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

Hamburg, February 2013
THE SPATIAL OFFSHORE GRID PLAN

Under Section 17a Federal Energy Act (Energiewirtschaftsgesetz – EnWG, latest version) the German Federal Maritime and Hydrographic Agency (Bundesamt für Seeschifffahrt und Hydrographie, BSH) has the legal task to issue and annually update a **Spatial Offshore Grid Plan** for the Exclusive Economic Zone (EEZ) of the Federal Republic of Germany.

1 Draft Procedure

<table>
<thead>
<tr>
<th>Preparation of scoping documents (preliminary investigation scope and first draft of grid plan)</th>
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<td>Scoping</td>
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<td>Development of the Spatial Offshore Grid Plan and implementation of strategic environmental assessment (SEA)</td>
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<td>Opportunity for comments</td>
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<td>Revision of the Spatial Offshore Grid Plan</td>
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<td>Publishing of the Spatial Offshore Grid Plan</td>
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<td>Update (annual)</td>
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[to be carried out]

2 Introduction

The legal task for the BSH is to issue and annually update the Spatial Offshore Grid Plan in consent with the Federal Network Agency (Bundesnetzagentur, BNetzA) and in consultation with the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz - BfN) and the coastal states (Länder) – for the Baltic Sea Mecklenburg-Vorpommern and Schleswig-Holstein.

**Annual development of the Spatial Offshore Grid Plan for the EEZ, i.e. pursuant to Section 17a (1) Clause 2 Energy Management Act (latest version), definition of:**

1. Offshore facilities (offshore wind farms) which spatial context and suitable for collective grid connections (Chapter 3).
2. Cable routes and corridors for cable routes for grid connections for offshore facilities (offshore wind farms) (Chapter 5),
3. Points where the grid connections for offshore wind farms cross the border between the exclusive economic zone and the territorial sea (gates),
4. Sites for converter platforms or transformer substations (Chapters 4 and 6),
5. Cable routes or corridors for cable routes for interconnectors (Chapter 7) and
6. Cable routes or corridors for cable routes to or for possible cross-connections between the facilities and cable routes mentioned in 1, 2, 4 and 5 or corridors for cable routes (Chapter 8)

7. Standardised technical specifications and planning principles.

The standardised technical specifications and planning principles form the basis of the plan's spatial planning determinations. The standardised technical specifications and planning principles proposed in this draft shall be put up for discussion as the Baltic Sea offshore grid plan drafting process progresses in order to be examined, amended and evaluated in their significance in relation to one another.

When creating the Offshore Grid Plan, the Federal Maritime and Hydrographic Agency will examine whether the determinations 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
- serious alternatives to cable routes, corridors for cable routes or sites.

3 Identification of Offshore Wind Farms for Collective Grid Connections

3.1 Planning Horizon

Alignment of the Spatial Offshore Grid Plan with the objectives of the Federal Government: 25 GW by 2030

3.2 Spatial Definition of Clusters

Clusters for offshore wind farms = in spatial context and distinguishable planning for offshore wind energy installations.

In principle, three clusters for offshore wind farms can be identified in the German EEZ of the Baltic Sea as, according to the applied for projects, the planned offshore wind farms are spatially connected to one another in three distinguishable areas. The clusters will be defined in accordance with spatial planning requirements.

The following will be included (cf. Map 1 to Map 3):

- **Cluster 1**: Contains the priority area for wind energy, “Westlich Adlergrund”, in which two approved projects are in existence; several overlapping applications have been made in the remaining areas for the same space.

- **Cluster 2**: Several applications have been made for the same space over the entire cluster area. In some cases, up to three applications overlap one another.

- **Cluster 3**: Contains the priority area for wind energy “Kriegers Flak”, one offshore wind farm project is currently being implemented and two competing applications have been submitted for the southern area of the cluster.
3.2.1 Cartographic Representation of Clusters Included

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

Map 2: Offshore wind farm planning in the area of Clusters 1 and 2
3.3 Determination of the Expected Offshore Wind Farm Capacity

The expected generation capacity for the three clusters defined in Chapter 3.2 must be calculated in order to be able to make spatial planning for the grid connections necessary for this capacity. The capacity last specified to the Federal Maritime and Hydrographic Agency forms the basis for the calculation of the cluster capacity for the projects which have been approved and those which are currently being implemented.

The cluster capacity for the remaining areas cannot be calculated on the basis of the applications pending at the Federal Maritime and Hydrographic Agency – contrary to the approach in the offshore grid plan for the EEZ of the North Sea – as the clusters largely contain offshore wind farm projects which overlap each other, sometimes repeatedly.

A decision can currently not be made for these spaces, on which competing projects have been applied for, as to which offshore wind farm planning should be taken into account to calculate capacity and for the spatial planning, as the competing projects are mostly at a similar stage in approval procedures.

The planning is further complicated as the offshore wind farm projects which have been applied for differ significantly in their basic parameters regarding the number of individual sites applied for per area and the planned wind turbine capacity.

As it is currently unclear which offshore wind farm projects will be advanced and realised in the future (particularly due to the competition situation), a different approach must be followed for calculating generation capacity in order to enable any kind of grid planning in these areas. For this reason an approach should be followed in the first step of this planning stage which does not make any commitment to individual projects, with the exception of the three approved projects. At the same time, an approach should be chosen which allows the development of the clusters without any commitment to specific projects.

An “area approach” would seem applicable to calculate the potential installed capacity, whereby the cluster capacity is calculated on the basis of an average capacity of the offshore wind farm projects applied for. Table 1 shows the average capacity for the projects applied...
for in the Baltic Sea and, by way of comparison, the average value of the projects so far approved in the area of the EEZ of the North Sea.

Table 1: Average capacity of offshore wind energy projects applied for

<table>
<thead>
<tr>
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<th>Installations/km²</th>
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<tbody>
<tr>
<td>Cluster 1</td>
<td>3.9</td>
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<tr>
<td>Cluster 2</td>
<td>2.5</td>
</tr>
<tr>
<td>Cluster 3</td>
<td>2.0</td>
</tr>
<tr>
<td>All applications (Baltic Sea)</td>
<td>2.8</td>
</tr>
<tr>
<td>Without “rogue results”</td>
<td>2.0</td>
</tr>
<tr>
<td>North Sea approved projects</td>
<td>1.9</td>
</tr>
</tbody>
</table>

On the basis of the average facilities applied for per unit area listed in Table 1, it is proposed that the initial spatial planning will be carried out with a figure of 2.0 facilities per square kilometre (km²) in the areas planned by competing applications. This value corresponds to the average of the planned Baltic Sea offshore wind farms in the EEZ without considering the sometimes considerable “rogue results” as, for these projects, a very high number of up to more than eight wind turbines per square kilometre have been applied for. The assumption of 2.0 turbines per km² tends to be slightly above the average of the offshore wind farms approved in the North Sea.

For the capacity of the individual facilities, wind energy facilities with a capacity of 7 MW are assumed within the framework of the area approach for the competing proceedings applied for. This capacity is more in the upper realm of the capacity range applied for with the Federal Maritime and Hydrographic Agency.

This assumption is justified because, based on the current stage of the process, Cluster 2 in particular is not expected to be the cluster to be developed first. Therefore, in view of the planning period, a larger individual wind turbine capacity may be assumed. This approach also seems sensible in order to allow for sufficient space for future developments.

The expected areas required for cable route corridors were subtracted when the offshore wind farm cluster areas were calculated, as well as the areas of approved projects which, as described, are being factored in with the capacity last specified to the Federal Maritime and Hydrographic Agency.

Building on these assumptions, the capacities outlined in Table 2 emerge for the clusters and an expected total installed offshore wind capacity in the EEZ of the Baltic Sea of approximately 3,660 MW.

Table 2: Calculation of the expected offshore wind farm capacity

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<tbody>
<tr>
<td>Cluster 1</td>
<td>880</td>
<td>55</td>
<td>7</td>
<td>2.0</td>
<td>770</td>
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<tr>
<td>Cluster 2</td>
<td>0</td>
<td>92</td>
<td>7</td>
<td>2.0</td>
<td>1288</td>
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<tr>
<td>Cluster 3</td>
<td>288</td>
<td>31</td>
<td>7</td>
<td>2.0</td>
<td>434</td>
<td>722</td>
</tr>
</tbody>
</table>
4 Sites for Transformer Substation Platforms

Transformer substation platforms Platform on which the electricity generated by the offshore wind turbines is bundled and transformed. According to the transmission system operator’s connection concept, the offshore wind farm transformer platform is used jointly by the transmission system operator.

4.1 Standardised Technical Specifications

By way of example

- Use of three-phase alternating current (AC) technology
- Standard transmission voltage 220 kV
- Requirements on nature and number of switching sections
- “Rules of the game” for coordination and joint use of the transformer platform by the offshore wind farm operator and the transmission system operator.
- Creating the preconditions for the cross connections

4.2 Planning Principles

Exemplarily and to be weighed up against one another:

- Use of offshore wind farm transformer platform for grid components
- Location as far at the edges of the offshore wind farm as possible
- Space of 100m x 200m and additional space for manoeuvring
- No impairment of traffic (500m distance from priority and reservation areas for shipping)
- Consideration of all existing and approved uses, distance 500m
- Construction in Natura2000 areas/protected biotopes not permitted, outside these areas only using noise reduction measures
- Consideration of cultural assets and ordnance sites
- Obligation to dismantling

4.3 Spatial Representation: Search Areas for Sites for Transformer Substation Platforms

As illustrated in Chapter 3.2, in all of the clusters there are several overlapping applications for the construction of offshore wind farms, although the number of wind turbine sites applied for and the distances between them differ massively. At the same time, the concept for the grid connections of the responsible transmission system operator relies on using the offshore wind farm’s transformer platform for the necessary grid components. Therefore, determining the transformer platform’s site without committing to a project is barely possible. In order to avoid pre-empting the authorisation decision for individual offshore wind farm projects, no specific sites will be defined yet. Instead, so-called search areas for transformer substation platform sites will be determined. These search areas should be specified as much as possible in the course of the process. If possible, the aim will be to determine sites which represent a reasonable option for the various options.
4.4 Spatial Definition
[To be determined during consultation]

5 Route Corridors for AC Subsea Cable Systems

AC subsea cable systems

Alternating current (AC) subsea cable systems conduct the electricity produced offshore from the transformer platform to the grid connection point. Within the framework of the Offshore Grid Plan, the cable routes will be planned up to the point where the cable system crosses the border between the EEZ and the territorial sea (gate).

5.1 Standardised Technical Specifications

By way of example

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

Exemplarily and to be weighed up against one another:

- Maximum bundling possible by parallel routing
- Distances in the case of parallel routing 100m; 200m 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 at right-angles as possible
- Consideration of all existing and approved uses (construction with distance of 500m, shipping routes 300m distance)
- Avoiding of cable crossings and, if they are absolutely necessary, then crossing at right-angles as possible; distance between turning points 250m
- Depth of burial 1.5m outside of the traffic separation schemes unless the geological site conditions demand different installation depths
- Routing outside of Natura2000 areas/protected biotopes
- Use of gentle burial procedures and coordinated timing of the overall burial/trenching campaigns
- Consideration of cultural assets and ordnance
- Obligation to remove structures after useful life

5.3 Spatial Representation: Gates for AC Subsea Cable Systems

The following gates to the territorial sea are being proposed (cf. Map 5):

- Gate I – corresponds to the target corridor for subsea cables in the Maritime Spatial Plan for the German EEZ of the Baltic Sea, which must be expanded due to the number of cables to be expected,
- Gate II – is not seen as an alternative to gate I; instead it might be necessary for leading the AC subsea cable systems from an offshore wind farm project located in the territorial sea onshore via the EEZ and for cross connection with this wind farm,
- Gate III – bundling the AC subsea cable systems along the route to connect the wind farm “EnBW Baltic 2” which is currently under construction.
5.4 Spatial Definition
[To be determined during consultation]

5.5 Spatial Representation: Corridors for Cable Routes for AC Subsea Cable Systems

Building on the potential generation capacity calculated in Chapter 3.3, the AC subsea cable systems necessary for grid connections of the offshore wind farms have to be determined. The necessary cable corridors are being determined spatially on the basis of the capacity of each cluster. This capacity is calculated with the help of the area approach (cf. Table 2).

For the calculated capacity of clusters 1 and 2, a number of 11 to 13 cable systems are expected to be necessary in gate I plus, if this option will be implemented, two further cable systems from the wind farm project located in the territorial sea. For cluster 3 four cable systems through gate III will be necessary.

Additional routes are secured for the case that the capacity of individual connection systems cannot be exploited to their standard capacity for different reasons and therefore a larger number of connection systems becomes necessary, for instance, due to the capacity of the individual wind farms in the cluster.

Based on this approach, corridors for cable routes for AC subsea cable systems are proposed (cf. Map 6):
Map 6: Corridors for cable routes for AC subsea cable systems

5.6 Summarised Representation: Search Areas for Transformer Substation Platforms and Platforms with Bundling Function, Corridors for Cable Routes and Gates for AC Subsea Cable Systems

Map 7: Summarised representation of proposed search areas for transformer platforms and corridors for cable routes for AC subsea cable systems
6 Technical Option: Platforms with Bundling Function

Platform with bundling function  Platform with bundling and distribution function. The AC subsea cable systems coming from the transformer platforms leading onshore will be bundled on this platform. A platform with bundling function can reduce the number of cable systems leading towards the territorial waters needed and create redundancies in the system.

6.1 Standardised Technical Specifications
By way of example
- Use of three-phase alternating current (AC) technology,
- Standard transmission voltage 220 kV
- Requirements for type and number of switching sections

6.2 Planning Principles
Exemplarily and to be weighed up against one another:
- Location at the edges of the offshore wind farm while the system relevance of the platform with bundling function has to be taken into particular consideration
- Accessible by ship and helicopter
- Space of 100m x 200m and additional room for manoeuvring
- No impairment of traffic (500m distance from priority and reservation areas for shipping)
- Consideration of all existing and approved uses, distance 500m
- Construction in Natura2000 areas/ protected biotopes not permitted, outside these areas only using noise reduction measures
- Consideration of cultural assets and ordnance sites
- Obligation to dismantling
6.3 Spatial Representation: Search Areas for Sites for Platforms with Bundling Function

Map 8: Search areas for platforms with bundling function in wind farm clusters

6.4 Spatial Definition
[To be determined during consultation]

7 Corridors for Cable Routes for Interconnectors

Interconnector Subsea cable system which runs through at least two Baltic States.

7.1 Standardised Technical Specifications
By way of example
  o Consideration of and inclusion in offshore grid planning

7.2 Planning Principles
Exemplarily and to be weighed up against one another:
  o Maximum bundling possible by parallel routing
  o Distances in the case of parallel routing 100m; 200m after every second cable system depending on the geological site conditions
  o Routing through the gates
- Crossing of priority and reservation areas for shipping at right-angle or as close as possible.
- Consideration of all existing and approved uses (construction with distance of 500m, shipping routes 300m distance)
- Avoid cable crossings and, if they are absolutely necessary, the crossing at right-angles as possible; distance between turning points 250m
- Depth of burial 1.5m outside of the traffic separation schemes unless the geological site conditions demand different installation depths
- Routing outside of Natura2000 areas/ protected biotopes
- Use of gentle burial procedures and coordinated timing of the overall burial /trenching campaigns
- Consideration of cultural assets and ordnance
- Obligation to remove structures after useful life

### 7.3 Spatial Representation: Possible Gates for Interconnectors

Map 9: Possible gates for interconnectors

### 7.4 Spatial Definition

[To be determined during consultation]
8 Corridors for Cable Routes for Cross Connections between Grid Infrastructures

Cross connection = Corridors for possible cross connections between offshore installations, cable routes for grid connections for offshore wind farms transformer substation platforms or interconnectors.

Within the framework of this plan, a cable which connects the transformer substation platforms of the offshore wind farms to one another. In future, a so-called “platform with bundling function” may possibly be used for cross connections. This platform bundles the AC subsea cable systems, combining the individual connections and thereby creating redundancies.

8.1 Standardised Technical Specifications
By way of example
- Use of three-phase alternating current (AC) technology,
- Standard transmission voltage 220 kV

8.2 Planning Principles
Exemplarily and to be weighed up against one another:
- Maximum bundling possible by parallel routing
- Distances in the case of parallel routing: 100m; 200m after every second cable system depending on the geological site conditions
- Crossing of priority and reservation areas for shipping at right-angles as possible.
- Consideration of all existing and approved uses (construction with distance of 500m, shipping routes 300m distance)
- Avoiding of cable crossings and, if they are absolutely necessary, the crossing as right-angles as possible; distance between turning points 250m
- Depth of burial 1.5m outside of the traffic separation schemes unless the geological site conditions demand different installation depths
- Routing outside of Natura2000 areas/ protected biotopes
- Use of gentle burial procedures and coordinated timing of the overall burial /trenching campaigns
- Consideration of cultural assets and ordnance
- Obligation to remove structures after useful life
8.3 Spatial Representation: Possible Corridors for Cable Routes for Cross connections

Map 10: Corridors for cable routes for cross connections

8.4 Spatial definition
[To be determined during consultation]

9 Assessment of Public and Private Concerns – Summarised Considerations

Prevailing public and private concerns which create an obstacle to any determination must be examined, in particular the compliance of the definitions with the requirements of spatial planning, coordination with other spatially significant types of planning and measures and any alternatives to cable routes, corridors for cable routes or sites to be given serious consideration.

This chapter will be developed after the consultation process has been completed.

10 Non-Technical Summary of Environmental Effects
[To be carried out after the implementation of the strategic environmental assessment]
11 Annexes: First Draft of the Spatial Offshore Grid Plan for the EEZ of the Baltic Sea 2013 Maps
## 12 English Translation of Map Legends

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<th>English Translation</th>
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<td>all maps</td>
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<td>Grenzen</td>
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<td>Territorial Waters/ 12 nm Zone</td>
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<td>Februar 2013</td>
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<tr>
<td><strong>Map 1</strong></td>
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<tr>
<td>Cluster für Offshore-Windparks</td>
<td>Cluster for offshore wind farms</td>
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<tr>
<td><strong>Map 2 + 3</strong></td>
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<td>Raumordnung</td>
<td>Spatial Planning</td>
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<td>Reservation Area Shipping</td>
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<td><strong>Map 4 + 8</strong></td>
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<td>Suchraum für Plattformen</td>
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<td><strong>Map 5</strong></td>
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<td>gates</td>
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<td><strong>Map 6 + 7</strong></td>
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<tr>
<td>mögliche Trassen für Anbindungsleitungen</td>
<td>routes for grid connections</td>
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<td><strong>Map 9</strong></td>
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<tr>
<td>grenzüberschreitende Seekabelsysteme in Betrieb</td>
<td>cross-border cable systems (in use)</td>
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<tr>
<td>geplante grenzüberschreitende Seekabelsysteme</td>
<td>cross-border cable systems (planned)</td>
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