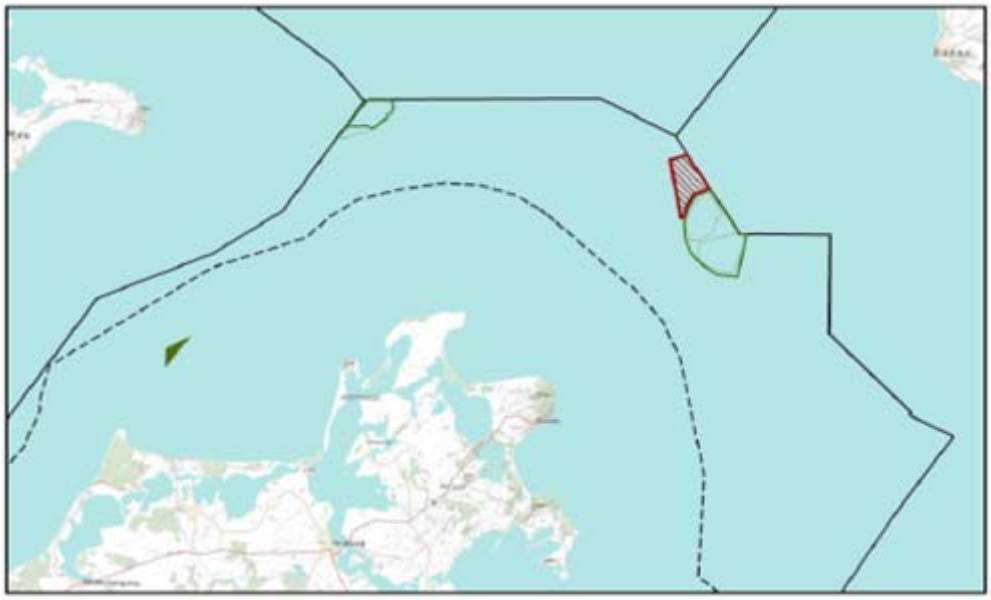
Technical description of project

"WINDANKER" WIND FARM



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IBERDROLA

Table of contents

1 Introduction 6
1.1 Objective 6
1.2 Applicant 6
1.3 Purpose and motivation 8
1.4 Legal framework 8
2 Brief description of the project 9
3 Project area 11
3.1 Description of the project area 12
3.2 Selection of the site 14
3.3 Other possible solutions investigated 16
3.4 Impacts on matters of public interest affected by the project 16
3.4.1 Marine environment and bird migration 16
3.4.2 Shipping 16
3.4.3 Air Traffic 17
3.4.4 Pipelines and submarine cables 18
3.4.5 Extraction of raw materials 18
3.4.6 Military interests 19
3.4.7 Fishing 19
3.4.8 Tourism 20
3.4.9 Material and cultural assets 22
4 Concept for the determination and evaluation of the impact on public interests 23
5 Technical concept 26
5.1 Configuration of the wind farm 26
5.2 Wind energy plant 26
5.2.1 REpower 6M 27
5.2.2 SIEMENS SWT-6.0 28
5.3 Foundation and installation concept 29
5.3.1 Jackets 30
5.3.2 Monopiles 32
5.3.3 Gravity foundations 33
5.4 Electrical engineering concept 35
5.4.1 Power connection 35
5.4.2 Offshore Transformer Platform 35
5.4.3 Internal Cabling of the Wind Farm 36

5.5 Construction concept 36
5.5.1 Installation of the foundations 38
5.5.2 Construction of the wind energy plant 38
5.5.3 Internal cabling of the wind farm 38
5.6 Operational, protection and safety concepts 39
5.6.1 Protection and safety concept 39
5.6.2 Operation and maintenance concept 40
5.6.3 Remote monitoring 40
5.6.4 Waste management and operating materials concept 41
5.6.5 Operational safety in case of emergency 41
5.6.6 Safety zones 41
5.6.7 Marking 41
5.6.8 Lightning protection 44
5.6.9 Corrosion protection 45
5.7 Decommissioning concept 46
6 Time schedule and plan of measures 47
7 Sources 48

List of abbreviations

AIS	Automatic Identification System
AVV	General Administrative Regulation
EEZ	Exclusive economic zone
EEZ Nordsee-ROV	Ordinance on the regional development of the German exclusive economic zone in the North Sea
BAW	Federal Agency for Waterways Engineering
BBergG	Federal Mining Act
BSH	Federal Maritime and Hydrographic Agency
CONTIS	Continental Shelf Information System
DFS	German Air Navigation Services
EnWG	German Energy Act
R&D	Research and development
FFH	Flora Fauna Habitat
HGÜ	High voltage direct current transmission
IALA	International Association of Lighthouse Authorities
LEP	Regional Development Plan
ODAS	Ocean Data Acquisition System
OWEA	Offshore wind energy plant
OWP	Offshore wind farm
ROG	Regional Development Act
ROV	Regional Development Procedure
SeeAnlV	Offshore Installations Ordinance
SeeAufgG	Federal Maritime Responsibilities Act
SRÜ	United Nations Convention on the Law of the Sea
StUK 3	Standard investigation of the effects of offshore wind energy plants on the marine environment, status: February 2007
UK	United Kingdom - Great Britain
UVPG	Environmental Impact Study Act
ÜNB	Transmission grid operator
VTG	Traffic Separation Scheme

WEA	Wind energy plant
WSD	Waterways and Shipping Directorate
WSV	Waterways and Shipping Administration

List of figures

Fig. 1.: Location of the wind farm 12
Fig. 2: Location of the project and further approved wind farm projects 13
Fig. 3: Detailed view with corner points of the wind farm 13
Fig. 4: Visibility of the "Wikinger" and "Arkona-Becken Südost" offshore wind farms, observation point "Königsstuhl" (Arcadis 2005) 21
Fig. 5: Example of daytime marking with painting and lettering. 42

List of tables

Table 1: Key Data of the project 11
Table 2: Corner coordinates of the application area 14
Table 3: Concept for the determination and evaluation of the impact on public interests 25
Table 4: Technical data of the REpower 6M 27
Table 5: Technical data of the SIEMENS SWT-6.0 29
Table 6: vessels necessary during the construction phase 37
Table 7: planned time schedule 47

1 Introduction

1.1 Objective

In the interest of climate protection, it is the declared objective of the German Federal Government to increase the proportion of renewable energy in the electricity supply. According to the integrated energy and climate programme of the German Federal Government (2007) in the current version of the Renewable Energy Act (EEG) (2012), a specific proportion of at least 35% by the year 2020 was set, which is to be continuously increased to 80% by the year 2050.

Considerable potential for this lies in the use of offshore wind energy. According to the strategy of the Federal Government for the use of offshore wind energy in the context of its policy for sustainability (January 2002), the framework conditions for this are to be set up as quickly as possible. By 2030, a wind energy output of between 20,000 and 25,000 MW is to be achieved.

Against this background, in 2005, areas of special suitability were specified in the German exclusive economic zone (EEZ) according to § 3a SeeAnlV (Offshore Installations Ordinance). The ordinance on regional development in the German exclusive economic zone in the Baltic Sea (EEZ Ostsee-ROV) came into effect on 10th December 2009. In accordance with the SeeAnlV, the areas of special suitability "Westliche Adlergrund" and "Kriegers Flak" were taken into account in keeping with the objectives of the regional development for the Baltic Sea and were declared to be priority areas for wind energy.

The permissibility is governed by the Offshore Installations Ordinance (SeeAnlV). The planning procedures for offshore plants as required by the SeeAnlV take into account separate questions regarding safety ease of navigation, the marine environment and other potentially overriding public interests, whereby the specification of the development and priority area is taken into account.

1.2 Applicant

The applicant and project sponsor of the "WINDANKER" offshore wind farm project is **Iberdrola Renovables Offshore Deutschland Zwei GmbH**.

Renewable energy Division - Iberdrola Renovables

The Renovables Division is particularly concerned with the promotion, building and operation of power generation equipment using renewable energy sources, as well as the sale of the electricity which is generated. At present, the company concentrates its activities on wind energy as well as the generation of energy by means of small hydroelectric power stations. In addition, Iberdrola is involved in the development of technologies such as thermal solar power plants and the generation of energy from biomass and tidal range.

With over 13,500 MW of plants for renewable energy in operation, and over 62,000 MW in the world's largest project pipeline, Iberdrola has established itself as the world market leader in the

field of wind energy. At present, the Renovables Division is represented in over 20 countries and employs approximately 2,000 worldwide. In recent years, the Iberdrola Renovables Division has developed into the strongest growth engine within the Iberdrola Group. The Iberdrola Group is represented in about 40 countries and is one of the leading Spanish groups in the energy sector, and one of the five largest electricity utilities in the world. At present, the Iberdrola Group employs about 30,000 people worldwide.

Iberdrola Renovables and Offshore Wind Energy

Iberdrola prioritises the development of offshore wind energy, as this technology for the generation of electricity from the renewable energy source of offshore wind energy is comparable to that of onshore wind energy with regards to efficiency, costs and the volume of energy generated. At present, offshore wind projects are being developed in Great Britain and Germany and are in the course of preparation in other European countries.

In Great Britain, Iberdrola is involved in three different offshore projects with a total of 9,500 MW, partly via joint ventures. Iberdrola's share in planned offshore wind farms is approximately 5,730 MW. Iberdrola has a two-third share in the 389 MW offshore wind farm "West Duddon Sands" on the west coast of Britain - a joint venture with DONG. In addition, our company has acquired the exclusive rights from the "Crown Estate" to exploit an area in Scottish waters near to the island of Tiree, known as the "Argyll Array", with a potential power output of up to 1,800 MW. In line with our commitment to offshore wind energy, we have founded a bidding consortium together with Vattenfall Europe, the world's second largest offshore operator and together have successfully participated in the 3rd round of the offshore bidding process of the British Crown. This joint venture was granted the exclusive rights to the Norfolk Zone (now East Anglia) with a development potential of up to 7,200 MW. In France, Iberdrola is also participating in the bidding round for offshore wind farm projects. In Spain, the development of offshore wind energy is also being prepared with support from Iberdrola.

Iberdrola is involved in R&D projects for offshore wind energy, for example the "Offshore Wind Accelerator" project promoted by the Carbon Trust from Great Britain (with the main emphasis being the reduction of costs). New foundation concepts, such as raft foundations are also being analysed and new research infrastructures for offshore wind energy are being promoted. Furthermore, Iberdrola is also involved in the EU project "Twenties" which is concerned with the integration of wind energy and renewable energies into the European electricity grid.

Iberdrola in Germany

Since 1st July 2005, Iberdrola has been represented on the German market via its subsidiary company. Among other things, Iberdrola is a member of the EWEA, the Federal Wind Energy Association (BWE), the Offshore Wind Energy Foundation and the Offshore Wind Energy Forum (OFW).

One of the most important objectives of Iberdrola Renovables Offshore Deutschland Zwei GmbH is to extend its activities in the German sustainable market in the medium to long term, and to establish itself as a sustainable power plant operator, especially in the offshore field in the North Sea and the Baltic Sea. With the takeover of the entire project rights in March 2010, Iberdrola is the new owner of the "WIKINGER" offshore wind farm project (formerly Ventotec Ost 2). In addition, in 2009, application procedures were initiated for offshore wind energy projects in the German EEZ in the Baltic Sea, namely the "STROM-NORD" and "STROM-SÜD" offshore wind farms.

1.3 Purpose and motivation

With the present documents, Iberdrola Renovables Offshore Deutschland Zwei GmbH applies for the construction and permanent operation of the "WINDANKER" offshore wind farm. To the north, the planned project area directly adjoins the areas of special suitability according to the Offshore Installations Ordinance (SeeAnlV) and the "Westlich Adlergrund" priority area for wind energy according to the regional development of the German EEZ for the Baltic Sea (EEZ Ostsee-ROV). The approved "Wikinger" and "Arkona-Becken Südost" wind farm projects are within its boundaries. Knowledge of the relevant approval procedures was used for the identification of the areas of special suitability. With the present application, the adjoining northern area is to be investigated with regard to its suitability for the exploitation of wind energy. Due to the spatial association, to some extent similar conditions for approval are to be expected. Essentially, the project corresponds to the objectives of the Federal Government with regards to the implementation of the turnaround in energy policy and the development of offshore wind energy.

1.4 Legal framework

The application area is located in the exclusive economic zone (EEZ) of the Federal Republic of Germany. Plan approval procedures for projects for the generation of wind energy in the EEZ are governed by the Offshore Installations Ordinance (SeeAnlV). The basis of the SeeAnlV is the United Nations Convention on the Law of the Sea dated 10th December 1982 (SRÜ) and the Federal Maritime Responsibilities Act (SeeAufgG).

In 2005, areas of special suitability were specified in the German exclusive economic zone (EEZ) according to § 3a SeeAnlV (Offshore Installations Ordinance). The declaration of the areas of suitability functions as an expert assessment, which establishes the fundamental suitability of the

areas for the construction of wind farms (§ 3a paragraph 2 SeeAnlV). In the Baltic Sea, the two areas "Kriegers Flak" and "Westlich Adlergrund" have been declared as areas of suitability. With the ordinance for regional development in the German exclusive economic area in the Baltic Sea (EEZ Ostsee-ROV), which came into effect on 10th December 2009, the areas of special suitability "Westlich Adlergrund" and "Kriegers Flak" were also declared to be priority areas for wind energy. Accordingly, these areas are primarily used for the generation of wind energy; other uses, which are not compatible with the generation of wind energy, are not permitted (so-called "reservation function" of priority areas). The present "WINDANKER" wind farm project application directly adjoins the special development and priority area "Westlich Adlergrund".

According to § 17, paragraph 3 in association with § 5 paragraph 6 of the new version of the SeeAnlV, valid as of 31.01.2012, a plan for a project in the EEZ can only be approved if:

1. the safety and ease of navigation and the security of State and Federal defence is not impaired,
2. the marine environment is not endangered, in particular pollution of the marine environment within the meaning of Article 1 paragraph 1, no. 4 of the United Nations Convention on the Law of the Sea dated 10th December 1982 (BGBI 1994 II S. 1798, 1799) is not to be expected, and the migration of birds is not endangered and
3. other requirements of the Offshore Installations Ordinance or other regulations under public law are fulfilled.

According to §3 paragraphs 1 and 2 of the new version of the SeeAnlV, protection against competition can be achieved by an application which complies with certain minimum requirements. Due to the transitional provision in § 17 paragraph 6 of the new version of the SeeAnlV, the regulation for protection against competition must not be used to the detriment of competitive applications which were made before the new version of the SeeAnlV came into effect. However, the regulation for protection against competition can also protect old applications against new applications, which were made after the new version of the SeeAnlV came into effect.

2 Brief description of the project

Iberdrola Renovables Offshore Deutschland Zwei GmbH applies for planning approval for the construction and operation of the "WINDANKER" wind farm in the German EEZ of the Baltic Sea.

The project area is located 37 km to the north-east of the island of Rügen and to the north directly adjoins the areas of special suitability according to § 3a SeeAnlV, and the "Westlich Adlergrund" wind energy priority area according to the regional development of the German EEZ of the Baltic Sea (EEZ OStsee-ROV). The depth of water is between 41 and 45 m.

The project plans for the construction of 60 wind energy plants and a transformer platform as well as the necessary cabling for the wind farm. The components of the wind farm which are to be installed correspond to the latest technology at the relevant time.

The grid connection of the wind farm from the transformer platform to the feed point on land for the delivery of the electricity generated offshore is the responsibility of the relevant transmission grid operator and is therefore not the subject of the present application. An application for the grid connection has already been made to the relevant transmission grid operator 50Hertz Transmission GmbH. There is also close contact with 50Hertz in order to take the mutual requirements for the project into account at an early stage.

The type of wind energy plant cannot be finalised at the present time, as the development of plant technology is progressing rapidly and will be taken into account at the time of construction of the wind farm. The final selection of the type of plant will therefore be made in the course of the construction phase. Aspects of reliability and efficiency, market availability and environmental impact will be decisive. From the present point of view, it is expected that at the time of construction of the wind farm, the established offshore wind energy plants will have an output range of between 5 to 8 MW and rotor diameters from about 120 to 170 m. The hub height will be selected specifically for the project and is expected to be in the range between 80 and 120 m.

The selection of the foundations has not been finalised at the present time. From the present point of view, foundations such as jackets or tripods, monopiles and gravity foundations come into question. Environmental impact and technical feasibility play a central role in the selection of the foundation type. In particular, with regards to the aspect of environmental impact, the latest technology and suitable measures for the reduction of the impact on the marine environment must be identified and further developed. The final selection of the foundations will be the subject of the development and construction phase.

The plant in the wind farm will be identified according to the valid requirements for shipping and air traffic. This includes the equipment of the wind farm with visual signals as well as with AIS and sonar. The stipulation of the specifications will be carried out in coordination with the relevant authorities.

Access to the plants for the purpose of maintenance and servicing will essentially be by means of ships. The use of a helicopter will be considered for certain situations. The "Wikinger" offshore wind farm, which adjoins this project to the south will also be developed, constructed and operated by

Iberdrola. Especially with regards to maintenance and servicing of the plants, there will be synergies, which will result in optimisation and therefore minimisation of maintenance traffic.

The start of construction of the offshore wind farm is planned for 2018.

Application area	
Shortest distance to coast (island of Rügen)	37 km
Depth of water	41...45 m
Area of application area	approx. 30 km²
Technical concept	
Number of wind energy plants	60
Number of transformer platforms	1
Wind energy plant power class	expected to be 5 to 8 MW
Total output of wind farm	300 to 480 MW
Rotor diameter of wind energy plant	120 to 170 m
Hub height of wind energy plant	80 to 120 m
Time schedule	
Start of construction and commissioning	2018

Table 1: Key Data of the project

3 Project area

3.1 Description of the project area

The area of the planned "WINDANKER" wind farm project is located in the eastern part of the German EEZ of the Baltic Sea, to the north-east of the island of Rügen. The shortest distance to the coast is to the Jasmund peninsula (island of Rügen) and is 37 km. The nearest point on the mainland is located in the southern area of the Greifswalder Bodden (municipality of Lubmin) at a distance of 82 km.

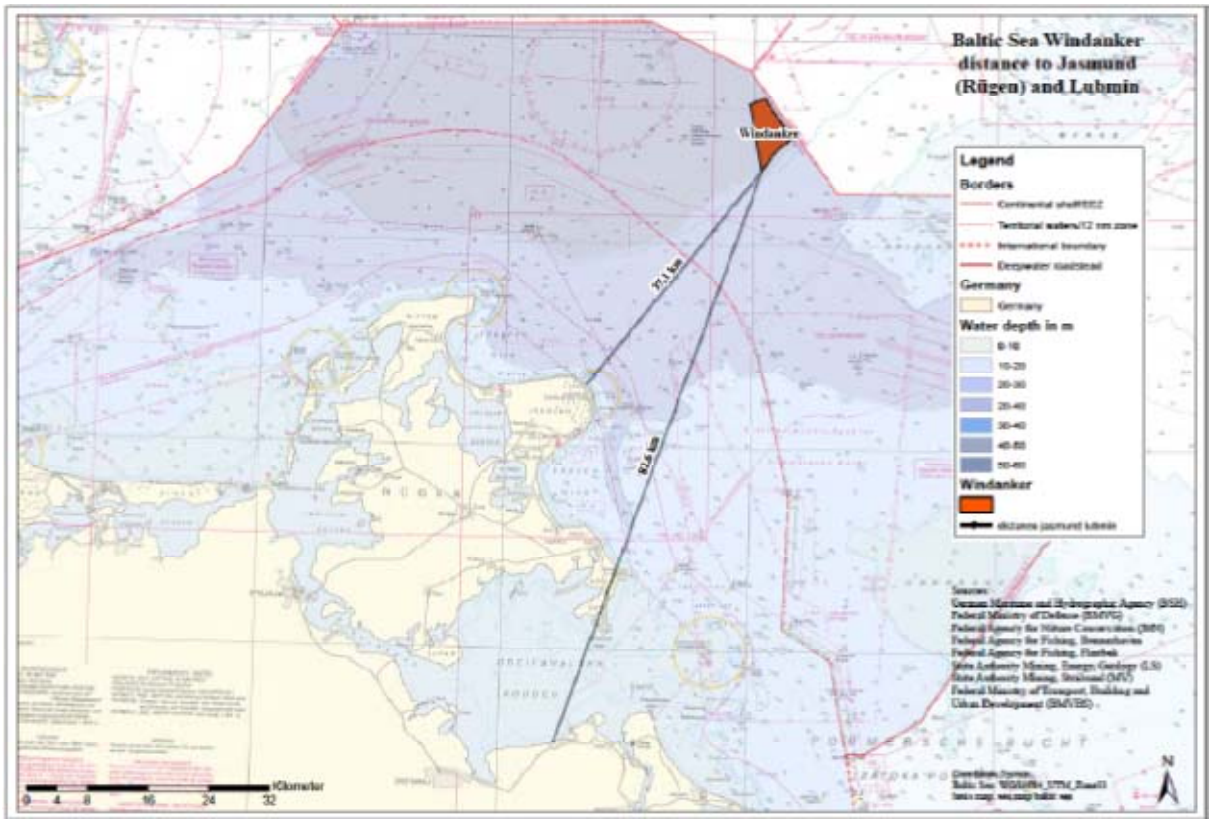

Fig. 1.: Location of the wind farm

The outer boundary of the German EEZ with the Danish EEZ is directly to the east of the wind farm. The plants in the wind farm are separated by a minimum distance of 500 m, measured from the outermost point of the plant. The Swedish EEZ starts at a distance of over 4 km to the north of the project area.

To the south, the project area is directly bounded by the areas of special suitability and priority area of wind energy "Westliche Adlergrund" in which the offshore wind farms "Wikinger" and "Arkona-Becken Südost" are located.

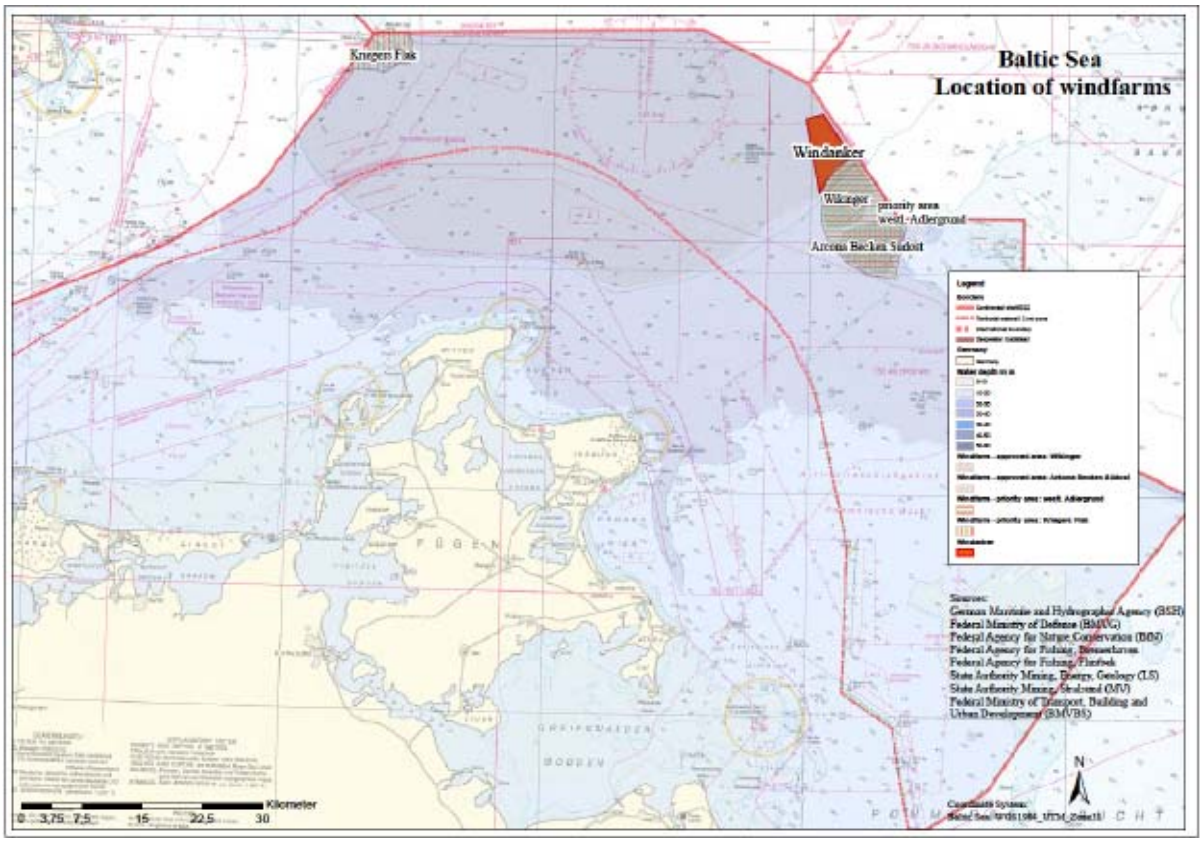

Fig. 2: Location of the project and further approved wind farm projects

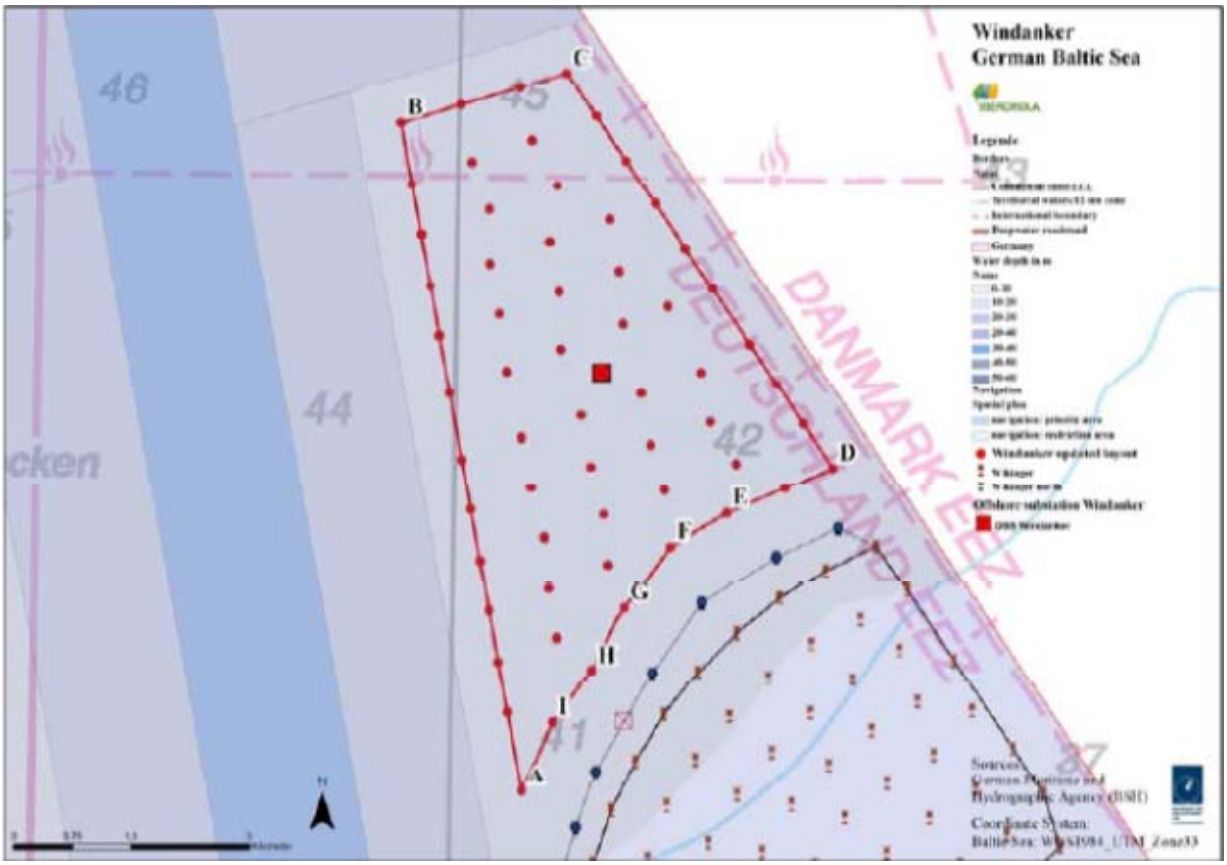

Fig. 3: Detailed view with corner points of the wind farm

The corner coordinates of the project area are listed in Table 2.

World Geodetic System 84 (geographical)		
point	Eastern longitude	Northern latitude
A	14°0' 50.379" O	54°50' 45.221" N
B	13°59' 17.083" O	54°55' 20.318" N
C	14°1' 15.807" O	54°55' 42.126" N
D	14°4' 30.797" O	54°53' 0.543" N
E	14°3' 14.711" O	54°52' 41.101" N
F	14°2' 34.920" O	54°52' 27.044" N
G	14°2' 2.398" O	54°52' 1.257" N
H	14°1' 39.448" O	54°51' 35.589" N
I	14°1' 11.862" O	54°51' 13.619" N

Table 2: Corner coordinates of the application area

The depth of water in the region of the application area is between 41 and 45 m.

No underwater obstructions are stated in the BSH (Federal Maritime and Hydrographic Agency) nautical charts for the site.

To some extent, the application area covers an area in which, according to the BSH CONTIS information system, an offshore wind farm project is planned by another company.

The distance from the western marine area of suitability (LEP M-V 2005) within the 12 nautical mile zone in the jurisdiction of Mecklenburg-Vorpommern is 22.3 km. The target corridor in the regional development plan for the Baltic Sea German EEZ for submarine cables for the delivery of the energy generated in the EEZ is located approximately 15 km to the south.

3.2 Selection of the site

In the interest of the concentration of offshore wind energy plants, an area which extends the existing "Westlich Adlergrund" area of suitability according to § 3a SeeAnlV and the priority area for wind energy according to EEZ Ostsee-ROV has been selected. The approved "Wikinger" and "Arkona-Becken Südost" offshore wind farm projects lie within this area of special suitability.

According to §5 paragraph 6 of the new version of the SeeAnlV, the planning approval for plants must prevent dangers to safety, ease of navigation, the marine environment and other public interests.

Natura 2000 areas were excluded from the selection of the application area. Furthermore, with regard to avoiding impairments to safety and ease of navigation, areas were excluded which are reserved for shipping according to the regional development plan for the German EEZ in the Baltic Sea.

In the regional development plan, in consideration of traffic density priority areas for shipping were specified and supplementary reserved shipping areas were defined as safety zones. To the west and to the north, the application area is adjoined by the reserved and priority areas for shipping according to the regional development plan for the German EEZ in the Baltic Sea. The plants maintain a minimum distance of 500 m from these areas. (see fig.3)

The planned area was selected on the basis of the existing regional development plan for the German EEZ in the Baltic Sea with the criterion of being a site which presents as few conflicts as possible.

A completely blank area for the construction of an offshore wind farm, without any regional development assignment and designated categorisation of the area, does not exist within the regional development plan for the German EEZ in the Baltic Sea. Thus, the "Westlich Adlergrund" priority area for wind energy overlaps an area which is used for military purposes (designated as "military exercise areas"). However, this is an exercise area used by the German Luftwaffe, which occupies the airspace at a considerable altitude above sea level. Therefore there is no conflict with the use of the military exercise area.

To the east, the project area is bounded by the outer boundary of the EEZ with the Danish EEZ. A minimum distance of 500m from the outer boundary of the German EEZ will be maintained by the wind farm. To the south the area directly adjoins the "Westlich Adlergrund" area of special suitability and priority area for wind energy.

To the south, the project area of the "Windanker" wind farm adjoins the planned project area of the "Wikinger Nord" wind farm. The plants maintain a minimum distance of 500 m.

The water depths in the range of 41 and 45 m in the application area allow the use of currently known foundation methods.

The distance of 37 km from the island of Rügen ensures economically justifiable expenses for the maintenance and servicing of the plant.

The overall appearance of the landscape at the site is characterised by the previously approved "Westlich Adlergrund" offshore wind farm projects within the area of special suitability and priority area, as up to then, these offshore wind farms will be the only structures on the site. The construction of the "WINDANKER" offshore wind farm will not significantly change the overall appearance of the landscape due to the additional plants which will be perceivable in suitable weather.

3.3 Other possible solutions investigated

The basis for the project which is applied for, is the public interest in the expansion of offshore wind energy as an important component of the turnaround in energy policy. The following aspects were considered in the selection of a suitable site for the application for an offshore wind farm within the German EEZ in the Baltic Sea:

- Use by shipping (ocean shipping lanes)
- Marine environment, including designated and potential protected areas
- Military interests
- Distance to the shore, impact on the overall appearance of the landscape and ease of access to the plants
- Existence of areas of suitability for the use of wind energy
- Regional development plan of the German EEZ in the Baltic Sea
- Pipelines and Submarine Cables

The established planning area offers the lowest potential for conflict and is therefore suitable for wind energy use.

3.4 Impacts on matters of public interest affected by the project

3.4.1 Marine environment and bird migration

Due to their exceptional importance, the impacts on the marine environment, including bird migration, must be especially carefully determined, analysed and evaluated. With regards to this, reference is made to the attached "Study of the Marine Environment and Technical Concept of the Windanker Offshore Wind Farm" as well as the "Investigation Concept for the Baseline Survey of Possible Impacts of Offshore Wind Energy Plant on the Marine Environment for the Windanker Project".

3.4.2 Shipping

The specifications for shipping in the regional development plan of the German EEZ in the Baltic Sea are the result of extensive regional development considerations, based on the determination of the main ocean shipping lanes on the basis of evaluation of current traffic streams. The basic framework for this specification is formed by the priority and reserved areas for shipping, which are to be kept free of all incompatible forms of use, in particular building structures. In addition, in consideration of the establishment of safety zones around the physical structures of the wind farm plants according to § 11 of the new version of the SeeAnlV, Minimum distances of 500 m from priority and reserved areas for shipping must be maintained in accordance with the regional development plan for the German EEZ in the Baltic Sea.

The "WINDANKER" offshore wind farm is located to the south of the shipping area No. 19 (from the traffic separation area "North of Rügen" to the traffic separation area "Bornholmsgat") and to the east of No. 20 (ferry connection Swinemünde-Ystad) as listed in the regional development plan. The planned offshore wind farm is located outside of the designated priority and reserved areas for these regularly travelled routes and therefore continues to ensure the essential safety and ease of navigation of shipping traffic in these areas according to § 5 paragraph 6 no.1 of the new version of the SeeAnlV. Any danger of collision is therefore minimised.

There is only a limited amount of shipping traffic which is bound to routes in the vicinity of the area of special suitability "Westlich Adlergrund" (BSH 2005). The only exceptions to this are the seasonal ferries between Sassnitz and Bornholm. However, this route is not affected by the application area.

Therefore, it is ensured that all regularly travelled routes can be used without interruption or problems. An impairment to shipping can therefore be avoided as far as possible.

A collision risk analysis according to the BSH standard "Constructional Implementation of Offshore Wind Energy Plants" for the determination of the risk of collision will be provided in the course of the plan approval procedure.

The safety of shipping can be increased by additional equipment which complies with the requirements for an offshore wind farm. Hence, according to the current requirements, the offshore wind farm will be equipped with AIS and sonar transponders in order to warn vessels which are on a collision course and therefore prevent a collision.

The equipment and marking of the wind farm during the construction and operational phase will be carried out according to the latest technology, taking into account the provisions of the directives by the Waterways and Shipping Directorates North and North West in the currently valid version and according to the IALA directives.

3.4.3 Air Traffic

The project area directly adjoins the area of special suitability "Westlich Adlergrund". The area of suitability "Westlich Adlergrund" is used for training flights by the German armed forces, pollution control flights by the German Police as well as by amateur pilots (BSH 2005). There are no firing practices in the airspace above the area of suitability. Rather, the airspace from approx. 2,100 m to 9,200 m is used to position aircraft for the approach to the southern training areas for target practices. Pollution control flights are usually carried out at heights which are considerably above 300 m Amateur pilots with small propeller-driven planes may use the airspace below 150 m.

In the context of the specification of the area of special suitability "Westlich Adlergrund" it was established that an impact on air traffic due to the construction and operation of wind energy plants within the area of special suitability was not to be expected (BSH 2005). To the north, the "Windanker" offshore wind farm directly adjoins the "Westlich Adlergrund" area of suitability. Due to

the spatial vicinity, it can be assumed that this finding can also be applied to the "Windanker" offshore wind farm project. An impact on air traffic due to the project is therefore not to be expected.

The wind farm plants will be entered as obstructions to flight in the aviation charts and will be equipped with day and night warning lights according to the latest technology and the current regulations.

3.4.4 Pipelines and submarine cables

The application area is not affected by any pipelines or submarine cables which are in service or which are planned. The BALTICA Segment 3 submarine cable runs to the south west at a distance of approx. 8 km. The planned route for the pipeline connection between Denmark and Poland runs approximately 13 km to the south west of the project area. The "Nord-Stream" natural gas pipeline between Russia and Germany, which was inaugurated in November 2011, runs at a distance of 35 km to the south of the project area.

In the course of the connection of the offshore wind farm to the transmission grid it is expected that further submarine cable routes will be planned in the immediate vicinity of the wind farm. n the regional development plan for the Baltic Sea German EEZ for submarine cables for the delivery of the energy generated in the EEZ are planned. These are located approximately 15 km to the south west of the project.

There is no conflict with existing cables or pipelines. Details of the route planning will be coordinated with the power plant operator in the course of the grid connection.

3.4.5 Extraction of raw materials

The project area is located outside of the regional development plan area of the EEZ in the Baltic sea which is designated for permits according to the Federal Mining Act (BBergG). To the south east, outside of the "Westlich Adlergrund" area of special suitability there are the areas "Adlergrund Nord" (distance 11.5 km) and "Adlergrund Nordost" (distance 20 km) with mining permits (BSH 2009). The period of these has been extended until 31.12.2040.

Due to the distance of the project which is applied for here from the stated areas with mining permits it can be assumed that no mining interests according to the Federal Mining Act will be affected. During the procedures undertaken for the establishment of the area of special suitability "Westlich Adlergrund" the statement by the Stralsund Mining Authority confirmed that there is no overlap with the areas "Adlergrund Nord" and "Adlergrund Ost" (BSH 2005). During the application procedures for the "Wikinger Nord" and "Wikinger Süd" projects (within the area of special suitability "Westlich Adlergrund") the statement by the Stralsund Mining Authority stated that no mining interests according to the Federal Mining Act are affected. At present (July 2011) there are no new applications for the issue of mining permits. As the project area which is applied for is at an even greater distance from the stated areas with mining permits, it can be assumed that it is also the

case that no mining interests will be affected by the application area. In the case of any simultaneous claims to the area due to wind energy use and applications for the extraction of raw materials, the interests would need to be coordinated and criteria for mutual use would need to be agreed (BSH 2009).

3.4.6 Military interests

According to designations in the regional development plan, the EEZ in the Baltic Sea overlaps large areas which are used as military exercise areas. The application area is below the aviation warning area (danger area) ED-D 47 C in which only aerial manoeuvres for the approach to the southern target practice areas are carried out (BSH 2009).

Military interests will not be impacted by the project.

3.4.7 Fishing

Fishing is a traditional economic sector (BSH 2009). Fishing and fish processing is carried out in the context of fishery quotas. There are no spatially defined fishing rights in the sense of individual allocations (BSH 2005).

The international catches landed from the German Baltic Sea were approx. 62,000 tons of fish in 2006 - primarily herring, cod and sprat. In 2006, in the immediate area of the "Windanker" project, cod and flounder were fished with demersal otter trawls and gillnets. According to PEDERSEN et al. (2009) the "Windanker" project area can be classified as "less fished" based on the geographical distribution of the international fishing efforts (IfAÖ 2012).

Due to the size of the project area and the low intensity of fishing, the applicant assumes that the implementation of the offshore wind farm project will not be associated with a significant impact on fishery in the Baltic Sea.

As far as appears permissible with regard to the operating and safety concept, from the point of view of the applicant there is no objection to the navigation of small vessels in the offshore wind farm. However, in order to protect the wind farm plants (measuring equipment, probes, internal cabling of the wind farm), the use of trawls and drift nets will not be possible. Therefore a restriction to fishing must be expected during the operating phase of the offshore wind farm.

3.4.8 Tourism

There is no direct use of the project area for leisure purposes. Visits to the waters by sailing boats or leisure craft is estimated to be an exception, even in summer. Therefore there should be no impact on tourism (IfAÖ 2012).

At present the EEZ in the Baltic Sea is free of physical structures which are visible from the coast and therefore is characterised by its typical expanse and clear view. The offshore wind farm is located at a distance of over 37 km from the nearest point on the coast (island of Rügen, Jasmund peninsula).

The wind farm will be visible from the coast. However, the visibility will depend on the height of the viewpoint and in particular on the visibility due to weather conditions.

A visibility report which was produced in the context of the determination of the "Westlich Adlergrund" area of special suitability comes to the conclusion that the horizon from the "Königstuhl" (eye level 120 m above mean sea level) on the Jasmund peninsula is 42 km away. Installations at a distance < 42 km will therefore be visible if the meteorological conditions allow it. According to these investigations, visibilities of 40 km and more occur on approx. 94 days per year (26%). From the beach at the foot of the "Königstuhl" (eye level 2 m above mean sea level), the horizon is 5 km away, i.e. only parts of the plants will be visible from the beach under the appropriate meteorological conditions.

With the present application for an offshore wind farm, taking into account the "Wikinger" and "Arkona-Becken Südost" offshore wind farms, which have already been approved in the "Westlich Adlergrund" area of special suitability, the area of the horizon with wind energy plants which are visible from the coast will be enlarged. As a result of the concentration in the eastern region of the Arkona Basin, due to linkage with offshore wind farms which have already been approved, large areas of the horizon will remain unobstructed (see fig. 2).

Due to their distance, the plants in the project areas will only be visible as very small objects on the horizon and only when there is good visibility. A high degree of impairment is therefore not to be expected.

Fig. 4: Visibility of the "Wikinger" and "Arkona-Becken Südost" offshore wind farms, observation point "Königsstuhl" (Arcadis 2005)

A study by the Baltic Institute for Marketing, Transport and Tourism of Rostock University (2003) deals with the expected effects of offshore wind energy plants on the tourism supply and demand structures of Mecklenburg-Vorpommern, based on the evaluation of 8 acceptance studies from various Federal States and the analysis of the effects of wind energy plants in Denmark and Holland. The study concludes that there is no direct correlation between the number of wind energy plants on land and the number of guests or overnight stays. In contrast, in parallel to the increasing number of wind energy plants, the investigated tourist numbers increased in Mecklenburg-Vorpommern. Offshore wind energy plants are perceived as being less of a disturbance than large onshore wind farms. Accordingly, continued negative effects on the number of visitors are not to be expected with the installation of offshore plants.

In addition to visibility, the degree of impairment also depends on subjective perception and the attitude of the viewer to this form of regenerative power generation. Negative effects on tourism due to the planned offshore wind farm are not forecast at present.

In the interest of positive communication of the offshore wind farm project, the applicant is considering measures for the promotion of acceptance in the context of public relations, such as guided tours and in agreement with cooperative coastal communities, the construction of an onshore observation platform with extensive provision of information.

3.4.9 Material and cultural assets

Cultural assets are objects and structures of special cultural importance as well as cultural and natural monuments. In the marine environment, primarily wrecks or special geomorphological structures, (continental shelf) come into question as cultural assets. Known underwater objects, in particular wrecks, are listed in the nautical charts or in the BSH list of wrecks. There are no such entries in the project area.

If underwater objects of archaeological importance are found during the geophysical investigations, the applicant will contact the relevant authorities.

4 Concept for the determination and evaluation of the impact on public interests

In accordance with § 3 paragraph 2 no. 3 of the new version of the SeeAnlV, a concept for the determination and evaluation of the impact on public interests is to be presented. The following table presents this concept for the impacts on all public interests.

Interest	Concept for the determination and evaluation of the impact on the
marine environment and bird migration	– Submission of an investigation concept according to StUK for the evaluation of possible impact on the marine environment and bird migration as well as coordination of the investigation concept with the BSH and other authorities – Performance of environmental investigations according to agreed investigation frameworks – Submission of an environmental impact study
Shipping	– Production and submission of a collision risk analysis – Coordination with the relevant Waterways and Shipping Directorate - WSD Nord, in particular for the evaluation of impairment to ease of navigation, probability of collisions and safety markings
Aviation	– Enquiry to the relevant agencies with regard to the specific extent of air traffic use – Coordination with the relevant Military District Administrative Office North - Kiel Office - as well as with any other relevant agencies (e.g. DFS [and amateur flying associations]), in particular for the evaluation of impairments to air traffic and safety markings
Cables and pipelines	– Comparison of the project area with representations in charts – Comparison of the project area with the regional development plan representations (EEZ Ostsee-ROV), etc. – Recording of any pipelines in the context of the geophysical investigation – Coordination with potential operators of cables and pipelines,

	in particular for the evaluation of any usage conflicts with regard to the foundations and internal cabling of the wind farm
Raw materials	– Enquiry to the relevant authorities with regards to the specific extent of activities for the extraction of raw materials – Comparison of the project with the regional development plan representations for the German EEZ in the Baltic Sea. – Coordination with the Stralsund Mining Office with regard to the existence of mining permits or applications for the granting of mining permits in the project area, as well as the evaluation of any conflicts of use
Military	– Enquiry to the relevant authorities with regard to the specific extent of military use. – Coordination with the relevant Military District Administrative Office North - Kiel Branch Office - in particular for the evaluation of possible impacts and any necessary studies;
Regional development	– Comparison of the project with the regional development plan representations for the German EEZ in the Baltic Sea. – Coordination with the Federal Ministry of Transport, Building and Urban Development, in particular for the evaluation of potential usage conflicts in the project area.
Fishing	– Determination of the impact on fishing by means of an appropriate report – Coordination with the relevant authorities and fisheries associations, in particular for the assessment of potential conflicts of use in the project area as well as impacts on the marine environment.
Leisure and tourism	– Enquiry to the relevant agencies with regard to the specific extent of previous use of the project area for leisure and tourism – Coordination with coastal communities, tourism associations and tourist boards, in particular for the evaluation of any impairment to tourism on the coast in the environmental impact study as well as any impact on leisure boat and leisure aircraft traffic due to the traffic regulations for the wind farm

	area which are to be issued by the authorities.
Cultural and material assets	– Information from the BSH list of wrecks with regards to the existence of any archaeological site – Recording of any objects on the seabed in the context of the geophysical investigation of the seabed – Coordination with the State Office for Culture and the Preservation of Historical Monuments, in particular for the evaluation of the importance, documentation, preservation or recovery of any cultural assets in the project area

Table 3: Concept for the determination and evaluation of the impact on public interests

5 Technical concept

The technical concept which is presented here reflects the present state of planning, taking into account the latest technology and the current state of information regarding the site. Details will be worked out in the context of the development phase, taking into account the currently valid versions of the BSH standards. The plants and components of the wind farm will be described below, as far as is possible at the present time:

5.1 Configuration of the wind farm

The building and operation of 60 wind energy plants and a transformer platform is planned. (See Fig. 3) The selection of the type of plant and the type of foundation forms the subject of the development and construction phase, in which the detailed solutions will be worked out and coordinated with consideration of technical, ecological and economic aspects. The construction of the plant is subject to any public interests which are to be taken into consideration in the plan approval procedure, as well as any special requirements which result from the environmental investigations which are to be performed.

The definitive technical criteria for the construction of the plants are the necessary distances between the individual wind energy plants, taking into account the prevailing wind direction and therefore optimisation of the degree of efficiency of the wind farm. The distances required according to planning law will be complied with, if necessary with consideration of the required safety zones of 500 m around the plants. Essentially, the priority and reserved shipping areas and the outer boundary of the German EEZ, as stipulated in the regional development plan of the Baltic Sea German EEZ, will be taken into account.

5.2 Wind energy plant

The type of wind energy plant cannot be finalised at the present time, as the development of plant technology is progressing rapidly and will be taken into account at the time of construction of the wind farm. The final selection of the type of plant will therefore be made in the course of the construction phase. Aspects of reliability and efficiency, market availability and environmental impact will be decisive.

The basic requirement is that the plants must conform with the latest technology.

From the present point of view, it is expected that at the time of construction of the wind farm, the established offshore wind energy plants will have an output range of between 5 to 8 MW and rotor diameters from about 120 to 170 m. The hub heights vary according to the specific requirements of the project and can be in the range from 80 to 120 m.

From the present point of view, an example of the type of wind energy plant which comes into consideration is the REpower 6M. Looking ahead, developments such as the SIEMENS SWT-6.0 can be cited. However, other plant manufacturers, including Vestas, Nordex, Alstom, Gamesa are

working on the development of offshore plants in the multi-megawatt class, which in some cases exceed 6MW. The following section presents the REpower 6M and the SIEMENS SWT-6.0, which are already in operation at plants or for which prototypes exist.

5.2.1 REpower 6M

The 6M is a further development on the basis of the technology of the 5M. With the same external dimensions, the 6M achieves a rated output of 6.15 MW. At present, this is the most powerful and efficient offshore wind energy plant in the portfolio of REpower Systems SE.

The 6M is designed for demanding offshore requirements and ensures a long life span with high levels of availability, reliability and maintenance-friendliness. The redundant design of many components enables improved availability in comparison with conventional systems. Due to optimised accessibility of the components, maintenance work can be carried out quickly and cheaply. The plant features continuous monitoring of operation, reliable corrosion protection and many safety measures for both man and machine. In the development of the 6M, REpower was able to utilise the experience from a large number of existing wind energy plants.

The REpower 5M is already in operation in several offshore wind farms, such as "Beatrice" (Scotland), "Thornton Bank" (Belgium), "alpha ventus" (Germany) and "Ormonde" (Great Britain). Prototypes of the REpower 6M were put into operation in 2009 in Ellhöft (Schleswig-Holstein). For 2012, deployment of the REpower 6M is planned in the "Beatrice II&III" wind parks (Belgium) and in the "Nordsee Ost" wind park (Germany). The plants are produced in Bremerhaven.

Plant	
Plant type	REpower 6M
Rated output	6.150 kW
Rotor diameter	126 m
Rotor speed	7.7 - 12.1 rpm (+15%)
Power control	electrical pitch control - pitch and speed control
Hub height	specific to the project (80 ... 120 m above sea level)
Total height	specific to the project (143 ... 183 m above sea level)
Gear unit	Three-stage planetary helical gear unit
Generator	double-fed asynchronous generator
Tower	
Design	Tubular steel tower
Rotor	
Rotor	3-blade
Material	Glass-fibre reinforced plastic (GRP)

Table 4: Technical data of the REpower 6M

The wind energy plant operates fully automatically and starts automatically at wind speeds in excess of 3.5 m/s. The plant achieves its rated output at wind speeds of approx. 14 m/s. Regulation of the rotor speed and the pitch angle of the rotor blades ensures maximum aerodynamic efficiency.

The use of especially corrosion-resistant materials and a special multilayer coating of all susceptible components according to the highest protection classes of DIN EN ISO 12944, ensure optimum protection against corrosion. Cooling and ventilation of the components is by means of air-air or water-air heat exchangers. By this method, damp and saline external air does not enter into the nacelle.

Operating materials are used in the wind energy plants in order to ensure continuous operation of the plant. These include oils and greases for the lubrication of plant sections, cooling media for the dissipation of the heat which is produced, as well as hydraulic oils for the operation of the hydraulic systems. The wind energy plants are designed so that in case of leakage of operating materials from the particular units, precautions are taken that these materials are captured by means of constructional measures (leakage sumps) and do not escape into the environment.

5.2.2 SIEMENS SWT-6.0

The SIEMENS SWT-6.0 is a further development of the Siemens wind energy plants with direct drive, which were specially developed for future offshore power stations. Due to the smaller number of components and a lower total weight, this plant is predestined for use in offshore wind farms. Its main features are its output, durability and maintenance-friendliness. During development, the experience gained from a large number of existing plants was referred to. The plant is expected to be available with rotor diameters of 120 m and 154 m. A prototype of the SIEMENS SWT-6.0-120 (120 m rotor diameter) went into trial operation in June 2011 in Høvsøre, Denmark. Construction of further preproduction series plants is planned for the coming years. Series production is planned for 2014.

Plant	
Plant type	SIEMENS SWT-6.0
Rated output	6000 kW
Rotor diameter	120 m / 154 m
Rotor speed	5–11 rpm (SWT-6.0-154)
Power control	Pitch control with variable speed
Hub height	specific to the project (80 ... 120 m above sea level)
Total height	specific to the project (140 ... 197 m above sea level)
Generator	Permanent magnet synchronous generator, direct drive
Tower	

Design	Conical tubular steel tower
Corrosion protection	Painted
Surface gloss	semi-matte, 25–45 / ISO 2813
Surface colour	Light grey, RAL 7035
Rotor	
Rotor	3-blade
Material	GRE (epoxy resin, glass-fibre reinforced)
Surface gloss	semi-matte, <30 / ISO 2813
Surface colour	Light grey, RAL 7035

Table 5: Technical data of the SIEMENS SWT-6.0

The wind energy plant operates fully automatically. The wind energy plant starts automatically at wind speeds of approx. 3-5 m/s and achieves its rated output at 12 - 14 m/s. Regulation of the rotor speed and the pitch angle of the rotor blades ensures maximum aerodynamic efficiency.

An internal communication network connects the plant to the mainland for the purpose of monitoring of the plant. In addition, permanent control and monitoring and if necessary, intervention in the operation of the plant is possible. Remote monitoring of the plant enables continuous operation and the transmission of fault messages, electrical, mechanical, statistical and meteorological information as well as data regarding the electricity grid.

The wind energy plants are equipped with a condition monitoring system. The vibration levels of the main components of the wind energy plant are continuously recorded and evaluated. This enables regular detection of the status of the components and if necessary, the forward planning of further inspection and maintenance measures.

In order to ensure continuous operation of the wind energy plant, operating materials such as oils and greases for lubrication of the plant sections, cooling media for the dissipation of the heat produced, as well as hydraulic oils for the operation of hydraulic systems are used in the wind energy plant. Lubrication of the plant, e.g. the main or pitch bearings is performed automatically by means of a central system. The plant is cooled by means of a simple, robust water-cooling system. The heat which is produced is dissipated to the environment via water-air heat exchangers. The plants are designed so that in case of leakage of operating materials from the particular units, precautions are taken that these materials are captured by means of constructional measures (leakage sumps) and therefore do not escape into the environment.

5.3 Foundation and installation concept

At present various foundation concepts such as monopiles, jacket, tripod, bucket or gravity foundations, or combinations of these are used for offshore wind energy projects. In addition to the particular technical advantages and disadvantages, the various foundation methods have different

impacts on the marine environment. The selection of the foundation method will be greatly influenced by the specific requirements of the project.

At the present time, it is not possible to finally specify the type of foundation, as the determination of the information regarding the subsoil and the environments conditions on the site will only be carried out in the context of the development phase. The selection of the wind energy plant will also influence the details of the foundations. The expected progress in development with regard to the latest technology of foundation technology up to the time that the project is implemented will be taken into account. Development of a suitable foundation structure is the subject of the development and construction phase. The fundamentals for this are provided by the standards published by the BSH for the investigation of the environmental impacts of wind farms on the marine environment, investigation of the subsoil and the constructional design of offshore wind energy plants as well as the current relevant directives and standards.

5.3.1 Jackets

Jackets are lattice tower structures, which have three or four main vertical columns (legs). These are interconnected by means of cross-members. The legs are anchored to the seabed by means of foundation piles, which can be installed prior to or subsequent to the installation of the jacket. After alignment of the jacket, the piles and the jacket are connected by means of grouted joints. The tower of the wind energy plant is mounted on the tower flange at the upper end of the foundation structure, if necessary by means of a transition piece.

The installation of the foundation piles prior to or subsequent to the positioning of the jacket depends on the general design and installation concept. In general, no preparation of the seabed is required for jackets. However, depending on the site, small-scale levelling may be required for the preparation of ground.

Typical dimensions of a jacket

- With a water depth of 35 m, the area of the seabed occupied by the jacket is between 15 m x 15 m up to 30 m x 30 m. This depends on site conditions and the choice of wind energy plant.

Installation concept for pre-installation (pre-piling) of the foundation piles

- Transport of the piles and the guide template to the construction site by barge or installation ship.
- Positioning of the installation ship with hoist and installation equipment
- Lifting and positioning of the guide template on the seabed
- Lifting, positioning and driving of the foundation piles down to the necessary installation depth.
- Removal of the guide template and departure from the installation position
- Inspection of the pile positions and if necessary, modification of the jacket mounts
- Transport of the jackets to the construction site by barge or installation ship
- Lowering of the jackets onto the foundation piles by means of a floating crane or a jack-up ship
- Alignment of the jacket and production of the grouted joint

Installation concept for subsequent-installation (post-piling) of the foundation piles

- Transport of the piles and jacket to the construction site by barge or installation ship
- Positioning of the installation ship with hoist and installation equipment
- Preparation of the seabed if necessary
- Lifting and positioning of the jacket on the seabed
- Lifting of the foundation piles and insertion into the guide sleeves of the jacket
- Driving of the foundation piles down to the necessary installation depth
- Alignment of the jacket and production of the grouted joint

Scour protection

From the present point of view, additional scour protection around the legs of the jacket is not necessary. The design of the foundation takes any possible scouring into account, however this depends on the conditions of the site. However, the necessity for additional scour protection measures in certain situations cannot be completely ruled out.

5.3.2 Monopiles

Steel monopiles are often used for the foundations of present-day offshore wind farms. The monopile can be anchored into the ground by means of various dumping methods. The so-called transition piece is placed on the upper end, aligned and the joint grouted. The tower of the wind energy plant is mounted on the tower mount of the transition piece.

Usually, no extensive preparations of the seabed are required for the installation of the monopile. An exception to this would be if the seabed was so uneven that levelling of the ground would be required. Large stones or boulders on the seabed would have to be removed.

Installation of the steel monopile is carried out by the following steps

- Installation of a scour protection filter layer
- Transport of the monopile and the transition piece to the construction site by barge or installation ship. The piles can also be floated to the development area by means of a tugboat.
- Positioning of the installation ship with hoist on installation location. Additional support from a supply ship may be required.
- Lifting of the monopile with the crane and alignment in the vertical position
- Lowering of the monopile onto the seabed
- Installation of the installation equipment on the upper end of the monopile and driving of the monopile down to the required installation depth. Additional drilling activities may be required in case of difficult ground conditions.
- Placement of the transition piece on the upper end of the monopile
- Alignment of the transition piece and production of the grouted joint
- Installation of the scour protection

Typical dimensions and size of the monopile foundation

- With a depth of water of 35 m, a monopile would have a diameter of between 6 m and 7,5 m, depending on local conditions and the selected wind energy plant.
- The typical volume of the scour protection (filter layer and surface layer) for the monopile dimensions stated above could be between 1,000 m3 and 2,000 m3.
- The typical diameter of the scour protection for the monopile dimensions stated above will be between about 15 m and 40 m.

Scour protection

Scour protection is normally required for monopile foundations. First of all, a filter layer (consisting of small stones) is laid and then the monopile is inserted into the seabed. A surface layer consisting of larger stones is then laid around the installed monopile. The installation of the scour protection layer is mainly carried out by means of special ships, which apply the material at the installation location by means of downpipes. The size of the scour protection varies according to the conditions and design and can be up to 2 to 5 times the diameter of the pile.

5.3.3 Gravity foundations

The design of gravity foundations varies with regard to shape and size for the specific project. These foundations are usually made of concrete and usually have a foundation base, a conical section and a cylindrical section. A main factor which has a decisive effect on the design of gravity foundations is the question of handling and transport - by means of a floating pontoon, or submersed by means of a floating crane. Structures with a buoyancy effect (for transport) are usually large.

Most gravity foundations have a similar basic structure. The basis of the foundation is hexagonal, octagonal or round, with a thickness of 1 to 2 m. The size of the foundation plate largely depends on the framework conditions. The shaft in the central section is usually conical and ends in an upper cylindrical shaft. The upper cylindrical shaft has a diameter of about 5.0 to 7.5 m. The cylindrical shaft, including the tower mount and the working platform, ends at the necessary height above the surface of the water.

Installation

Preparation of the seabed is usually necessary for gravity foundations in order to produce an appropriate plane surface with adequate load-bearing capacity and the necessary contact between the foundation base and the seabed.

The preparation of the seabed can essentially be divided into two steps; removal of sediment and the installation of a bedding and levelling layer. The excavation work is usually carried out by a suction dredger (hopper dredger). The installation of the bedding and levelling layer is carried out using special ships with a downpipe.

The sediment which is removed is usually taken to a previously agreed area near to the removal site. For sites at which very extensive removal of sediment is required, the sediment can be used to back-fill the edge areas or can be used as ballast material.

The transportation of the foundation structure to the project area can be carried out by two different methods, depending on the design of the foundation structure:

1. Floating by means of tugboats; lowering onto the construction site with the addition of ballast
2. Traditionally, transportation with barges and installation with heavy lift cranes

With the first method, a special barge may be used to assist the transportation to the development area. With the second method a crane with a large lifting capacity may be required.

Installation of the gravity foundation

- Preparation of the subsoil (removal of sediment and insertion of a foundation layer)
- Transportation of the foundation body to the development area with tugboats; floating or by barge
- Positioning of the heavy lift floating crane (in the case of non-floating transport)
- Lifting of the foundation structure from the barge and lowering onto the prepared subsoil; in the case of floating transport addition of ballast and sinking of the foundation onto the foundation bed
- Back-filling of the edge areas (as far as is necessary)
- Installation of the scour protection (probably rock fills).

Typical dimensions and volumes of gravity foundations

- For a depth of water of 35 m an area of 25 m to 45 m in diameter can be assumed. This depends on the site conditions and the selection of the wind energy plant.
- - The plane area of the seabed which is prepared by the removal of sediment is between 35 x 35 m and 55 m x 55 m.
- - The amount of sediment removed for the preparation of the seabed varies according to the specific site. An assumed removal depth of 2 m results in the removal of 6,000 m3 to 9,000 m3 of sediment.

Scour protection

Scour protection is necessary. The size of the scour protection (filter and surface layer) depends on the sediment conditions and therefore depends on the amount of sediment which needs to be removed in order to prepare the subsoil. In addition, local currents and the details of the foundation play an essential role. The extent of the area will approximately correspond to the area of site preparation.

5.4 Electrical engineering concept

5.4.1 Power connection

According to § 17 paragraph 2a of the German Energy Act (EnWG) the operator of the transmission grid for the control energy is responsible for connecting the wind farm to the grid. The installation of the cables from the wind farm transformer station to the mainland is therefore not the subject of the present application. According to the EnWG the grid connection must have been set up at the time that the offshore installations are technically ready for operation. The applicant will contact the relevant transmission grid operator, 50 Hertz Transmission GmbH in good time with regard to coordination of the project.

5.4.2 Offshore Transformer Platform

The construction of an offshore transformer platform is planned for the "WINDANKER" offshore wind farm. The connection of the "WINDANKER" wind farm to the grid of the transmission grid operator onshore is made via this offshore transformer station.

Due to the distance of the offshore wind farm from the mainland, transmission of the electricity at the internal voltage level of the wind farm is not economical. The transmission power plant operator (ÜNB) will develop a suitable solution for this at the appropriate time. Transmission of three-phase current at a higher voltage level would be conceivable and technically feasible.

Because of the early planning phase, the electrical engineering concept of the wind farm, including the planning of the transformer platform positioned in the wind farm has not yet been finalised. This will be worked out and specified further in the context of the development and construction planning. From the current state of knowledge it can be assumed that the appearance of this station will be similar to that of existing offshore stations. Use of a jacket structure for the foundation of the transformer platform would be conceivable.

The electrical engineering planning will be coordinated with the transmission grid operator for the purpose of optimising the grid connection process.

The transformer platform will accommodate one or more transformers, which convert the electrical energy from the internal voltage of the wind farm to the external voltage level. Due to their size, these transformers will be oil-cooled. The transformer oil capacity of transformers of this size may be several tons. According to current regulations, the design of the steel construction will include oil catchment devices (e.g. leakage sumps) so that no oil can escape to the environment in case of leakage.

The offshore transformer station will also accommodate the high voltage switchgear (gas-insulated SF6 technology). As well as this, the offshore transformer platform will also accommodate all of the communications technology which is required for the operation of the entire plant.

The transformer platform will probably also include rooms which can be used for servicing work of the offshore wind farm, for example for storage of material or accommodation of personnel in case of necessity.

5.4.3 Internal Cabling of the Wind Farm

The internal cabling of the wind farm will probably be constructed as a medium-voltage three-phase network, probably with an operating voltage of 33kV and a frequency of 50 Hz. In order to increase operational reliability, the creation of ring mains systems will be considered.

Due to the greater use of material and the greater effort for installation, ring main systems are more expensive than simple stubs, however they provide better facilities for bypassing plant failures and therefore greater grid availability.

The submarine cables will be laid by cable-laying ships, inserted into the seabed with special equipment and secured against floating. The choice of the type of laying will be determined by the geological characteristics of the seabed. For example, if necessary the cables can be secured with rock fills.

At the medium voltage level, the cables of the individual lines of the cabling for the wind farm are combined at the offshore transformer station. Plastic-insulated medium voltage cables will be used for the internal cabling of the wind farm. Due to the differing transmission distances and efficiencies, cable systems with three-core XLPE-insulated copper cables and cross sections of between 120 mm2 and 800 mm2 will be used. The cable design consists of multiple-strand copper or aluminium conductors with cross-linked polyethylene insulation (PEX). The cables are watertight in the longitudinal and radial directions and are armoured with steel wires to prevent damage.

5.5 Construction concept

The final construction concept essentially depends on the foundation structure which is selected and can be specified in greater detail towards the end of the development phase, see Section 5.3. All details of the construction concept will be specified in the implementation planning and will be submitted to the planning approval authority in good time prior to the start of construction.

With the submission of the construction concept, the planning approval authority will be informed in good time with regard to the specific location of the construction site. According to the agreement with the authorities, the construction site will be marked for navigation (e.g by means of light buoys) and according to the progress of construction, marking for shipping and aviation will be put into operation. The appropriate authorities will be regularly informed of the status of the construction work.

During the construction phase, the sea traffic area around the construction site will be secured by means of a suitable construction site guard vessel. This vessel observes the traffic area by means of radar and AIS and if necessary provides information for safe passage. If necessary, measures for securing the construction site and the construction vehicles will be initiated.

As far as possible, the plant components and foundations will be prefabricated or equipped onshore.

Vessel	**Task**
Floating crane	Loading and installation of the foundations, transport of the topside of the transformer station into the development area and if necessary, transportation of foundation structures (gravity foundations)
Lifting platform / Installation ship (construction)	Handling, positioning and installation of piles, grouting work, installation of the tower and the wind energy plant.
Lifting platform / Installation ship (transport)	Transportation of piles, tower and plant sections
Cable-laying ship	Laying of internal wind farm cables
Transport barge	Transport of piles, plant sections etc.
Tugboats	Transport, positioning, anchor handling, assistance, stand-by
Transfer ships	Transportation of personnel to and from the development area
Supply ships	Transportation of materials to and from the development area
Research ships	Monitoring during construction
Construction site guard vessel	Monitoring of the berth around the construction site

Table 6: vessels necessary during the construction phase

5.5.1 Installation of the foundations

The construction of the offshore wind park is carried out with various vessels and equipment, some of which are specially designed for this purpose (see 5.3. Foundation and installation concept).

In principle, as far as possible, prefabrication onshore will be aimed for. This includes the equipment of the foundation structure with mooring facilities and ladders, the installation of the service platform and the tower mount as well as equipment with cable conduits, mounts for navigational signs, etc. The application of corrosion protection and coats of paint will also be carried out onshore.

During pile driving, appropriate measures will be used to minimise pile driving noise. At present, noise reduction methods are being intensively investigated. For construction of the wind farm with pile driving methods, appropriate noise reduction measures will be proposed and agreed with the relevant authorities on submission of the construction concept before start of construction. Other installation methods for the insertion of deep foundations, e.g. by means of a vibrating pile driver will also be considered.

5.5.2 Construction of the wind energy plant

As far as possible, prefabrication of the wind energy plants will be carried out onshore. The assembly and transportation to the construction site will be carried out by means of appropriate installation ships. These ships can often load and transport several complete plants to the development area, from the tower base and nacelle up to the completely pre-assembled rotor.

Usually, installation ships or installation platforms are equipped with a so-called jack-up system. With the aid of suitable hydraulic systems, feet are placed on the seabed and the vessel is lifted out of the water. This provides appropriate stability for the construction process.

Installation of the entire wind energy plant is carried out in a single step. After installation of the tower components, the nacelle is placed on the tower and installed. Then the rotor is lifted up and fastened to the hub. The lifting work is performed by the crane of the installation vessel. If necessary, the installation may be assisted by the use of auxiliary cranes.

The installation cranes are equipped with appropriate day and night warning lights, which indicate that the crane itself is an obstruction to aviation during the construction of the wind energy plant.

5.5.3 Internal cabling of the wind farm

The installation of the internal cabling of the wind farm can be performed prior to or subsequent to the installation of the wind energy plant. If the installation is performed prior to the construction of the wind energy plant, the location of the cable must be noted for the positioning of the lifting installation vessels in order to avoid damage to the cable.

The submarine cables will be either installed directly in the seabed or will be installed in the seabed from the surface by means of a subsequent method. For subsequent installation in the seabed, the

cable is first laid on the seabed and then installed in the seabed, for example by means of flushing methods. In the case of flushing methods, the subsoil is fluidised in specific areas with the aid of high pressure water jets, e.g. by so-called jet ploughs or jetting lances. The cable then sinks into the seabed to the intended installation depth. Due to the immediate re-sedimentation of the soil material the laying area is closed again.

Cable-laying ploughs can be used in methods in which the cable is laid directly on the seabed. In this case, the cable from the cable-laying ship is directly inserted into the required final position by means of the plough, which mechanically creates the laying trench. The ploughed laying trench closes itself immediately after laying.

The cables are guided into the plant via so-called J-tubes, which are attached to the foundation structure.

5.6 Operational, protection and safety concepts

Operational, protection and safety concepts for the project will be produced in good time and submitted to the planning approval authority according to the progress of the planning and the project. This will be based on the valid directives and standards. In addition, our own practical experience from other offshore wind farm projects such as the "West of Duddon Sands" offshore wind farm in Great Britain or the "Wikinger" offshore wind farm in the immediate vicinity of this project will be utilised. In addition, the company's own high requirements for Health and Safety and Environment (HSE) will be implemented in the project.

5.6.1 Protection and safety concept

In good time prior to the start of construction, a protection and safety concept according to the valid requirements will be worked out and agreed with the appropriate authorities. This protection and safety concept will include aspects of navigational and air safety, in particular the marking of the plants (navigation lighting plan), failure concept, emergency and rescue concept, concepts for safety at work etc.

In order to ensure the correct procedure for rescue and safety measures, special arrangements must be made at the offshore wind energy plants. The offshore wind energy plants will be equipped with rescue devices, first-aid equipment, fire extinguishers, heat insulation blankets etc. In addition, communication systems will be provided, which enable direct communication with the rescue coordination centre on the mainland, so that a rapid response is possible in case of emergency. All safety measures which have already been installed in the offshore area will be modified and used in the new environment. The fastenings and ladders in the towers of the wind energy plants enable persons in distress at sea to rescue themselves without external assistance.

Details of the equipment will be agreed with the relevant authorities prior to the start of construction.

The service personnel will receive special training, which is tailored to the specific requirements of the offshore sector and which specifies special codes of conduct. Appropriate work safety and safety rules will be produced and implemented for the safety of the maintenance and service personnel.

5.6.2 Operation and maintenance concept

The plants will be designed so that continuous maintenance of all operating parameters is possible. Faults which occur will be transmitted to the maintenance centre onshore via data transfer. A large proportion of faults can be remedied via a remote control system. In cases where this is not possible, the deployment of a service team on site is necessary. It is expected that access to the plants will be by means of ships. In exceptional cases, the access may be by means of a helicopter.

All of the plants are equipped with moorings as an access facility.

In order to prevent accidents and to ensure the long-term functionality of the entire plant, all maintenance and repair work will be carried out exclusively by trained specialists.

The wind energy plants will be equipped so that they comply with the industrial health and safety regulations. A detailed description of the corresponding maintenance concept, which complies with the industrial health and safety regulations will be produced in the course of the implementation planning and will be submitted to the relevant authorities prior to the start of construction.

The foundation structures are also subject to periodic inspection and will be taken into account in the maintenance concept.

Inspection of the submarine cable at regular intervals is planned, in which in addition to freedom from damage, the position and coverage as well as the cable connection will be inspected. During the inspection, a ship passes over the cable route and records the coverage of the submarine cable by means of a geophysical system (e.g. echo sounder). If an insufficient coverage thickness is detected, appropriate repair and maintenance measures will be initiated.

5.6.3 Remote monitoring

By means of measurement and analysis systems, integrated early warning systems (Condition Monitoring Systems) can detect sources of errors at an early stage and enable remote monitoring and diagnosis, as well as condition-orientated maintenance and the prevention of consequential damage by means of early repair. All of the plants are connected to a communication network, so that all operational and measurement data can be recorded via a central point and action regarding the operation of the plant can be taken if necessary.

5.6.4 Waste management and operating materials concept

All of the waste which is produced and the materials which are used in the wind farm will be brought onshore after use and properly disposed of. The proper disposal of all waste and residual materials will be regulated in the waste management and operating materials concept. This concept will be submitted to the authority prior to the start of construction.

5.6.5 Operational safety in case of emergency

The plants of the offshore wind farm will be designed so as to be fail-safe. This means that before a safety-critical condition is reached, the plant, or appropriate parts will be automatically set to a safe or shut down condition, even in cases in which, for example there is a complete failure of the power supply.

5.6.6 Safety zones

On the basis of § 11 of the new version of the SeeAnlV, normally a safety zone of 500 m around the offshore plants will be created and appropriate navigation regulations will be issued. According to the present status, the use of trawls and drift nets, as well as anchoring in the area of the wind farm will be prohibited. In addition, access in poor visibility and bad weather conditions will not be allowed.

5.6.7 Marking

The visual and radio day and night warning lighting in the wind farm will be performed according to the so-called lighting concept, which will be produced according to the regulations of the directives of the Waterways and Shipping Directorate North and North-west [*Wasser-und Schifffahrtsdirektion Nord- und Nordwest*] and according to the IALA directives..

The wind farm will be equipped with AIS and sonar transponders.

The offshore wind farm will be equipped with latest technology equipment which ensures the safety and ease of navigation of shipping and air traffic. The specific marking of the wind farm in the construction and operation phase will be carried out in compliance and agreement with the regulations of the waterways and shipping administration as well as the relevant authorities for civil and military air traffic control.

5.6.7.1 Markings for marine safety

In addition to the creation of safety zones around the wind farm, the SeeAnlV and the Ordinance of the 1972 International Regulation for the Prevention of Collisions at sea also require the marking of the wind energy plant with permanent warning devices.

The marking of the plants is carried out according to the generally valid regulations of the IALA and complies with the directive of the Waterways and Shipping Directorate (WSD) "Directive for the

Design, Marking and Operation of Wind Energy Plant in the Area of Responsibility of the WSD North and North-west for the Guarantee of Safety and Ease of Navigation" [Richtlinie für Gestaltung, Kennzeichnung und Betrieb von Windenergieanlagen im Verantwortungsbereich der WSDen Nord und Nordwest zur Gewährleistung der Sicherheit und Leichtigkeit des Schiffsverkehrs] (issued by the WSD Nordwest, the WSD Nord and the WSV traffic agency, version 20 May 2009).

An appropriate lighting plan will be agreed with the relevant WSD and submitted to the planning approval authority prior to the start of construction.

The following lists some examples from the cited WSD "Directive for the Design, Marking and Operation of Wind Energy Plants..." [Richtlinie für Gestaltung, Kennzeichnung und Betrieb von Windenergieanlagen...].

Examples of daytime marking (excerpts from the cited WSD directive)

The daytime marking of offshore wind energy plants is made by means of a 15 m high yellow paint on each individual wind energy plant, as well as lettering. Within this area, the mast or tower shaft as well as all plant sections, e.g. ladders, platforms, cranes, etc. must be painted yellow. For plants in the Baltic Sea, this applies to an area from 2 to 17 metres above the "average water level".

The tower shaft of each individual wind energy plant in a wind farm block must be marked with black lettering for the purpose of identification. The top line of the lettering sequence must provide an abbreviated designation of the wind farm, consisting of up to three capital letters. The bottom line of the sequence must provide the number of the wind energy plant of the relevant wind farm, consisting of up to 4 figures. The lettering must be applied three or four times in a round arrangement. In addition, the lettering may be supplemented with an arrow with the word "EXIT". The arrow informs of the shortest possible route to exit from the wind farm.

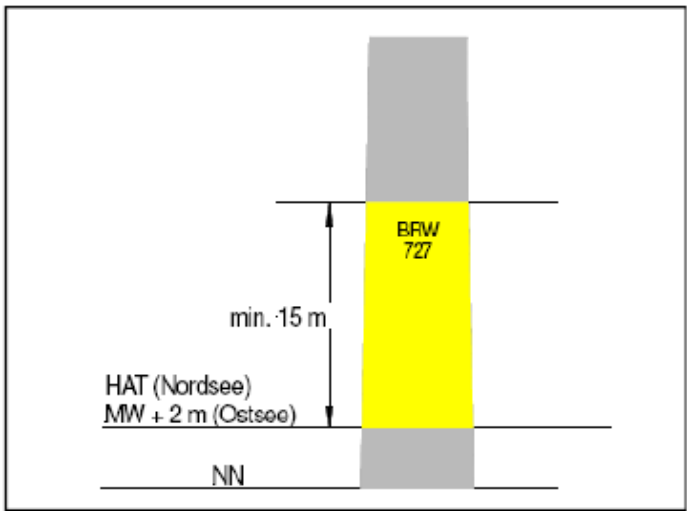

Fig. 5: Example of daytime marking with painting and lettering.

Examples of night-time marking (excerpts from the cited WSD directive)

The night-time marking consists of lighting of all peripheral wind energy plants with yellow 5 nautical mile lights and short-range marking of each individual wind energy plant. If a safety zone in accordance with § 7 paragraph 1 VOKVR cannot be created in individual cases (see Table 1, column b), the short-range marking must be replaced by an indirect illumination of the shaft.

The lighting must be switched on one hour before sunset and switched off one hour after sunrise. The lights must also be switched on during the day when the horizontal illumination is below 150 Lux, or if the practical meteorological visibility is below 1,000 m or by order of the relevant agency of the WSV.

The 5 nautical mile light must be mounted at a height of between 10 and 25 m above HAT (Highest Astronomical Tide). To prevent impact of breaking waves, in agreement with the relevant WSV agency, the lights may be mounted at a greater height - taking into account the definitive 50-year wave measurement for the waters.

Short-range marking must be implemented for all plants in the wind farm. The short-range marking must meet the following requirements:

- Horizontal visibility: 360°, visibility distance:1,000 m
- Letter size of at least 0.65 m must be used
- Colour: Yellow
- Fixed light
- Unnecessary light emissions must be avoided

The short-range marking is performed either by illumination of the daytime marking or by a self-illuminated negative marking. Combinations of illumination and negative displays as well as the display of the lettering by internally illuminated lettering panels are permissible.

The required luminance of inverse markings should be between 5 to 10 cd/m². The letter size is at least 65 cm. The same font as for the daytime marking is to be used.

In the case short-range marking by illumination of the daytime marking, the lights must be designed so that no direct light is radiated outwards from the illuminant in a horizontal direction. The amount of light which falls on the area which is not to be illuminated (stray light) must be minimised.

5.6.7.2 Markings for Air Safety

As the planned plants will exceed a total height of 100 m, for safety reasons they must be marked as air traffic obstacle. They will therefore be equipped with day and night markings according to the relevant rules. The design of the markings will be according to the relevant latest technology. The general administrative regulations for the marking of air traffic obstacles (AVV Luftfahrthindernisse) (NfL I 143/07) issued by the BMVBS on 8 May 2007 will be taken into account.

The offshore wind farm will be entered into the aviation charts as an obstacle to flight. For the notification of an air traffic obstacle in the Aeronautical Information Publication and in the *Notices to Airmen* [*Nachrichten für Luftfahrer*] (NfL) the start of construction, completion and commissioning as well as any modifications to the plants will be notified in good time to the German Air Navigation Services(DFS) or the Mecklenburg-Vorpommern Ministry of Economic Affairs, Aviation Department.

Examples of daytime marking

The daytime marking of the plants can be implemented by coloured marking of the plants. The rotor blades of wind energy farms and other plants are each to be marked with three orange/white/orange or red/grey/red stripes, 6 m in length, starting at the tip of the blade, according to No. 5.2 (of the AVV). The marking of the mast is according to the rules of the Federal Waterways and Shipping Administration for the design, marking and operation of wind energy farms and other installations for the maintenance of safety and ease of navigation.

Alternatively, the AVV allows daytime marking by means of white flashing lights. However, if white flashing lights are used, it must be ensured that there is no impairment to safety and ease of navigation, in particular in that a confusion with navigational signs is ruled out.

Examples of night-time marking

According to the AVV [General Administrative Regulations], the night-time marking can be implemented by means of a white (W) and (double) red light, or lighting at the tip of the blade. These lights are red flashing omnidirectional lights whose switch-on time during the flashing phase is longer than the dark interval. Maintenance-free systems with long-life LED lights are used. The effective intensity in the horizontal area of the beam is 100 cd. The switching times of all air traffic obstacles as well as the flashing sequence (identification) within blocks of wind energy plants will be coordinated with the navigational signs (synchronised or at least harmonised). For the maintenance of safety and ease of navigation the rules of the Waterways and Shipping Administration for the design, marking and operation of offshore wind farms must be complied with.

Standby lighting is required during the construction period. The standby lighting must be operated at night at the highest point of the construction site until the final night-time marking light can be switched on. This must also be supplied with emergency power

5.6.8 Lightning protection

All of the plants are equipped with lightning protection systems, which protect them against the effects of lightning strikes. The design is according to the requirements of IEC directives for lightning protection.

5.6.9 Corrosion protection

All of the steelwork of the offshore wind energy plants (nacelle, tower, etc.) and the foundation must be protected against corrosion. To protect the individual structures, coatings will be selected, for which there is evidence that they are resistant to sea water, in particular in the area of the water-air layer of the foundation, even in combination of UV radiation with sea water. The coat of paint will correspond to the latest technology in hydraulic engineering. A particular value is placed on the compatibility of the paints with the marine environment. Painting of the foundations with anti-fouling agents to prevent possible growths is not planned. The underwater area is especially vulnerable to corrosion and for the lifetime of the foundation is practically inaccessible or very difficult to access for coating work.

Due to the highly corrosive ambient conditions, the design of offshore systems must particularly ensure that dimensioning for the assumed strengths is maintained over the planned lifetime.

For areas which are exposed to spray water, a corrosion rate of 0.3 mm per year is assumed. A removal of material which reduces strength, or a change to the specific strength of the material can also be reduced or minimised by the use of alloy additions, cathodic corrosion protection and protective coatings.

In order to achieve adequate corrosion protection, special coatings will be used for technical components. Corrosion class C5-M applies for the exterior surfaces of constructions which are exposed to high concentrations of salt spray and spray water, C4-M for internal surfaces which are exposed to external air and C3-M for internal surfaces which are not exposed to external air.

The corrosion protection will be implemented according to DIN EN ISO 12944 and the guidelines listed for the testing of coating materials for corrosion protection of steel structures in hydraulic engineering [Richtlinien für die Prüfung von Beschichtungsstoffen für den Korrosionsschutz im Stahlwasserbau] published by the BAW Karlsruhe (RPB 2001).

5.7 Decommissioning concept

After the expiry of the plan for the plants, according to §13 of the new version of the SeeAnlV, they must be removed insofar as they present an obstruction to traffic or to State or Federal defence, or if required for the protection of the marine environment or other public interests. Decommissioning of the plant is carried out according to the latest technology at the time of decommissioning. The decommissioning concept will be produced during the implementation planning and will be submitted to the authorities in good time prior to the start of construction.

After the final termination of operation, the wind energy plant and the tower will be dismantled and the foundation removed from the water. Foundation elements which are inserted into the ground will be cut off so deep below the seabed, that they will not present a hazard to navigation and fishing, even after any possible shift in sedimentation. According to present knowledge, this means that the piles will be cut off at a depth of about 3 to 5 m below the upper surface of the seabed.

For the decommissioning, a similar requirement for vessels is expected as for the construction of the wind farm.

6 Time schedule and plan of measures

The time schedule for the project will be determined by the phases of the project and the steps required. These result from the requirements of the development and the plan approval process. Orientated to the standards of the BSH, the implementation of an offshore wind farm is divided into the project phases design, construction, implementation, operation and decommissioning. A detailed time schedule and plan of measures is attached as an appendix. This time schedule and plan of measures is intended to meet the requirements of §3 paragraph 2 No. 4 of the new version of the SeeAnlV.

The time schedule and plan of measures is a business and trade secret and will therefore not be publicly displayed. The following presents a summary of the intended time schedule up to commissioning.

Phase	Measures	Period
Development	2 years environmental investigations Production of the environmental impact study Preliminary foundation soil investigation Design basis, preliminary design Application for planning approval and 1st approval by the BSH	2011 – 2014
Construction	Main investigation of foundation soil Design planning (Basic Design) Implementation planning Attainment of the 2nd and 3rd BSH approval Consent for power connection 3rd ecological investigation year	2014 – 2017
Design	Production of foundations and plant sections Power connection Construction and commissioning of the wind farm	2018 – 2020
Operation	Operation of the wind farm	from 2020

Table 7: planned time schedule

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