# Information about Thor Offshore Wind Farm

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## *1. Introduction*

With the Energy Agreement 2018, all parties of the Danish Parliament decided to construct three new offshore wind farms by 2030 as part of Denmark's green transition. Thor Offshore Wind Farm (Thor OWF) marks the first of these farms and will be completed by the end of 2027.

In December 2021, Thor Wind Farm I/S, owned by RWE, won the tender for Thor OWF. Thor Wind Farm I/S are therefore responsible for delivering the offshore installation, part of the onshore installation, and will operate the turbines for a period of at least 30 years. In this respect, Thor Wind Farm I/S are further responsible for preparing the environmental impact assessment for the offshore facilities at Thor OWF.

## *2. Project description*

Thor Wind Farm I/S are responsible for establishing the following elements at Thor OWF:

1. The offshore wind farm, comprising wind turbines, turbine foundations and internal cables between the wind turbines.
2. One or two offshore transformer substations, where the internal cables between the wind turbines are routed and gathered. From here, the electricity generated by the wind turbines is transformed to a higher voltage. Export cables will then carry the power from the offshore transformer station(s) to the coast at Tuskær, north of Nissum Fjord, where the cables will be joined to land cables. Alternatively, power can be carried directly from the turbines to a series of export cables connected to land without installation of an offshore transformer station.
3. Onshore cables, carrying power to a coastal substation by Volder Mark.
4. A high-voltage substation at Volder Mark.

The environmental impact assessment for the Thor OWF will address those parts of the project to be established offshore and up to the coastline and therefore includes points 1 and 2 above, which are described further below.

### *2.1 Offshore wind farm*

Thor OWF is planned within a 220 $km^2$ site approximately 22 km from the west coast of Jutland, off Thorsminde by Nissum Fjord. The location of the planned site can be seen in Figure 1. The offshore wind farm is expected to have a nominal installed capacity of approx.. 1,000 MW — the largest offshore wind farm in Denmark to date — and will supply green electricity to more than one million Danish households.

All wind turbines within Thor OWF will be of the same type and capacity. As individual turbine capacities of either 14-15 MW or 21-23 MW are being considered, a maximum of either 72 or 48 turbines would need to be installed within the outlined area to achieve a combined capacity of approx. 1,000 MW.

The total height of the turbines, i.e. the height from mean sea level to the upper wing tip, depends on the type of turbine chosen, but is likely to be between 260–300 metres. The hub height, i.e. the height of the turbine tower, will be between 140 metres and 160 metres, while the rotor diameter will be between 236 metres and 270 metres.

The turbines will be attached to foundations installed on the seabed. The foundations will comprise either monopiles, consisting of a steel pile driven into the seabed, or jacket foundations comprising a steel structure with 3-4 legs attached to the seabed by smaller driven piles.

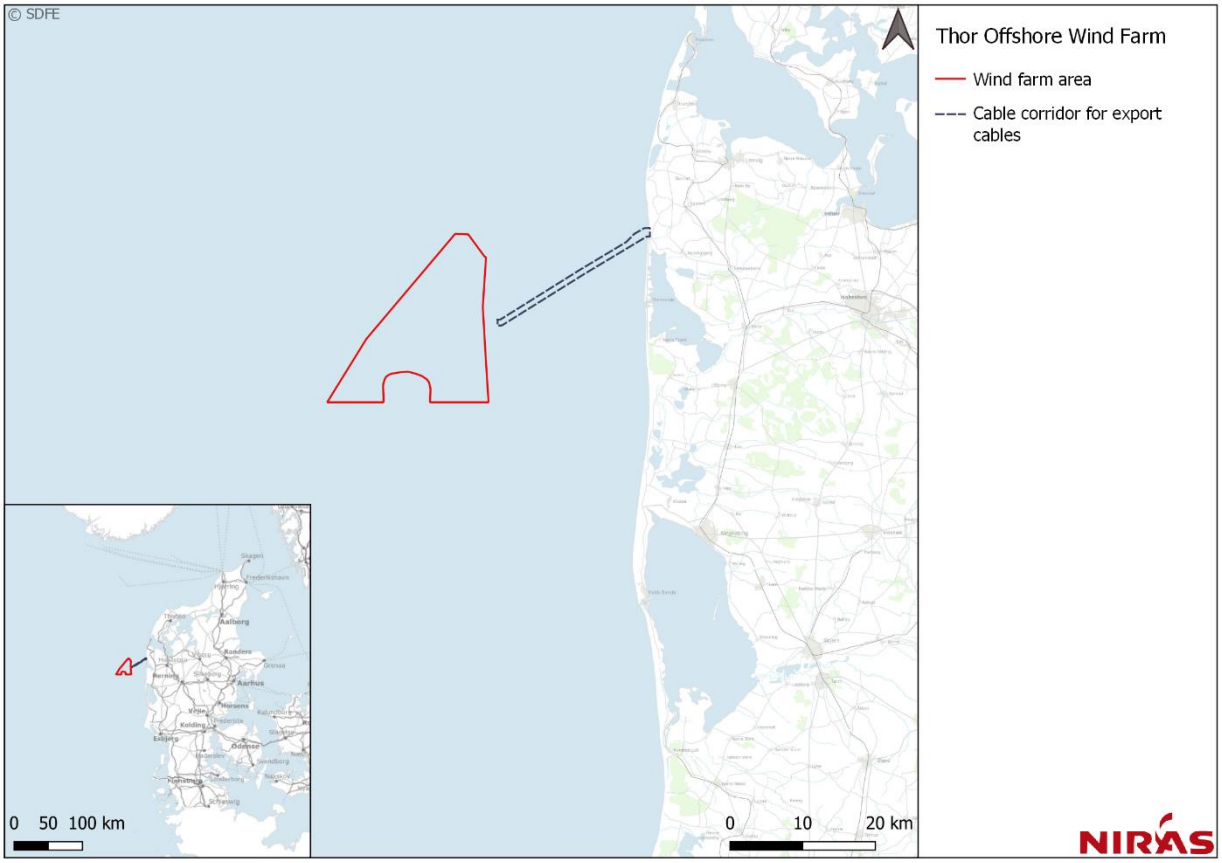


*Figure 1. The Thor OWF area and cable corridor for submarine export cables, which will carry power from the offshore wind farm to land. The total site area is 286 km². The final offshore wind farm may not exceed 220 km² of the total outlined area.*

## *2.2 Transformer substation(s) and submarine cables*

One or two transformer substations may be installed within the area outlined in Figure 1, to which the internal cables between the wind turbines are routed and gathered, and from where the power generated is subsequently transformed to a higher voltage before being carried to shore. The substation(s) will be attached to foundations installed on the seabed. The type of foundations used for the substation(s) will either comprise monopiles (steel piles driven or vibrated into the seabed) or jacket foundations (steel structures with legs attached to the seabed by driving smaller piles at each leg). The type of foundation chosen will depend on the terrain and composition of the seabed.

Alternatively, power from the offshore wind farm can instead be carried directly to land via 1–5 export cables, thereby removing the need for transformer substations. This can be achieved by:

a) Installing up to five high-voltage cables which connect to the wind turbines and allows power to be carried directly to land without transformation on an offshore transformer substation, or;
b) By placing transformers, built and integrated into the turbine and foundation, on up to five individual wind turbines. The internal cables from the other turbines will then be routed to turbines with built-in transformer functionality, where the power will be transformed to a higher voltage. The power will then be brought onshore via a series of cables.

In all cases, the export cables will carry the power to the coast north of Nissum Fjord. Both export cables and the cables between turbines will be buried in trenches, jetted or ploughed into the seabed (or a combination of these methods) to a maximum depth of 1.5 meter to protect the cables from external effects. However, there may be stretches where it is advantageous to place the cables on top of the seabed and cover them with a protective layer of rocks.

## 3. Cross-border effects

This section describes the environmental topics where it is considered relevant to assess whether Thor OWF could give rise to transboundary effects. These relate to effects concerning seabirds, bats and marine mammals.

### 3.1 Seabirds and bats

Birds and bats may collide with the turbines, in particular the rotating wind turbine blades. In the worst case, this can have a significant impact on populations passing through, or living in, the area around the offshore wind farm. Collisions with offshore wind turbines are a significant problem, especially if the turbines are located within a migratory corridor. The installation of wind turbines may also result in the loss of resting areas or the loss of access to important food sources for seabirds, as they will tend to avoid activity near the wind turbines.

In 2019, bird counts were conducted in and near the Thor OWF to identify the potential impacts on birds. This information, which was subsequently analysed and reported on, forms the basis of the assessments regarding the area's significance for resting and migrating birds. Furthermore, the assessments will be based on calculations of collision estimates, as well as estimates of the number of birds displaced from the area due to the presence of the offshore wind farm.

### 3.2 Marine mammals

Offshore construction works will generate underwater noise that may affect marine mammals such as seals and porpoises that move in, or near, the project area. A impact upon the feeding and migratory patterns of marine mammals may also occur. The environmental impact assessment will describe the occurrence and distribution of marine mammals in and around the Thor OWF, based on existing knowledge and information collected in the area in 2020. The assessments of noise impacts on marine mammals will be based on the modelling of underwater noise, which will be carried out in accordance with current guidance from the Danish Energy Agency as well as existing knowledge and expert assessments.