BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

## Comprehensive Summary

# Spatial Offshore Grid Plan for the German Exclusive Economic Zone of the Baltic Sea and non-technical Summary of the Environmental Report 2013

– unofficial translation –

Federal Maritime and Hydrographic Agency

© Bundesamt für Seeschifffahrt und Hydrographie (BSH)

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BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

# Spatial Offshore Grid Plan for the German Exclusive Economic Zone of the Baltic Sea 2013

– unofficial translation –

Hamburg, March 2014

# Content

# 1 The Spatial Offshore Grid Plan

## 1.1 Legal Basis

When Section 17 (2a) Clause 3 and 4 Federal Energy Act (EnWG)[1] entered into force in 2011, the Federal Maritime and Hydrographic Agency was given the task of elaborating an annual offshore grid plan ("Bundesfachplan Offshore" – BFO) for the exclusive economic zone (EEZ) of the Federal Republic of Germany, in consultation with the Federal Network Agency and in coordination with the Federal Agency for Nature Conservation and the coastal federal states.

When Article 1 of the Federal Energy Act[2] amended in December 2012 came into force, some fundamental changes arose regarding grid planning and its more detailed configuration, effective as of 28 December 2012.

The requirements of this plan are now regulated in Section 17a EnWG. During the change to the law, the term "offshore grid plan" ("Offshore Netzplan" – ONP) was replaced by the term "Spatial Offshore Grid Plan". The rules apply to this plan.

According to the statutory assignment, the Offshore Grid Plan in the first place defines the offshore wind farms which are suitable for collective grid connections. Along with the stipulation of the necessary cable routes and sites for the offshore wind farms' grid connections, the Offshore Grid plan contains the cable routes for interconnectors and descriptions of possible cross connections.

It is the goal of the Spatial Offshore Grid Plan to spatially coordinate the existing grid infrastructure and grid topology, particularly in view of the offshore wind farm grid connections in the EEZ, within the parameters given, and to define them in the interests of forward-looking and coordinated overall planning.

## 1.2 Planning Framework

With the Ordinance on Spatial Planning in the German Exclusive Economic Zone in the Baltic Sea (AWZ Ostsee-ROV)[3] of 10th December 2009, there is a spatial plan available for the Baltic Sea (Annex on Section 1 AWZ Ostsee-ROV – hereinafter: Maritime Spatial Plan). According to Section 17a (1) Clause 2 No. 1 EnWG, compliance with the requirements of spatial planning in terms of Section 3 Federal Spatial Planning Act[4] must be checked. According to Section 4 (1) Federal Spatial Planning Act, when the current plan is compiled, the spatial planning goals must be observed and the principles and other spatial planning requirements considered in decisions based on deliberations and discretion.

In principle, the current plan completes the framework set out by the Maritime Spatial Plan. The plan has the same accuracy such as the Maritime Spatial Plan that corresponds to the scale 1:400000. The fundamental spatially-significant stipulations in this plan are in the identification of offshore wind farms which are related in a spatial context and suitable for collective grid connections and in the site, cable route and corridor planning for grid connection systems.

Proceeding from the conditions ascertained, the technical requirements and the priority areas for wind energy already determined in the Maritime Spatial Plan, the plan identifies clusters

[1] Law of 7 July 2005, Federal Law Gazette I p. 1970, corr. p. 3621, last amended by Art. 1, 2 of the third Federal Energy Act amended 20.12.2012, Federal Law Gazette I p. 2730.

[2] Federal Law Gazette I p. 2730.

[3] Federal Law Gazette I p. 3861.

[4] Law of 22 December 2008, Federal Law Gazette I p. 2986, last amended by Article 9 of the law of 31 July 2009 Federal Law Gazette I p. 2585.

of offshore facilities for collective grid connections. The clusters, as far as they go beyond the priority areas stipulated for wind energy thus far, create the conditions for the ordered further development of the grid connection systems which were only sketched out as suggestions in the Maritime Spatial Plan. This corresponds in particular to the existing Federal Spatial Planning Act principle of an economic use of space.

In view of the stipulation of cable routes for cables transmitting electricity towards shore, the sectoral plan continues to develop the stipulation of target corridors to the territorial sea in the Maritime Spatial Plan. This is done taking into account the progressing technical experience and on the basis of the identified clusters and the requirements of spatial planning.

A large part of the plan's remaining stipulations, in particular regarding standardised technical specifications and planning principles, generally derive from the existing Maritime Spatial Plan or they implement it. Due to the degree of detail, a range of further technical stipulations do not find any equivalent in the Maritime Spatial Plan; instead, they express the sectoral, in this respect independent, planning carried out.

## 1.3 Scope of Application, Legal Nature

The plan's scope of application comprises the spatial identification of offshore wind farms which are suitable for collective grid connections and the spatial stipulation of cable routes for subsea cable systems and sites for transformer substation platforms in the German Baltic Sea EEZ. The grid topology is spatially defined and stipulated within the Baltic Sea EEZ. In addition, the Offshore Grid Plan contains standardised technical specifications and planning principles necessary to determine the spatial requirements and for overall coordination. With these specifications, it is intended that a reliable planning basis is created without preventing technical progress. The plan therefore corresponds to the nature of sectoral planning.

According to the currently applicable legal situation, the grid plan will become legally binding through an update of the Maritime Spatial Plan for the EEZ of the Baltic Sea. The Federal Ministry of Transport, Building and Urban Development is the responsible body for updating this regulation pursuant to Section 17 (3) Clause 1 Federal Spatial Planning Act. In late 2012, the Federal Maritime and Hydrographic Agency submitted an evaluation report which states the need to update the spatial planning in the EEZ in relation to the sectoral grid planning.

During the EnWG amendment, it was expressly ruled that the stipulations of the Spatial Offshore Grid Plan are legally binding for planning approval procedures in accordance with the provisions of the Marine Facilities Ordinance.

From a spatial perspective, the plan's scope of application extends to the German EEZ, according to the statutory allocation of powers in Section 17a (1) Clause 1 EnWG. Therefore, there is no stipulation of cable routes going beyond the borders of the German EEZ. The circumstance that particularly the cable routes for subsea cable systems stipulated spatially in the EEZ must be added to an overall system consistent up to the grid connection points onshore is accommodated in the consultation and coordination requirement with the Federal Network Agency, the Federal Agency for Nature Conservation and the coastal federal states for the Baltic Sea region Mecklenburg-Vorpommern and Schleswig-Holstein. In this respect, close consultation is carried out.

## 1.4 Instruments of power system planning

Scenario Framework

Pursuant to Section 12a EnWG, the transmission system operators (TSO) must draw up a common scenario framework annually. This contains various energy management development paths for energy generation and use in the form of scenarios A, B and C, with scenario B representing the central scenario. The scenario framework is the basis for the compilation of the Grid Development Plan (NEP) pursuant to Section 12b EnWG and the Offshore Grid Development Plan (O-NEP) pursuant to Section 17b EnWG and was approved

by the Federal Network Agency in compliance with Section 12a (3) EnWG after conducting a consultation and examination.

Offshore Grid Development Plan and Grid Development Plan

According to Section 17b EnWG, the transmission system operators must submit to the Federal Network Agency an Offshore Grid Development Plan ("Offshore-Netzentwicklungsplan – O-NEP) for the EEZ and the territorial sea up to and including the grid connection points onshore for confirmation every year by 3rd March, for the first time on 3rd March 2013. The O-NEP must contain all effective measures for the needs-based optimisation, reinforcement and expansion of the offshore grid connections which are necessary for a step-by-step, needs-based and cost-effective expansion in the next ten years and a secure and reliable operation of offshore grid connections along with a timescale. The O-NEP therefore specifies the specific chronological order of implementation of the grid connection systems for the next ten years and an additional outlook for the next 20 years.

Since 2012, the transmission system operators have to annually submit a Grid Development Plan (NEP) according to Section 12b (1) EnWG, which must include, amongst other things, all effective measures for the needs-based optimisation, reinforcement and expansion of the grid which are necessary for secure and reliable grid operation over the next ten years.

Stipulation Proceedings

In addition to the task of confirming the O-NEP, the Federal Network Agency also has decision-making authority according to Section 17d (5) EnWG, which states that more detailed provisions regarding content and procedure in the creation of the O-NEP, its implementation and chronology as well as regarding the procedure allocating and transferring connection capacities may be stipulated. Stipulations regarding the procedure for allocating and transferring capacities of grid connections for offshore wind farms will take place in consultation with the Federal Maritime and Hydrographic Agency.

This regulation meets the during the so-called system change of grid connections for offshore wind farms frequently demanded specific chronological order of implementation of the grid connection systems and the allocation of their correspondingly available capacities to the offshore wind farms.

The offshore wind farm operator's former claim to grid connection pursuant to Section 17 (2) EnWG (old version) was thus superseded by the new system described.

Ten Year Network Development Plan

According to Article 8 (3 (b)) of Regulation (EC) No. 714/2009, the European Network of Transmission System Operators for Electricity (ENTSO-E) will adopt a non-binding Community-wide decennial network development plan ("Community-wide network development plan") including a European generation adequacy outlook, every two years. In this context, the European transmission system operators published a so-called Ten Year Network Development Plan in its final and consulted version on 5 July 2012 (TYNDP 2012). This plan contains trans-regional and international expansion measures which are significant for transboundary European energy transmission. The results developed at national level in the NEP and O-NEP will be included in future TYNDP.

Spatial Offshore Grid Plan

The Spatial Offshore Grid Plan stipulates the cable routes, corridors for cable routes or sites for the O-NEP measures to be confirmed based on standardised technical specifications and planning principles. This plan for the Baltic Sea comprises the technical and spatial stipulations for the German Baltic Sea EEZ.

The corresponding plan for the North Sea EEZ is being compiled in a separate procedure. The final version of the Spatial Offshore Grid Plan for the North Sea EEZ for the year 2012 was published on 22nd February 2013.

# 2 Draft Procedure

**Summarised Overview of the Fundamental Procedural Steps**

| |
|---|
| Elaboration of scoping documents (scope of preliminary environmental investigation and first draft of the plan) |
| Scoping Meeting on 23 April 2013 |
| Compilation of the plan and implementation of strategic environmental assessment (SEA) |
| Public Hearing Meeting on 10 September 2013 |
| Deadline for national responding to draft documents 14 October 2013 |
| Deadline for international responding to draft documents 10 January 2013 |
| Revision of grid plan and SEA report |
| Coordination and consultation process |
| Publication of Spatial Offshore Grid Plan |
| Update |

# 3 Introduction

The development of a strategically planned grid topology for the transmission of energy is of enormous significance for the power supply using renewable energy sources. A systematic and efficient grid expansion is an essential requirement, above all for the accelerated expansion of offshore wind energy.

In order to legally stipulate the cable routes and sites necessary for the grid topology in the Spatial Offshore Grid Plan, the Federal Maritime and Hydrographic Agency was given the task of spatially planning the grid connection systems in the EEZ within the sense of a coordinated, overall system.

The following chapters will illustrate in more detail the individual subject matters of Section 17a (1) Clause 2 No. 1 to 7 EnWG. The structure is following the statutory specifications.

According to this, the plan contains stipulations regarding:

1. Offshore facilities (offshore wind farms) in spatial context and suitable for collective grid connections (Chapter 4).
2. Cable routes and corridors for cable routes for grid connections for offshore facilities (offshore wind farms) (Chapter 5.3),
3. Locations where the grid connections for offshore wind farms cross the border between the Exclusive Economic Zone and the territorial sea (gates, Chapter 5.3.2.3),
4. Sites for converter or transformer substation platforms (Chapters 4 and 5.2),
5. Cable routes or corridors for cable routes for interconnectors (Chapter 6) and
6. Cable routes or corridors for cable routes for possible cross connections between the facilities and cable routes mentioned in 1, 2, 4 and 5 (Chapter 7)
7. Standardised technical specifications and planning principles.

The standardised technical specifications, defined in the BFO and implemented in the spatial planning, as well as the planning principles have to be understood as principles, which can be deviated from in a justified case. In the context of the implementation of the specifications and principles within spatial planning of the BFO deviations from individual principles had to be made, because in individual cases not all principles could or can be implemented

simultaneously due to existing framework conditions. Therefore they must be weighed against each other. In the corresponding chapters the deviations from the principles are described and justified. If a deviation is required it must be submitted in the individual approval procedures as well as in the procedure of updating the plan while it has to be justified comprehensibly and plausibly. It is essential that the deviation achieves the pursued objectives and purposes in an equivalent manner or do not affect them significantly.

Within the consultation procedures suggested standardised technical specifications and planning principles for the objects of regulation are shown below and implemented in spatial planning. The spatial definitions are described in text form and illustrated cartographically.

When creating the Spatial Offshore Grid Plan for the Baltic Sea, the Federal Maritime and Hydrographic Agency will examine whether the stipulations are obstructed by any predominant public or private concerns. The following will be examined in particular:

- compliance with spatial planning requirements
- coordination with other spatially significant planning and measures
- alternatives to cable routes, corridors for cable routes or sites to be given serious consideration.

# 4 Identification of Offshore Wind Farms for Collective Grid Connections

## 4.1 Planning Horizon

### 4.1.1 **Objectives of the Federal Government**

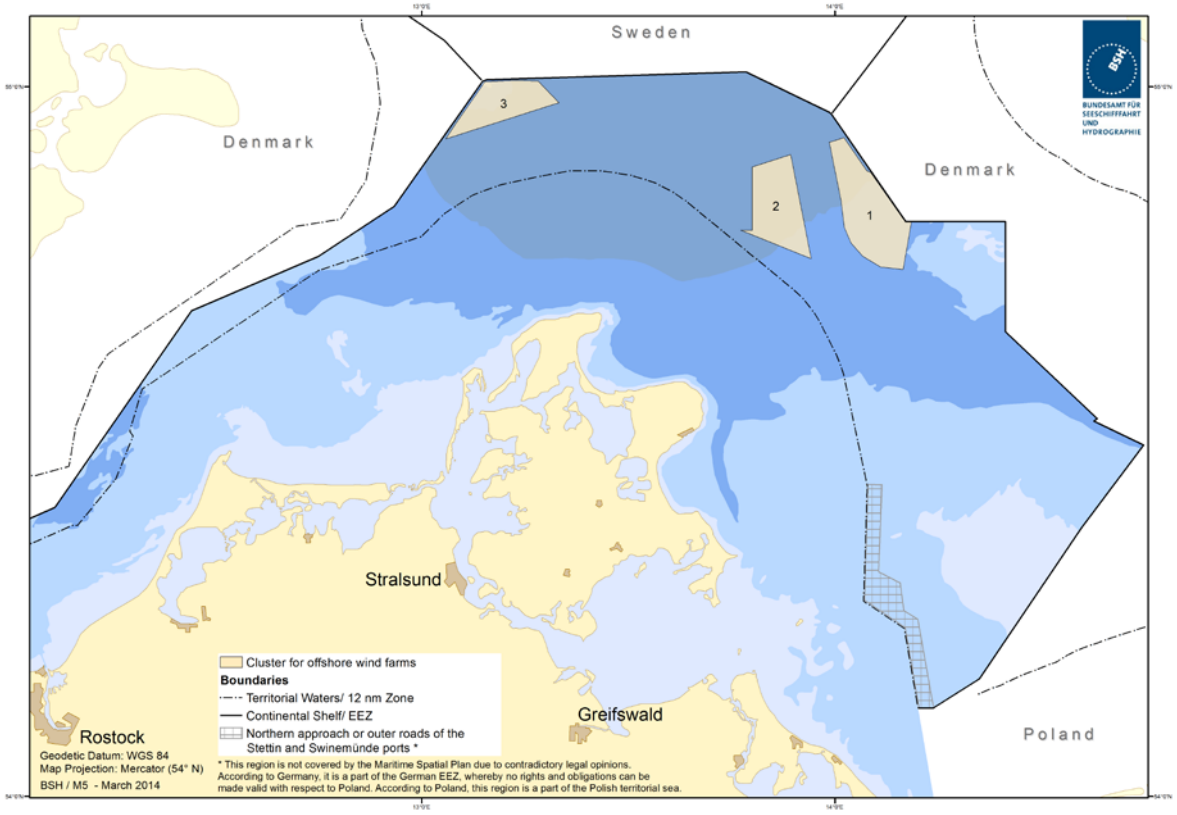
### 4.1.2 **Scenario framework and Offshore Grid Development Plan**

## 4.2 Spatial Definition of Clusters

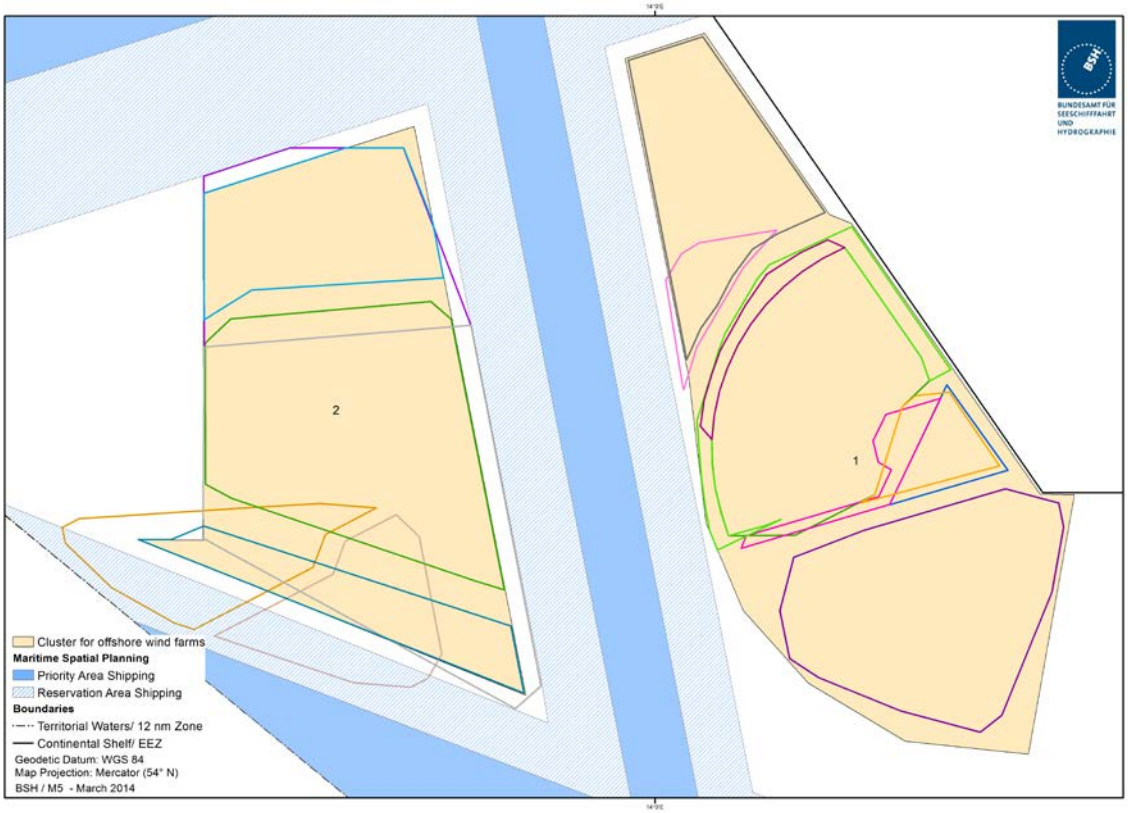
### 4.2.1 **Clusters included**

### 4.2.2 **Assessment of projects and framework conditions**

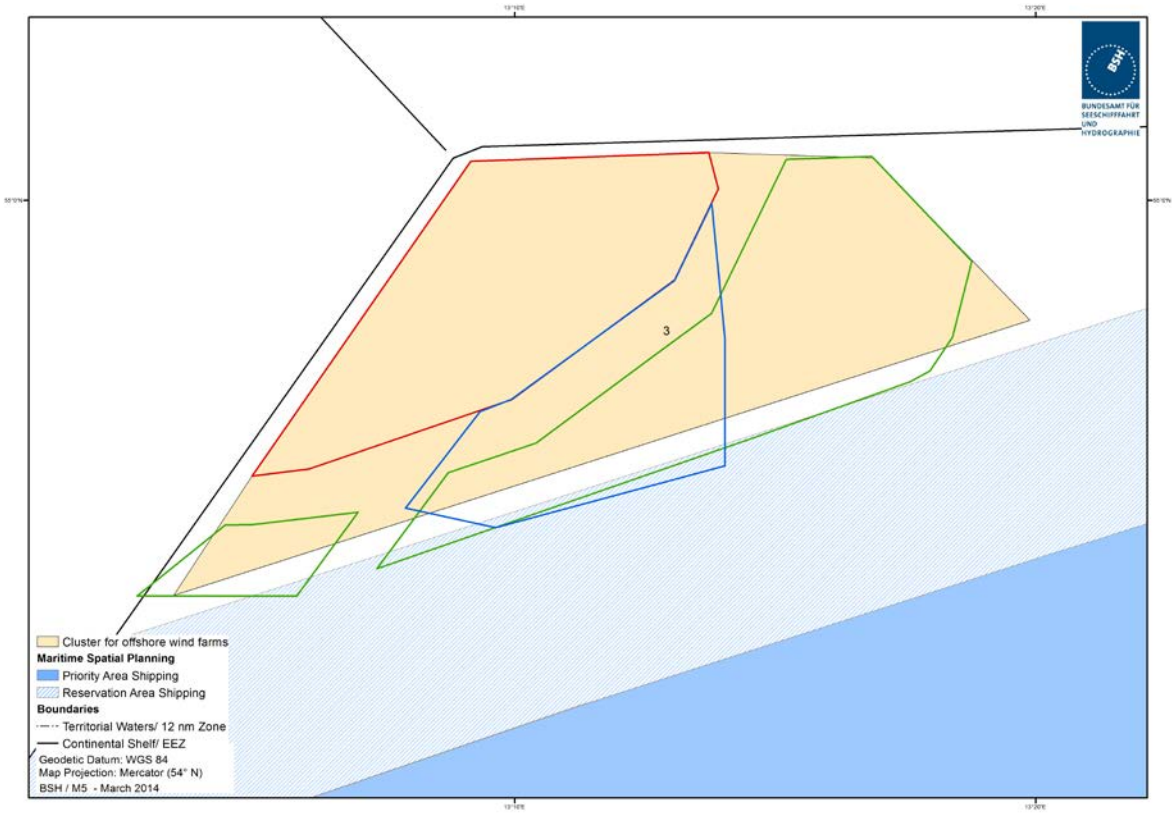
### 4.2.3 **Cartographic representation of clusters included**




Map 1: Clusters for offshore wind farms in the Baltic Sea EEZ




Map 2: Offshore wind farm projects in the area of Clusters 1 and 2




Map 3: Offshore wind farm projects in the area of Cluster 3

## 4.3 Determination of the Expected Offshore Wind Farm Capacity

### 4.3.1 Calculation Method for determining the capacity

The following table shows the calculation of the expected offshore wind farm capacity for the individual clusters.

| Wind farm cluster | Approved wind farm capacity [MW] | Estimated capacity of planned wind farms | | | | Cluster capacity [MW] |
|---|---|---|---|---|---|---|
| | | Area [km$^2$] | Turbine capacity [MW] | Turbines/area [No./km$^2$] | Area approach capacity [MW] | |
| **Cluster 1** | 880 | 55 | 7 | 2.0 | 770 | 1650 |
| **Cluster 2** | 0 | 92 | 7 | 2.0 | 1288 | 1288 |
| **Cluster 3** | 288 | 31 | 7 | 2.0 | 434 | 722 |
| ∑ | 1168 | | | | | 3660 |

### 4.3.2 **Cluster capacity planning horizon 2030**

| Wind farm clusters | Approx. MW/ cluster | Approved wind farm capacity [MW] | Number of cable systems [maximum] | Transmission capacity [MW] |
|---|---|---|---|---|
| **Cluster 1** | 1650 | 400 | 8 | 250 |
| | | | | 250 |
| | | 480[5] | | 250 |
| | | | | 250 |
| | | | | 250 |
| | | | | 250 |
| | | | | 250 |
| | | | | 250 |
| **Cluster 2** | 1288 | | 7 | 250 |
| | | | | 250 |
| | | | | 250 |
| | | | | 250 |
| | | | | 250 |
| | | | | 250 |
| | | | | 250 |
| **Cluster 3** | 722 | 288 | 4 | 200 |
| | | | | 200 |
| | | | | 250 |
| | | | | 250 |
| **Σ** | **3660** | | | **4650** |
| **Baltic Sea territorial sea (for information only)** | **Potential of 1,6 up to 8 GW** | | | |

### 4.3.3 **Cluster capacity planning horizon 2023**

| Wind farm clusters | Under construction/ approved (MW) |
|---|---|
| **Cluster 1 (priority area)** | 880 |
| **Cluster 3** | 288 |
| **Σ** | **1168** |

[5] The project is currently subject to revision procedures. According to the project company a reduction of the wind farm power and a connection, together with the still in the approval process adjacent offshore wind farms in the priority area for wind energy, is provided. A reduction of power and number of planned cable systems for cluster 1 is possible and can be considered as part of the updating of this plan.

# 5 Grid Connections for Offshore Wind Farms

According to Section 17d (1) Clause 1 EnWG, the responsible transmission system operator (TSO) must secure the grid connection of offshore wind farms or, according to the specifications of the O-NEP confirmed by the Federal Network Agency, construct and operate it. It is the task of this plan to spatially determine the necessary cable routes and sites for the entire grid topology in the Baltic Sea EEZ up to the border of the 12 nm zone within the framework of the existing parameters.

The spatial planning is developed on the basis of standardised technical specifications and planning principles. The stipulation of the technical concept for grid connections, which forms the basis for the definition of the individual principles, is central for determining and securing of the areas required for the grid connection of offshore wind farms. Based on this, standardised technical specifications and planning principles will be stipulated individually for the regular components of the grid connections. The necessary spatial requirements will be determined on the basis of the standardised technical specifications and planning principles, cartographically represented and stipulated.

## 5.1 Technical Concept for grid connections

### 5.1.1 Standardised technical specifications

**Summary**

- Use of three-phase alternating current (AC) technology
- Standard transmission voltage 220 kV

#### 5.1.1.1 Use of three-phase alternating current (AC) technology

Grid connections for offshore wind farms will be set up using AC technology.

#### 5.1.1.2 Standard transmission voltage 220 kV

The AC system for the grid connections will be implemented with a standard transmission voltage of 220 kV.

## 5.2 Sites for Transformer Substation Platforms

The transformer substation platform is the platform on which the electricity generated by the offshore wind farm is bundled and transformed to the transmission voltage for conducting the energy towards land. Pursuant to Section 17a (1) Clause 2 No. 4 and 7 EnWG, the grid plan contains stipulations regarding sites for transformer substation platforms and standardised technical specifications and planning principles.

### 5.2.1 Standardised technical specifications

**Summary**

- Use of AC technology
- Standard transmission voltage 220 kV
- Use of the offshore wind farm’s transformer substation platform by the grid operator
- Standardisation of grid components on the transformer substation platform
- Creation of the conditions for an efficient use of grid connections

#### 5.2.1.1 Use of AC technology

The grid connection on the transformer substation platform will be implemented using AC technology.

#### 5.2.1.2 Standard transmission voltage 220 kV

The grid connection system on the transformer substation platform will be implemented with a standard transmission voltage of 220 kV.

#### 5.2.1.3 Use of the offshore wind farm's transformer substation platform by the transmission system operator

The offshore wind farm's transformer substation platform will be jointly used by the transmission system operator, close cooperation with regards to construction and operation is therefore necessary.

#### 5.2.1.4 Standardisation of grid components on the transformer substation platform

Standardisation of all grid components to be installed on the transformer substation platform is aimed for.

#### 5.2.1.5 Creation of the conditions for an efficient use of grid connections

When transformer substation platforms are being planned and constructed, allowances must be made for an efficient use of grid connection. . This applies in particular for the allocation of capacities in the allocation process and for connections from grid connections between them.

### 5.2.2 Planning Principles

**Summary**

- Selection of a site from which the total length of the cable route to the grid connection point is as small as possible and below 100 km
- Space requirement of 100 x 100 m and additional room for manoeuvring
- Secure accessibility
- Traffic safety may not be compromised (500 m distance from priority and reservation areas for shipping)
- Consideration of all existing and approved uses, distance 500 m
- Construction in Natura2000 areas/protected biotopes not permitted, beyond this only with noise mitigation measures
- Consideration of cultural assets and sites where munitions have been discovered
- Obligation to remove

#### 5.2.2.1 Selection of a site from which the total length of the cable route to the grid connection point is as small as possible and below 100 km

The site for the transformer substation platform should be as close to the edge of the wind farm as possible so that the AC subsea cable system is as short as possible and the total length of the cable route between the grid connection point and site of the transformer substation platform is, where possible, less than 100 km.

#### 5.2.2.2 Space requirement 100 m x 100 m

For a transformer substation platform, an area of 100 m x 100 m must be secured.

#### 5.2.2.3 Secure accessibility

The determination of the site and the planning of the transformer substation platforms must ensure their accessibility.

#### 5.2.2.4 No impairment of traffic

Traffic safety may not be impaired by the construction and operation of transformer substation platforms.

#### 5.2.2.5 Consideration of all existing and approved uses

All existing and approved pipelines and subsea cables as well as those that are being stipulated in this plan, offshore wind farms and other superstructures have to be taken into consideration by keeping a regular distance of 500 m.

#### 5.2.2.6 Construction in Natura2000 areas not permitted; Construction outside protected biotopes

The construction of transformer substation platforms in Natura2000 areas is not permitted. Adverse effects on the marine environment, in particular on the natural functions and their eco-systematic importance for the marine environment should be avoided during construction and operation of the platform. Areas known as protected biotope types according to Section 30 Federal Nature Conservation Act or corresponding structures have to be avoided as far as possible. Possible effects of the transformer substation platforms on the marine environment should be investigated and demonstrated in a project-related monitoring concept according to the specifications of the approval authority.

#### 5.2.2.7 Noise reduction

If transformer substation platforms are installed with pile foundations, the use of an effective sound reduction system is to be provided during the pile driving of the foundations. The noise reduction system must be integrated into the design of the foundation construction early on in proceedings.

#### 5.2.2.8 Consideration of cultural assets

Known sites where cultural assets have been discovered must be taken into consideration during the site selection. If unknown cultural assets located on the seabed should be found during the planning or construction of the transformer substation platforms, the appropriate measures to secure the cultural assets must be taken.

#### 5.2.2.9 Consideration of sites where munitions have been discovered

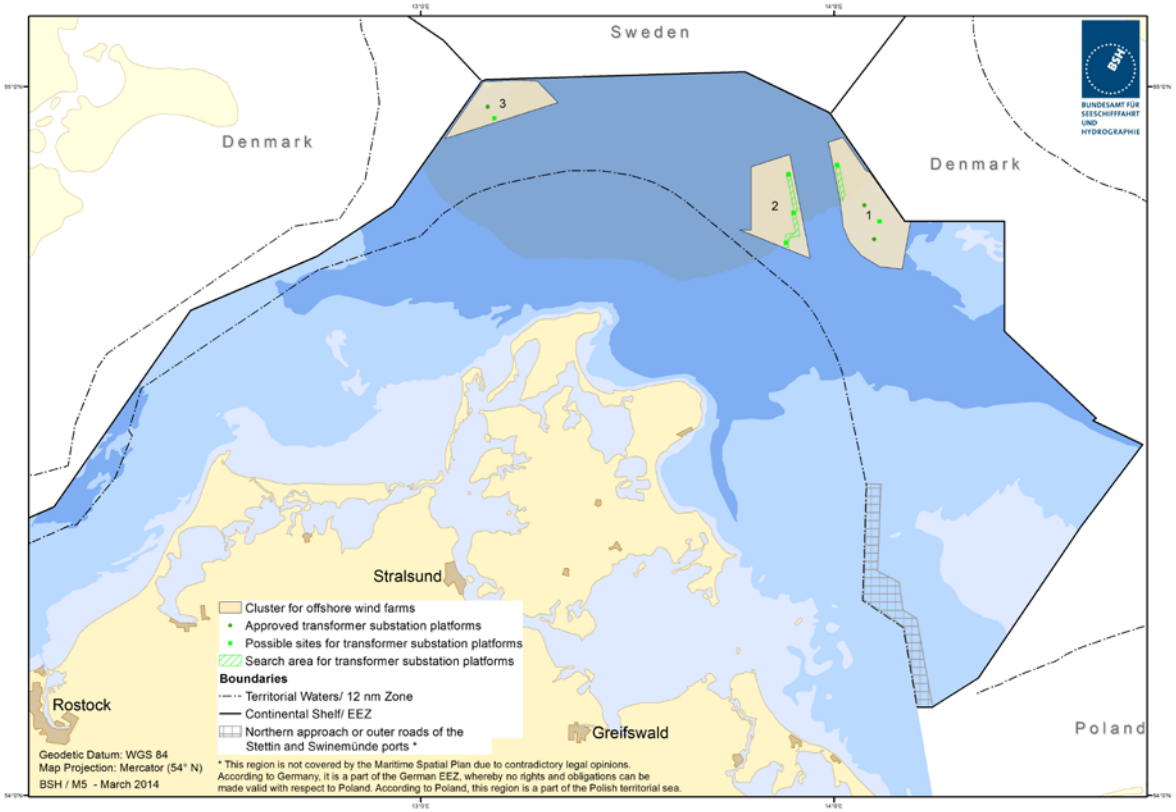
Known sites where munitions have been found must be avoided during the site selection. If unknown munitions-contaminated sites should be found during the planning or construction of the transformer substation platforms, then appropriate protective measures must be taken.

#### 5.2.2.10 Obligation to remove

After the transformer substation platforms are no longer being used, they must be removed.

### 5.2.3 **Spatial stipulations**

### 5.2.4 **Cartographic representation**




Map 4: Possible sites and search areas for transformer substation platforms

## 5.3 Corridors for Cable Routes for AC Subsea Cable Systems

### 5.3.1 Standardised technical specifications

**Summary**

- Use of AC technology
- Standard transmission voltage 220 kV

#### 5.3.1.1 Use of AC technology

AC subsea cable systems will be implemented using AC technology.

#### 5.3.1.2 Standard transmission voltage 220 kV

AC subsea cable systems will be implemented with a standard transmission voltage of 220 kV.

### 5.3.2 Planning Principles

The Maritime Spatial Plan for the German Baltic Sea EEZ has defined the targets and principles of the Spatial Planning with regards to grid connections under 3.3.1. These concern the laying, operation and removal of subsea cables. The following planning principles refer to the respective statements of the Maritime Spatial Plan. The target of consideration of existing uses/ rights of use will be implemented through the stipulations and the following planning principles. Further principles will be implemented as far as is possible.

**Summary**

- Maximum bundling possible by parallel routing
- Distances in case of parallel routing: 100 m; 200 m after every second cable system depending on the geological site conditions
- Routing through gates I and III
- Crossing of priority and reservation areas for shipping as right-angled as possible
- Consideration of all existing and approved uses (construction with distance of 500 m, shipping routes 300 m distance)
- Avoiding of cable crossings and, if they are absolutely necessary, then crossing as right-angled as possible; distance between turning points 250 m
- Coverage, which ensures a permanent safety of subsea cable systems
- Routing as far outside of the Natura2000 areas/protected biotopes
- Avoiding heating of sediment (maximal 2 K)
- Environmentally-friendly installation procedure
- Coordinated timing of the overall installation works
- Consideration of cultural assets and sites where munitions have been discovered
- Obligation to remove

#### 5.3.2.1 Bundling

Concerning AC subsea cables routing, the maximum degree of bundling possible in terms of parallel routing should be implemented as well as routing parallel existing structures.

#### 5.3.2.2 Distances in case of parallel routing

When AC subsea cable systems are routed parallel, a distance of 100 m between the individual systems is required. After every second cable system, a distance of 200 m should be met. The specific geological site conditions must be taken into account.

#### 5.3.2.3 Routing through gates

On the border of the EEZ and the 12 nm zone AC subsea cable systems must, be routed through gates I and III, respectively.

#### 5.3.2.4 Crossings of priority and reservation areas for shipping

AC subsea cable systems must cross the priority and reservation areas stipulated for shipping in the Baltic Sea EEZ Maritime Spatial Plan by the shortest route possible if they cannot be routed parallel existing structures.

#### 5.3.2.5 Consideration of existing and approved uses

When the routing of AC subsea cable systems is selected, consideration should be given to existing and approved uses and rights of use as well as to the concerns of shipping and fisheries. There must be appropriate consideration for already existing piping and subsea cables when the routing for new subsea cable systems is selected; a distance of 500 m must be observed insofar as the geological site conditions do not require greater distances.

#### 5.3.2.6 Crossings

Crossings of AC subsea cable systems should be avoided as far as possible between one another and with other existing pipelines and existing subsea cables or those which have been stipulated within the framework of this plan. If crossings cannot be avoided, they must be implemented as right-angled as possible according to the respective state of the technology.

If crossing other infrastructure cannot be implemented at a right angle, the crossing angle should not fall short of 45°, and a distance of at least 250 m should be provided between the turning points which become necessary.

#### 5.3.2.7 Covering

In determining the permanently guaranteeing coverage of AC subsea cable systems, the needs of shipping and fisheries, protection of the marine environment and system security should be considered particular. For this purpose a low position of the cable which ensures a permanent security of the cable systems is to produce during installing. The determination of the produced coverage is done in individual evaluation based on a comprehensive study to define the required coverage.

#### 5.3.2.8 Installation outside of Natura2000 areas and protected biotopes

When the AC cable systems are installed, possible impairments to the marine environment should be minimised. For that to happen, the AC cable systems should be installed outside of Natura2000 areas. Known areas of protected biotope types according to Section 30 Federal Nature Conservation Act or corresponding structures have to be avoided as far as possible.

The specifications in Section 45 a Water Management Act must be observed; best environmental practice pursuant to the Helsinki Convention and the applicable state of technology should be considered and specified in the individual licensing procedure.

#### 5.3.2.9 Heating of Sediment

When installing AC subsea cable systems potential adverse effects on the marine environment through a cable-induced heating of sediment should be largely reduced. As precautionary nature conservation value the so-called "K-2 criterion" must be observed,

which sets a maximum acceptable temperature increase of the sediment by 2 kelvin in 20 cm sediment depth.

#### 5.3.2.10 Environmentally-friendly installation procedures

In order to protect the marine environment, burial procedures for AC subsea cable systems should be selected being as environmentally-friendly as possible.

#### 5.3.2.11 Coordinated timing of the overall installation works

In order to avoid or reduce cumulative effects, taking into account the project-specific conditions, the AC subsea cable system burial and trenching campaigns should be coordinated.

#### 5.3.2.12 Consideration of cultural assets

Known sites where cultural assets have been discovered must be taken into consideration during the cable route selection. If unknown cultural assets located on the seabed should be found during the planning or installation of AC subsea cable systems, the appropriate measures to secure the cultural assets must be taken.

#### 5.3.2.13 Consideration of sites where munitions have been discovered

Known sites where munitions have been found must be avoided during the selection of the routes. If unknown munitions-contaminated sites should be found during the planning or the laying of the AC subsea cable systems, then appropriate protective measures must be taken.

#### 5.3.2.14 Obligation to remove

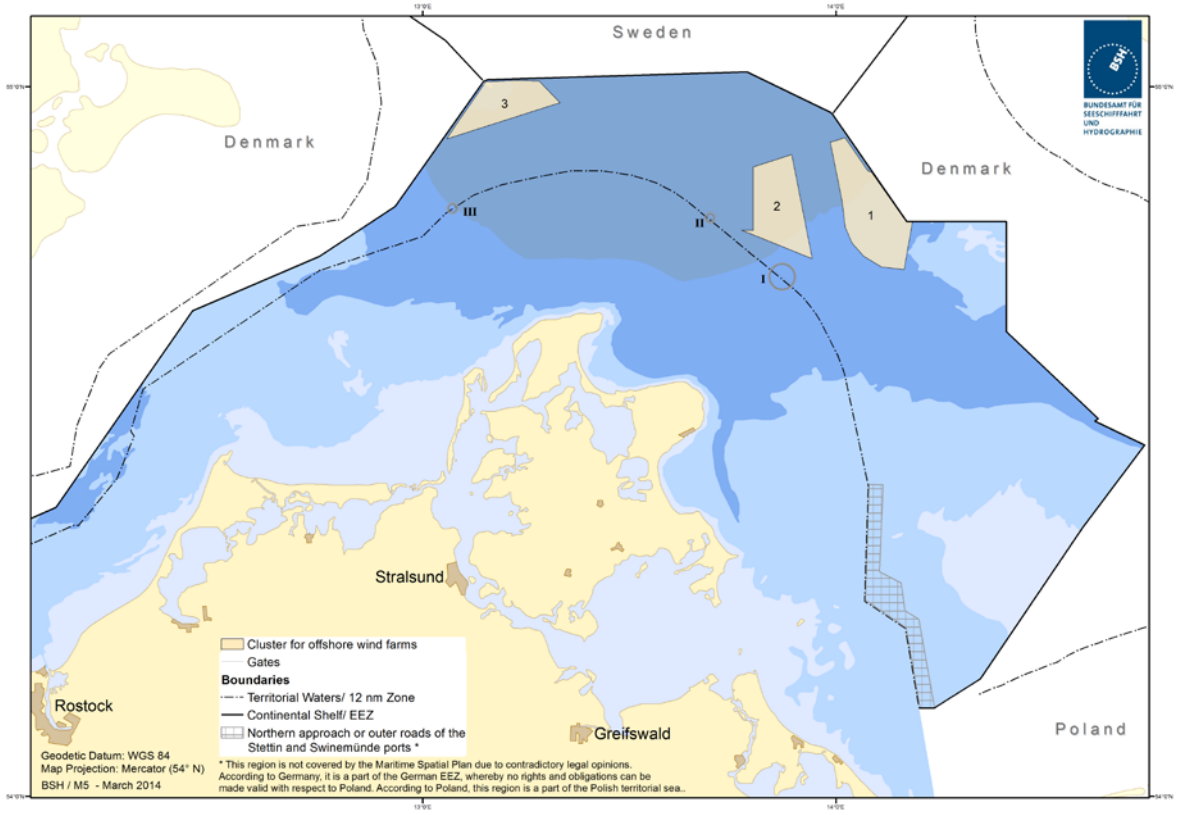
AC subsea cable systems must be removed after they are no longer used. If the removal causes greater adverse effects than leaving them there, the removal must be completely or partly abandoned unless it is necessary for reasons of traffic safety and ease. If they are left there, suitable monitoring measures should be arranged regarding possible future risks.

### 5.3.3 Spatial stipulations

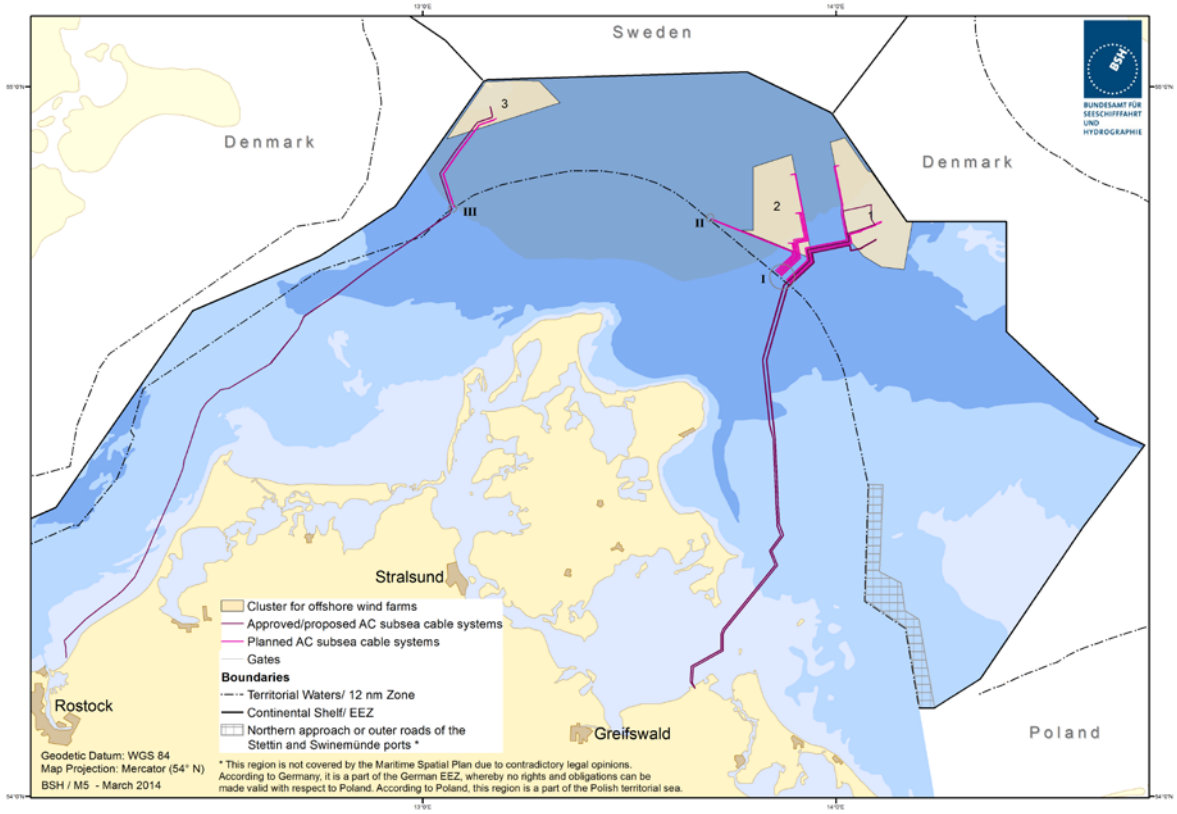
#### 5.3.3.1 Gates

#### 5.3.3.2 Corridors for Cable Routes for AC Subsea Cable Systems

### 5.3.4 **Cartographic representation**




Map 5: Gates I to III for Grid Connections




Map 6: Corridors for Cable Routes for AC Subsea Cable Systems

## 5.4 Technical Option for Platforms with Bundling Function

A **bundling platform** is a platform which has the sole function of bundling the power arriving from several offshore wind farms on a standard voltage type and level.

The TSO's technical concept proposes the connection of the wind farms via AC systems. It is however not foreseeable at the moment that the wind farm output can be adapted to the cable capacities. Therefore, the wind farm cable systems are to be "collected" on the bundling platform in order to possibly reduce the number of systems leading towards the shore. The question of "if" and "when" establishes a platform with bundling function is not part of this plan. This is an object of the Federal Network Agency in the context of the O-NEP.

### 5.4.1 Standardised technical specifications

**Summary**

- Use of AC technology
- Standard transmission voltage 220 kV

#### 5.4.1.1 Use of AC technology

Platforms with bundling function will be implemented using AC technology.

#### 5.4.1.2 Standard transmission voltage 220 kV

Platforms with bundling function will be implemented with a standard transmission voltage of 220 kV.

### 5.4.2 Planning Principles

**Summary**

- set back as much as possible to the margins of the cluster, considering the system relevance of the platform with bundling function in site selection
- Accessible by helicopter and ship
- Space requirement of 100 x 200 m and additional room for manoeuvring
- Traffic safety may not be compromised (500 m distance from priority and reservation areas for shipping)
- Consideration of all existing and approved uses, distance 500 m
- Construction in Natura2000 areas/protected biotopes not permitted, beyond this only with noise mitigation measures
- Consideration of cultural assets and sites where munitions have been discovered
- Obligation to remove

#### 5.4.2.1 Position of bundling platforms

Bundling platforms must be constructed on the edge of the cluster where possible.

#### 5.4.2.2 Accessibility by helicopter and ship

Bundling platforms must be planned in such a way that they can be accessed reliably by helicopter and ship.

#### 5.4.2.3 Space requirement 100 m x 200 m

For a bundling platform, an area of 100 m x 200 m must be provided. For platforms arranged next to one another, additional room for manoeuvre must be secured.

#### 5.4.2.4 No impairment of traffic

Traffic safety may not be impaired by the construction and operation of bundling platforms.

#### 5.4.2.5 Consideration of all existing and approved uses

All existing and approved pipelines and subsea cables as well as those that are being stipulated in this plan, offshore wind farms and other superstructures have to be taken into consideration by keeping a regular distance of 500 m.

#### 5.4.2.6 Construction in Natura2000 areas not permitted; Construction outside protected biotopes

The construction of bundling platforms in Natura2000 areas is not permitted. Adverse effects on the marine environment, in particular on the natural functions and their eco-systematic importance for the marine environment, should be avoided during construction and operation of the platform. Areas known as protected biotope types according to Section 30 Federal Nature Conservation Act or corresponding structures have to be avoided as far as possible. Possible effects of the bundling platforms on the marine environment should be investigated and demonstrated in a project-related monitoring concept according to the specifications of the approval authority.

#### 5.4.2.7 Noise reduction

If bundling platforms are installed with pile foundations, the use of an effective sound reduction system is to be provided during the pile driving of the foundations. The noise reduction system must be integrated into the design of the foundation construction early on in proceedings.

#### 5.4.2.8 Consideration of cultural assets

Known sites where cultural assets have been discovered must be taken into consideration during the site selection. If unknown cultural assets located on the seabed should be found during the planning or construction of the bundling platforms, the appropriate measures to secure the cultural assets must be taken.

#### 5.4.2.9 Consideration of sites where munitions have been discovered

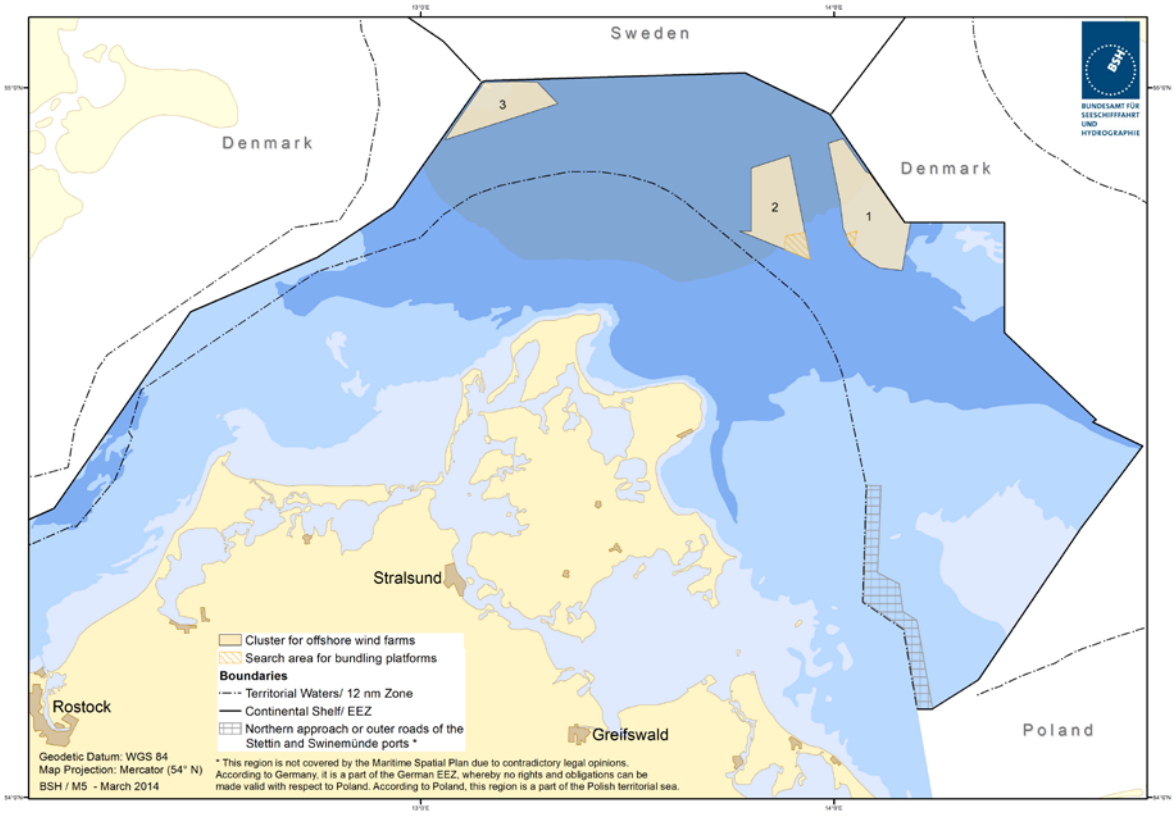
Known sites where munitions have been found must be avoided during the site selection. If unknown munitions-contaminated sites should be found during the planning or construction of the bundling platforms, then appropriate protective measures must be taken.

#### 5.4.2.10 Obligation to remove

After the bundling platforms are no longer being used, they must be removed.

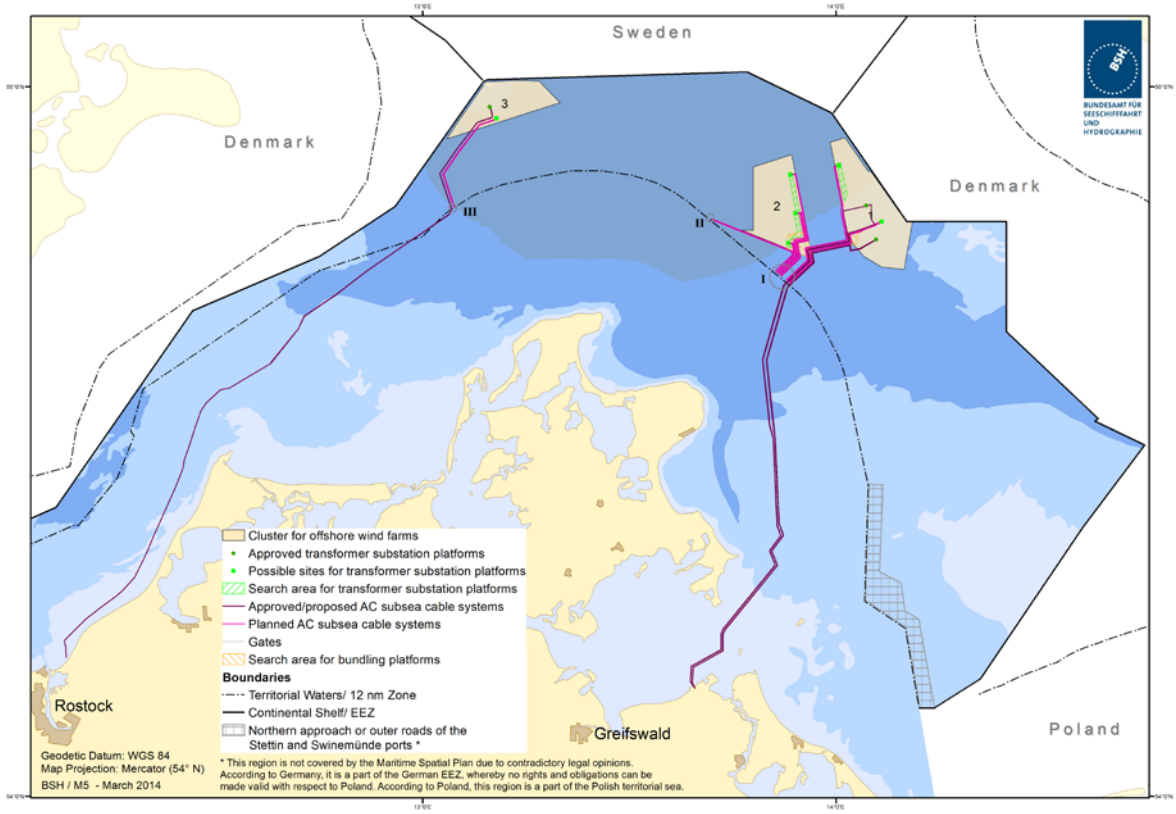
### 5.4.3 Spatial stipulations

### 5.4.4 **Cartographic representation**

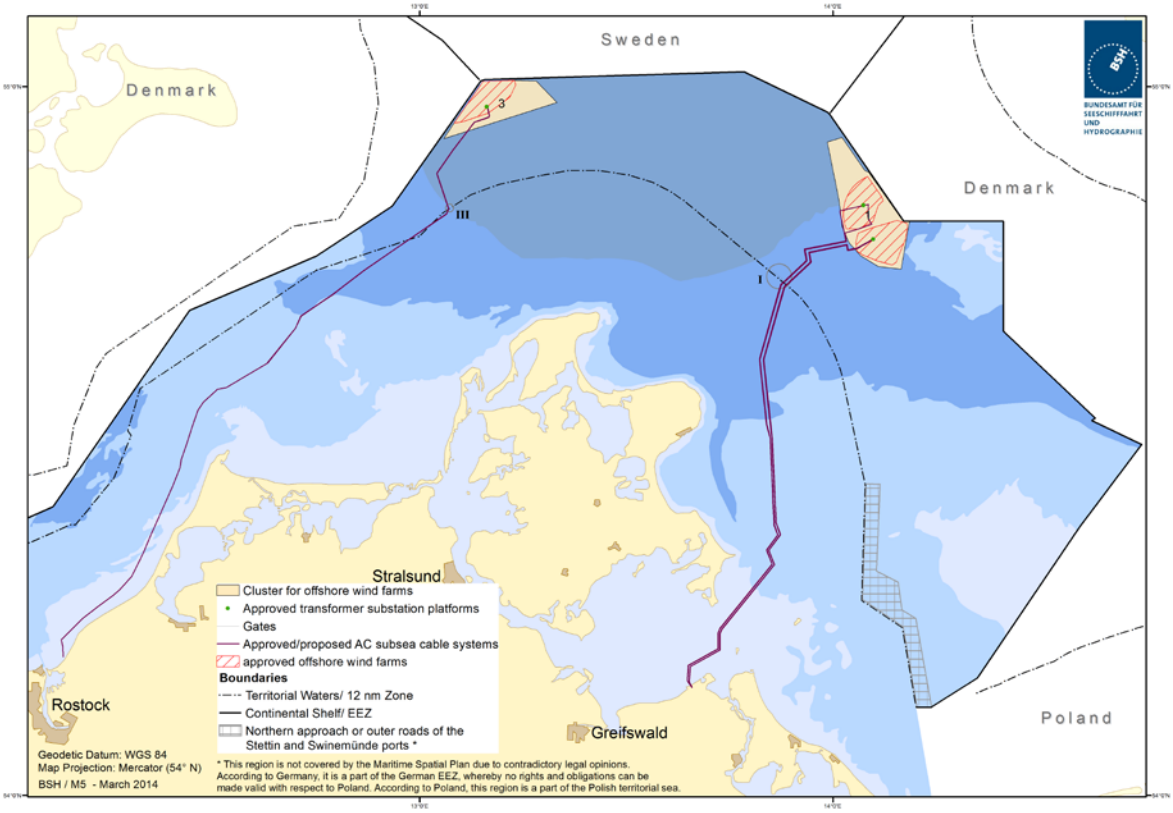



Map 7: Search areas for bundling platforms

## 5.5 Cartographic Representation of Grid Connections




Map 8: Summarising representation of grid connection for offshore wind farms (2030)




Map 9: Summarising representation of grid connection for offshore wind farms (2023)

# 6 Corridors for Crossborder Subsea Cable Systems (Interconnectors)

Pursuant to Section 17a (1) Clause 2 No. 5 EnWG, the Spatial Offshore Grid Plan contains stipulations regarding cable routes or corridors for cable routes for crossborder subsea cable systems (interconnectors) and standardised technical specifications and planning principles. **Interconnectors** in terms of this plan should be understood as **subsea cable systems** which **run through at least two countries bordering on the Baltic Sea**. This plan should ensure that cable routes for possible interconnectors are spatially secured in order to ensure that they are spatially fitted into a coordinated overall system, in particular with regard to the grid connection systems for offshore wind farms. The so-called "Combined Grid Solution", the requested crossborder subsea cable system is spatially depicted in the plan in addition to the currently operating interconnectors "Kontek" and "Baltic Cable". The CGS connects Denmark and Germany across the offshore wind farm cluster 3.This project was already listed as a priority requirement measure in the grid development plan for power 2012 and approved last year by the Federal Network Agency. In the German Network Development Plan, which entered into force on 27.07.2013, the project is proposed as Project No. 29, in which the energy economical need and priority requirement is set out. The project is also included in the Annex of the TYNDP 2012 for the Baltic Sea area without referring to special aspects. The grid plan now stipulates the specific corridors or cable routes for the project in the EEZ.

Based on the NEP 2013 approved by the Federal Network Agency commissioning of the interconnector CGS project is aimed at between 2020 and 2022. The Danish regulator plans the beginning of operation for this cable already in 2018.

In order to create the spatial conditions for a transnational Baltic Sea grid, gates through which future interconnectors are to be routed when entering the German EEZ will be

stipulated over and above the existing specific planning, complying with the following standardised technical specifications and planning principles.

## 6.1 Standardised Technical Specifications

**Summary**

- Implementation as direct current (DC) subsea cable system with bundled supply and return conductor
- Consideration of and incorporation in grid planning

### 6.1.1 **Implementation as direct current (DC) subsea cable system**

Interconnectors are usually implemented as DC cable systems with a supply conductor and return conductor as a bundled cable system.

### 6.1.2 **Consideration of overall system**

The planning interconnectors should take into consideration the stipulations of the spatial offshore grid plan and be fitted into the overall system.

## 6.2 Planning Principles

**Summary**

- Maximum bundling possible by parallel routing
- Distances in case of parallel routing: 100 m; 200 m after every second cable system depending on the geological site conditions
- Routing through gates
- Crossing of priority and reservation areas for shipping as right-angled as possible
- Consideration of all existing and approved uses (construction with distance of 500 m, shipping routes 300 m distance)
- Avoiding of cable crossings and, if they are absolutely necessary, then crossing as right-angled as possible; distance between turning points 250 m
- Coverage, which ensures a permanent safety of subsea cable systems
- 
- Routing as far outside of the Natura2000 areas/protected biotopes
- Avoiding heating of sediment (maximal 2 K)
- Environmentally-friendly installation procedure
- Coordinated timing of the overall installation works
- Consideration of cultural assets and sites where munitions have been discovered
- Obligation to remove

### 6.2.1 **Bundling**

Concerning interconnectors routing, the maximum degree of bundling possible in terms of parallel routing should be implemented as well as routing parallel existing structures.

### 6.2.2 **Distances in case of parallel routing**

When interconnectors are routed parallel, a distance of 100 m between the individual systems is required. After every second cable system, a distance of 200 m should be met. The specific geological site conditions must be taken into account.

### 6.2.3 **Routing through gates**

Interconnectors must be routed through the gates specified on the outside border of the German EEZ and at the border of the EEZ and the 12 nm zone.

### 6.2.4 **Crossing of priority and reservation areas for shipping**

For the priority and reservation areas stipulated for shipping in the Baltic Sea EEZ Maritime Spatial Plan, the interconnectors have to cross via the shortest possible route as far as parallel routing to existing structures is not possible.

### 6.2.5 **Consideration of existing and approved uses**

When the routing of interconnectors is selected, consideration should be given to existing and approved uses and rights of use as well as to the concerns of shipping and fisheries. There must be appropriate consideration for already existing pipelines and subsea cables when the routing for new interconnectors is selected; a distance of 500 m must be observed insofar as the geological site conditions do not require greater distances**.**

### 6.2.6 **Crossings**

Crossings of between interconnectors should be avoided as far as possible between one another and with other existing pipelines and existing subsea cables or those which are being stipulated within the framework of this plan. If crossings cannot be avoided, they must be implemented as right-angled as possible according to the respective state of the technology.

If crossing other infrastructure cannot be implemented at a right angle, the crossing angle should not fall short of 45° and a distance of at least 250 m should be provided between the turning points which become necessary.

### 6.2.7 **Covering**

In determining the permanently guaranteeing coverage of interconnectors, the needs of shipping and fisheries, protection of the marine environment and system security should be considered particular. For this purpose a low position of the cable which ensures a permanent security of the cable systems is to produce during installing. The determination of the produced coverage is done in individual evaluation based on a comprehensive study to define the required coverage.

### 6.2.8 **Installation outside of Natura2000 areas and protected biotopes**

When the interconnectors are installed, possible impairments to the marine environment should be minimised. For that to happen, the interconnectors should be installed outside of the Natura2000 areas. Known areas of protected biotope types according to Section 30 Federal Nature Conservation Act or corresponding structures must be avoided as far as possible.

The specifications in Section 45a Water Management Act must be observed; best environmental practice pursuant to the Helsinki Convention and the applicable state of technology should be considered and specified in the individual procedure.

### 6.2.9 **Heating of Sediment**

When installing interconnectors potential adverse effects on the marine environment through a cable-induced heating of sediment should be largely reduced. As precautionary nature

conservation value the so-called "K-2 criterion" must be observed, which sets a maximum acceptable temperature increase of the sediment by 2 kelvin in 20 cm sediment depth.

#### 6.2.10 **Environmentally-friendly installation procedure**

In order to protect the marine environment, an installation procedure for the interconnectors which is as environmentally-friendly as possible should be selected.

#### 6.2.11 **Coordinated timing of the overall installation works**

In order to avoid or reduce cumulative effects, taking into account the project-specific conditions, the cables burial and trenching campaigns should be coordinated.

#### 6.2.12 **Consideration of cultural assets**

Known sites where cultural assets have been discovered must be taken into consideration during the selection of cable routes. If unknown cultural assets located on the seabed should be found during the planning or installation of interconnectors, the appropriate measures to secure the cultural assets must be taken.

#### 6.2.13 **Consideration of sites where munitions have been discovered**

Known sites where munitions have been found must be avoided during the routing. If unknown munitions-contaminated sites should be found during the planning or construction of the interconnectors, then appropriate protective measures must be taken.

#### 6.2.14 **Obligation to remove**

Interconnectors must be removed after they are no longer used. If the removal causes greater adverse effects than leaving them there, the removal must be completely or partly abandoned unless it is necessary for reasons of traffic safety and ease. If they are left there, suitable monitoring measures should be arranged regarding possible future risks.

## 6.3 Spatial stipulations

#### 6.3.1 **Gates**

According to the allocation of legal competence of § 17a para 1 sentence 1 of the Energy Act, the spatial requirements of the BFO extend to the German EEZ. There is consequently no over the limit of the German EEZ beyond defining the routes. The planned routes in the BFO must be able to be continued sense. For coordination with neighbouring countries, the gates are served as places where interconnectors crossing the border between the German EEZ and the EEZ of the neighboring country or the territorial sea. For the area of the Baltic Sea EEZ this concerns Denmark, Sweden and Poland, and towards the coast sea of Mecklenburg-West Pomerania. In neighboring countries and the territorial sea of Mecklenburg-West Pomerania, the route planning are not yet so far advanced, that, based on the information currently available, it can be ensured that all possible cross-border systems were considered. The gates have been provided that way that they affect existing uses as little as possible. The bases for determination of the gates were the planning principles for cables, as far as no applications for cross-border systems existed.

The BFO takes into account both the known plans of cross-border subsea cable systems as well as possible future projects. For the avoidance of a planning torso a more closely aligns the rules established in this plan gates are provided with the relevant authorities. In determining the corridors in the EEZ was no vote yet of the possible continuation of the corridors about in relation to the Natura2000 areas.

The for the connection lines specified gates I and III (see also planning principle 5.3.2.3) are used also by the cross-border subsea cable systems. Gate II is used exclusively for connection of the coastal sea project.

For interconnectors additional gates are defined.to the territorial sea as well as on the outer border of the German EEZ with neighboring states. The other gates IX to XIII proposed for the outer edge of the EEZ will serve to route possible interconnectors, which have not yet been named as specific cable routings, in or through the German EEZ bundled and in parallel to existing or planned structures.

The gate proposed in the first draft of the Spatial Offshore Grid Plan (status February 2013) for the area of the Fehmarnbelt fixed link will not be implemented for nature and species conservation reasons in accordance with the statement given in the first consultation round by Schleswig-Holstein.

The gates IV and V are in the area of spatial cluster 6 of the O-NEP 2013, where they performed as a project "Baltic Energy Bridge". In this area are already an interconnector ("Kontek") and three in-service data cable ("DK-D 3", "Elektra GC1" and "KNPQwest"), so that in particular followed the bundling principle 6.2.1.

In the area of Kriegers Flak the three gates VI, VII and VIII are currently planned. For the corridor VI of the application for the "Combined Grid Solution" is submitted. The other two gates will provide the basis for a possible offshore grid in the area of Kriegers Flak, because here in all three countries are wind farms provided.
Gate IX illustrated another possible connection to Sweden. A possible interconnector has been included in the BFO. The gate is located that way that already existing uses (especially shipping, military submarine area and research area) are affected as little as possible. If it is not possible, to continue this corridor in Sweden in the updated plan the gate will be amended accordingly.

Gate X and XI possible can be used for grid connections to wind farms west of Bornholm. Any use of gate XI on the German side should be done preferably between projects "Wikinger" and "Arkona Becken Südost". This is only possible if the search area for transformer substation platforms and the precaution secured two three-phase submarine cable systems are not required. A cable routing south of "Arkona Becken Südost " to Gate XI would possibly lead to an impairment of the FFH area “Adlergrund” or Danish FFH-area "Adlergrund Og Rønne Banke".

On Gate XII and XIII, which are proposed in the second draft BFOO (August 2013), are renounced due to the opinion of the BfN of nature and species conservation reasons. If this gates are necessary for the development of wind farms on the Polish side, this can be discussed again in the context of updates.

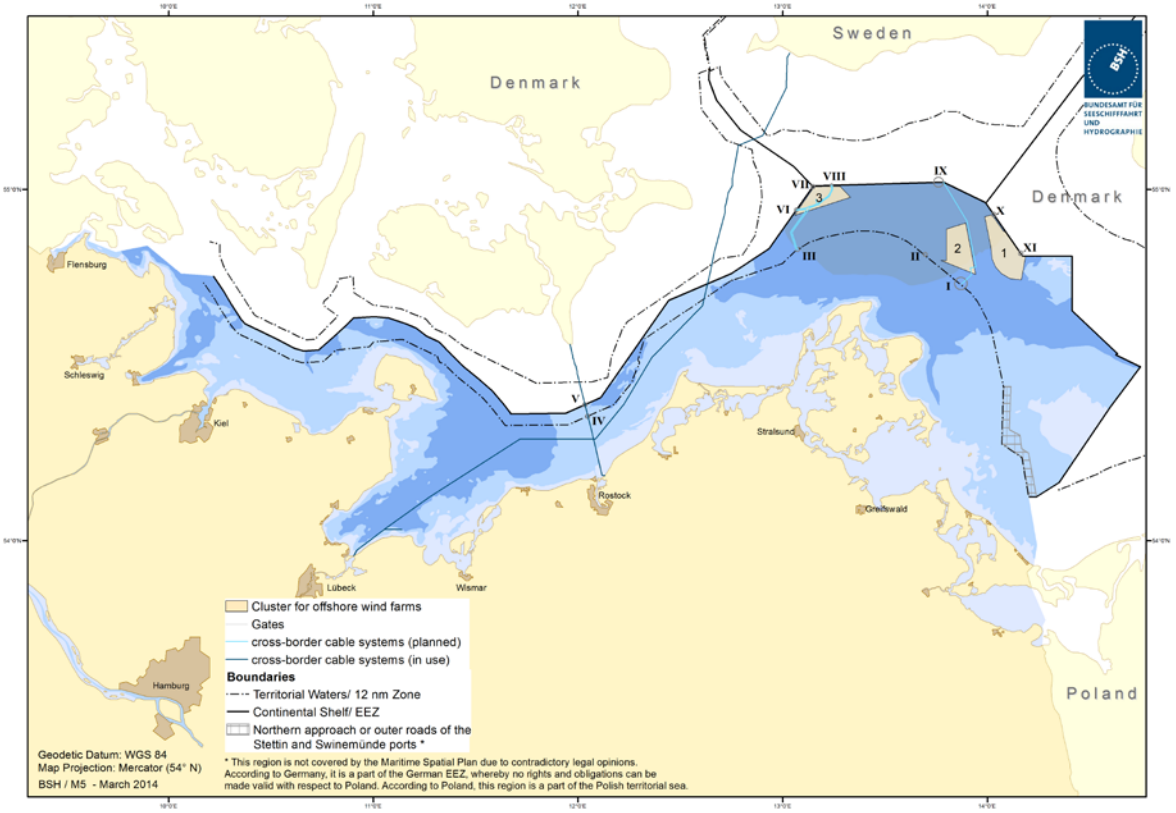
### 6.3.2 **Corridors for Cable Routes for interconnectors**

The "Combined Grid Solution" (CGS) is applied to the Federal Maritime and Hydrographic Agency as a specific plan for crossborder subsea cable systems in the Baltic Sea EEZ area. The CGS is planned as a connection between Germany and Denmark. The current plan is to lay two AC cable systems between the transformer substation platform of the offshore wind farm "EnBW Windpark Baltic 2", currently under construction, and the converter platform of the neighbouring wind farm "Kriegers Flak 3" located in the Danish EEZ and connected to the Danish grid via direct current. Gate VI is proposed in the grid plan for the routing of this cable route, which lies primarily in the safety zone of the wind farm "EnBW Windpark Baltic 2". The possibility of an additional connection via DC cable from the Danish converter platform to the German coast and/or to Sweden is also being investigated. To enable this planning in future, cable route corridors will be safeguarded for these connections and the gates VII and VIII proposed. The secured route for a possible DC cable system from the Danish converter platform runs through Cluster 3 and then parallel to the cable route corridor proposed for the connection of the offshore wind farms up to gate III. The corridor for connecting up to three cable systems to Sweden runs towards the East through Cluster 3 to gate VIII. Gate VIII is stipulated to enable an alternative connection of the offshore wind farm projects in the Kriegers Flak area. These routes to Denmark and Sweden cross the Falster-Roenne" data cable (status unknown), "SE-D 4" (not operational) and "Baltica Segment 3" (operational).

Another interconnector project, the so-called "Baltic Energy Bridge", intended to connect Germany in the Rostock area with Denmark, is depicted as Cluster 6 in the TSO grid development planning in the drafted O-NEP 2013 in addition to the "Combined Grid Solution". The Federal Maritime and Hydrographic Agency has no information about this project. Consequently, it is only represented by the stipulation of gates IV and V in this plan.

Additionally to the described existing planning, it is proposed, to provide a route in the area of Cluster 2 for a future interconnector to Sweden. Otherwise a connection to Sweden would be significantly hindered due to the existing offshore wind energy planning and other uses. A cable route from gate I over the eastern edge of Cluster 2 to the gate IX is proposed. In the area of Cluster 2, this route is planned without any distance to the shipping reservation area No. 20 in order to interfere as little as possible with the planned wind farm in Cluster 2 because of this still very abstract stage of planning. Within the German EEZ, this route crosses the data cables "Falster-Roenne" (status unknown) and "Baltica Segment 3" (operational).

## 6.4 Cartographic Representation




Map 10: Representation of interconnectors

# 7 Corridors for Cable Routes for Cross Connections

Pursuant to Section 17a (1) Clause 2 No. 6 EnWG, the Spatial Offshore Grid Plan should also include stipulations regarding cross connections between routes or corridors for cable routes to or for possible connections of offshore facilities, cable routes for grid connections and interconnectors, sites for converter platforms or transformer substation platforms as well as standardised technical specifications and planning principles.

Cross connections are subsea cable systems which can, i.e. in the case of the AC connection concept in the Baltic Sea EEZ, connect the grid infrastructure, the transformer substation platforms and the cable systems and therefore the offshore wind farms to one another and which contribute to guaranteeing system security, increase feeding-in security

using (partial) redundancy in order to reduce breakdown damage and increase system security and are compatible with efficient grid expansion. The grid plan sets out the spatial requirements for these cross connections. The decision as to “whether” and “when” a cross connection will be implemented is reserved in the context of the evidence that network operators mitigation of damages concepts confirmed by the Federal Network Agency. The O-NEP 2013 draft presented by the TSO already proposes connecting two transformer substation platforms of offshore wind farms.

## 7.1 Standardised Technical Specifications

**Summary**

- Use of AC technology
- Standard transmission voltage 220 kV

### 7.1.1 **Use of AC technology**

Cross connections will be implemented using AC technology.

### 7.1.2 **Standard transmission voltage 220 kV**

Cross connections will be implemented with a uniform transmission voltage of 220 kV.

## 7.2 Planning Principles

**Summary**

- Maximum bundling possible by parallel routing
- Distances in case of parallel routing: 100 m; 200 m after every second cable system depending on the geological site conditions
- Routing through gates
- Crossing of priority and reservation areas for shipping as right-angled as possible
- Consideration of all existing and approved uses (construction with distance of 500 m, shipping routes 300 m distance)
- Avoiding of cable crossings and, if they are absolutely necessary, then crossing as right-angled as possible; distance between turning points 250 m
- Coverage, which ensures a permanent safety of subsea cable systems
- Routing as far outside of the Natura2000 areas/protected biotopes as possible
- Avoiding heating of sediment (maximal 2 K)
- Environmentally-friendly installation procedure
- Coordinated timing of the overall installation works
- Consideration of cultural assets and sites where munitions have been discovered
- Obligation to remove

### 7.2.1 **Bundling**

Concerning cross connections the maximum degree of bundling possible in terms of parallel routing should be implemented as well as routing parallel to existing structures.

### 7.2.2 **Distances in case of parallel routing**

When subsea cable systems for cross connections are routed parallel, a distance of 100 m between the individual systems is required. After every second cable system, a distance of 200 m should be met. The specific geological site conditions must be taken into account.

### 7.2.3 **Routing through gates**

Subsea cable systems for cross connections must be routed through the gates specified on the border to the EEZ and the 12 nm zone in the case that a transboundary cross connection of offshore wind farms is planned.

### 7.2.4 **Crossing of priority and reservation areas for shipping**

For the priority and reservation areas stipulated for shipping in the Baltic Sea EEZ Maritime Spatial Plan, the cross connections must cross via the shortest possible route as far as parallel routing to existing physical structures is not possible.

### 7.2.5 **Consideration of existing and approved uses**

When the routing of cross connections is selected, consideration should be given to existing and approved uses and rights of use as well as to the concerns of shipping and fisheries. There must be appropriate consideration for already existing pipelines and subsea cables when the routing for new subsea cable systems is selected; a distance of 500 m must be observed insofar as the geological site conditions do not require greater distances.

### 7.2.6 **Crossings**

Crossings of cross connections should be avoided as far as possible between one another and with other existing pipelines and subsea cables or those which are being stipulated within the framework of this plan. If crossings cannot be avoided, they must be implemented as right-angled as possible according to the respective state of the technology.

In the event that the unavoidable structure for crossing cables cannot be implemented at a right angle, the crossing angle should not fall short of 45° and a distance of at least 250 m should be provided between the turning points which become necessary.

### 7.2.7 **Covering**

In determining the permanently guaranteeing coverage of cross connections, the needs of shipping and fisheries, protection of the marine environment and system security should be considered particular. For this purpose a low position of the cable which ensures a permanent security of the cable systems is to produce during installing. The determination of the produced coverage is done in individual evaluation based on a comprehensive study to define the required coverage.

### 7.2.8 **Installation outside of Natura2000 areas and protected biotopes**

When cross connections are installed, possible impairments to the marine environment should be minimised. For that to happen, the cross connections should be installed outside of the Natura2000 areas. Known areas of protected biotope types according to Section 30 Federal Nature Conservation Act or corresponding structures must be avoided as far as possible.

The specifications in Section 45 Water Management Act must be observed; best environmental practice pursuant to the Helsinki Convention and the applicable state of technology should be considered and specified in the individual procedure.

### 7.2.9 **Heating of Sediment**

When installing cross connections potential adverse effects on the marine environment through a cable-induced heating of sediment should be largely reduced. As precautionary nature conservation value the so-called "K-2 criterion" must be observed, which sets a maximum acceptable temperature increase of the sediment by 2 kelvin in 20 cm sediment depth.

### 7.2.10 **Environmentally-friendly installation procedure**

In order to protect the marine environment, an installation procedure for installing the cross connections which is as environmentally-friendly as possible should be selected.

#### 7.2.11 **Coordinated timing of the overall installation works**

In order to avoid or reduce cumulative effects, taking into account the project-specific conditions, the cable burial and trenching campaigns should be coordinated.

#### 7.2.12 **Consideration of cultural assets**

Known sites where cultural assets have been discovered must be taken into consideration during the selection of cable routes. If unknown cultural assets located on the seabed should be found during the planning or installation of cross connections, then appropriate measures to secure the cultural assets must be taken.

#### 7.2.13 **Consideration of sites where munitions have been discovered**

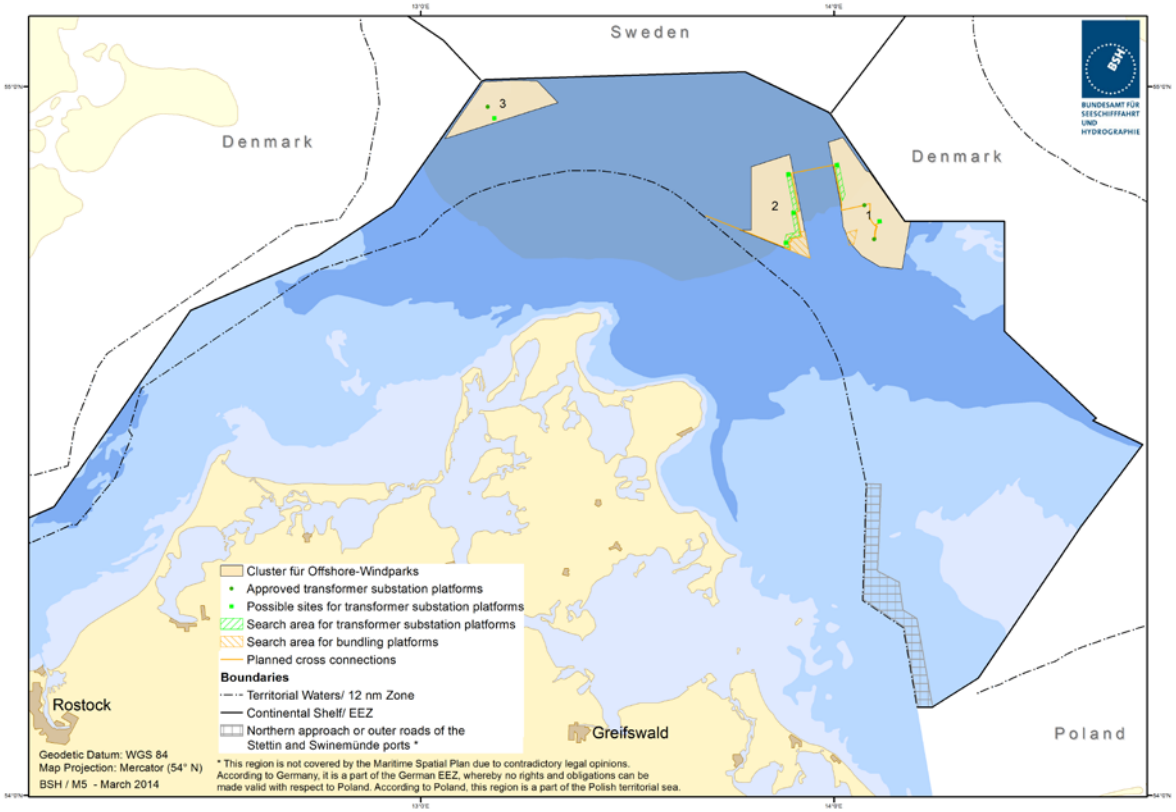
Known sites where munitions have been found must be avoided during the routing. If unknown munitions-contaminated sites should be found during the planning or construction of the cross connections, then appropriate protective measures must be taken.

#### 7.2.14 **Obligation to remove**

Cross connections must be removed after they are no longer used. If the removal causes greater adverse effects than leaving them there, the removal must be completely or partly abandoned unless it is necessary for reasons of traffic security and ease. If they are left there, suitable monitoring measures should be arranged regarding possible future risks.

## 7.3 Spatial Stipulations

## 7.4 Cartographic Representation




Map 11: Representation of cross connections

# 8 Examining Public and Private Concerns – Summarised assessment

Predominant public and private concerns which create an obstacle to any stipulation must be examined, in particular the compliance of the stipulation with the requirements of spatial

planning, coordination with other spatially significant types of planning and measures as well as any alternatives to cable routes, corridors for cable routes or sites to be given serious consideration.

To prepare the Spatial Offshore Grid Plan for the Baltic EEZ, BSH carried out consultation procedures including two hearings.

Based on the comments received, the results of the public hearing and the coordination discussions of the second draft of the Spatial Offshore Grid Plan and the draft environmental report have been revised.

## 8.1 Fundamental changes and additions to the final Spatial Offshore Grid Plan compared with the second draft

Chapter 1 to 4: Clusters, planning horizons and assumed capacity

The Spatial Offshore Grid Plan adopts and extends the targets and principles set by the Maritime Spatial Plan for the EEZ of the Baltic Sea from the scope of technical planning. In this context, it was supplemented to clarify that the technical plan has an accuracy that corresponds to the scale of 1:400 000.

Based on the targets contained in the strategy of the federal government by 2030 are to be installed 25 GW offshore wind energy. The adopted on 22 January 2014 the decision of the Federal Cabinet reduced this to 6.5 GW by 2020 and 15 GW by 2030. This is mentioned in the plan, but not taken as a basis.

The scenario framework 2013 approved by the Federal Network Agency and the confirmed Offshore Network Development Plan 2013 for the area of the EEZ of the Baltic Sea are considered in this plan. It will be shown spatially in particular the four confirmed network connectivity measures until 2023 in this Spatial Offshore Grid Plan.

It would clarify additional, indicate the purpose of the methodology presented in Chapter 4.3 of the performance determination for offshore wind farms.

Chapter 5: standardised technical specification, planning principles and spatial stipulations

The definition of the AC connection concept was specifies to the effect that it applies to the short-term, confirmed in the offshore network development plan projects.

In the planning and construction of substation platforms also the conditions for the connection of a wind farm in the context of the procedure for capacity allocation are to provide for the efficient use of grid connection capacities in addition to creating the conditions for cross connections.

Based on the comments received, the requirements were formulated and justified on the noise reduction in the installation of pile foundations as well as the installation of cable systems in relation to the sediment in their own planning principles.

The principle for covering subsea cable systems was fundamentally revised based on comments received and their current knowledge.

In cluster 1, the search area for transformer substation platforms between "Wikinger" and "Arkona Becken Südost" has been moved to the most western corner of overlapping projects.

In addition to the requirement of the consensus authority in the chapter spatial description was introduced a separation of cables and border corridors.

Chapter 6: Crossborder subsea cable systems

With view on the comments from the Federal Agency for Nature Conservation it was dispensed to define the border corridors XII and XIII.

## 8.2 Summary of the fundamental assessment results

### 8.2.1 Scope of Spatial offshore grid plan, legal nature and other instruments

### 8.2.2 Identification of offshore wind farms for grid connections

### 8.2.3 Grid connection for offshore wind farms

#### 8.2.3.1 Technical Concept for grid connection

#### 8.2.3.2 Sites for Transformer Substation Platforms

Planning principle 5.2.2.4 No impairment of traffic

Within the framework of the international participation Poland demanded not to affect shipping routes to polish ports. With the planning principle 5.2.2.4 this request is implemented. The defined priority and restricted areas for shipping in the Spatial Planning on the basis of AIS data are kept clear from construction. Furthermore it is necessary for the defined substation platforms to observe a distance of 500 m to these areas.

#### 8.2.3.3 Route Corridors for AC-Subsea Cable Systems

The planning principle 5.3.2.5 Consideration of existing and approved uses

Within the framework of the international participation Poland demanded not to affect shipping routes to polish ports. With the planning principle 5.3.2.5, 5.3.2.6 and 5.3.2.7 this request is implemented. There is to observe a distance of 300 m to shipping routes at parallel laying. If a cable system crosses the shipping routes, it has to occur in such a way, that shipping is impaired as little as possible. Furthermore to ensure the lasting security of the cable system there is to establish a guaranteed coverage. This ensures that the cable systems do not have any negative impact on shipping. Hence it can be assumed that there are no negative effects for polish ports by specifications, defined in the BFO.

#### 8.2.3.4 Technical Option Transformer Substation Platform

### 8.2.4 Crossborder Subsea Cable Systems

Planning principles and technical specifications (chapter 6.1 and 6.2)

The general objections concerning subsea cable systems are discussed in chapter AC-subsea cable systems.

Spatial Definitions (chapter 6.3)

Due to the statement of the Federal Network Agency in chapter 6.3 the spatial definitions were subdivided in border corridors and interconnectors.

The Federal Agency for Nature Conservation explained in their statement, that the definition of the border corridors XI and XIII would implicate a crossing of the FFH area „Westliche Rönnebank“, even thought of the FFH area “Adlergrund”. In addition, previously approved offshore wind farms inclusive the cabling within the wind farms would have to be crossed. When defining the border corridor XII and the corresponding cable systems even border corridor XIII would cross the European protection of birds area “Pommersche Bucht” although the cable systems of the border corridor XIII are perspective and not consolidated projects. With regard to the FFH compatibility of these projects it must be observed that the border corridors XI and XIII would cause a crossing of the said FFH areas and extensive existing reefs, which also are a protected type of biotope under § 30 Federal Nature Conservation Act (BNatSchG). With regard to the requirements of the spatial planning as well as the named nature conservation issues the border corridors XI and XIII should be removed. At this time even the border corridor XII should be abandoned from the point of

view of the Federal Agency for Nature Conservation (BfN). In addition there is the requirement to distinguish the border corridors by their status in the corresponding planning process in the territorial sea. The plans of Mecklenburg-Western Pomerania concerning the offshore wind energy expansion in the context of the Regional Development Plan of the State (Landesentwicklungsplan - LEP) should be taken into account and be integrated into a joint connection conceptIn the BFO was added illustratively that the border corridor XI can only be used if the currently planned cable systems for the projects between the approved wind farms “Wikinger” and “Arkona Becken Südost” are not required. In that case a route outside of the approved wind farms and protected areas is possible. In the framework of the revision of the BFO there was no designation of the border corridors XII and XIII in the bird protection area. On the German side the border corridors are in the bird protection area “Pommersche Bucht” so that a cable obstructed development can be excluded and furthermore the BFO don´t have to secure necessarily areas. Currently, for the border corridors there aren´t known concrete plans for the cable route towards Poland. If these corridors should become necessary in the context of the development of wind farms on the Polish side for a future pan-baltic offshore grid, then it can be discussed again in the context of the updates. The rout planning’s in the territorial sea as well as the possible developments of the offshore wind farms in the territorial sea are beyond the scope of this plan. The currently applied routs or routs under construction will be included for information only. A overall connection concept can only be established on the level of the O-NEP, because the responsibilities of the offshore activities are only centered here.

Moreover the Swedish authorities have asked for not to be limited on the border corridors when developing interconnectors between Sweden and Germany but to search for an optimal route in the entire area. In contrast to this, the Federal Agency of Infrastructure, Environmental Protection and Services of the Bundeswehr demanded to not develop routes in military training areas particularly in the U-boat diving sites “Bravo 2 – 5”. In the case of routes in these areas it must be ensured that rule-consistent exercises are still possible. This would relate in particular to the coverage of the cable systems, that have to be ensured with at least 1.5 m. At the moment the request of the Swedish authorities cannot be complied with. In the area of Kriegers Flak and parallel to the ferry line Ystadt – Swinemünde are border corridors towards Sweden. In the area between these border corridors are inter alia the U-boat diving areas “Bravo 2 – 5” as well as a indicated reserve area for research. These areas should not be crossed by cable systems. If within the context of the update of the BFO or within the framework of a concrete project a different route can prove to be reasonable this can be taken into account in the update. In this case it will be necessary to discuss the project’s framework conditions due to the existing uses.

The earlier time of commissioning of the “Combined Grid Solution” – named by the TSO – is adopted into the BFO.

### 8.2.5 **Cross Connections**

### 8.2.6 **Environmental Report**

Corridors

Following the statement of the Federal Agency for Nature Conservation (BfN) it was decided to refrain from the definition of the border corridors XII and XIII in the context of the revision of the BFO, which were included in the draft at edge of the nature reserve “Pommersche Bucht” for possible perspective cross-border subsea cable systems towards Poland. Because a route through these border corridors would cause a crossing of the protected area and therefore the route would pass through an area of outstanding importance for resting birds, considerable impacts for resting birds during construction without the use of preventive measures cannot be excluded for certain according to the Federal Agency for Nature Conservation (BfN)

Furthermore the Federal Agency for Nature Conservation (BfN) demanded in their statement the deletion of the border corridor XI. According to the Federal Agency for Nature Conservation (BfN) the definition of the border corridors XI and XIII would have as consequence at least a crossing of the FFH area „Westliche Rönnebank” if not furthermore

of the FFH area “Adlergrund” and therefore a crossing of the extensive occurring, strictly protected type of biotope reefs. In the BFO (see chapter 6.3.1) is illustratively added, that the border corridor XI should only be used if the currently planned connections between the approved wind farms “Wikinger” and “Arokona Becken Südost” are not needed. In this case a route outside the approved wind farms and protected areas is possible (see consideration for chapter 6.3.1).

# 9 Summary Environmental Statement and measures envisaged concerning monitoring the significant environmental impacts

## 9.1 Summary Environmental Statement in Accordance with Section 14l Environmental Impact Assessment Act

A strategic environmental assessment (SEA) was carried out in terms of the Environmental Impact Assessment Act during the preparation of this Spatial Offshore Grid Plan as an accompaniment and integrated into proceedings. According to Article 1 of the SEA Directive, the SEA aims at providing for a “high level of environmental protection and contributing to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development by ensuring that, in accordance with this Directive, an environmental assessment is carried out of certain plans and programmes which are likely to have significant effects on the environment.”

The extent and level of detail of the SEA report were discussed on 23 April 2013 during a scoping meeting with representatives from the authorities, associations and private interests.

On the basis of the results of the scoping meeting and the relevant comments submitted, a SEA report has been created following the criteria of Annex I of the SEA Directive. The studie area was diversified into further subspaces as far as possible, in accordance with the situation regarding natural environment and geology. The focus of the SEA report is especially on the description and evaluation of the significant effects on the marine environment expected from the implementation of the Spatial Offshore Grid Plan, with the description and estimate of the state of the marine environment serving as a foundation. According to Section 14f (2) Clause 2 Environmental Impact Assessment Act, the SEA report shall contain the information which may be ascertained with reasonable effort and shall take into consideration the current state of knowledge and generally recognised testing methods.

At the same time, measures are outlined which prevent, reduce and as fully as possible offset any significant, adverse effects on the marine environment resulting from the implementation of the grid plan. Along with the brief outline of reasons for selecting the examined alternatives, the planned measures to monitor the expected significant effects on the marine environment arising from the implementation of the grid plan are named and the results of the Habitats Directive impact assessment as well as of the assessment of species conservation are outlined.

The plan is the result of this earlier, comprehensive environmental assessment. Environmental concerns and the information gained during the preparation of the SEA report influenced the preparation of the plan's stipulations. Therefore, the results ascertained in the SEA in view of the significance of individual spatial sub-areas for biological nature conservation interests were consulted as a decision-making basis when the sites for transformer substation platforms and subsea cable routes were stipulated. At the same time, the plan stipulations were checked and adjusted continuously regarding their possible environmental effects during the preparation of the plan.

The likely significant, adverse effects of the transformer substation platforms and subsea cable systems discussed in the SEA report draft led to general and source-based stipulations in the plan to prevent and mitigate these effects. In addition to the consideration of the relevance of individual, spatial sub-areas for biological nature conservation interests, these

planning principles to prevent and reduce significant, negative effects ensure that no significant impairments are caused by the implementation of the grid plan, but instead that negative effects are avoided or reduced – compared with the outlined development of the marine environment if the grid plan were not to be implemented. This concerns, amongst other things, a planning principle for noise reduction and the stipulation to avoid the use of Natura2000 areas and known areas of strictly protected biotope types according to Section 30 Federal Nature Conservation Act.

The plan only contains area definitions which, according to the impact assessment in the environmental report on the basis of current information, have no significant effects on the relevant protection elements and conservation objectives of Natura2000 areas in terms of Section 34 (2) Federal Nature Conservation Act and give no reason to expect prohibitions regarding species conservation pursuant to Section 44 Federal Nature Conservation Act.

All currently in this plan made area designations are outside of protected areas and known occurrence of protected habitat structures. This can be significantly reduced impairments in important habitats. A detailed examination of the needs of the species and area protection can take place only if the project-specific conditions in the individual evaluation are known. Therefore it is reserved to the respective individual evaluation.

From the date that the Spatial Offshore Grid Plan for the Baltic Sea EEZ was announced, the environmental report has been displayed for one month at the Federal Maritime and Hydrographic Agency, Bernhard-Nocht-Straße 78, 20359 Hamburg (Germany) and Neptunallee 5, 10857 Rostock (Germany), and published on the Federal Maritime and Hydrographic Agency's web site

The SEA report including impact study, together with the responses from the participating authorities and the public, has been taken into account during the preparation of the plan according to Section 14k Environmental Impact Assessment Act (in detail see assessment in chapter 8).

During the consultation procedure, the draft Spatial Offshore Grid Plan and the draft SEA report was sent to the German authorities and the public as well as to the states bordering on the Baltic Sea with the opportunity to respond. The national hearing meeting was held on 10 September 2013 in Rostock.

After analysis of the 46 received comments, changes or additions to the draft plan and the content of the environmental report regarding the following points were made:

In the context of the revision additional planning principles, that serve the reduction and prevention of environmental impacts, were incorporated into the BFO or existing principles were complemented. In particular the planning principle on heating of sediment, that ensures the compliance of the so-called K-2 criterion, was incorporated. The existing planning principle concerning noise reduction has been concretised so that the current noise emission values of 160 dB (SEL) and 190 dB (SPL) were included into the explanatory of the principle.Following the statement of the Federal Agency for Nature Conservation (BfN) it was decided to refrain from the definition of the border corridors XII and XIII in the context of the revision of the BFO, which were included in the draft at edge of the nature reserve "Pommersche Bucht" for possible perspective cross-border subsea cable systems towards Poland. A route through these border corridors would cause a crossing of the protected area and therefore the route would pass through an area of outstanding importance for resting birds. Therefore considerable impacts for resting birds during construction without the use of preventive measures cannot be excluded for certain according to the Federal Agency for Nature Conservation (BfN)

An essential part of a strategic environmental assessment (SEA) is the consideration of reasonable alternatives. In connection with the definitions of the BFO for the Baltic Sea in particular an alternative connection concept via high voltage DC transmission technology was examined. Because of the relatively short routes in the EEZ and the additional negative effects by a necessary converter it was unable to make a final assessment of alternatives at

the present time in the context of the examination. In the long term a DC connection concept for areas outside the priority areas could be, in certain circumstances, a suitable alternative for the EEZ. The annual update of the BFO provides the opportunity to incorporate any gaining knowledge regarding expected effects of a DC connection concept in comparison to an AC connection concept into the BFO and the SEA.

For the consideration of the connection concept is rather crucial the continuation through the territorial sea, because the major part of the routes is within the 12 nautical mile zone and in these areas large parts of protected areas are being crossed. According to the comments received of the Federal Network Agency (BNetzA) and the Federal Environmental Agency (UBA) a reference to the results of the SEA of the Network Development Plan (NEP) of the Federal Network Agency (BNetzA) was therefore included into the environmental report.

In principle the revision and additions of the BFO do not change the result of the SEA, because the changes aim a better take into account of concerns of nature conservation.

In summary, it may be said that the implementation of the grid plan is not expected to have any significant effects on the marine environment, in particular on account of the general and source-based stipulations to prevent and reduce effects on the basis of information currently available and on the abstract level of sectoral planning. The potential effects are small-scale and largely short-term as they are limited to the construction phase. With regard to the assessment of the effects on individual nature conservation interests, particularly the cumulative consideration of bird and bat migration, there is currently still a lack of sufficient scientific knowledge and standard evaluation methods. In this regard, new knowledge is to be seen from individual evaluation to make a final assessment. In addition, sufficient information for technical implementation (installation procedure, construction procedure) is lacking for individual areas, particularly those outside the priority areas that evidence high levels of mud, as proven state of the art from BSH perspective is not available here. The assessment of the effects depends primarily however on the procedures used. These effects cannot therefore be conclusively evaluated within the framework of the existing SEA and are fraught with uncertainties. A more in-depth investigation must be carried out within the framework of the individual licensing procedure and the update to the Spatial Offshore Grid Plan.

Based on the current status according to the Habitats Directive impact assessment of the areas stipulated by the plan for transformer substation platforms and subsea cable systems, no significant effects on the protection and conservation objectives of Natura2000 areas within the meaning of constituents § 34 Paragraph 2 BNatSchG can be determined, either in the German EEZ, the EEZ of neighbouring states or in the territorial sea. During the Habitats Directive impact assessment, only the possible long-distance effects of the transformer and bundling platforms and subsea cable routes planned within the EEZ are explicitly investigated. These usually lie sufficiently distant from the protected areas in the territorial sea and the EEZ of the neighbouring states so that no significant effects on these protected areas are expected. However, this consideration is not made in relation to the gates planned in the grid plan and the cable routing in the territorial sea necessarily connecting to them. This is the object of the O-NEP or the respective administrative procedures.

The overall conclusion can be made that no significant effects are to be expected on the nature conservation interests through the coordinating and concentrating effects of the plan's stipulations. Negative effects will instead be prevented or reduced in comparison to the event of non-implementation of the plan.

## 9.2 Monitoring Programmes in Accordance with Section 14m Environmental Impact Assessment Act

The potential significant effects on the environment arising from the implementation of the grid plan must be monitored pursuant to Section 14m (1) Environmental Impact Assessment Act. This is intended to ascertain unforeseen, negative effects so that suitable corrective actions can be taken. The monitoring also serves to examine the gaps in knowledge

described in the SEA report or the uncertain forecasts. According to Section 14m (4) Environmental Impact Assessment Act, the monitoring results must be considered when the plan is updated. The actual monitoring of potential effects on the marine environment can only begin when the stipulations of the plan are realised. Therefore, the project-related monitoring of the effects of transformer substation platforms and subsea cables is assigned great significance.

The main objective of the monitoring is to combine and assess the findings from the various monitoring programmes. In summary, the planned monitoring measures can be outlined as follows: Combination and assessment of project-related effect monitoring carried out on a project level (according to the Standards for Environmental Impact Assessments, StUK 4) and any accompanying research, assessment of national and international monitoring programmes in the Baltic Sea, including the Federal and State Government Monitoring Programme, the marine environmental monitoring network of the Federal Maritime and Hydrographic Agency, "MARNET", HELCOM and ICES-based monitoring programmes, the Federal Agency for Nature Conservation's monitoring programme for Natura2000 reporting in the North Sea and Baltic Sea EEZ and measures based on the Marine Strategy Framework Directive and the Water Management Act.

### 9.2.1 **Monitoring of the potential effects of transformer substation platforms**

The study of the potential environmental effects of transformer substation platforms must take place on project level, based on the standard “Investigation of the Impacts of Offshore Wind Turbines (StUK 4)” and in consultation with the approval authority. The results from the studies of neighbouring offshore wind farm projects must be used as a basis for the assessment of sites in relation to biological nature conservation interests. Monitoring during the construction phase of transformer substation platforms with deep foundations includes measurements of underwater sound and acoustic recordings of the effects of the pile-driving noise on marine mammals using porpoise click detectors. During the operational phase, no special monitoring is necessary. The transformer substation platform as an individual construction and as part of the wind farm must only be appropriately monitored on an ecological basis insofar as the corresponding programmes with monitoring for projects which are being connected to transformer substation platforms are coordinated and, if possible, contained therein. In accordance with current licensing practice, a registration of birds and bats found dead on the transformer substation platform must also be carried out and documented (on every maintenance and repair visit) with the aid of digital images.By order for the Federal Maritime and Hydrographic Agency a research and development study on assessment approaches for underwater sound monitoring in connection with offshore approval procedures, spatial planning and the Marine Strategy Framework Directive get developed. The goal of the project is the joint evaluation of approval-related information from sound monitoring offshore wind farms in the EEZ and the development of suitable evaluation tools. The results are intended to contribute to designing the impact study effectively and to assessing the efficiency of the noise-mitigation measures and, where necessary, to be able to adapt the measures and draft coordination plans. The project serves the continuous further development of a uniform and quality-tested basis of marine environment information to assess the possible effects of offshore wind energy facilities. The results can also be transferred to a great extent to transformer substation platforms.

The same monitoring measures can be applied to the optionally planned bundling platforms.

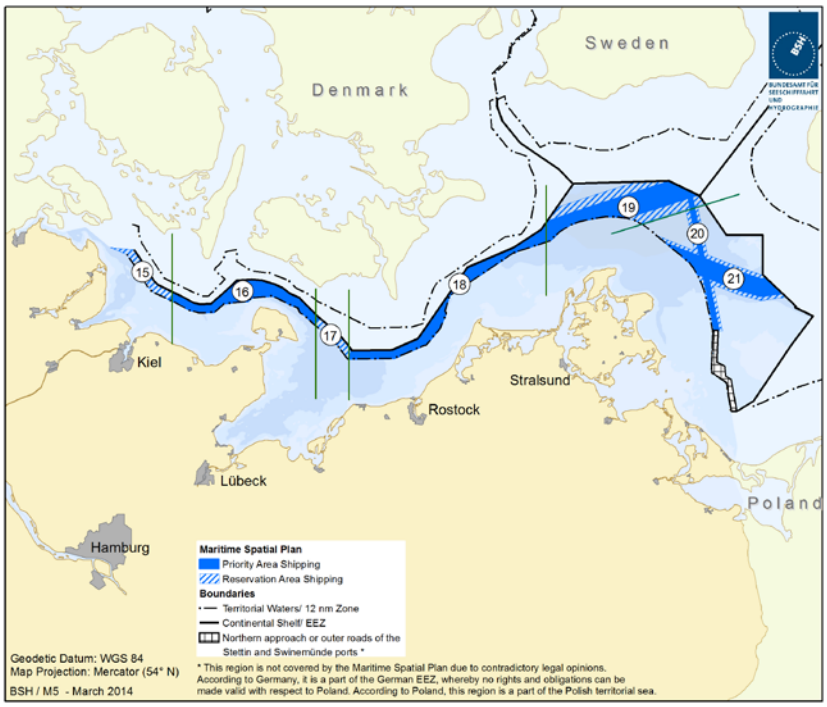
### 9.2.2 **Monitoring of the potential environmental effects of subsea cable systems**

The same applies for subsea cable systems; it is only possible to examine their potential effects on the marine environment in the specific project. For the first time StUK4 also contains monitoring requirements for the examination of subsea cable routes in terms of benthic habitat structure and habitat types during the baseline survey and the operating phase. Each habitat structure, which was determined on the basis of sediment studies along the cable run must be occupied by at least three cross-transects for the benthos. Each cross-

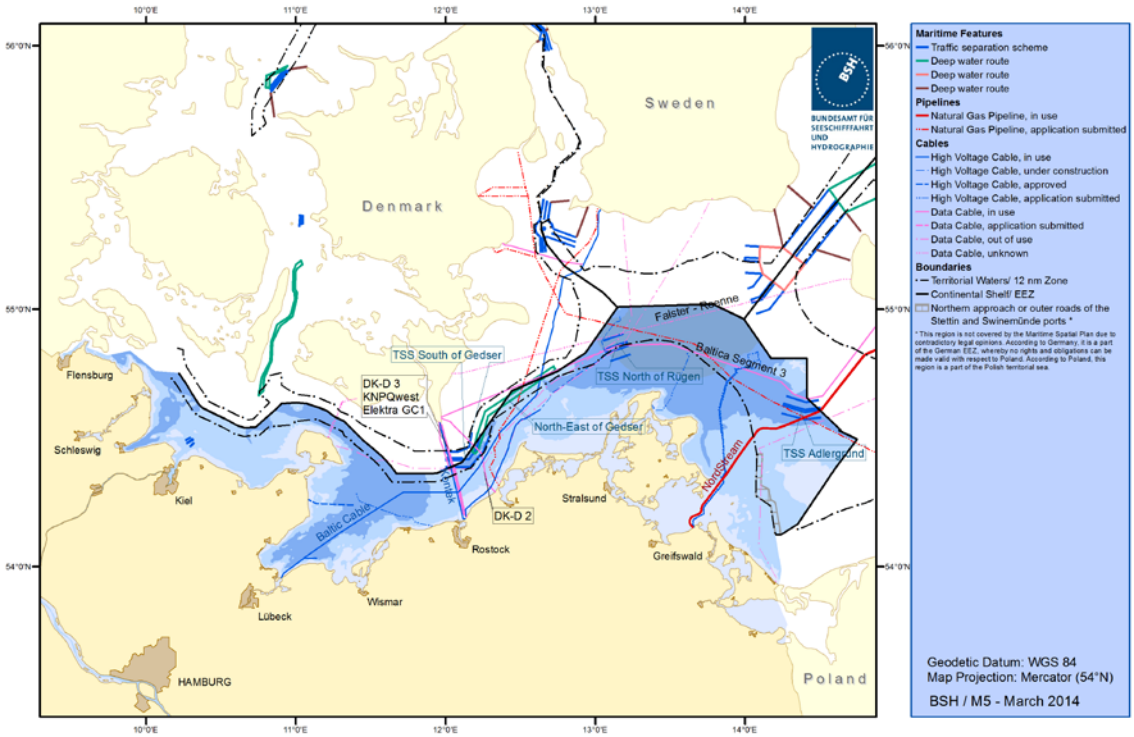
transect turn consists of five stations. Identified suspicious areas of protected habitat types according to § 30 Federal Nature Conservation Act are to investigate the spatial boundaries additionally according to the current mapping instructions of the Federal Agency for Nature Conservation. After the cables have been installed, their position must be checked via operational monitoring measures. According to the current licensing practice, the position of the cable must be verified to the approval authority annually in the first five years of operation by at least one survey of the depth position. The number of surveys in the following years is stipulated by the approval depending on the individual case.

The studies into the marine environment must be carried out in coordination with the approval authority and in a way specific to the project. The study methods must be outlined as much as possible as described in the “Investigation of the Impacts of Offshore Wind Turbines on the Marine Environment (StUK 4)”. One year after the subsea cable systems are commissioned, studies into the benthic communities must be carried out on the same transects as in the baseline survey.

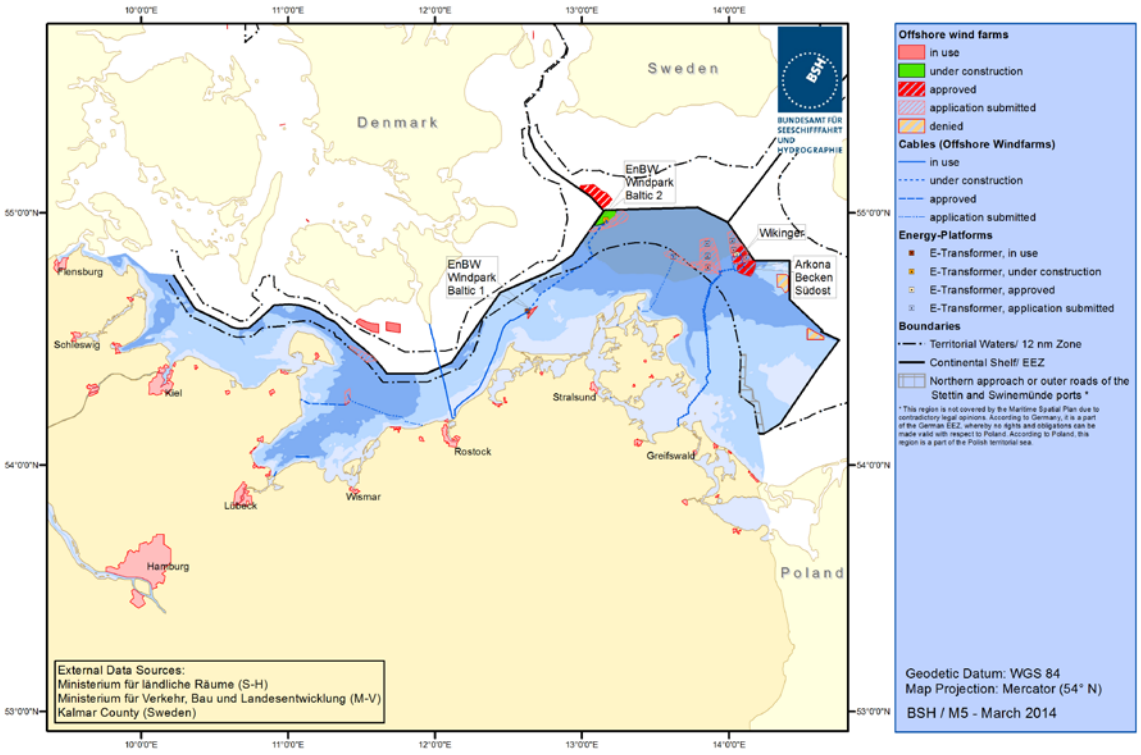
# 10 Annex




Map 12: Baltic Sea EEZ Maritime Spatial Plan shipping routes

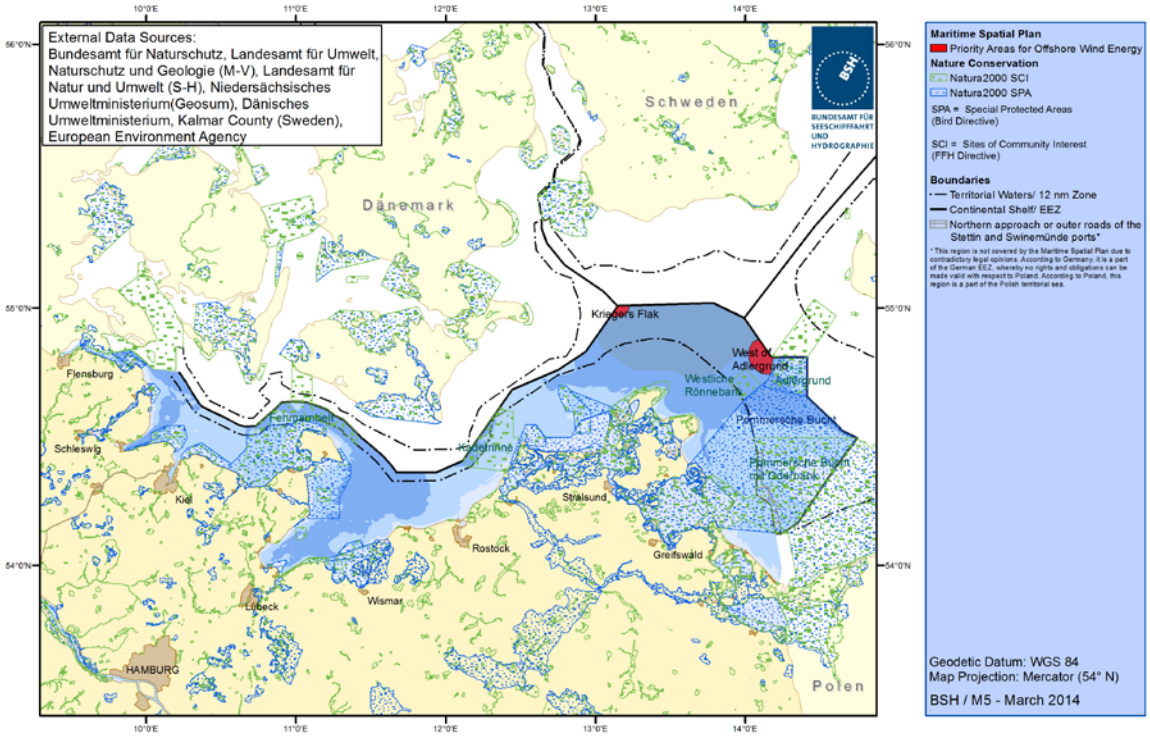



Map 13: Subsea cable, pipelines, traffic separation scheme description

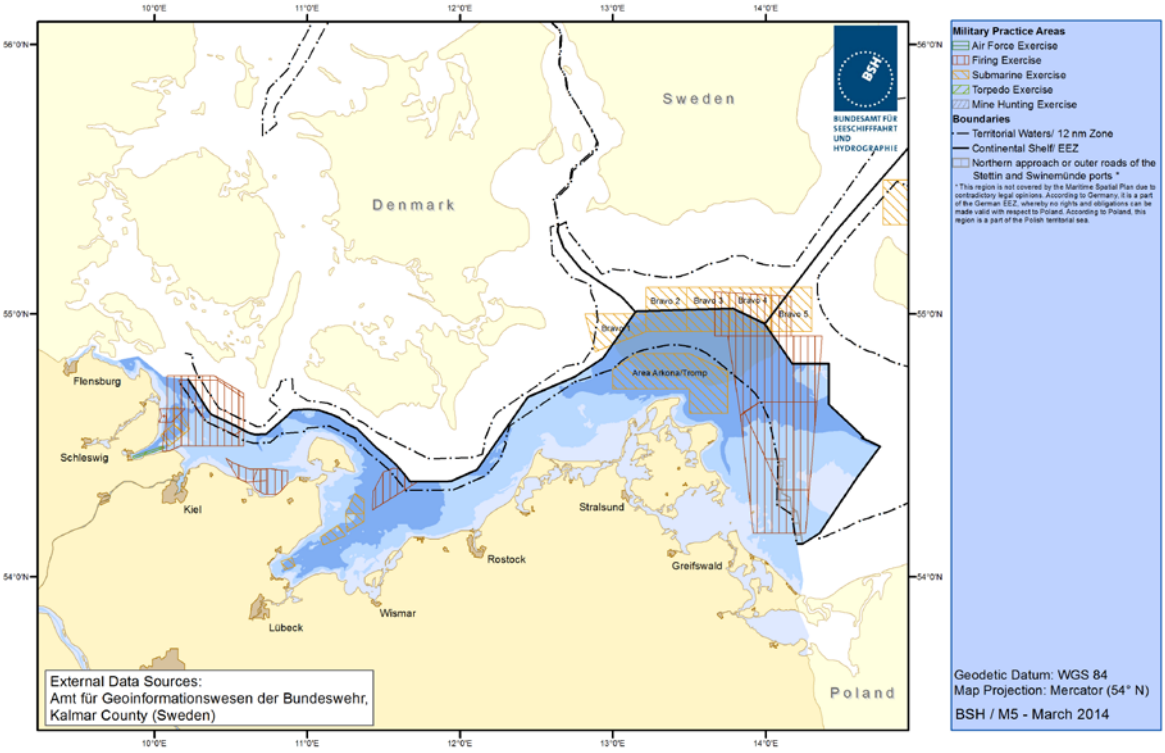



Map 14: Offshore Wind farms descriptions (only the offshore wind farms which are approved)

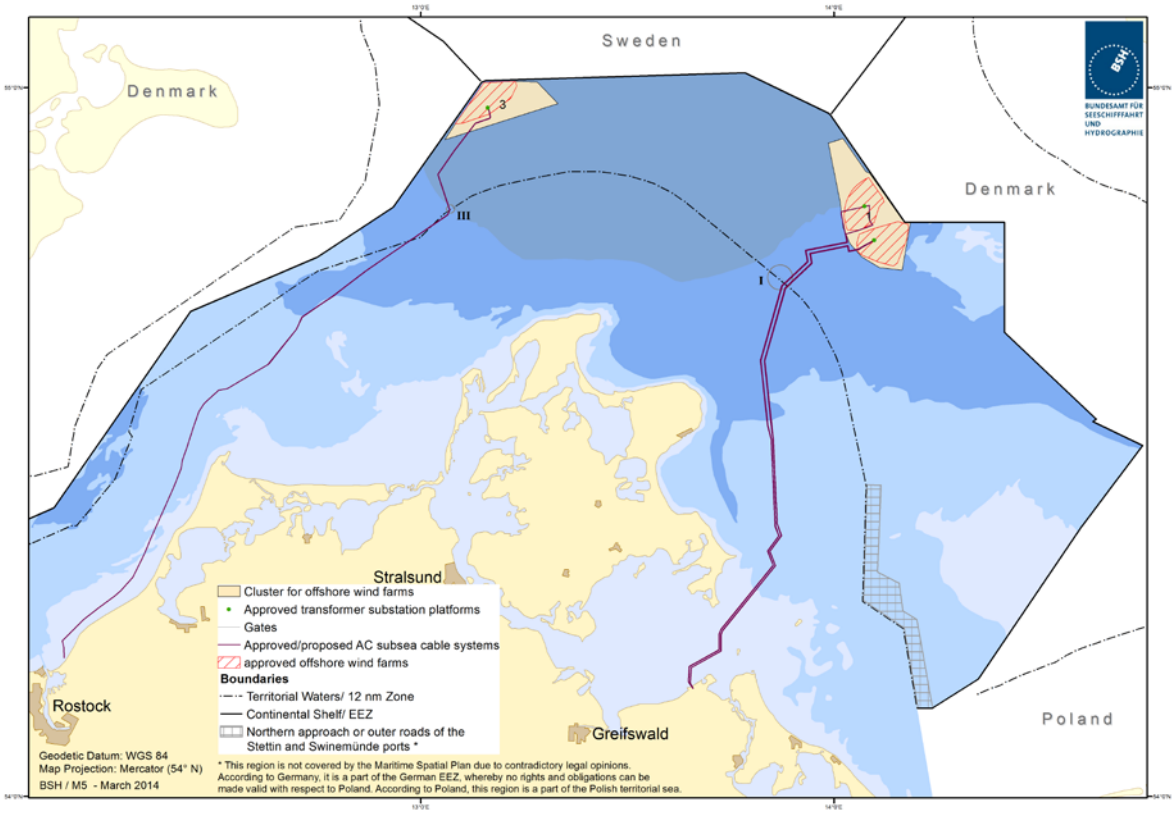

Map 15: Offshore Wind farms descriptions (only the offshore wind farms which are approved or consolidated und planning law)



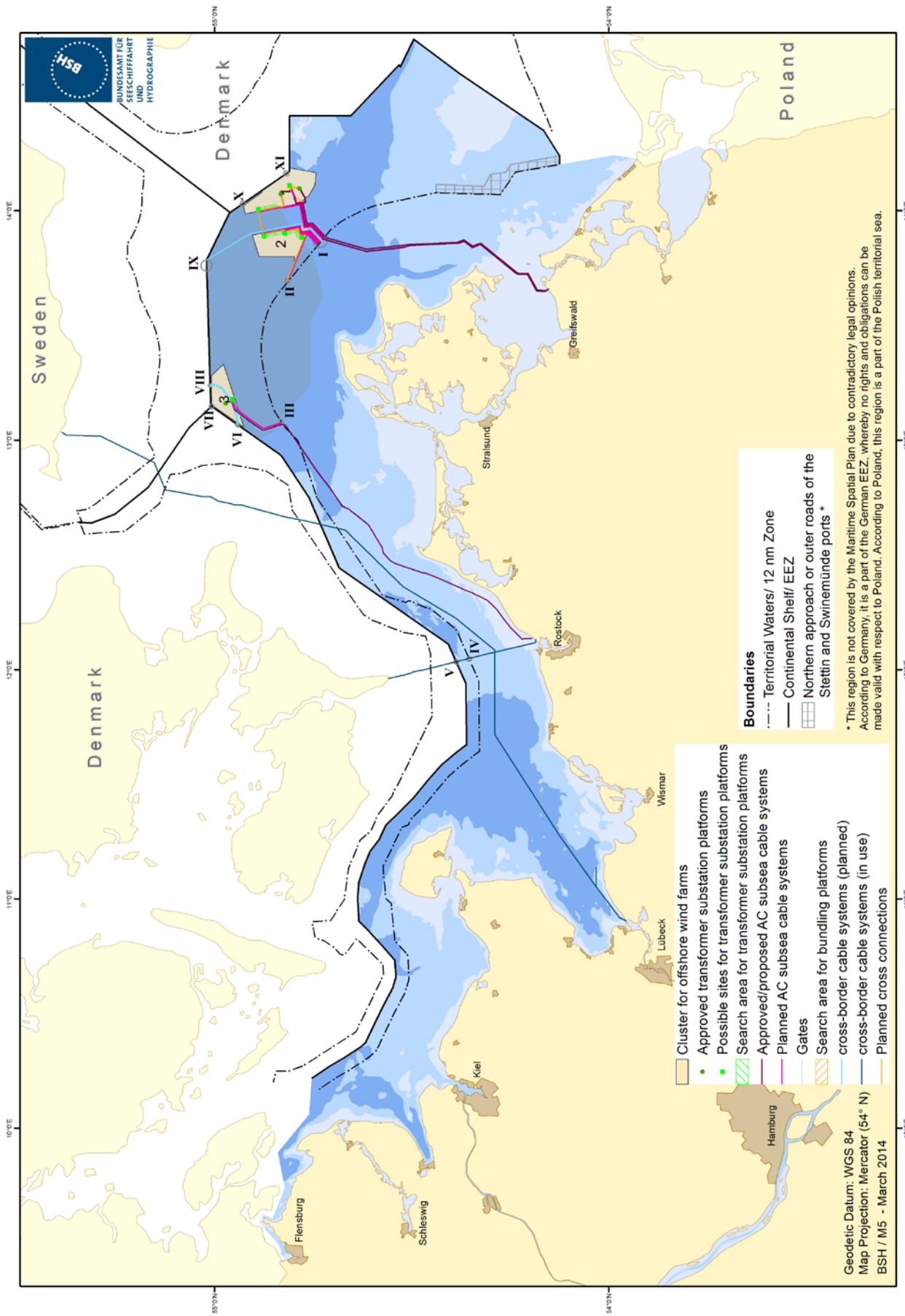

Map 16: Description of nature conservation sites and priority areas for wind energy from the Baltic Sea EEZ Maritime Spatial Plan




Map 17: Areas of national defence




Map 18: Summerising depiction of grid connection for offshore wind farms (2023)




Map 19: Spatial Offshore Grid Plan-EEZ Baltic Sea 2013 overall planning

BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

# Non-Technical Summary of the SEA Report on the Spatial Offshore Grid Plan for the German Exclusive Economic Zone of the Baltic Sea 2013

– unofficial translation –

Hamburg, March 2014

## Content

# 1 Subject and Purpose

The environmental assessment for the preparation of the Spatial Offshore Grid Plan for the Exclusive Economic Zone (EEZ) of the Baltic Sea is based upon the German Environmental Impact Assessment Act[1]. The aim of the Strategic Environmental Assessment (SEA) is to identify, describe and assess likely significant environmental effects of the implementation of the plan on the nature conservation interests mentioned in Section 2 (1) Environmental Impact Assessment Act.

Pursuant to the provisions of Section 17a (1) Clause 2 No. 1 of the Federal Energy Act (EnWG), the Spatial Offshore Grid Plan defines offshore facilities suitable for collective grid connections. In accordance with Section 17a (1) No. 2 to 6 EnWG, the grid plan contains stipulations referring to sites for transformer substation platforms, required routes for the grid connections for offshore wind farms, cable routes for interconnectors as well as a description of possible cross-connections between grid infrastructures inside the German EEZ. The scope of this plan covers the German EEZ of the Baltic Sea.

The Offshore Grid Plan aims at ensuring coordinated and consistent spatial planning of grid infrastructure in the EEZ, meaning transformer substation platforms and subsea cable systems in particular for offshore wind farms. To ensure consistent planning with terrestrial grid planning up to the grid connection points onshore, consent and consultation procedures with the responsible authorities are required. These requirements have been taken into account by the agreement and consultation process with the Federal Network Agency, the Federal Agency for Nature Conservation and the coastal federal states – for the Baltic Sea region Mecklenburg-Vorpommern and Schleswig-Holstein. The transition to the territorial Sea is organised by gates for the bundled routing of cables. The grid plan defines standardised technical specifications and planning principles for implementation. The Spatial Offshore grid Plan has the character of a sectoral plan and is closely linked to the Maritime Spatial Plan for the EEZ of the German Baltic Sea and the Offshore Grid Development Plan (O-NEP). An additional instrument was created with the O-NEP pursuant to Section 17b EnWG following the revision of the EnWG. This plan stipulates the specific details of the chronological order of the grid infrastructure systems spatially planned in the Spatial Offshore Grid Plan. On 10th January 2014 the Offshore Grid Development Plan 2013 has been confirmed by the Federal Network Agency in consultation with the BSH.

The SEA report describes and assesses likely significant environmental effects of the implementation of the planned subsea cable systems and transformer substation platforms in the construction, operation and dismantling phases on the marine environment.

Environmental protection objectives have been considered when preparing the plan and implementing the SEA. Those objectives are based on international, EU and national conventions and regulations related to marine environmental protection. The plan primarily takes into account the (marine) environmental protection objectives through its various planning principles.

# 2 Description and Assessment of the Environmental Status

Within the spatial scope of the grid plan, i.e. the EEZ of the Baltic Sea, the examined scope of the SEA extends to the area for which specific spatial stipulations are made. In addition, as part of the Habitats Directive impact assessment, potential long-distance effects on the protected marine areas of neighbouring countries and in the adjacent territorial sea are also taken into account.

[1] In the version as published on 24 February 2010, Federal Law Gazette I p. 94, last amended by Art.10 Promotion of Electronic Government Act and for the modification of further regulations on 25 July 2013 (Federal Law Gazette I p. 2749).

The SEA does not, however, investigate whether the cable routes in the territorial sea necessarily arising from the stipulation of the gates could cause significant impact on those protected areas. This is subject of the SEA that has been carried out for the German Grid Development Plan by the Federal Network Agency or subordinate planning levels.

The SEA report on the Spatial Offshore Grid Plan describes and assesses the environmental status with regard to the following nature conservation interests:

- Seabed
- Water
- Plankton
- Benthos
- Biotope Types
- Fish
- Marine Mammals
- Seabirds and Migratory Birds
- Bats
- Biological Diversity
- Air
- Climate
- Natural Scenery
- Tangible Assets, Cultural Heritage
- Human Population and Human Health
- Interactions

In addition to data from large-scale surveys and findings from research projects and literature studies, a vast amount of data derives from small-scale data of environmental impact studies for offshore wind farms and subsea cable projects. Pursuant to Section 14f (2) Clause 2 Environmental Impact Assessment Act, the SEA report shall contain the information which may be ascertained with reasonable effort and shall take into consideration the current state of knowledge and generally recognised testing methods.

# 3 Development in Case of Non-Implementation of the Plan

The expansion of offshore wind energy plays an important role in fulfilling the climate protection and energy policy objectives of the Federal German Government. According to Section 17d (1) Clause 1 EnWG, the responsible transmission system operator (TSO) must ensure the grid connections for offshore wind farms or, according to the specifications of the O-NEP confirmed by the Federal Network Agency, construct and operate the grid infrastructure. Pursuant to Section 17a EnWG, the Federal Maritime and Hydrographic Agency has be given the assignment of preparing a Spatial Offshore Grid Plan for the German EEZ under the conditions stated therein and update it on an annual basis. The plan spatially defines the required cable routes and sites for the entire required grid infrastructure in the EEZ of the Baltic Sea up to the 12-nm-border.

The installation of subsea cable systems for conducting power to the grid connection points onshore is absolutely necessary in order to be able to feed the power generated in the offshore wind farms in the EEZ of the Baltic Sea into the terrestrial transmission grid. The grid infrastructure for the offshore wind farms will remain necessary even if the plan is not implemented. Areas for subsea cable systems and transformer substation platforms will be used regardless of whether or not the grid plan will be implemented. The Spatial Offshore Grid Plan aims at ensuring coordinated and consistent spatial planning of grid infrastructure, especially the grid connections of the offshore wind farms in the EEZ.

Without the implementation of the Spatial Offshore Grid Plan, the existing system of individual grid connections without the coordination and systematic consideration of the overall area of the plan would continue to be carried out. The plan defines planning principles and standardised technical specifications that make it possible to minimise the space requirements. Therefore, as a matter of principle, it should be noted that in the event of the non-implementation of the plan, the potential effects described below on the individual nature conservation interests should, potentially, be deemed more significant than in case of the implementation of the plan.

The lack of spatial coordination in the event of non-implementation of the plan would probably lead to longer cables and more cable crossings with corresponding effects on the nature conservation interests due to the necessary structures for cable crossings. Based on the coordinated overall planning within the framework of the grid plan, only one single crossing or structure for crossing cables will be required between the subsea cable routes stipulated in the plan.

# 4 Description and Assessment of the Likely Significant Effects of the Implementation of the Spatial Offshore Grid Plan on the Marine Environment

The assessment of the likely significant environmental effects of the implementation of the Spatial Offshore Grid Plan comprises secondary, cumulative, synergistic, short, medium and long-term, permanent and temporary, positive and negative effects.

There is no standard definition of the term “significance” since the “significance in question is individually determined in each individual case” and cannot be regarded independently of the “specific characteristics of plans or programmes” (SOMMER, 2005). Generally speaking, significant effects could refer to ones which are serious and decisive in the context under consideration.

The SEA of the Spatial Offshore Grid Plan for the EEZ of the Baltic Sea examines, in contrast to an Environmental Impact Assessment at project level, the likely significant effects on the marine environment at a clearly more abstract level. In accordance with the character of the plan, large-scale environmental effects are investigated and the detailed investigation of small-scale environmental effects left to the subsequent, specific approval level. Therefore, the planned transformer substation platforms and cable routes are investigated as an “overall system” within the framework of the SEA and their effects are investigated with regard to the entire study area.

At this superior level, taking into consideration the criteria mentioned in Appendix II of the SEA Directive, the environmental effects as they pertain to the total area are considered to be not significant. This conclusion is based on the currently available information and under the condition that mitigation and prevention measures will be applied. This does not mean, however, that the environmental assessment can declare the extent of the environmental effects of an individual facility (transformer substation platform or subsea cable) to be insignificant for a specific, individual case. Such an assessment is subject to the individual licensing procedure and cannot yet be made at this more abstract level of the SEA in the context of which the project-specific parameters are not yet known. However, a positive finding at this level means that, at least on a larger scale, no apparent circumstances could be detected which would prevent a corresponding designation due to obvious incompatibility.

## 4.1 Effects on the individual nature conservation interests

The examination of likely significant environmental effects of the implementation of the Spatial Offshore Grid Plan is conducted separately for transformer substation platforms and subsea cable systems. The construction and dismantling, as well as the system and operating-related effects, are considered. The possible effects of repair and maintenance work are also considered here. The potential effects of dismantling depend on the method used. Since these effects cannot yet be realistically estimated at present, it is not possible to provide specific details on the effects. The effects will, however, generally be comparable to the construction-related effects (without noise impact by pile-driving).

### *Seabed and Water*

The upper sea floor of the Baltic Sea is characterised by the ice age and very heterogeneous in composition. The sediments close to the surface in the EEZ of the Arkona Basin consist almost entirely of fine silts with various grades. Clusters of fine and medium sand can be found in the transition to Kriegers Flak and to Adlergrund.

The Kriegers Flak shoal is characterised by a very heterogeneous sediment composition of lag sediments, till, coarse sands and gravel with numerous stones and blocks. The area of the Adlergrund bordering on the south-east of the Arkona Basin also evidences a very heterogeneous sediment composition. The surficial sediments consist primarily of lag sediments and various well sorted gravels and sands. Extensive stone and block fields can be found here, together with till. The sediments change to fine sands, silts and clays in the direction of the Arkona Basin.

The transformer substation platforms have a very locally limited environmental effect with regard to the nature conservation interest “seabed”. Only in the immediate vicinity the sediment is permanently affected by the foundations and the resulting soil sealing. Sediment resuspension and turbidity plumes associated with the construction of the foundations of the transformer substation platforms are also of limited duration and spatial scale, according to the current state of knowledge.

Due to operations, long-term resuspension and redistribution of the sediment may occur through the interaction of the foundations and hydrodynamics in the immediate vicinity of the pile. Based on experience gained so far in the North Sea, current-dependent permanent sediment redistribution is only expected locally around the individual piles. Such experiences are currently not available for the Baltic Sea. However, due to the low flow rates close to the seabed, only local scouring is expected here as well. Thus no significant effects on the seabed or the water are expected as a result of the planned transformer substation platforms, according to the current state of knowledge.

In addition, according to the current state of knowledge, there are no significant effects to be expected on the seabed and water due to the installation and operation of subsea cable systems. The potential effects are locally limited. There is a brief disturbance to the sediment structure when subsea cables are installed. The turbidity of the water column increases as a consequence of the sediment resuspension. The extent of the resuspension mainly depends on the installation procedure and the fine grain contents in the seabed. In areas with lower fine grain content, the majority of the disturbed sediment will settle relatively quickly in the immediate vicinity. In areas with soft sediments and correspondingly higher fine grain contents, the seabed currents are relatively low so that only temporary local effects are expected in these areas. Pollutants and nutrients may be briefly released from the sediment into the water body. The possible release of pollutants from the sandy sediments is deemed to be negligible. A significant release of pollutants from the sediment into the water body may occur in the seabed areas containing silts and clays. The pollutants generally adhere to falling particles which, due to the low currents in the Baltic Sea basin, hardly drift over great distances and remain within their local environment. In the medium term, this remobilised material is deposited back in the silty basin.

Operationally, energy losses of the subsea cables result in heating of the surrounding sediment. The Spatial Offshore Grid Plan stipulates a planning principle with regard to sediment warming. This planning principle defines that the cable-induced sediment heating should not exceed a limit of 2 kelvin 20 cm under the seabed. If this precautionary value is kept, significant effects on the seabed and water can be avoided according to the current state of knowledge.

### *Plankton*

According to the current state of knowledge, no significant effects on the plankton will result from the uses planned in the grid plan. During the construction of transformer substation platforms and installation of subsea cable systems, there may be effects on the phytoplankton and zooplankton as a result of sediment turbidity plumes. However, as these effects are small-scale and short-term, significant effects on the phytoplankton and zooplankton due to the transformer substation platforms and subsea cable systems can be ruled out with fair certainty. Effects on the plankton during operation can also be ruled out with the necessary certainty.

### *Benthos*

The species inventory of the EEZ of the Baltic Sea, with approx. 200 macrozoobenthos species, is viewed as average. The benthos communities are also typical for the Baltic Sea and do not present any particularities in the main. Based on currently existing studies, the macrozoobenthos of the EEZ of the Baltic Sea is also to be seen as average with regards to the number of red listed species found here.

Investigations into the macrozoobenthos within the framework of the approval procedure for offshore wind farms from 2002 to 2012 have confirmed this evaluation. The inventory of species found and the number of red listed species suggest an average importance of the study area for benthos organisms.

The installation of the piles for the transformer substation platforms results in small scale and short-term disturbances to the seabed, sediment resuspension and turbidity plumes. Due to the resuspension of sediment and the subsequent re-sedimentation, it is possible that the benthos in the immediate vicinity of the platform foundations will be affected or damaged for the duration of construction. These effects are only expected to have a small spatial effect and are very limited in duration. Facility-related, changes in the species composition may arise in the immediate vicinity of the construction as a result of the local surface sealing and insertion of hard substrates. As the colonisation of the artificial hard substrate is linked to an increase in organic material, it is possible that a local decrease in oxygen occurs due to the biodegradation process.

In addition, as a result of the installation of the subsea cable systems, only small-scale disturbances to the benthos due to sediment resuspension and turbidity plumes are to be expected in the area around the cable route. Possible impacts on the benthos are dependent on the installation method used and the geological and hydrographical conditions. Only negligible disturbances to the benthos in the area around the cable route are expected due to the comparatively environmentally-friendly jet burial method. Local sediment dispersal and turbidity plumes are expected for the duration of the subsea cable installation. The cable will be laid by milling where the seafloor consists of more cohesive and rocky soil. This method is also linked to a disturbance of the sediment and the benthos fauna, as well as sediment resuspension. In areas with lower fine grain contents, the majority of the disturbed sediment will settle relatively quickly directly in the immediate vicinity of the cable route. In areas with soft sediments and correspondingly higher fine grain contents, the seabed currents are relatively low so that only temporary local effects are expected in these areas.

Pollutants and nutrients may be briefly released from the sediment into the water body. The possible release of pollutants from the sandy sediments is deemed to be negligible. A significant release of pollutants from the sediment into the water body may occur in the seabed areas containing silts and clays. The pollutants generally adhere to falling particles which, due to the low currents in the Baltic Sea basin, hardly drift over great distances and remain within their local environment. In the medium term, this remobilised material is deposited back in the silty basin.

Benthic habitats will be directly overbuilt in areas where rock fills are required for cable crossings or for cable sections laid on the seafloor. The resulting loss of habitat will be permanent, but small-scale. A hard substrate foreign to the location will result and this can lead to small-scale changes in the species composition. Due to operations, the sediment may heat up right over the cable. This can lead to impairments to benthic communities.

The Spatial Offshore Grid Plan stipulates a new planning principle with regard to sediment warming. This demands that the cable-induced sediment heating should not exceed a limit of 2 kelvin in 20 cm under the seabed (so-called 2 K-criterion). If this precautionary value is kept, significant effects on benthic organisms can be avoided according to the estimate of the German Federal Nature Conservation Agency.

According to the current state of knowledge no significant effects on benthic communities are expected as a result of the planned transformer substation platforms and subsea cables, provided that the 2 K-criterion is kept. Only very small-scale areas outside of protected areas will be used and a rapid re-colonisation is very probable due to the generally rapid regeneration capability of the existing populations of benthos organisms with short generation cycles and their widespread presence in the German Baltic Sea.

### *Biotope Types*

Possible effects of transformer substation platforms and subsea cables on biotope types can occur as a result of a direct use of protected biotopes, potential habitat changes or their covering under sedimentation from material released by construction. Direct use of Natura2000 sites, which is generally prohibited for transformer substation platforms, will also be completely avoided by subsea cable routes due to the spatial stipulations of the Spatial Offshore Grid Plan. In accordance with the planning principles of the plan, known areas of protected biotopes according to Section 30 Federal Nature Conservation Act (BNatSchG) shall be avoided to the greatest extent possible or treated with special consideration within the framework of the licensing procedure.

Impairment due to burial is likely to be small in scale due to the prevailing nature of the sediment in areas where the presence of protected biotopes can be expected as the released sediment will quickly settle. Due to the prevailing low seafloor currents in areas with soft sediments, turbidity plumes that significantly exceed natural suspended particulate matter maxima may be expected up to a distance of approx. 500 m. The released material remains for such a period of time in the water column that it is dispersed over a wide area, and a high level of deposited material is therefore not expected due to the comparably low volume. Simulations show that the released sediment is re-deposited after max. 12 hours. The effects are therefore generally small-scale and temporary based on the current level of knowledge.

Permanent habitat changes are limited to the immediate vicinity of the platform foundations and the rock fills that become necessary in the case of cable laying on the seafloor and for cable crossings. The rock fills represent a permanent hard substrate foreign to the location. This offers benthos organisms a new habitat and can lead to a change in the species composition. Significant effects on the nature conservation interest “biotope types” are not expected as a result of these small-scale areas. In addition, the risk of a negative impact on the soft-bottom benthos community caused by species atypical to the region is low since the recruitment of species is very likely to occur from the natural hard substrate habitats. Possible effects on the protected habitat types after the Habitats Directive are considered within the framework of the Habitats Directive impact assessment.

### *Fish*

The habitat-typical fish fauna is present in the German EEZ according to the current state of knowledge. The pelagic fish community is represented by herring, sprats, salmon and sea trout, while the demersal fish community includes larger fish species such as cod, plaice, flounder and dab. This character is of average significance due to the habitat-typical fish communities. Within the framework of various studies, a total of 63 fish species were found in the eastern area of the EEZ, including 12 red listed species. The planned transformer platform locations do not represent a favoured habitat for any of the protected fish species according to the current state of knowledge. Accordingly, the fish stocks in the area of the planned transformer substation platforms do not have any particular ecologically importance compared with adjacent marine regions.

According to the current state of knowledge, there is nothing to suggest a significant impact on the fish fauna as a result of the planned transformer substation platforms and subsea cable routes. The effects of the transformer substation platforms and subsea cable systems on the fish fauna are very limited in scale and time.

During the construction of the transformer substation platforms and installation of subsea cables, the fish fauna may be impaired temporarily and on a limited spatial scale due to sediment resuspension and turbidity plumes. Due to the prevailing low seafloor currents in areas with soft sediments, turbidity plumes that significantly exceed natural suspended particulate matter maxima may be expected up to a distance of approx. 500 m. Simulations show that the released sediment is re-deposited after max. 12 hours. The effects are therefore generally small-scale and temporary based on the current level of knowledge.

All things considered, negligible, small-scale impairments are expected for adult fish. In addition, fish may be temporarily dispelled by noise and vibrations during the construction phase. Noises produced during the construction phase shall be minimised with appropriate measures. For this purpose the Spatial Offshore Grid Plan stipulates a planning principle regarding noise-mitigation (cf. 5.2.2.7 grid plan). More local effects on the fish fauna may be caused by the hard substrates introduced additionally as a result of a potential change in the benthos.

With regards to the operation-related effects of the subsea cable systems due to sediment heating and magnetic fields, no significant effects on the fish fauna are expected.

### *Marine Mammals*

The areas of the three wind farm clusters, like the entire western Baltic Sea, are a part of the harbour porpoise habitat. According to the current state of knowledge, these areas are used by harbour porpoises for crossing purposes. There are as yet no indications that these areas have any special functions as feeding or breeding grounds for harbour porpoises. Common seals and grey seals only use the three cluster areas sporadically as crossings. Based on the findings from the monitoring of the Natura2000 areas and studies for offshore wind farms, a low to medium importance for harbour porpoises can currently be identified. These areas have no particular significance for common seals and grey seals.

Risks to marine mammals can arise due to noise emissions during the installation of the transformer substation platform foundations. Without the implementation of noise-mitigation measures, significant impairment to marine mammals during pile driving in individual sub-areas cannot be ruled out. The pile-driving of transformer substation platform foundations will therefore only be permitted in the individual licensing procedure if effective noise-mitigation measures are implemented. In this regard, the Spatial Offshore Grid Plan defines a written commitment with regard to the principle noise-mitigation (cf. 5.2.2.7 grid plan).

This states that the installation of the platform foundations may only be carried out if strict noise-mitigation measures are implemented. In the individual licensing procedure, extensive noise-mitigation and monitoring measures are ordered for the purpose of compliance with applicable noise prevention values (sound exposure level (SEL) of 160 dB re 1µPa²s and peak level of 190 dB re 1µPa at 750 m distance around the pile-driving site). Suitable deterrence measures must be taken to ensure that no marine mammals are residing in the immediate vicinity of the pile-driving area. Significant effects on marine mammals during the operational phase of the transformer substation platforms can be ruled out according to the current state of knowledge.

The exclusion of construction of transformer substation platforms in Natura2000 areas will contribute to a reduction of the risks to harbour porpoises in important feeding and breeding grounds.

Significant adverse effects on marine mammals as a result of the construction and operation of the planned transformer substation platforms are not currently estimated considering the successful implementation of noise-mitigation measures by meeting the noise prevention values. These measures have to be ordered in the individual licensing procedure. No significant effects on marine mammals are expected as a result of the installation and operation of subsea cable systems either.

### *Seabirds and Migratory Birds*

The individual wind farm clusters are of differing importance for seabirds. A medium importance for seabirds must be assumed in general for cluster 1. This partial area touches at its southern and south-eastern borders the extensive resting habitats of the Pomeranian Bight and the Adlergrund. Overall, cluster 1 shows a medium seabird occurrence and a medium occurrence of endangered and protected species. According to the current state of knowledge, clusters 2 and 3 have a lower importance as feeding and resting habitats for seabirds. Both clusters show a low occurrence of endangered and protected species. They do not belong to the main resting, feeding and over-wintering habitats for species in Appendix I to the Birds Directive.

Due to the water depth and the seabed composition, all three clusters are of low importance as feeding grounds for diving sea ducks. Like divers, these only use the partial areas as crossings. For breeding birds, the cluster areas do not have any special importance as a feeding ground due to the distance from the coast with breeding colonies.

Primarily, seabird disturbances during the construction phase will be due to noise and light emissions and visual disturbances. These can cause differing, species-specific scare and barrier effects. Direct disturbances during the construction phase are expected to be limited in scale and time. Due to the high mobility of the birds, significant effects can be ruled out with high certainty. The transformer substation platforms will have a permanent disturbance and scare effect on certain bird species. Generally, an avoidance distance of approx. 2 km is assumed. No additional loss of habitat for seabirds or migratory birds will occur from the transformer substation platforms and its operation as a result of the immediate proximity of the platforms to the offshore wind farms. Due to the exclusion of transformer substation platforms in the Natura2000 areas, habitat losses in important habitats will be reduced.

In addition, the EEZ has an average to above average importance for bird migration. Every year, up to one billion birds migrate across the Baltic Sea. The Baltic Sea is an important crossing for sea ducks and geese from Northern Europe and Russia (up to Western Siberia), whereby the majority of the migrations occur in autumn close to the coast from East to West. The Western Baltic Sea is crossed by several species that require special protection (e.g. barnacle geese, whooper swans, eider ducks, black scoters and white-winged scoters), in varying to high levels.

Birds that use thermals and other species migrating in the daytime preferably migrate along the “bird flight line” (“Vogelfluglinie”; along the islands of Fehmarn, Falster, Møn and Seeland, Falsterbo). These birds migrate in substantially less densities to the east of this main route. The Western Baltic Sea has an above average significance for crane migration.

Potential effects of the planned transformer substation platforms in the operations phase could result from barrier effects or collision risks for the migrating birds. Under clear weather conditions, which are preferred by the birds for their migrations, the probability of a collision with a platform is very low. Poor weather conditions increase this risk.

As the transformer substation platforms are individual structures which are also located in the immediate operating area of offshore wind farms, a significant impairment to bird migration is not expected. It is assumed that any negative impact can be avoided by use of suitably compatible lighting during the operation of the transformer substation platforms. Regarding potentially cumulative effects caused by transformer substation platforms in interaction with the offshore wind farms, please see below.

According to the current state of knowledge, no significant effects are to be expected on migratory birds or seabirds during the time-limited construction phase as a result of either the construction of the planned transformer substation platforms or the installation of the planned subsea cable systems. Scaring effects occurring during construction will be local in scope and will not extend beyond the disturbances generally associated with slow ship movements.

According to the Spatial Offshore Grid Plan (planning principle no. 5.3.2.7) a sufficient sediment cover of the cable systems has to be permanently guaranteed. Therefore facility- and operation-related effects of the subsea cables on the avifauna can be ruled out.

### *Bats*

The migratory movements of bats across the Baltic Sea have been documented to various extents, but definitive information about migratory species, migration corridors, altitudes and concentrations is not available so far. The information available up to now merely confirms that bats, in particular long-distance migrating species, fly over the Baltic Sea. Risks to bats can arise in particular during the operation phases of the transformer substation platforms. Attractant effects may occur. In addition, risk of collisions is assumed. The sensitivity of bats to onshore structures and the related risk of collision are known, as well as the risk of collision with wind turbines. In addition, possible barrier effects onshore, and habituation and attractant effects are known.

However, effects of tall structures in the offshore region are mainly unknown. Based on observations so far, it is assumed that bats primarily migrate in swarms across the sea, probably at significant altitudes and along regularly used migration routes.

As there are insufficient observations and results with regards to bats and the potential effects of tall structures in the offshore region on bats, an assessment of the possible risk potential is not possible at present. Since the transformer substation platforms are individual structures which, based on the currently proposed plans, will be located within the offshore wind farms, and will also be of a lower height than the surrounding wind turbines, significant impacts on bat migration due to the proposed maximum eleven platforms are improbable according to the current state of knowledge. Risk to single individuals through collisions cannot be excluded. As the locations are more than 25 km from the coast, it is assumed that the major concentrations of the bats migrating along the coast will not be endangered. A cumulative assessment is currently impossible for lack of reliable data.

### *Biological Diversity*

Biological diversity comprises the diversity of habitats and communities, the diversity of species and genetic diversity within species (Art. 2 Convention on Biological Diversity, 1992). The public's focus is on the diversity of species.

With regard to the current status of biological diversity in the Baltic Sea, it should be noted that there are countless indications of changes in the biodiversity and the species structure at all systematic and trophic levels of the Baltic Sea. These are mainly attributable to climate changes or human activities such as fishing and marine pollution. Red lists of endangered species have an important control and warning function in this context since they show the status of the inventories of species and biotopes in a given region. Potential effects on the biodiversity are considered in the SEA report under the individual nature conservation interests. In summary, it should be noted that, according to the current state of knowledge, there are no significant effects to be expected on biological diversity by the planned transformer substation platforms and cable routes.

### *Air*

No measurable effects on air quality arise as a result of the construction and operation of the transformer substation platforms and installation of subsea cable systems within the framework of the implementation of the grid plan.

### *Climate*

Adverse effects on the climate caused by the planned transformer substation platforms are not expected since climate-relevant emissions are not measurable either during construction or operation. Rather, planning security for the expansion of offshore wind energy is enhanced thanks to the coordinated development of the grid infrastructure in the offshore area. The $CO_2$ savings associated with the expansion of offshore wind energy is expected to have a positive impact on climate protection over the long-term. This can make a significant contribution to the achievement of the Federal Government's climate protection objectives.

### *Natural Scenery*

The landscape of the EEZ of the Baltic Sea has been largely unspoiled up to now. The realisation of offshore wind farms will lead to effects on the natural scenery since it will be changed due to the construction of vertical structures.

The construction of transformer substation platforms can also lead to visual changes in the natural scenery. However, due to the distance of the planned sites from the coast (more than 25 km), significant impacts on the natural scenery as seen from the coastline can be ruled out. At such a distance, it will barely be possible to make out the transformer substation platforms even if visibility conditions are good. This also applies to navigation lights at night.

Another factor to take into account is the fact that the transformer substation platforms are always planned in spatial connection with the offshore wind farms. Therefore the change in the natural scenery resulting from individual structures in the immediate geographical vicinity of the wind farms will only be negligibly increased. Adverse effects on the natural scenery can be ruled out for the subsea cable systems as the cables are laid in the seabed.

### *Tangible Assets, Cultural Heritage*

Due to existing hydro-acoustic studies as well as according to the evaluation of the underwater obstruction database, there is no information on tangible assets or cultural heritage in the area of the planned transformer substation platforms. Individual underwater obstructions are present in two areas along the planned subsea cable routes. These must be treated with special consideration in the individual licensing procedure.

Should culturally significant findings or tangible assets be detected during the required geotechnical survey within the licensing procedure for the construction of transformer substation platforms and installation of subsea cables, then appropriate measures must be taken to preserve them. With this requirement in mind, there are no significant effects on the nature conservation interest “tangible assets, cultural heritage” to be expected as a consequence of the implementation of the grid plan.

### *Human Population including Human Health*

In general, the area to which the grid plan definitions apply has limited importance for human health and well-being. Humans are not directly affected by the stipulations of the plan instead they may be indirectly affected through their perception of the natural scenery (cf. nature conservation interest “natural scenery”) and possible influences on the leisure function of the landscape for water sports people and tourists. Due to the considerable distance to the coast of about 25 km, those effects can be estimated as insignificant.

## 4.2 Interactions

Generally, effects on a conservation interest result in various consequential effects and interactions among the conservation interests. The interactions of the biotic natural conservation interests are based on the food chains. Possible interactions arise during the construction phase from sediment movements and turbidity plumes along with noise emissions. These interactions are, however, limited in duration restricted to just a few days or weeks.

Facility-dependent interactions, for example due to the insertion of hard substrate, are expected to endure, but only locally. A transformer or bundling platform as a stand-alone space-limited structure only results in very small-scale habitat changes. The same applies to required structures that may become necessary for crossing cable structures or for subsea cable systems laid on the seafloor.

Due to the variability of the habitat, interactions cannot be described very precisely. Generally speaking, it can be noted that there are no interactions which could endanger the marine environment.

## 4.3 Cumulative Effects

The SEA report also covers the assessment of cumulative effects pursuant to Art.5 (1) of the SEA Directive. Cumulative effects arise as a result of the interactions of various independent individual effects which are added together due to their co-action (cumulative effects) or which mutually reinforce each other, thereby having an effect which is greater than the sum of their individual effects (synergistic effects). Currently, there are still no Europe-wide evaluation criteria or investigation methods defined for considering cumulative effects in principle in terms of time and space.

In order to assess the cumulative effects, it is necessary to evaluate to what extent a significant negative effect can be attributed to the transformer substation platforms and subsea cable systems contemplated in their interaction with the wind farm clusters outlined in the plan. The wind farm projects are being examined at the level of this sectoral plan based on the state of knowledge up to know in terms of Art.5 (2) of the SEA Directive.

In clusters 1 and 3, there are primarily approved wind farm projects within the priority areas for wind energy. Therefore, statements about cumulative effects are possible for these areas, based on information available so far in the environmental impact studies (EIS). Existing knowledge gaps concern the areas outside the priority areas, particularly cluster 2, in which there are currently no definitive approvals or planning approval decisions following the implementation of an environmental impact assessment.

These gaps can only be partially filled with results from research projects, from the monitoring of protected areas and project-specific environmental impact assessments.

So far no serious or lasting licensing restrictions have been determined, however, the projects are located in an area of the Arkona Basin in which the information available so far regarding the geomorphological conditions and sediment distribution indicates that restrictions may arise with regards to construction of wind turbines and grid infrastructure systems.

As the project-specific requirements and detailed information about environment and geological site conditions only normally become known at the level of the individual licensing procedure, any additional environmental effects caused by the wind farm projects can only be checked in detail at the individual project level. Additionally, the Federal Agency for Nature Conservation in its statement within the scoping process refers to the location of cluster 2 in an area of particular importance for bird migration.

### *Seabed, Benthos and Biotope Types*

A significant proportion of the environment effects caused by the transformer substation platforms and subsea cable systems on the seabed and benthos will take place exclusively during the construction time (turbidity plumes, sediment movement, etc.) and within a small and local area. Construction-related cumulative effects are less probably because of the incremental implementation of the individual projects.

Possible cumulative effects on the seabed that can directly affect the nature conservation interests “benthos” and specially protected biotope types arise from the permanent surface sealing by the foundations of the transformer substation platforms and installed subsea cable systems in interaction with the surface sealing caused by the foundations of wind turbines. The individual effects are small and local in scale. In order to estimate direct use of space, an approximate calculation is carried out for the planned platforms and subsea cable systems and the included wind farms. On the basis of a model assumption, direct use of space of around 20 to 30 ha has been determined for the subsea cables, structures for cable crossings and local cable laying on the seafloor, transformer substation platform foundations and the foundations of the wind turbines and measuring masts stipulated in the grid plan. In total, this represents a total use of significantly less than 0.1‰ of the overall EEZ area. In comparison, 55% of the Baltic Sea EEZ is under protection. Areas within the Natura2000 areas are not used within the EEZ. No statements can currently be made regarding the use of specially protected biotope types pursuant to Section 30 Federal Nature Conservation Act due to the lack of a reliable scientific basis. Comprehensive sediment and biotope mapping currently underway will provide more reliable information for the planned updates in the future.

In addition to the direct use of the seabed and thus the habitat of the organisms living there, the foundations and structures for cable crossings will result in an additional supply of hard substrate. The hard substrate introduced leads to a loss of habitat for the macrozoobenthos fauna adapted to soft-bottoms. This could give rise to cumulative effects due to the construction of several offshore structures. However, as with regard to the grid infrastructure and the wind farms the use of space will be in the ‰ range, there are no significant cumulative negative effects on the seabed and the benthos to be expected according to the current state of knowledge.

### *Marine Mammals*

Cumulative effects on marine mammals, in particular harbour porpoises, could occur primarily due to noise pollution during the installation of foundations. Therefore, marine mammals could be significantly impaired due to the fact that there is not enough space available for these animals to avoid and withdraw if pile-driving is carried out at various locations within the EEZ at the same time. Since, to date, normally only one offshore construction site has been active at the same time, there is no experience regarding the time and space overlapping in the propagation of pile-driving noise. There is also no scientific basis for evaluating the potential cumulative effects on marine mammals. For this reason, the approval authority reserves the right, in respect of the individual project pile-driving operations, to coordinate in terms of time and space in order to minimise the overall noise periods.

It is also obvious, from the descriptions of the Offshore Grid Development Plan 2013 that grid infrastructure systems and individual offshore wind farms will be built gradually over the next 20 years, not simultaneously.

### *Seabirds*

Vertical structures, such as transformer substation platforms and wind turbines, can have different effects on seabirds, such as loss of habitat, increased collision risk or scare and barrier effects. The habitat loss due to the realisation of multiple constructions can be of importance to resting birds in particular.

Multi-area consideration of the cumulative effects of offshore wind farms and the transformer substation platforms planned in the grid plan on seabirds and resting birds can be made based on results and observations from already realised offshore wind farm projects. Therefore, results such as those from offshore wind farms in neighbouring countries make it possible to anticipate changes in habitat use by seabirds. In particular, endangered and sensitive seabird species, for example divers, must be given consideration with regard to cumulative effects. The assessment of the cumulative effects on divers has to consider additive to the effects of offshore wind farms also the effects of shipping (for operation and maintenance of the cables and platforms).

In order to be able to assess the significance of cumulative effects on seabirds, any effects must be investigated for species-specific. In this regard, questions regarding population biology-based thresholds and the significant reference value for such a threshold arise. The literature suggests that, for resting birds, an encroachment should be considered inadmissible if 1% of the bio-geographical population is affected by a loss of habitat. In the absence of other reliable criteria, the 1% criterion seems at least suited to approach the quantification of an encroachment. For divers, the reference value for the relevant winter resting population of north-western Europe is 110,000 animals, for example (SKOV et al., 1995). This figure served as the basis for the first decisions of the approval authority for the assessment of possible cumulative effects caused by the operation of offshore wind farms.

As all findings to date suggest a low importance for the wind farm cluster regarding species in Appendix I to the Birds Directive, no visible obstacles appear to stand in the way of implementing the plan according to the current state of knowledge. All of the transformer substation platforms are planned in the direct vicinity of offshore wind farms, meaning that there is also no cumulative loss of habitat to be expected in addition for species sensitive to disturbances. Due to the distance of the cluster from the SPA “Pomeranian Bight”, any disturbance to overwintering birds in the protected area can be excluded. This also refers to potential disturbance effects by shipping associated with the operation and maintenance of cables and platforms. Since the Baltic Sea is highly frequented by shipping, no additional impact on sensitive species is expected from the increased shipping traffic during construction or during repair and maintenance operations. The exclusion of construction of transformer substation platforms in Natura2000 areas will contribute to prevent significant disturbances in protected areas.

To date there is still a lack of sufficient observations and findings regarding negative or positive effects on seabirds arising from the construction of offshore facilities at both the individual and population levels. In the studies relating to the “Horns Rev” wind farm, there are indications of negative effects due to loss of habitat for species sensitive to disturbances; other effects have not been investigated. Only an increase in species inventory and therefore the feeding ground for seabirds in the vicinity of offshore platforms can be determined and forecast.

### *Migratory Birds*

There is a potential risk for migratory birds on one hand due to the collision risk with the transformer substation platform and the individual wind turbines and on the other due to the negative effects brought about by forced changes to their flight path.

Under normal migration conditions preferred by the migratory bird species, no indications have been found that the birds typically migrate through the danger zone of the facilities and/or do not detect and avoid these barriers. Under clear weather conditions which are preferred by the birds for their migrations, the probability of a collision with transformer substation platforms or wind energy facilities is therefore very low. Sudden fog and rains resulting in poor visibility and low flight altitudes represent a potentially dangerous situation. Particularly problematic is the coincidence of poor weather conditions with so-called mass migration events. The risk of collision for birds migrating during the day and seabirds is considered to be low. These birds orientate themselves visually and are usually able to land on water. The risk of a bird strike would therefore be more likely to occur with nocturnally migrating, numerous songbird populations.

In order to avoid and/or minimise the collision risk, the facilities should be constructed such that light emissions are avoided during construction and operation to the greatest extent possible provided that they are not necessary and unavoidable pursuant to safety regulations for ship and air traffic and occupational safety requirements.

Cumulative effects of the transformer substation platforms in interaction with adjacent offshore wind farms could, in addition to the bird strike risk, also lead to a lengthening of the migration path for the migrating birds. The migration path could be diverted and thus lengthened due to a potential barrier effect. It is known that wind farms are avoided by birds, meaning that they fly around or over them. The transformer substation platforms are a part of the individual wind farms. Flying around the transformer substation platforms on an indirect route is, in this context, be negligible since, due to their immediate geographical proximity to a wind farm, they do not generate their own barrier effect, nor do they amplify that of the wind farm. Even though the number of birds concerned is higher due to the cumulation with other facilities along the migration route, the extra energy expenditure for the individuals remains the same and therefore low. The effects will be slightly more significant for individuals which have to avoid multiple structures. The increase in energy used is also minimal here compared with the total route. Taking into account that the non-stop flight distances covered by most migratory bird species are in the range of over 1,000 km (BERTHOLD, 2000) significant effects on the energy budget of migratory birds is not expected.

A maximum diversion of approx. 60 km would be necessary for birds migrating from East to West and bypassing all three clusters. The possible barrier effect is in the same order of magnitude when looking at the North-South migration route. The distances between the individual clusters are wide enough, so there is sufficient space for flying around them. Taking into account the wind farm “Arcadis Ost 1”, planned in the territorial sea, a maximum barrier effect spanning 25 km results for the North-South migration route.

Based on the available knowledge about the migratory behaviour of the various bird species, the usual flight altitudes and the migration distribution over the time of day, it can be concluded that significant effects on bird migration are unlikely from a cumulative perspective of the already approved projects in the priority areas, according to the current state of knowledge. Flying around the priority areas on an indirect route should not give any reason to expect any significant negative effect on the further development of the populations.

In this regard, it should be noted that this forecast is made according to the current state of science and technology under premises which are not yet suited to guaranteeing the basis for migratory birds in a satisfactory manner. There are knowledge gaps with regard to species-specific migration behaviour in particular. It has not been possible to fill these gaps, despite extensive research.

Due to the abovementioned knowledge gaps, a conclusive cumulative consideration of all offshore wind farms to be taken into account, including projects in areas for which there are not yet any definitive approvals or planning approval decisions following an environmental impact assessment, as well as of additional offshore wind farms outside the German EEZ, is not yet possible. The environmental impact assessments available for the projects in cluster 2 do not indicate any significant importance of these areas for bird migration. However, in

addition to other things, increased crane migration was observed within the framework of the basic investigations for the projects in cluster 2. The experts determined that this was due to the birds drifting because of unfavourably changing winds during the Baltic Sea crossing.

Based on these observations, significant cumulative effects cannot be excluded at this point, particularly due to the fact that a concentration of bird migration is assumed in the sea area between Ruegen and Schonen (cf. Federal Nature Conservation Agency, 2006).

## 4.4 Transboundary Effects

The SEA report comes to the conclusion that no significant impacts on the areas of the neighbouring states bordering on the German EEZ of the Baltic Sea can be noted based on the stipulations made in the Spatial Offshore Grid Plan, according to the current state of knowledge. In addition to the subsea cable routes and transformer substation platform sites, the plan also stipulates clusters for offshore wind farms which are, however, not its primary subject matter. The individual wind farms in the clusters are included within the framework of the cumulative assessment. A comprehensive assessment of the possible significant environmental impacts of these wind farms will be implemented within the framework of the individual licensing procedures, where environmental impact assessments will be regularly implemented, taking into account the stipulations for transboundary assessment.

Significant transboundary impacts can be generally excluded for the following nature conservation interests: seabed, water, plankton, benthos, biotope types, natural scenery, tangible assets and human population, including human health. Possible significant transboundary impacts could at the most arise for the highly mobile fish, marine mammals, seabirds, migratory birds and bats species with regards to the cumulative assessment, taking into account all planned wind farm projects in the German Baltic Sea.

The SEA concludes that, according to the current state of knowledge, the implementation of the Spatial Offshore Grid Plan will not have any significant transboundary impact on the fish fauna. This is because the area in which the plan stipulations apply does not have any significant function for fish and also because the recognisable and predictable effects are temporary and small scale. The same applies to marine mammals, seabirds and passage migrants. They primarily use the cluster areas as crossing areas. A significant loss of habitat for strictly protected seabird species is not expected.

Significant transboundary impacts can therefore be excluded, according to the current state of knowledge, and taking into account prevention and mitigation measures. For example, in the individual licensing procedure the installation of the platform foundations is permitted solely under strict application of effective noise mitigation measures (cf. section 5.2.2.7 Spatial Offshore Grid Plan).

Due to the fact of particular risk to the separate Baltic Sea population of harbour porpoises, intensive monitoring measures must be implemented during the implementation. Where necessary, noise mitigation measures must be adapted or pile-driving operations coordinated to exclude any cumulative effects.

The planned transformer substation platforms could represent a barrier or collision risk for migratory birds. As the transformer substation platforms are individual structures located in the immediate operating area of offshore wind farms, a significant impact on bird migration due to the plan stipulations alone is not expected. Significant impacts regarding the cumulative consideration of bird migration in interaction with the offshore wind farms cannot be excluded with the necessary certainty at present. A cumulative assessment of the level of risk for bat migration is currently not possible as sufficient knowledge is still not available. As the transformer substation platforms are individual structures, significant impairment to bat migration is not expected solely due to the proposed maximum eleven platforms, according to the current state of knowledge. As the locations are more than 25 km from the coast, it is assumed that the major concentrations of the bat migrating along the coast will not be endangered.

## 4.5 Summary of the Assessment

In summary, with regard to the planned transformer substation platforms and subsea cable routes, the coordinated overall planning of the offshore grid infrastructure should minimise impacts on the marine environment. Significant effects caused by the planned transformer substation platforms can be avoided through strict compliance with prevention and mitigation measures, in particular through sound protection measures during the construction phase.

The installation of subsea cables can, amongst other things, be performed in a way which is as environmentally friendly as possible such that protected areas and biotope structures are circumvented to the greatest extent possible. A new planning principle with regard to sediment warming is intended to ensure, that any significant adverse effects of sediment warming on benthic communities can be avoided. The avoidance of cable crossings to the greatest extent possible will also serve to prevent adverse impacts on the marine environment, particularly on the seabed, benthos and biotope types.

Based on these descriptions and assessments, and also with regards to any interactions, it can be noted for the SEA that no significant impacts on the marine environment are expected from the planned transformer substation platforms and subsea cable systems, according to the current state of knowledge and at the abstract level of sectoral planning. The potential effects are small-scale and largely short-term as they are limited to the construction phase.

Large parts of the cluster 1 and 3 areas are located within the priority areas for wind energy of the Maritime Spatial Plan for the German EEZ of the Baltic Sea. For those areas adequate knowledge is available. For individual areas, particularly those outside the priority areas that have a high thickness of mud, sufficient information for technical implementation (cable installation procedure, platform construction procedure) is lacking as proven state of the art is currently not available here. The evaluation of the effects depends primarily, however, on the procedures applied.

In addition, there is currently still a lack of sufficient scientific knowledge for the cumulative consideration of effects on individual nature conservation interests such as bird and bat migration. Therefore these effects cannot be conclusively evaluated within the framework of the existing SEA and are fraught with uncertainties. A more in-depth investigation must be carried out within the framework of the individual licensing procedure and the update to the Spatial Offshore Grid Plan.

# 5 Species Conservation Assessment

In addition, the SEA report contains a statutory species conservation assessment pursuant to Section 44 Federal Nature Conservation Act in conjunction with Art.12 of the Habitats Directive. At the more abstract level of the SEA, this assessment concludes that, according to the current state of knowledge, in strict compliance with prevention and mitigation measures, no significant negative effects via which prohibitions under species conservation law will be met are associated with the transformer substation platforms and subsea cable routes planned in the grid plan. The potential effects are small-scale and largely short-term as they are limited to the construction phase. This also applies to the transboundary impact assessment. A detailed statutory species conservation assessment is incumbent upon the individual licensing procedure.

# 6 Habitats Directive Impact Assessment

Pursuant to Sections 34 and 36 Federal Nature Conservation Act, in conjunction with Art.6 (3) of the Habitats Directive, the SEA shall also contain a Habitats Directive impact assessment, i.e. an assessment of the compatibility of the plan contents with the protection and conservation objectives of Natura2000 areas (Habitats Directive sites and special protected areas according to EU Birds Directive).

Therefore, it must initially be determined as part of a preliminary study whether a Natura2000 area can, in principle, be significantly impaired. The nature conservation area “Pomeranian Bight” (EU special protected area, SPA) and the five Habitats Directive sites “Fehmarnbelt”, “Kadetrinne”, “Adlergrund”, “Westliche Roennebank” and “Odra Bank” are located in the German EEZ pursuant to the ordinance of 15 September 2005.

Potential long-distance effects on the protected areas in the adjacent territorial sea and in the adjacent waters of neighbouring countries are also taken into account as part of the impact assessment.

Nature conservation interests include the habitat types “reefs” and “sand banks” pursuant to Appendix I of the Habitats Directive, certain fish species and marine mammals pursuant to Appendix II of the Directive and various bird species pursuant to the EU Birds Directive (Appendix I Art. 4 (2)). Species defined according to Appendix IV of the Habitats Directive (e.g. harbour porpoises) must be strictly protected everywhere, therefore also outside the defined protected areas.

## 6.1 Habitats Directive Impact Assessment of the Planned Transformer Substation Platforms

The Spatial Offshore Grid Plan stipulates a total of 9 sites or search areas for transformer substation platforms and 2 additional, optionally proposed, bundling platforms. None of the facilities is planned in a Natura2000 area. 9 of the planned 11 sites are located near Habitats Directive sites and must therefore be assessed with regard to their Habitats Directive compatibility. The two planned transformer sites in cluster 3 are located more than 30 km away from a protected area. For these locations, the preliminary study concludes that significant effects from the planned transformer substation platforms on Natura2000 areas can be ruled out, according to the current state of knowledge, due to the distance. Due to the large distance of all planned transformer sites from Natura2000 areas in the territorial sea, significant impairments to such areas in the territorial sea can be ruled out with certainty.

The Habitats Directive impact assessment concludes that, according to the current state of knowledge, the construction and operation of the transformer substation platforms defined in the grid plan, in strict compliance with prevention and mitigation measures, will not have any significant effects on the neighbouring Habitats Directive areas or the bird conservation area “Pomeranian Bight”. In order to prevent significant impacts the plan sets written stipulations, in particular with regard to noise protection.

## 6.2 Habitats Directive Impact Assessment of the Planned Cable Routes

Potential effects of subsea cables are normally limited to the installation phase and thus very limited in terms of space and time. Effects on Natura2000 sites are only expected in case that the cables are routed in the immediate vicinity of those special protected areas; long-distance effects are not anticipated according to the current state of knowledge. Therefore, following an extensive preliminary study for the Habitats Directive impact assessment, only cable corridors which are routed in the immediate vicinity, i.e. along the edge of Natura2000 sites, will be considered.

In particular due to the small scale and short duration of the cable installation, significant impacts on marine mammals can be ruled out. With regard to potential operational effects, there are also no significant effects to be expected based on the cable configurations and the planning principles regarding sediment cover and sediment warming stipulated in the grid plan. Potential significant impairment to the conservation objectives of special protected areas resulting from the installation and operation of subsea cable systems can also be excluded. The cable installation works only last a few days and are only associated with typical ship noise and scaring effects.

Significant impacts on the protected areas due to sediment drifting during the construction phase can be excluded according to the current state of knowledge. The closest Habitats Directive area “Westliche Roennebank” is located at a distance of min. 1 km from a cable route and therefore outside the drift distance discussed in the scientific literature of about 500 m. Therefore, no release of nutrient or pollutant concentrations that might impact Habitats Directive areas is expected.

## 6.3 Result of the Habitats Directive Impact Assessment

At the more abstract level of this SEA and according to the current state of knowledge, the Habitats Directive impact assessment comes to the conclusion that the implementation of the Spatial Offshore Grid Plan, in strict compliance with prevention and mitigation measures, will not have significant effects on Natura2000 sites. This refers to protected areas in the German EEZ as well as Natura2000 sites in neighbouring countries or in the territorial sea. The above mentioned prevention and mitigation measures are stipulated within the framework of the individual licensing procedure. For this purpose the grid plan stipulates general planning principles.

In summary, the plan’s stipulations ensure that any possible negative environmental effects due to subsea cable systems and transformer substation platforms in the area of the Natura2000 network will be kept as low as possible. A detailed Habitats Directive impact assessment is subject to the individual licensing procedure.

With regards to the function of the protected area network, no indications can be found at the current level of knowledge that the coherence of Natura2000 areas could be significantly affected by the grid plan stipulations. All clusters are located to the north-west of the SPA “Pomeranian Bight”, the Habitats Directive areas “Adlergrund”, “Westliche Roennebank” and “Pomeranian Bight with Odra Bank”, and the protected areas in the territorial sea, so that no barrier effect results that could affect the exchange or networking between the protected areas.

In addition to the effects within the EEZ, the present Habitats Directive impact assessment explicitly only investigates possible long-distance effects of the stipulations in the EEZ on protected areas in the neighbouring territorial sea or waters of neighbouring countries. The transformer substation platforms and subsea cable corridors are usually sufficiently far away from the protected areas in the territorial sea. That is why significant effects on these protected areas are not to be expected. This assessment does not take into account, however, the direct effects of the inevitable cable routes in the territorial sea resulting from the gates provided for the Spatial Offshore Grid Plan. This is subject to the SEA that has been carried out by the Federal Network Agency for the Offshore Grid Development Plan or subordinate planning levels.

# 7 Measures to Prevent, Reduce and as fully as possible Offset any Significant Adverse Effects of Implementing the Spatial Offshore Grid Plan on the Marine Environment

In accordance with the requirements of the SEA Directive, the planned measures designed to prevent, reduce and, as fully as possible, offset significant adverse effects resulting from the implementation of the plan will be presented.

Basically, any negative effects resulting from the stipulations in the Spatial Offshore Grid Plan on the development of the environmental status of the EEZ of the Baltic Sea should be avoided. If the plan is not implemented, the investigated uses would develop without the space and resource-saving management and coordination effect of the Spatial Offshore Grid Plan.

Concretely speaking, the plan sets spatial and written stipulations which, in accordance with the environmental protection objectives defined in Chapter 1.4 of the SEA report, serve to prevent or reduce the significant negative effects of the implementation of the plan on the marine environment. This mainly refers to written stipulations regarding space-saving planning, avoiding use of protected areas and habitat structures pursuant to Section 30 Federal Nature Conservation Act, noise mitigation, compliance with the 2 K-criterion, the obligation to dismantling and following the best environmental practice and the state of the art.

Mitigation and prevention measures will be concretely defined and ordered by the competent approval authority at the project level for the planning, construction and operation phase. With regard to the planned transformer substation platforms, this concerns in particular noise mitigation and prevention measures as well as environmentally-friendly lighting during the operation of the platforms. Measures to prevent and reduce any potential negative effects of subsea cables must be considered within the framework of the cable routing and technical design. To prevent significant adverse impacts on benthic communities by cable heating the revised Spatial Offshore Grid Plan specifies a planning principle regarding sediment warming.

# 8 Examination of Possible Alternatives and Description of the Implementation of the Environmental Assessment

## 8.1 Examination of Possible Alternatives

Pursuant to Article 5 (1) Clause 1 of the SEA Directive, the environmental report includes a brief presentation of the reasons for the selection of examined reasonable alternatives. In addition, Section 17a EnWG stipulates that seriously considered alternatives for cable routes, corridors for cable routes and sites must be examined. Various types of alternatives can be considered for examination of alternatives, particularly strategic, spatial or technical alternatives. The main requirement is that they are reasonable and serious enough for consideration. At the same time, the effort for the determination and evaluation of alternatives to be considered must be reasonable.

It must be noted in general that all stipulations in the form of planning principles and standardised technical specifications emerge from a “preliminary study” of possible and conceivable alternatives. There are already a number of different uses and legally protected interests in the EEZ. As can be gathered from the justification of the individual planning principles, particularly those concerning the environment, the respective principle is already based on a consideration of the potential public interests and legal positions involved, meaning that a “preliminary examination” of potential alternatives was carried out as a result.

A strategic alternative, e.g. with regards to the Federal Government's objectives the Spatial Offshore Grid Plan is based on, is not currently being considered for the plan as the expansion targets of the Federal Government also represent the planning horizon for the plan. These objectives are also an essential basis of the demand planning for the land-based grid expansion. The regular updating requirements of the Spatial Offshore Grid Plan offer the opportunity to respond flexibly and quickly to possible adjustments of the objectives. The zero option is not a reasonable alternative as the lacking coordination would probably lead to greater use of space, more cable crossings and therefore additional negative environmental effects (cf. Chap. 3).

With regard to the examination of spatial alternatives, the grid plan sets both spatial and written stipulations in the form of planning principles and standardised technical specifications for subsea cable systems and transformer/bundling platforms in the EEZ. These specifications serve largely to stipulate these uses in an environmentally sound way and to balance the concerns and legal positions in a manner that meets all interests. The spatial stipulations of the grid plan fit in with the existing uses and the area designations defined within the framework of the Maritime Spatial Plan for the Baltic Sea EEZ. Tight limitations are therefore set on the planning of routes right from the start.

The cable routes are planned on the shortest possible path (also to minimise the environmental effects) insofar as there are no overwhelming opposing concerns. There are no basic alternatives to these cable routes in the Baltic Sea EEZ.

One option of evaluating spatial alternatives is offered by the definition of search areas for transformer or bundling platforms that have not been approved yet.

Within the framework of the consultation procedure, it was demanded that a direct current (DC)-connection-concept should be examined in the SEA as a technical alternative. The advantage of such a connection-concept lies primarily in that a DC cable system, with approx. 900 MW transmission capacity, can transmit several times more power than an AC cable system (250 MW). This would lead to a significantly reduced quantity of cable systems compared to the AC-technology proposed by the TSO and significantly reduce the area used by the subsea cable systems. On the other hand, however, it is fact that by using the DC-technology a converter platform must be built at sea and an additional one onshore to convert the alternating current generated by the wind farms to direct current.

For the grid connection of the wind farm "EnBW Baltic 2" which is already under construction an AC-connection-concept is fixed. Also for both the offshore wind farm "Arkona Becken Suedost" and the wind farm "Wikinger" located in the priority area that are already approved and under realisation over the short term due to the advanced status of the proceedings an AC-connection-concept is stipulated.

According to the current state of knowledge, the cable routes for the grid connection of both approved offshore wind farms in cluster 1 will not have any significant effects on the marine environment (cf. Chap. 4.2). A verification of this forecast will be carried out in the context of the single licensing procedure as well as in the framework of the plan's update. Accordingly, the question is whether a technical alternative applies for the areas outside the priority areas, particularly with regards to cluster 2.

Due to the by comparison low generation capacity it does not seem reasonable to provide a converter platform for the single wind farm outside the priority area in cluster 1, neither from an economic nor an ecological perspective. Another option could be a connection to a possible converter platform in cluster 2.

By implementing a DC-connection-concept in cluster 3 the installation for the power factor correction, that would be required for the AC-connection, would not be needed. However, the remaining generation capacity in cluster 3 is rather low for the areas outside of the priority area.

In the case of cluster 2, due to the potential generation capacity of the offshore wind farms, the environmental impacts of a possible additional converter platform (at sea) must be compared with those of five additional subsea cable systems and checked with regards to their potential effects during construction and operation. A final assessment is not possible at present, as the potential environmental impacts depend primarily on the methods and the foundation construction used, and also because proven state of the art is currently not available for the areas with high levels of mud, according to the current state of knowledge. A detailed investigation will only be possible after detailed, project-specific framework conditions are available. Even then, a final assessment is generally estimated to be difficult due to the very different environmental impacts of subsea cables and foundation constructions.

Basically it must be noted that from an ecological perspective a DC-connection-concept may represent a suitable alternative over the long term for cluster 2 and possibly also for the offshore wind farm in cluster 1 outside the priority area. A final assessment is not possible at this time due to the numerous uncertainties and unpredictabilities. However it needs to be noted, that to the current state of knowledge cluster 2 does not have a particular importance from a sedimentological aspect or with regards to benthos, biotope types or fish. So – taking into consideration the short lengths of the subsea cable systems within the EEZ – no significant impacts on these nature conservation interests are expected from the use of AC-technology (cf. Chap. 4.2). By using a transmission voltage of 220 kV the highest possible transmission capacity per cable system for an AC-connection can be realised.

The lower transmission capacity of an AC-cable can, in some circumstances, be evaluated as an advantage as this enables needs-based grid expansion. The lower transmission capacity might be regarded as an advantage especially considering the fact that outside the priority areas a number of issues are still unsolved, for instance regarding the sediment/ construction conditions or the cumulative impact on bird and bat migration. Therefore, the use of AC-technology offers the option of reacting as flexibly as possible to developments regarding offshore wind farms and avoiding over-capacity when setting up the grid infrastructures.

Rather, what is central for the consideration of the grid-connection-concept is the routing of the cables in the territorial sea because the predominant proportion of the cable routes (more than 80 percent) is located in the territorial sea. Furthermore in the territorial sea the cable routes cross protected areas. From an ecological view, factors such as material consumption, etc. also play a role with regards to the total length of the subsea cables.

The SEA report of the Federal Network Agency 2013 provides an abstract comparison of the potential environmental impacts of the two alternative grid-connection-concepts on the basis of the estimated area consumption. The examination of possible alternatives is based on the four grid connection projects (964 MW), that have been confirmed by the Federal Network Agency in the framework of the Offshore Grid Development Plan 2013. The assessment of alternatives comes to the conclusion that under the assumed framework conditions the area consumption of a DC-connection-concept would result in an approximately 42% reduction compared to an AC-grid connection-concept despite the necessary additional converter platform (cf. Federal Network Agency (BNetzA), 2014: Umweltbericht 2013 (only available in German). The SEA report 2013 of the Federal Network Agency points out that with respect to the considerable costs associated with the grid connection systems, however, beyond the SEA additional investigations concerning the economic consequences of a change of the connection-concept are needed (BNetzA, 2014).

Taking into account these economic considerations and as a result of the consultation procedure of the confirmation of the Offshore Grid Development Plan 2013 the Federal Network Agency comes to the conclusion that for all measures confirmed in scenario B2023 the chosen AC-technology is appropriate. The Federal Network Agency concludes that to the current state of knowledge the use of AC-technology seems to be the more economic alternative. In particular the advanced planning stage of the measures proposed in scenario

B2023 suggest that the AC-technology should be maintained. Any deviation from the intended use of AC-technology would likely lead to considerable delays of the grid connection of the wind farms affected (cf. Federal Network Agency, 2014b: Offshore Grid Development Plan 2013).

Therefore the Spatial Offshore Grid Plan stipulates for all projects that have been confirmed in the framework of the Offshore Grid Development Plan 2013 and that will be realised in the short term an AC-grid connection-concept (cf. Chap. 5.1.1.1). The reason is that it is currently estimated that at least for these projects a need-based development is made possible. Besides there are not any significant effects to be expected using AC-technology to the current state of knowledge. This estimation has to be evaluated in the further proceedings. Any new knowledge can be appropriately reacted on within the framework of the regularly update of the plan.

For all other projects to be realised over the long term the Spatial Offshore Grid Plan does not define the use of AC-technology because for those projects DC-technology might represent a reasonable alternative – at least from an ecological perspective. Nevertheless the Spatial Offshore Grid Plan takes an AC-connection concept as a basis for all planned cable routes and platform sites as well as search areas for platforms. This is to assume a maximum of the area required and as a consequence to reserve sufficient space for future grid topology.

A more detailed examination of the DC-connection-concept for those areas can be implemented within the scope of the regular plan update, when further knowledge, especially from practical experience, is available.

## 8.2 Information Gaps

The data base has improved over the last few years particularly thanks to the extensive surveys within the framework of environmental impact studies for the offshore wind farm projects and the accompanying ecological research. Information gaps continue to exist, in particular with regards to:

- lack of comprehensive sediment and biotope mapping in the EEZ
- reliable data pertaining cumulative effects (bird migration) and potential interactions
- bat migration (migration routes, migration behaviour) across the Baltic Sea
- compliance with measures pertaining to temperature losses in the sediment

In addition, there is a general lack of evaluation criteria with regard to both the evaluation of the status of biological conservation interests and the effects of anthropogenic activities on the development of the living marine environment. A transboundary assessment of the cumulative effects of existing uses on highly mobile conservation interests (seabirds and migratory birds, marine mammals, fish) is not possible as long as a comparable basis for evaluation is lacking. In terms of the consideration of cumulative effects, there is a lack of Europe-wide defined study methods and scientific evaluation criteria to fundamentally consider cumulative effects both in terms of time and space.

# 9 Measures Envisaged concerning Monitoring the Significant Environmental Effects of the Implementation of the Spatial Offshore Grid Plan

The potential significant effects on the environment arising from the implementation of the Spatial Offshore Grid Plan shall be monitored pursuant to Section 14m (1) Environmental Impact Assessment Act. This is intended to ascertain unforeseen, negative effects so that suitable corrective actions can be taken. The monitoring also serves to examine the gaps in knowledge described in the SEA report or the uncertain forecasts. Pursuant to Section 14m (4) Environmental Impact Assessment Act, the monitoring results must be considered when the plan is updated. The actual monitoring of potential effects on the marine environment can only begin when the definitions laid down in the plan are realised.

Therefore, the project-related monitoring of the effects of transformer substation platforms and subsea cables is assigned great significance. The main objective of the monitoring is to combine and assess the findings from the various monitoring results at the project level. In addition to this, existing national and international monitoring programmes must be taken into account to avoid duplication of effort.

The study of the potential environmental effects of transformer substation platforms and subsea cables must take place on project level, based on the standard “Investigation of the Impacts of Offshore Wind Turbines on the Marine Environment (StUK4)” and in consultation with the approval authority.

The results from the studies of neighbouring offshore wind farm projects and those to be connected must be used as a basis for the assessment of the transformer and bundling platform sites in relation to biological nature conservation interests. Monitoring during the construction phase of transformer substation platforms with deep foundations comprises measurements of underwater noise and acoustic recordings of the effects of the pile-driving noise on marine mammals. In addition, further monitoring programmes are planned to determine the effects of water layers on the expansion of the pile driving noise under certain hydrographical conditions in the Baltic Sea and to implement additional measures, where possible. In accordance with the current licensing practice, a registration of birds and bats found dead on the transformer substation platform must also be carried out at every visit and be documented.

The StUK4 for the first time contains monitoring requirements for the investigation of cable routes with regard to benthos, habitat structures and habitat types during the baseline study and operational phase. Each individual habitat structure, as determined by sediment investigations along the cable route, has to be covered by at least 3 transects for the benthos investigations. Each transect consists of 5 stations. Identified areas suspected to be specially protected habitats under section 30 of the Federal Nature Conservation Act shall be demarcated by additional benthos investigations according to the mapping guidelines issued by the Federal Nature Conservation Agency. After the cables have been installed, their position has to be checked via operational monitoring measures. One year after the subsea cable systems are put into operation, studies into the benthic communities must be carried out on the same transects as in the baseline survey.

The SEA for the Spatial Offshore Grid Plan will use new information from the environmental impact assessment studies and from the joint assessment of research and impact studies data. As a result of the joint assessment, products are also being created which enable a better overview of the distribution of biological nature conservation interests in the EEZ. The combination of information leads to an ever more solid basis for the forecasting of effects. Currently, on behalf of the Federal Maritime and Hydrographic Agency several research and development studies on evaluation approaches are in preparation. The projects serve for the continuous further development of a uniform and quality-tested basis of marine environment information to assess the possible effects of offshore facilities and provide an important basis for the updates of the Spatial Offshore Grid Plan.