIMATED MAXIMUM QUANTITY [kg]
16 81	**Waste generated in consequence of accidents and force majeure events**	
16 81 01*	Waste displaying hazardous properties	1
16 81 02	Waste other than that mentioned under 16 81 01	1
19	**Waste from systems and equipment used for waste management, water treatment plants and treatment of potable water and water for industrial purposes**	
19 08	**Waste from wastewater treatment plants not included in other groups**	
19 08 05	Stabilized municipal wastewater sludges	100
20	**Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions**	
20 01	**Municipal waste sorted and selectively collected (except for 15 01)**	
20 01 01	Paper and cardboard	10
20 01 02	Glass	10
20 01 08	Biodegradable kitchen waste	20
20 01 29*	Detergents containing hazardous substances	5
20 01 30	Detergents other than those mentioned in 20 01 29	10
20 01 33*	Batteries and accumulators including those mentioned in 16 06 01, 16 06 02, or 16 06 03, and unsorted batteries and accumulators containing these batteries	10
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	10
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components (1)	50
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	50
20 03	**Other municipal waste**	
20 03 01	Mixed municipal waste	100

The waste generated will be properly stored and secured on vessels in accordance with the marine pollution prevention plan in force on each vessel, drawn up in accordance with the requirements of the Act of March 16, 1995 *on the prevention of marine pollution from vessels* (consolidated text, Journal of Laws of 2020, item 1955, as amended). In ports, waste will be transferred to port reception facilities and managed in accordance with the applicable port waste management plan and cargo residues from vessels (Act of May 12, 2022 *on port reception facilities for the delivery of waste from vessels* (Journal of Laws of 2022, item 1250)).

13 DEMOLITION WORKS RELATED TO PROJECTS THAT MAY HAVE A SIGNIFICANT IMPACT ON THE ENVIRONMENT

In the area of the planned Project, there are no structures, plants, and other facilities. Therefore, there will be no need to perform demolition works prior to the commencement of construction of the 14.E.1 OWF.

14 SCOPE OF ENVIRONMENTAL SURVEYS FOR THE PREPARATION OF THE EIA REPORT

As part of the procedure for obtaining the decision on environmental conditions, the Applicant should perform environmental surveys for the 14.E.1 OWF area. The scope of surveys was prepared based on the conducted environmental surveys and performed environmental impact assessments as part of the procedures for obtaining the decision on environmental conditions for other offshore wind farms in the Polish maritime areas: Baltica-1 OWF, Baltic Power OWF, BC-Wind OWF, Bałtyk II OWF, Bałtyk III OWF, and FEW Baltic II.

The obtained results of surveys of the abiotic and biotic environment, taking into account the specificity of the 14.E.1 OWF location, will enable the performance of the environmental impact assessment of the project in question to the extent specified in Article 66 of the Act of October 3, 2008 *on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments* (consolidated text, Journal of Laws of 2023, item 1094). The conducted surveys will provide necessary and fully representative results necessary to characterize and assess the status of the tested components and determine their variability, depending on phenological phenomena, or in the case of biotic components, depending on their behavior and variable activity during the year in the area of the Project and its impact area.

The periods and frequency of surveys carried out for individual elements of the environment result from their specificity and time variability and take into account phenological periods of organisms and commonly used survey methodologies for them. The spatial ranges of surveys of individual elements were based on the assumed ranges of the Project's potential impact on these elements in each phase. The results of the performed surveys together with the available literature information will constitute the basis for preparing the full environmental characteristics within the 14.E.1 OWF area and the area of potential impact of the Project. The characteristics of the environmental status prepared in this manner will allow for a complete assessment of impacts, in accordance with the methodological requirements for analyses and calculations necessary to determine the environmental effects that may arise as a result of the implementation of the 14.E.1 OWF. Finally, the obtained results of environmental surveys, analyses, and assessments will be sufficient to determine potential actions minimizing the impact of the Project and to indicate the scopes of surveys to be performed in the construction, operation, and decommissioning phases of the Project.

Environmental surveys to obtain the decision on environmental conditions will be carried out as part of individual survey blocks described below. The Applicant will also use the results of publicly available environmental surveys, including those conducted in the analyzed area by GIOŚ, to characterize the project area.

Based on the available results of **geophysical** surveys, bathymetric and sonar maps will be prepared in the 14.E.1 OWF survey area, the seabed relief will be determined and the facilities present in the seabed that may affect further implementation of the Project will be preliminarily identified. On the basis of geophysical data and preliminary survey of bottom sediments, potential areas of occurrence of raw material resources (natural aggregates) in the survey area will be determined. Moreover, the results of geophysical surveys constitute detailed information on the nature of bottom habitats, used for final determination of sampling points for benthic organisms and for interpretation of the obtained results of benthic surveys and bird survey results, as well as for assessment of the impact of suspended matter agitation on the water depth related to seabed intervention works.

As part of **hydrological** and **meteorological** surveys taking into account sea currents within 12 full months, the measurements of air humidity, atmospheric pressure, wind speed and direction, air temperature, water flow speed and direction, height and period of waves, electrolytic conductivity of water, water turbidity, and water temperature will be performed by ongoing recording on the survey area of the 14.E.1. OWF. The obtained survey results will enable the preparation of a detailed description of hydrological and meteorological conditions prevailing in the area of the Project. The results of hydrological measurements will be used to model the spread of suspended matter in the water depth and its sedimentation as a result of works disturbing bottom sediments. Moreover, the obtained results will provide sufficient information on hydrological conditions necessary for analyzing and interpreting the results of biotic surveys in the fields of benthic organisms and ichthyofauna.

As part of **physical and chemical surveys of water** in the survey area of the 14.E.1. OWF, oxygen conditions will be determined **six times** per year by measurements of dissolved oxygen concentration, five-day oxygen demand (BOD5), and total organic carbon concentration. What is more, measurements of acidification (pH) and alkalinity of water and content of biogenic substances (ammonium nitrogen, nitrate nitrogen, nitrite nitrogen, total nitrogen, mineral nitrogen, phosphates and total phosphorus) and total suspended matter should be performed. The content of harmful substances, such as mercury, nickel, lead, cadmium, arsenic, total chromium, chromium (VI), phenols, cyanide, aluminum, mineral oils, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) will be determined **once**. At the measurement and testing stations, water samples taken from vertical profiles will be used to perform **one-time measurements** of the radioactive activity of caesium (^{137}Cs) and strontium (^{90}Sr) isotopes. The obtained results of physical and chemical tests of water will enable the development of detailed characteristics of the survey area, including in the context of the environmental impact assessment of the Project. They will also allow interpretation of the obtained survey results in the field of benthic organisms and ichthyofauna.

As part of **physical and chemical tests of bottom sediments** in the survey area of the 14.E.1. OWF, the following measurements will be performed once: measurements of moisture content, loss on ignition (LOI), organic carbon content, heavy metal content (lead, copper, zinc, nickel, cadmium, chromium, arsenic, mercury, and aluminum) and their labile forms; concentrations of polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs); the content of biogenic substances (total nitrogen and total phosphorus), mineral oils, butyltin compounds (BT) and radioactive activity of caesium (^{137}Cs). In addition, measurements of the content of biogenic substances (total nitrogen and total phosphorus) will be performed. The spatial scope of the surveys will be adapted to the area where interference with the seabed will occur as a result of the works, and thus to the release of suspended matter and substances contained in sediments into the water depth. The obtained results of physical and chemical tests of bottom sediments will enable the development of detailed characteristics of the survey area, including in the context of the environmental impact assessment of the Project. They will also be used to assess the risk of release of the analyzed chemical compounds as a result of seabed disturbance and exposure of biotic elements of the marine environment to them.

Background noise measurements will be performed using acoustic recorders equipped with ultrasonic hydrophones for one year in the vicinity of the 14.E.1. OWF survey area. The measurements will be carried out in accordance with the recommendations of the expert group on underwater noise under the Marine Strategy Framework Directive (Dekeling et al. 2014a, b, c) and BSH (2011). The obtained measurement results will allow for development of detailed characteristics of the survey area, including in the context of the environmental impact assessment of the Project.

Phytobenthos surveys will be carried out in the area of the 14.E.1. OWF survey area to verify its occurrence. If phytobenthos is found and sampling is possible, its taxonomic composition and biomass should be determined. The obtained results will allow to develop the characteristics of the survey area in the context of the impact assessment of the Project on phytobenthos communities.

Zoobenthos surveys will be carried out in the 14.E.1. OWF survey area. As part of these surveys, taxonomic composition, population, and biomass will be determined and the length of bay mussels will be measured in the context of the seabird food base. The obtained results will allow to develop the characteristics of the survey area in the context of the impact assessment of the Project on zoobenthos communities. Information on the prevailing abiotic conditions, i.e.: hydrological, geochemical, and geophysical conditions in the survey area, used to interpret the results of zoobenthos surveys, will be determined based on the results of surveys of these environmental elements carried out as part of the above-described surveys of abiotic components.

In the 14.E.1. OWF survey area, **ichthyofauna** surveys covering ichthyoplankton, pelagic fish, and demersal fish will be carried out. The purpose of the surveys will be to determine the characteristics of the ichthyofauna complex occurring during the year in the area of the planned construction and operation of the 14.E.1. OWF, and in particular:

- examining the species composition and abundance of ichthyoplankton;
- determination of the occurrence and relative density of pelagic fish using acoustic equipment in conjunction with pelagic control fishing;
- determination of the occurrence and productivity of demersal fish on the basis of fishing with bottom trawls and sets of survey nets;
- determination of the structure and characteristics of fish species present in survey fishing, with particular emphasis on species being the target of fishing, through a set of biological data (length, age, sex, weight, sexual maturity).

Ichthyofauna surveys will be carried out on an annual basis, taking into account 4 field activities cycles covering all seasons of the year.

The obtained survey results together with the analysis of literature and available data describing the results of long-term ichthyofauna surveys, including in particular in the scope of: the condition of fish stocks (ICES studies), migration, presence of spawning grounds and feeding grounds for fish (HELCOM studies) will allow to develop the characteristics of the survey area in the context of the impact assessment of the Project on fish communities, including places important for their functioning, i.e. feeding grounds and spawning grounds.

Marine mammal surveys will be carried out in an ongoing recording mode using F-POD devices within one year in the 14.E.1. OWF survey area. Passive acoustic monitoring will allow to assess the occurrence and activity of porpoises in the survey area. It will also determine the variability of porpoises appearing during the year. For this purpose, indicators such as detection positive days (DPD) and detection positive minutes (DPM) will be specified. Additionally, observations for the presence of marine mammals will be carried out during surveys of seabirds from vessels (twice a month for a period of one year). The characteristics of the survey area should also include literature data and results of other international surveys, e.g. “Static Acoustic Monitoring of the Baltic Sea Harbor Porpoise – SAMBAH”. The data will also be used to indicate possible routes of movement of marine mammals. After considering the results from passive acoustic monitoring and observations of marine mammals from vessels, the significance of the 14.E.1. OWF area for individual species will be determined. The obtained results will allow to develop the survey area characteristics in the context of the impact assessment of the Project on marine mammals.

The surveys of avifauna covered seabirds (sitting on water and birds flying over the water) and migratory birds.

Seabird surveys will last one year (two inspections per month) and will include determination of taxonomic composition, number and distribution of birds sitting on water, additionally flying birds will be recorded.

Surveys of flying and **migratory birds** will be carried out from one measurement and research station, from which visual observations will be carried out in order to determine taxonomic composition, intensity of migrations and directions of bird flights. Moreover, the following radars will be used at the measurement and research station for surveys: a horizontal radar used to establish the flight trajectory and a vertical radar to determine flight altitudes. Acoustic recordings will also be made during migration periods in order to identify taxonomic composition. Surveys of migratory birds will be carried out during one year, including in winter and during spring and autumn migrations. The obtained results will allow developing the survey area characteristics in the context of the assessment of the impact of the Project on seabirds and migratory birds, including determining the significance of the survey area as the space used by birds. Moreover, they will be used to perform an analysis of bird collisions with the above-water structural elements of 14.E.1. OWF, to assess the barrier effect and potential driving out from the area and changes in bird density.

As part of **chiropterofauna** surveys, the taxonomic composition and activity of bats in 14.E.1. OWF survey area will be determined. The surveys will be performed in two survey periods. During spring migration (April-May), all-night inspections will be carried out along the survey transect (at least 6 inspections in total) and permanent all-night listening will be carried out on the measuring beacons from sunset to sunrise. During the autumn migration (August-October), all-night inspections will be carried out along the survey transect (at least 8 inspections in total) and permanent all-night listening will be carried out on the measuring beacons; in August and September, recordings will start 4 hours before sunset and end 4 hours after sunrise. In September, 2 of the transect inspections carried out this month will start 2–4 hours before sunset and end 2-4 hours after sunrise in order to detect migration of the common noctule (*Nyctalus noctula*) – spot recording at a designated point on the surface. The surveys carried out at the metering and research stations and at the same time at transects will enable spatial coverage of the entire area of the 14.E.1. OWF together with the area of its potential impact. The obtained results will allow developing the survey area characteristics in the context of the assessment of the Project impact on bats, including determining the significance of the survey area as the space used by them.

All tests and measurements shall be performed in accordance with the applicable regulations, standards and methodologies as well as the literature of the subject.

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