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Sæby Offshore Wind Farm

EIA and Environmental Report

Part 0: Non-technical summary: Marine Environment

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What is an EIA?

EIA is short for Environmental Impact Assessment.

The EIA rules for offshore electricity production plants are found in the Danish Ministry of Climate, Energy and Building's Executive Order no. 68 of 26 January 2012 on environmental impact assessments (EIA) for projects concerning establishment, etc. of offshore electricity production plants.

The EIA rules for onshore facilities are found in the Danish Ministry of the Environment's Executive Order no. 1184 of 6 November 2014 on assessment of the impact of certain public and private installations on the environment (EIA) pursuant to the act on planning. However, according to Section 17 of the Executive Order, this EIA report falls under the previous Executive Order no. 1510 of 15 December 2010. The related supplement to the Municipal Plan must also be environmentally assessed in accordance with the rules of the Ministry of the Environment's Consolidated Act no. 939 of 3 July 2013 on environmental assessment of plans and programmes. The environmental assessment has been prepared as an integral part of this joint EIA report and environmental report. Hereinafter the joint EIA report and environmental report will be referred to as the "EIA report".

The rules are aimed at ensuring that offshore electricity production plants and onshore building and construction projects which must be assumed potentially to have a significant impact on the environment are realised only on the basis of an EIA report.

The purpose of preparing an EIA report is to provide the best possible basis for both a public debate and the final decision to implement the project. The EIA report demonstrates, describes and assesses the project's direct and indirect impacts on the environment, including on:

- Human beings, fauna and flora
- Soil, seabed, water, air, climate and landscape
- Tangible assets and cultural heritage
- Interaction between these factors

The report provides a comprehensive description of the project and its environmental consequences and can form the basis for both a public debate and the final decision to implement the project. The EIA report is published together with the supplement to the Municipal Plan that provides guidelines and/or a framework for the future local planning for the project.

A local plan with an attached environmental assessment must also be prepared for the parts of the onshore facilities that require a local plan.

The purpose of the EIA report is to provide the best possible basis for both a public debate and the EIA authority's final decision as to whether to permit realisation of the project.

For further information about environmental assessments and EIA, see http://www.naturstyrelsen.dk/Planlægning/Miljoevurdering_og_VVM/

Contents

PART 0

Non-technical summary: Marine environment

This EIA and environmental report for Sæby Offshore Wind Farm comprises 5 sub-reports.

- Part 0: Non-technical summary
- Part 1: Introduction and background
- Part 2: The marine environment
- Part 3: Environmental conditions on shore
- Part 4: Summary and conclusion

This report, the "Non-technical summary: Marine environment" is an extract of Part 0 of the EIA and environmental report for Sæby Offshore Wind Farm. It comprises all issues assessed in relation to the marine environment. For further details on the report structure, see the relevant section of the EIA report's Part 1 "Introduction and background".

Photograph: Ricky John Molloy

1 Introduction

Like many other countries, Denmark is facing a major energy policy challenge in terms of ensuring the supply of energy while also contributing to reducing global warming by lowering greenhouse gas emissions.

Consequently, a broad majority in the Danish Parliament on 22 March 2012 adopted an energy policy agreement for the period 2012-2020. As part of the implementation of the energy agreement and the transition to green energy, it was decided to erect nearshore wind farms with a total installed capacity of 450 MW in six areas by 2020. The six areas designated by the parties to the energy agreement in a political agreement of 28 November 2012 are Vesterhav Syd, Vesterhav Nord, Sæby, Sejerø Bugt, Smålandsfarvandet and Bornholm. In each area, a maximum of 200 MW offshore wind turbines may be erected; for Bornholm the maximum is 50 MW, however.

In connection with a broad political agreement with the government on the Growth Package, the Danish Parliament on 14 July 2014 decided to reduce the total installed capacity of the nearshore wind farms from 450 MW to 350 MW.

In January 2013, the minister for Climate, Energy and Building ordered Energinet.dk to head up the preparation of preliminary investigations and EIA reports for the six offshore wind farms ahead of a concession tendering procedure. The order states that the EIA report must comprise and review the environmental impacts of the construction, operation and decommissioning of both the offshore wind farm and the onshore facilities required in order to connect the offshore wind farm to the existing Danish electricity grid.

The Danish Energy Agency is the competent authority and coordinates the work of the authorities in relation to the project. On the basis of, inter alia, the EIA report, the Danish Energy Agency grants permission to establish the offshore wind farm itself, including the inter-array cables at sea and the export cables leading to the landing points on the shore. The Danish Nature Agency is the competent authority in relation to the onshore facilities. On the basis of the EIA report, the Danish Nature Agency will grant EIA permission for the onshore facilities to be established in order to connect power from the offshore turbines to the Danish electricity grid.

The EIA process began in January 2014 with an invitation to the public to submit ideas and proposals. Together with the results of the preliminary investigations, the ideas and proposals received have subsequently been processed and presented as an overall assessment in this EIA report.

2 Sæby Offshore Wind Farm

2.1 The offshore wind farm project

Sæby Offshore Wind Farm is one of the six areas designated in the 2012 energy agreement for investigations and tender for nearshore wind farms. The location and boundaries of the study area for the marine facilities (offshore turbines and export cables) were determined by a political decision of 28 November 2012.

The plan is to place Sæby Offshore Wind Farm approx. 4 km from the coast at Sæby. The offshore wind farm project comprises an offshore wind farm with an installed capacity of up to 200 MW with related onshore facilities for connection to the existing electricity grid. The project area is shown in Figure 2-1 and comprises:

- Study area for offshore wind turbines
- Onshore and offshore cable corridors
- Existing station facilities for connection to the electricity grid
- Corridors for a potential onshore cable station

The wind farm is to be located within an approx. 60 km² large study area. Within this area, permission will be given to erect 200 MW offshore wind turbines within an area of maximum 44 km². If the installed capacity of the offshore wind farm is less than 200 MW, the maximum permitted area for offshore wind turbines will be reduced correspondingly, so that e.g. 100 MW offshore wind turbines must be placed within an area of 22 km² territorial waters.

The power produced by the offshore turbines will be lead ashore via up to 6 submarine cable systems. Two potential landing points have been identified for the cables, located north and south of Sæby, respectively. Both cable corridors are approx. 4 km long and 500 m wide and connect the study area for offshore wind turbines with the shore.

From the landing points, land cables are to be established within one or two approx. 300 m wide and approx. 10 km long cable corridors. The northern corridor starts on the coast at Haldbjerg and runs north-west in a curved line west of Frederikshavn to the station facility at Starbakke north-west of Frederikshavn. The southern corridor starts on the coast between Havgård and Hovmose south of Sæby and runs west to the station facility at Dybvad. Within each onshore corridor, a coastal corridor has been identified for potential establishment of a new coastal cable station (advanced transformer) between the landing points and the

existing station facilities. The purpose of the coastal cable station would be to collect and transform the power from the up to 6 cable systems in a single cable system leading to the connection point. Merging several cable systems into a single system will reduce the construction costs and the power loss when transferring the power to the electricity grid.

The actual connection to and expansion of the existing onshore facilities will depend on the size of the offshore wind farm.

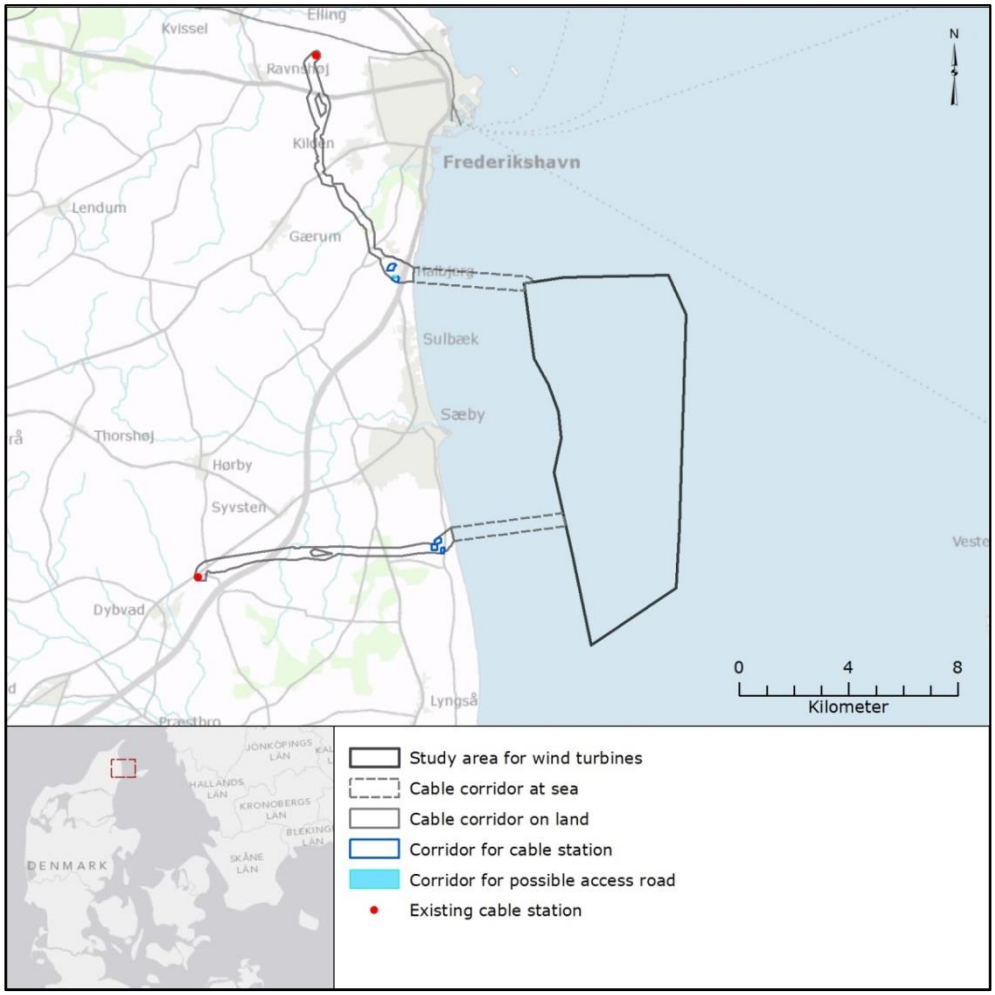


Figure 2-1 Project area for Sæby Offshore Wind Farm

2.2 Design of the offshore wind farm

The final location, layout, turbine types, etc. for the offshore wind farm within the study area will be determined by the future concession holder, taking into account factors such as energy utilisation in the area and the terms and conditions laid down by the Danish authorities. The concession holder will not be named until 2016, after which the detailed project planning and establishment will commence.

Hence, it is currently uncertain which turbine type and size may be erected. One option is to have many small turbines (e.g. up to 66 turbines of 3 MW). Alternatively, fewer, but larger, turbines may be erected (e.g. 20 turbines of up to 10 MW). Finally, turbines of an intermediate size may be chosen. Examples of dimensions are provided in Table 2-1. However, it should be noted that deviations may occur, depending on the make eventually chosen.

Table 2-1 Turbine capacity and expected dimensions.

Turbine capacity (MW)	Rotor diameter (metres)	Total height (metres)	Hub height (metres)
3.0	112	137	81
3.6	120	142	82
4.0	130	155	90
6.0	154	179	102
8.0	164	189	107
10.0	190	220	125

The two "worst case" options with either 3 MW or 10 MW turbines (see also section 2.6) within in the study area are shown in Figure 2-2. These layouts illustrate the maximum area utilisation within the area investigated as a location for offshore turbines and are referred to as the "principal proposal" in this EIA report. It should be noted that the area around two telecom cables from the south-west to the north-east and a disposal site in the eastern part of the study area are kept free of offshore turbines in the two worst-case layouts. See section 2.7 concerning area adjustments in connection with the preparation of the EIA report.

Figure 2-2 Potential layouts of Sæby Offshore Wind Farm

2.3 Establishment of the offshore wind farm

The turbines will be attached to foundations on the seabed. The final choice of foundation type will be based on an assessment of conditions in the area, including seabed conditions, water depths, waves, currents and wind. It is expected that the foundations will be of one of the following types:

- *Monopiles,* which are the most common foundation type, and which have been used for 70-80% of all offshore wind turbines currently in operation. Monopiles consist primarily of tubular steel structures driven into the seabed. The pile driving process is relatively fast and in most cases it is not necessary to prepare the seabed before installation.
- *Gravity-based foundations* of concrete are held in place by their weight. Gravity-based foundations have been used for offshore wind farms in Danish, Swedish and Belgian waters. They are well-suited for relatively hard seabed conditions and are particularly relevant if the location is expected to be affected by ice in the winter.

- A *jacket foundation* is a three- or four-legged steel lattice structure typically used for large turbines and large water depths and for soft seabed types. As the lattice structures are relatively costly to manufacture and the 3-4 legs are time-consuming and expensive to install, jacket foundations are chosen primarily if other, less expensive alternatives cannot be used.
- A *suction bucket foundation* consists of an upside-down bucket-like structure. The basic concept is derived from the suction anchor. Once the foundation has been placed on the seabed, the water is sucked out, and pumps generate a strong vacuum within the foundation, which affixes the foundation to the seabed. Suction bucket foundations require a soft and relatively homogeneous seabed. In connection with offshore wind farms, this type of foundation is relatively new.

Installation of turbines typically takes place using one or more jack-up or semi-jack-up vessels. The turbine components are either transported from the port of loading to the installation area on barges or on the actual installation vessel. Large turbine components (tower, nacelle including hub, and 3 rotor blades) are lifted into place one by one by a crane on the installation vessel. The installation is supported by a number of smaller auxiliary vessels for equipment and staff, see Figure 2-3.

Figure 2-3 Installation of turbine at Anholt using semi-jack-up vessel. Photograph: Rambøll

Export cables and all inter-array cables are laid out by a cabling vessel, on which the cables are placed on large turntables. The cable vessel may be pulled by tugboats or may rely on its own motors.

All cables will be buried in the seabed as protection against trawl fisheries, dragged anchors, etc. Depending on the nature of the seabed, the cables will be jetted or ploughed into the seabed, laid in dug trenches and covered by seabed sediment or, in special cases where the cables are located close to or on the sediment surface, covered by a protective rock layer.

2.4 Alternatives investigated

The EIA report for Sæby Offshore Wind Farm comprises only the principal proposal and the related 0 alternative.

Sæby Offshore Wind Farm is located in one of the six areas designated in the 2012 energy agreement for investigations and tenders for nearshore wind farms and planning for export cables and onshore facilities.

The location and boundaries of the study area for the marine facilities (offshore turbines and export cables) at Sæby were determined by a political decision of 28 November 2012. Consequently, no alternative locations are being considered relative to the six areas designed by the political parties behind the energy agreement, of which Sæby Offshore Wind Farm is the subject of this EIA report.

In connection with the preparatory work and the 1st public phase for the specific areas, no alternatives have been assessed for laying out of land cables and adaptation of station facilities or construction of new facilities.

2.5 Timeline

No concession holder has yet been named, so the detailed project timeline is not known at present. It is expected that the concession holder will be named in early 2016 and that the detailed project planning and construction work will start immediately after that. The offshore wind farm must be ready to produce electricity by 2020 at the latest and its expected life is around 30 years.

A generic timeline for the expected project relating to Sæby Offshore Wind Farm is shown in Figure 2-4. The timeline has been prepared on the basis of the experience gained by the Danish Energy Agency and Energinet.dk in connection with previous offshore wind projects.

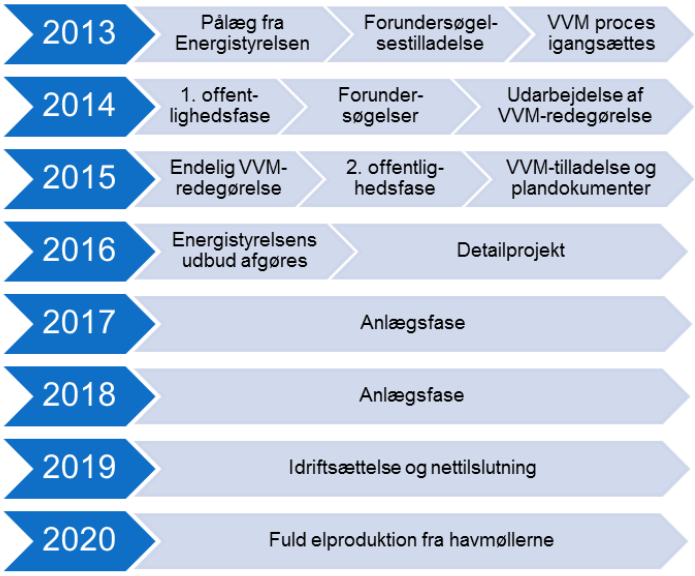


Figure 2-4 Expected project timeline

2.6 EIA report based on worst-case scenario

Since the construction project for onshore and offshore facilities will not be defined until the future concession holder has been granted permission to establish the facilities, no defined project exists for the preparation of this EIA report. Therefore the report has been based on a worst-case scenario, i.e. on assessment of the worst impact imaginable within the technically feasible framework for the project. Hence, each topic within the EIA report includes a description of worst-case scenarios, and it has been assessed in which scenario the environmental impact would be greatest.

The worst-case approach in the EIA report is to ensure that the final construction project will be comprised by the assessments made and will have either an equivalent or a smaller environmental impact than those assessed in the EIA report.

Within the worst-case framework for the EIA report, assessments of the environmental impacts for relevant alternative construction elements such as different sizes of offshore turbines, different foundation types or different onshore grid connection options have been made so that the EIA report covers the possible construction solutions within the worst-case framework.

2.7 Area-related project adaptations

In connection with the EIA process a number of assessments have been performed, which has led to a need to adjust the size of the area that may be used for installation of offshore turbines (the study area for offshore turbines). The following parameters apply:

- Two submarine cables running through the study area from the south-west to the north-east. Submarine cables are typically surrounded by a protection zone, in which anchoring, dredging and bottom trawling is prohibited. However, it will be up to the future concession holder to negotiate the size of the protection zone with the cable owner, and hence the cables do not give cause to reduce the area for installation of offshore turbines.
- A disposal site in the north-western part of the study area. No offshore turbines are to be placed within the disposal site, seen as a circular recess within the area. Disposal sites are also typically surrounded by buffer zones. However, it will be up to the future concession holder to negotiate the size of the buffer zone.
- High intensity of ship traffic to and from Sæby port. In the interest of these ships it has been decided to establish a navigational corridor through the study area, and no offshore turbines are to be placed within the corridor.
- Overlap with a lighthouse angle (light sector) in the north-eastern corner. It has been decided to keep the north-eastern corner of the area free of offshore turbines as this area is within the light sector of the lighthouse at Frederikshavn.

The final area where offshore turbines can be installed is shown in Figure 2-5.

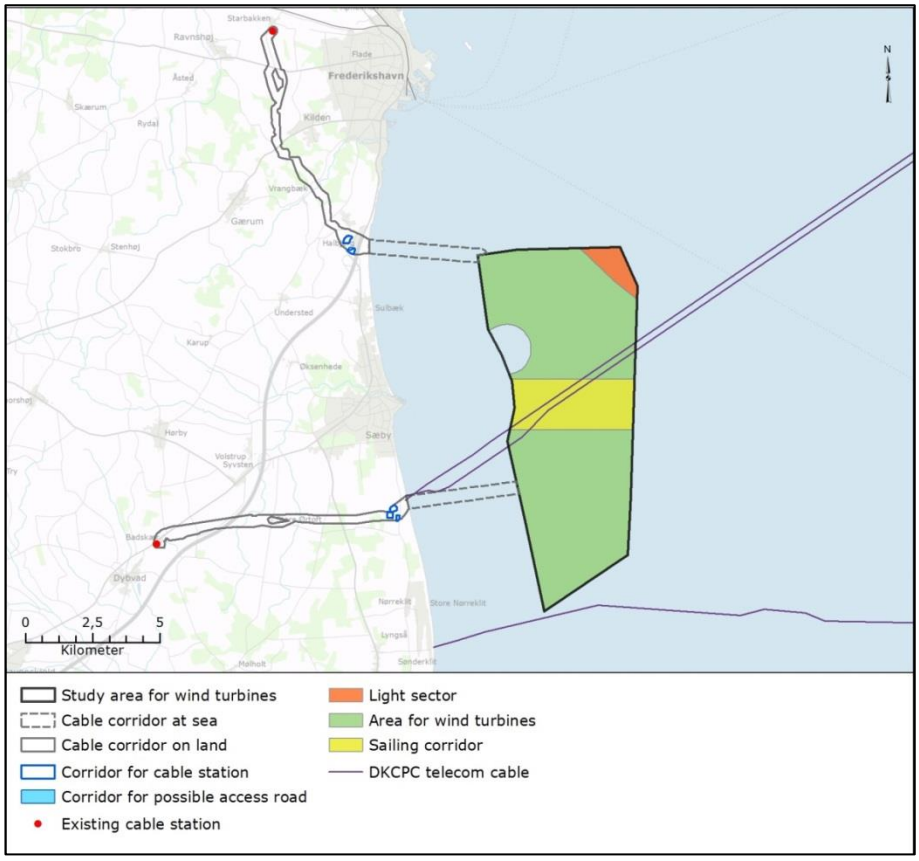


Figure 2-5 Area for installation of offshore turbines

3 Landscape and visual factors

The landscapes along the eastern coast of Vendsyssel are the result of the glacial formation processes of the last Ice Age and later land uplift and marine deposits. A characteristic of the landscape in Vendsyssel is that there are many places with marked transitions between the flat coastal plains and morainic hills further inland that form the boundaries of the coastal foreland.

With a view to assessing the visual impacts of the offshore wind farm, the description has been supplemented with visualisations of the offshore wind farm from points along the coast, in the hills further back and on Læsø, including in clear weather and in grey and misty weather and finally in nocturnal darkness.

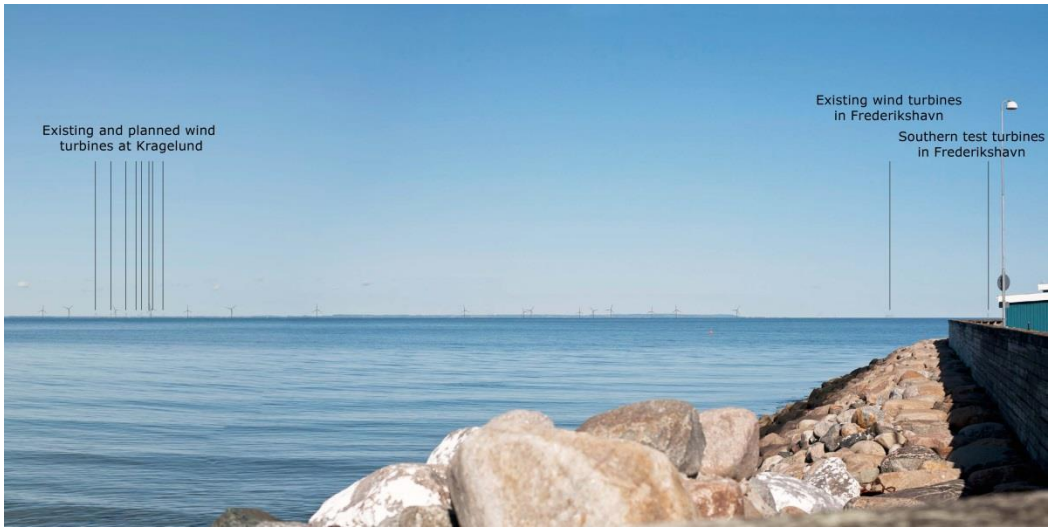
Visualisations were performed for a 200 MW offshore wind farm using 3 MW and 10 MW turbines, respectively, spaced out across the entire study area. In addition, visual examples have been prepared with turbines installed within selected sub-areas, as well as a few visualisations of 6 MW turbines.

Visualisation points were chosen on the basis of the landscape analysis and registrations in the area and show views from vulnerable places in the coastal landscape, places frequented by people and where people live and go for recreation in natural surroundings, on bathing beaches, in summer cottage areas and from viewpoints. In addition, visualisations were performed from different distances and directions, from high points along the coast or behind the coast and from low points on the coast. Visualisations were performed of clear weather, grey and misty weather and finally of nocturnal darkness.

Selected examples of visualisations can be found below. It should be emphasised that the pictures here have been reduced considerably relative to their original size (A3) and that this report is therefore for guidance only and cannot be taken to provide a true and fair view of visual impacts. Supplementary visualisations in larger formats can be found in a separate report on project landscapes and visualisations.

Detail of visualisation of 10 MW offshore turbines seen towards the south-east from the edge of the residential area Kilden, which is in a high location (the illustration in a larger format and supplementary visualisations can be found in the background report "Landskabsanalyse og visualiseringer")

In general, the turbines are highly visible from the coast, the coastal plains behind the coast and the morainic hills. The offshore wind farm will be visible in its entire horizontal extension from viewpoints well inland, and an impact on the grand scale of the area is unavoidable in several places. Further inland the intensity and the horizontal extension diminish, and the overall impact is reduced.



Detail of visualisation of 10 MW offshore turbines seen towards the west-north-west from Vesterø Havn on Læsø (the illustration in a larger format and supplementary visualisations can be found in the background report "Landskabsanalyse og visualiseringer")

There are generally many built-up areas along the coast facing the study area, in the form of towns as well as areas with summer cottages, and along most of the coast there are good bathing beaches and recreational areas, from which many people will notice the planned offshore turbines. This means that a significant number of locals and tourists will experience a visual impact.

Hence, the general assessment is that a nearshore wind farm at Sæby will have a significant visual effect in the near zone, i.e. the coastal areas closest to the wind farm. The turbines are highly visible from the coast, the coastal plains behind the coast and the morainic hills. Further to the north, at Ålbæk Bugt, and to the south, at Stensnæs and Aså, the overall visual impact from the coast will be small, and from the landscapes behind the coast it will be small to neutral.

Detail of visualisation of 10 MW offshore turbines seen towards the north-east from the coast at Sønderklitvej near the Sønderklit summer cottage area (top). Detail of visualisation from the Sønderklit summer cottage area of 6 MW set-up with 44 km² maximum permitted area (bottom). The illustrations in a larger format and supplementary visualisations can be found in the background report "Landskabsanalyse og visualiseringer".

It is assessed that it will be possible to reduce the visual impact by choosing a final layout in which the offshore turbines are placed closer to each other. This means that the offshore turbines will extend across a smaller part of the horizon compared with the visualised worst-case layout, in which they are spaced out across the entire study area.

Detail of visualisation of 10 MW offshore turbines seen towards the east from the coast at the newly developed residential area Standkanten in the northern part of Sæby (the illustration in a larger format and supplementary visualisations can be found in the background report "Landskabsanalyse og visualiseringer")

Lights

Visual safety markings (lights and colours) on the offshore turbines are necessary in relation to air traffic and ships. The lights are significant due to their intensity, colour and flashes.

At night, the offshore turbines will have an impact on their surroundings due to the requirement that strong red lights must be installed on the turbines. In the daytime, flashing white lights must also be mounted on 10 MW turbines located in corners and at line breaks.

From the coasts around the offshore wind farm, the lights will at any rate cut through the dark coastal space and give the nocturnal darkness are notable technical element. For people in the built-up areas at Sæby and Frederikshavn, the light from the port areas and other buildings will to a large extent "eclipse" the light from the offshore turbines. But for those standing on the coast in darkness, looking out to sea, the presence of the offshore turbines will have a moderate to significant impact on the nocturnal darkness. The further you move away from the offshore wind farm, the weaker the impact on the coastal darkness will be, and the overall impact is assessed to be small.

Since the strongest red light on the offshore turbines is equally intense for 10 and 3 MW, the 3 MW layout will be perceived more strongly as there will be far more offshore turbines that need to have markings and hence far more lights in the night. The 3 MW turbines will not be marked with lights in the middle of the tower, but this source of light is assessed to be insignificant compared with the light markings on the top section.

View from Sønderklit at night visualised with 10 MW offshore turbines (the illustration in a larger format and supplementary visualisations can be found in the background report "Landskabsanalyse og visualiseringer")

4 Flora and fauna

4.1 Natura 2000 areas

The project area has been investigated in relation to the "Natura 2000 areas". Natura 2000 areas constitute a network of natural habitats throughout the EU that contain nature that is particularly valuable seen in a European perspective. The Natura 2000 areas have been designated in order to protect the habitats and resting places of birds (bird protection zones) and in order to protect nature types and plant and animal species (habitat areas) that are endangered, vulnerable or rare in the EU.

There are several Natura 2000 areas near the study area for offshore wind turbines. They are shown in Figure 4-1. All Natura 2000 areas and their components (habitat areas, bird protection zones and Ramsar sites) are shown in Table 4-1.

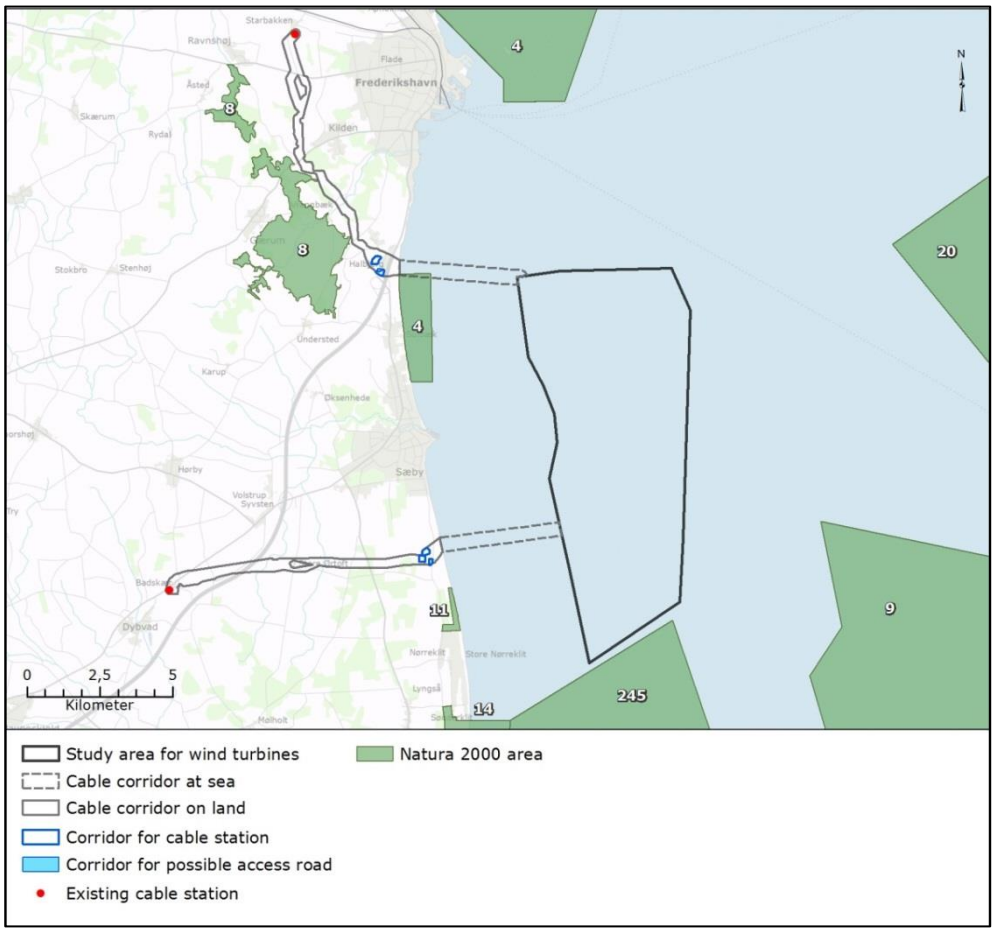


Figure 4-1 Natura 2000 areas near the project area for Sæby Offshore Wind Farm

Table 4-1 Offshore Natura 2000 areas in and around the study area.

Natura 2000 area		Habitat (H), Bird protection (F), Ramsar (R)	Distance to project area (km)
4	Hirsholmene, the sea west thereof and the mouth of El-	H4, F11, R8	overlap
9	Tidal meadows on Læsø and the sea south thereof	H9, F10, R10	5
14	Aalborg Bugt, northern part	H14, F2	3.5
20	The sea around Nordre Rønner	H176, F9, R9	7.3
245	Aalborg Bugt, eastern part	F112	0.2

It should be noted that the concept of significance applied in Natura 2000 legislation is not the same as that used in the other parts of this EIA report, which is based on the general methodology where "significant" designates the highest level of impact. Hence an impact may be significant in the sense that it triggers an actual Natural 2000 impact assessment without otherwise being assessed as a "significant negative impact" in the EIA report.

For this project, a Natura 2000 impact assessment has been prepared due to the potential effects on birds from the installation of the offshore wind farm. The actual Natura 2000 impact assessment has been based on the precautionary approach. This means that a project is permitted only if it can, from a scientific point of view, be ascertained without reasonable doubt that the project will not be detrimental to the Natura 2000 area.

In very rare and limited cases, it is possible to dispense with protection; if so, compensatory measures are required.

4.1.1 Marine Natura 2000 areas

This section contains Natura 2000 assessments relating to designated species and habitats in the surrounding marine Natura 2000 areas (e.g. grey seals, common seals and porpoises). Assessments have also been made according to the general methodology used in the EIA report in 4.3.4, and porpoises have been assessed as an Annex IV species in section 4.2.1.

As described above, there are several marine Natura 2000 areas surrounding the study area for offshore wind turbines, however there is no geographical overlap. There is limited overlap between the northern cable corridor and a Natura 2000 area (mouth of Ellinge Å) located approx. 1 km east of the study area for wind turbines.

Indirect impacts on designated species and habitats may occur as a result of dispersion of suspended sediment and sedimentation in the construction and operation phases. It is assessed that the dispersion of sediment into the Natura 2000 areas will result in only brief temporary increases in the concentrations of suspended matter, and that it will not be detrimental to the species, including birds and nature types, to be protected under the designation.

Impacts on the designated marine mammals in Natura 2000 areas (grey seals, common seals and porpoises) may occur as a result of sound impacts from the driving of monopiles if this is the foundation type chosen for the offshore turbines.

Sound propagation modelling performed for this EIA shows that seals and porpoises in the nearby Natura 2000 areas (e.g. N4, N9 and N20) will not be exposed to noise exceeding their permanent threshold shift (PTS). Hence there is no risk of a detrimental effect on marine mammals in the Natura 2000 areas.

Sæby Offshore Wind Farm will not have any impact on the condition of the habitats or the overall area of the habitats in the surrounding EC Special Protection Areas (SPAs) i.e. Læsø, sydlige del (F10/DK00FX345), Aalborg Bugt, østlige del (F112/DK00VA344) and Aalborg Bugt, nordlige del (F2/DK00FX002). However, the wind farm will cause increased density dependent mortality of Common Scoter, Velvet Scoter and Common Eider. Still current populations are expected to be able to compensate the loss.

The estimates of displacement related effects show that the planned Sæby Offshore Wind Farm in combination with existing offshore wind farms may cause a level of additive mortality of Common Eider which can be sustained by the current populations. With regards to Common Scoter, however, a relatively high proportion of the flyway population will suffer additive annual mortality in relation to Sæby Offshore Wind Farm in combination with existing offshore wind farms. Given the uncertainties regarding anthropogenic mortality factors, winter home range for the population and population size, which influence the PBR threshold (Potential Biological Removal is the additional annual mortality, which could be sustained by a population) for the Common Scoter, it is judged that the additive mortality in the SPAs as being at a level, which does not cause adverse effects on the integrity of the site in relation to Common Scoter. Overall, the integrity of the SPAs F2, F112 and F10 are not affected.

Cumulatively with Smålandsfarvandet Offshore Wind Farm, and even if a reduction in capacity and area of Smålandsfarvandet Offshore Wind Farm is an option, the additive mortality of Common Scoter will be at a level at which adverse effects on the integrity of the SPAs cannot be discounted in the light of the unaccounted other anthropogenic mortality factors. The size of the flyway population is uncertain, and may be larger than the currently estimated 550,000 individuals. The as-

sessment should therefore be regarded as precautionary. There will be no harm to Velvet Scoter and Common Eider as a result of cumulative effects.

Although the estimated cumulative displacement related mortality points at possible adverse cumulative effects of the wind farm development on the integrity of the SPAs, the uncertainties mentioned above warrant further considerations and simulations in order to quantify the exact range of outcomes in terms of additive mortality and long-term population development of the three species of seaducks in the SPAs and especially relevant for Common Scoter due to the uncertainties regarding the current size of the biogeographic population.

4.2 Annex IV species

As well as designating habitat areas, see section 4.1, the Danish Habitats Order includes a more general provision on protection of a number of species listed in Annex IV to the Habitats Directive (referred to as Annex IV species) which also applies beyond the boundaries of the Natura 2000 areas.

The marine Annex IV species naturally found in Denmark which may be seen around Sæby are:

- Whales, especially porpoises
- Migratory bats

Below, the potential impacts on relevant protected animal species as a result of Sæby Offshore Wind Farm are reviewed.

4.2.1 Marine Annex IV species

Porpoises. The presence of porpoises in the project area has been described on the basis of existing literature, published data and field surveys (visual observations in connection with aerial field surveys).

Sæby and the nearby areas of the sea are not characterised as core areas for porpoises. It is assumed that these areas are used by the animals to search for food, etc. to the same extent as the rest of the northern Kattegat. In the spring and summer, the area is characterised by high densities of porpoises, and the area is generally deemed to be of moderate interest. Porpoises have been in focus in relation to conservation for many years and are comprised by Annex IV of the Habitats Directive. Furthermore, porpoises are unconditionally preserved in Denmark.

In the construction phase, underwater noise from driving of monopiles may displace marine mammals from the area. It cannot be ruled out that the noise from pile driving may also result in either temporary loss of hearing or behavioural impacts for a number of individuals in the area, see also section 4.3.4. However, it is

assessed that these impacts will be fully reversible after completion of the pile driving.

As regards ecological functionality, the role of Sæby Offshore Wind Farm is not well known. But since porpoises use the area, it is assumed that they search for food there. Pile driving will expose the animals to sound levels that may induce temporary loss of hearing and behavioural changes.

Hence the risk of exposing porpoises to permanent loss of hearing must be reduced, e.g. by using appropriate mitigation measures, including bubble curtains (see section 9.1). The use of other foundation types, such as gravity-based foundations or bucket foundations, will not have any significant noise impact either.

Bats. The presence of migratory bats in the project area has been described on the basis of existing, but relatively limited literature for the Kattegat area, as well as field surveys using sound detectors placed at Sæby and Hirsholmene, via which data was collected in the period April-September.

An effect on bat populations caused by collisions may only be relevant in areas where the density of bats is high, e.g. in migration corridors or at preferred feeding grounds. The main species found are the common noctule, the soprano pipistrelle and the serotine bat. It should be noted that the Nathusius' pipistrelle was not observed. The project area for Sæby Offshore Wind Farm is not characterised as a migration route and hence it is expected that there will be relatively few bats during migration periods (spring and autumn).

Sæby Offshore Wind Farm will be located at least 4 km from the coast, and consequently it is deemed to be unlikely that local bats use the project area as a feeding ground.

Overall, it is assumed that the project area is not regarded as a migration corridor and that local bats do not use the area as a feeding ground on a regular basis. However, these assumptions are subject to uncertainty, and knowledge of the risk of collision is limited. Hence, it is assessed that the overall impact on bats is small to moderate. The deaths of a few migratory bats hit by turbine blades cannot be ruled out. But the project is not expected to have any impacts that are contrary to the protection of bats as an Annex IV species.

4.3 The marine environment

4.3.1 Hydrography and water quality

Hydrographic conditions (currents and waves, water exchange and layers) have been investigated by means of modelling. Modelling of the area has been performed with and without the impact from the offshore turbines.

Hydrographic conditions in the area are to a large extent determined by its location in the zone where the salty North Sea waters meet the less salty Baltic waters. Sea currents are driven mainly by winds and changes in atmospheric pressures, as well as differences in salt content. Tidal variations in internal Danish waters are small and therefore have only a small impact on currents in the project area. At the port of Sæby, the difference between mean high water and mean low water is approx. 0.4 m.

The impact on hydrographic conditions will be a result of the presence of foundations and offshore turbines that lead to changes in current flows and mixing ratio, wave climate and water exchange. However, the impact is assessed to be neutral to small.

Water chemistry has been described and assessed on the basis of monitoring data from Sæby collected by the former County of North Jutland. In addition, spreading of sediment and sedimentation has been modelled.

The impact on the water quality is a result of digging for laying the foundations, jetting of cables into the seabed and removal of installations during the construction and decommissioning phases, with resultant spreading of sediment in the water column. The impact is assessed to be neutral to small.

4.3.2 Benthic flora and fauna

Marine flora and fauna have been mapped on the basis of existing knowledge (e.g. data from the Danish Nature Agency's environmental portal and MADS, as well as basic analyses for Natura 2000, etc.) and field surveys in the project area, including spot investigations with a ROV (remotely operated underwater video camera) in March 2014 and sampling with a Van Veen grab in December 2013.

The study area is characterised by a sandy seabed. The presence of flora was very limited. Very few micro algae were observed due to lack of substrate for adhesion. Epifauna was also scarce and characterised by species such as serpent stars, common starfish, hermit crabs, crabs and clams, see Figure 4-.

Potential impacts on the seabed and its flora and fauna may occur as a result of the installation and presence of the offshore turbines. In the construction phase, there will be physical disturbances to the seabed, including suspension and spreading of sediment, etc. In the operation phase, the primary impact is expected to be linked to the presence of foundations and erosion protection (introduction of new substrate) and the cables (electromagnetic fields and changes in temperature).

The impact on flora and fauna as a result of the physical disturbance in the construction phase is assessed to be small. The introduction of hard substrate is expected to be a nuisance to the soft-bottom species originally found in the area, but it is an advantage for e.g. epifauna and epiflora, which may grow on the new

structures and form artificial reefs. Overall, the impact is assessed to be small. Electromagnetic fields around cables are, overall, assessed to be insignificant in relation to flora and fauna.

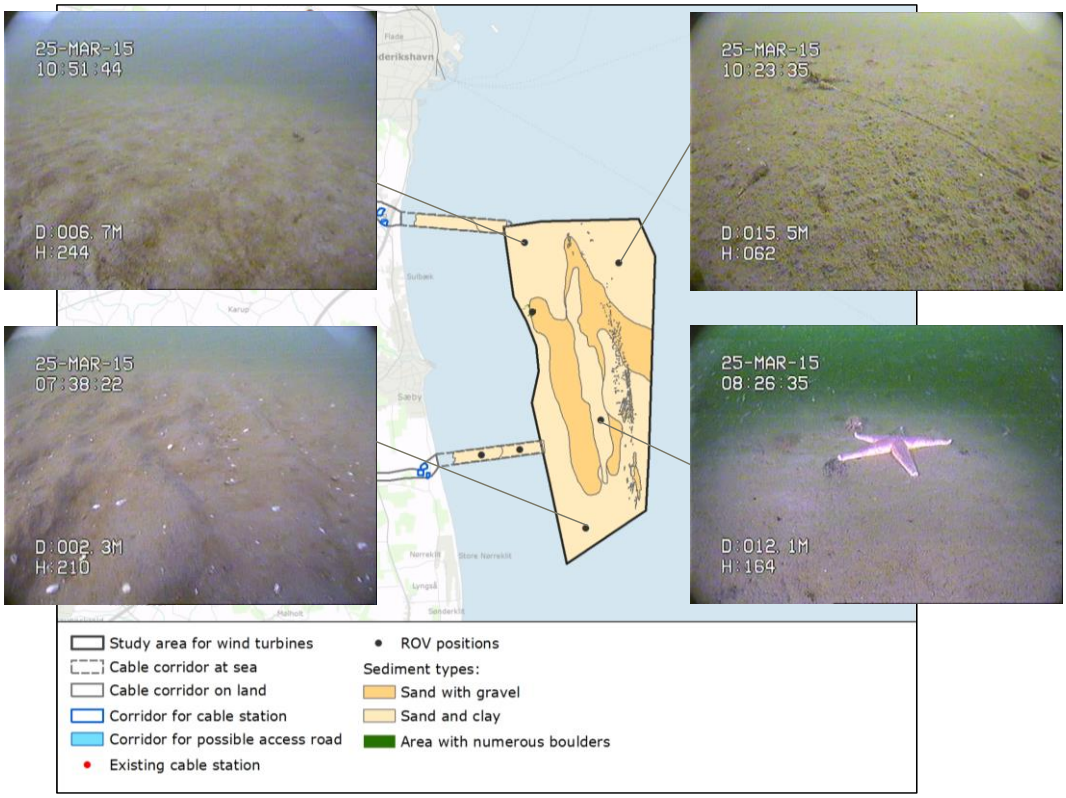


Figure 4-2 Areas of sandy seabed with examples of limited flora and fauna.

4.3.3 Fish

The description of fish is based first and foremost on official fisheries data and interviews with local fishermen. In addition, the mapping of seabed types and flora and fauna has been included in the description.

In the construction phase, the primary impacts on fish are linked to spreading of sediment and noise (mainly from pile driving) in connection with the construction work. Fish eggs and larvae are generally more sensitive to suspended sediment than juvenile and adult fish, and pelagic species are more sensitive to suspended sediment than demersal species. The overall impact on fish as a result of spreading of sediment is assessed to be insignificant. The primary effect of noise and physical disturbance is assessed to be that the fish leave the near zone in periods when construction activities and noise peak. It is expected that the fish will soon return once the construction work has been completed. In connection with the establishment of pile foundations, the impact from noise is assessed to be moderate due to the distinct character of the pile driving noise. It cannot be ruled out that fish found in the immediate surroundings (around 200 meters) of the

pile driving location may suffer physical tissue damage and possibly die. With the right mitigation measures (e.g. a soft start to pile driving), it will be possible to reduce the impact considerably.

In the operation phase, the potential impacts on fish fauna are assessed to be linked to the presence of the offshore turbines in the form of loss of area and introduction of new substrate (artificial reef), noise from the turbines, impacts on food sources and electromagnetic fields around the cables.

The total area of the substrate introduced and the associated fauna and flora (algae and invertebrates – typically barnacles – and blue mussels) will be very modest, and it is assessed that an impact on the density and composition of the fish fauna can be expected only in the immediate vicinity of the turbine foundations. The overall consequences for fish and fish populations in the area as a result of the presence of foundations and erosion protection are expected to be positive – for rock reef species at any rate.

The spreading of sound from offshore wind turbines is of a character and strength which makes is probable that fish which are sensitive to sound, such as herring and cod, will be able to register the turbine noise from a distance of up to several hundred metres. On the other hand, turbine noise will be registered only within short distances by flatfishes and other demersal species without swim bladders or with small swim bladders. However, it is assessed that sound waves from offshore turbines are so constant and diffuse that fish are able to get used to them so that the impact is insignificant.

The transmission of power via cables will create both magnetic and electrical fields which may have an impact on fish, especially migratory species. On the basis of experience from equivalent offshore wind projects, it has been assessed that the effect of both the inter-array cables and the export cables will be insignificant and that there will not be any impact on the overall populations of the individual fish species in the area.

4.3.4 Marine mammals

The presence of marine mammals in the project area has been described on the basis of existing literature, published data and field surveys (visual observations in connection with aerial studies).

Besides porpoises, see section 4.2.1 for a general description, seals are also found in the area. Seals breed on isolated islets, reefs, rocks, etc., but also use the Kattegat in connection with migration and food searches. The porpoise, the common seal and the grey seal are all comprised by Annex II of the Habitats Directive and are therefore protected in the habitat areas where they are listed on the designation basis, including the habitat areas near the study area for offshore turbines.

Furthermore, porpoises, common seals and grey seals are unconditionally preserved in Denmark.

Modelling and calculations of noise propagation during pile driving and the resulting impacts on marine mammals have been performed, based on recommendations from a working group on marine mammals and underwater noise set up by Energinet.dk. Based on these calculations and the animals' tolerance thresholds, it has been assessed that animals in the vicinity of the pile driving site can be exposed to sound levels that may lead to permanent loss of hearing. Injury on marine mammals (e.g. permanent loss of hearing) is not acceptable. It is calculated based on the present assumptions for modelling that the source noise level should be reduced with approximately 10 dB to avoid injury on marine mammals. It will however be up to the future concession holder to demonstrate that potential pile driving can be performed without injuring marine mammals. On this basis it is assessed that no animals will be exposed to sound levels leading to permanent loss of hearing.

Hence, it is assessed that pile driving noise leading to permanent loss of hearing will have an insignificant overall impact on marine mammals. It is also assessed that pile driving noise leading to temporary loss of hearing will have a moderate overall impact on porpoises and a small impact on seals. Finally, it is assessed that behavioural changes will be of short duration, and that the overall impact on porpoises will be small.

It is assessed that the impact can be reduced by means of mitigation measures, see section 9.1.

Finally, it should be mentioned that the foundations of the offshore turbines can create an artificial reef, which will become overgrown with algae and filtering species. Among other things, this will attract fish, thereby increasing the feeding opportunities for marine mammals. Hence, the reef effect will have a positive impact on marine mammals.

4.3.5 Birds

The study area at Sæby Offshore Wind Farm mainly has water depths of less than 20 metres and houses populations of non-migratory Common Scoter, Common Eider, and Red-throated/Black-throated Diver of international significance.

The primary impacts on birds will be seen in the operation phase and are linked to displacement from the area, deterioration/destruction of habitats, reef effects, risk of collision and barrier effects.

Sæby Offshore Wind Farm will lead to displacement of the Common Scoter from the turbine area, especially in the winter period, when the population peaks. However, this displacement is well below the PBR threshold value (Potential Biological Removal is the additional annual mortality, which could be sustained by a

population). Given the long impact time (at least the life of the turbines), it is expected that the birds will move to other nearby locations. It is uncertain whether there will be a risk that density-related effects, including scarcity of food and mortality, at these locations will reach a level where there will be an impact on the overall biogeographical population of common scoters. Due to the duration of the operation phase and uncertainty about the impact at population level, including the number-related mortality of common scoters, the displacement effect in the operation phase is therefore assessed to be moderate.

Displacement of Common Eiders will be most pronounced in the early winter, i.e. around November, when the population in the area has been calculated to peak. However, displacement is well below the PBR threshold value and hence the impact is assessed to be small.

For Divers, the displacement effect is also below the PBR threshold value, but the impact on the birds is assessed to be moderate since the Red-throated Diver is comprised by international conservation provisions.

For other waterbirds, such as Grebes, other diving seabirds and Auk species, displacement is expected to be low and below the PBR threshold value. Hence, the overall displacement effect for these species is assessed to be small. For seagulls, terns and cormorants, the impact is assessed to be insignificant.

An expansion of the offshore wind farm affecting the southern part of the area only has been assessed. As expected, this would lead to displacement of fewer birds, but it has not been assessed to have any decisive influence on the impacts on eiders and divers, which remain small and moderate, respectively. For the common scoter, however, the impact will change from moderate to small.

5 Other environmental factors

5.1 Air and climate

Denmark's long-term strategy for reducing greenhouse emissions is to ensure that by the end of 2050 Denmark's energy supply will be independent of fossil fuels. To achieve this target, it is necessary to further expand offshore wind power supplies, including by possibly establishing an offshore wind farm at Sæby.

Emissions of greenhouse gasses in connection with the construction, operation and decommissioning of the offshore wind farm will be insignificant. In the operation phase, electricity production from the offshore wind farm will, however, replace corresponding production based on fossil fuels. This will lead to an aggregate reduction of CO_2 emissions of approx. 3.84 million metric tons during the life of the wind farm, and similar reductions in emissions of sulphur dioxide and nitrogen oxides will be seen. In the long term, this reduction (positive impact) will prevent a worsening of the climate.

The share of greenhouse gasses released by the vessels servicing the offshore wind farm will be insignificant, accounting for less than 0.01% of Denmark's aggregate annual emissions.

5.2 Radars and radio links

Impacts on radars or radio link paths are seen in cases where radar signals or radio link paths are blocked or reflected.

Data has been sourced from the Danish Business Authority, the Frequency Register, Retsinfo, the Danish Armed Forces, the Danish Meteorological Institute (DMI) and relevant airports. A meeting has also been held with the Naval Staff (formerly the Danish Navy Operative Command) to discuss potential impacts on the Naval Staff's radar systems.

The impact on meteorological radars and civil air traffic monitoring (airport radars) is assessed to be insignificant. Potential impacts on defence radars used for maritime surveillance and flight registration in Danish territory include creation of radar shadows behind the offshore turbines and reflections resulting in false echoes. The nearest radars are at Frederikshavn, on Læsø and at Skagen, all of which could potentially be affected by an offshore wind farm at Sæby. Overall, the impact on the radars of the Danish Armed Forces during the offshore wind farm's operation phase is assessed to be moderate. This assessment should however be

verified, including an assessment of potential mitigation measures, when the design of the wind farm has been finalised.

Three radio links have been identified which pass through the study area for Sæby Offshore Wind Farm. For a radio link path to function optimally, there must be a direct line of sight between the two antennae. Hence, the radio links in question will be affected if wind turbines are installed within 200 m of the line of sight.

5.3 Air traffic

The nearest airfields relative to the project area for Sæby Offshore Wind Farm are Sæby, Læsø, Sindal and Stagsted Flyveplads. The nearest international airport is Aalborg Airport, which is located approx. 50 km south-west of the project area. The nearest military airport is Aalborg Air Base, which shares the runways of Aalborg Airport.

The project area for Sæby Offshore Wind Farm is outside the approach corridors of all airports and airfields and is therefore not subject to any restrictions in this connection.

The offshore wind farm is designed to have a life of approx. 30 years. The offshore turbines are expected to have a maximum total height of up to 220 m (10 MW turbines) from the surface of the sea to the tip of the top blade. Hence it will be necessary to put markings on the turbines so that they are visible to aircraft, etc. This will be done in accordance with applicable rules.

On the basis of information sourced from airfields, airports and air bases, as well as a review of applicable rules for air traffic and aviation markings, the overall assessment is that the impact on air traffic from Sæby Offshore Wind Farm will be insignificant.

It should be noted that the final assessment of whether the project is expected to endanger air security will be made by the Danish Transport Authority in connection with the registration of the project.

5.4 Marine archaeological interests

Since the last Ice Age, the sea around Denmark has gone through a number of changes in terms of relative surface level, which means that some areas of Stone Age land have now been flooded and possibly covered by sediment. The flooded remains of Stone Age settlements are often important archaeological sites in that tools and organic material may be very well-preserved relative to finds from similar sites on shore. The geophysical and geotechnical investigations performed do not give reason to designate areas with an increased potential for finding former Stone Age settlements.

In connection with geophysical surveys of the project area, a number of presumed man-made (anthropogenic) artefacts of marine archaeological interest were identified.

When the final locations of offshore turbines, cables, etc. are known, it must be decided whether there is a need for supplementary investigations in the form of geophysical investigations with subsequent marine archaeological examination of data and marine archaeological surveys (ROV and divers).

6 Population

Any new offshore wind farm at Sæby will have an impact on the people living in its vicinity, using the area or passing the facility in connection with outdoor activities. In addition, the facility will have an impact on businesses on the site, which may find that restrictions are imposed on their use of the area.

The main impacts in relation to the marine part of the project are related to fisheries and outdoor marine activities.

6.1 Fisheries

In a worst-case scenario, fishing could be banned completely within the area of the offshore turbines. However, typically only fishing with trawls and other dragged gear is prohibited around offshore turbines and submarine cables, while fishing with passive gear such as nets and pots is still permitted.

Fisheries in the area have been mapped on the basis of the last 10 years' fisheries and interviews with local fishermen. This mapping shows that in the period 2004-2013 catches landed decreased for most species. This applies to e.g. sole, cod, flounder and plaice. Catches of species such as sprat, sand eel and herring vary considerably from year to year.

In the assessment of local fishermen, the project area is used by around 15-20 commercial fishing vessels from all over Denmark in good years. Analyses of vessel data show that in the period 2004-2013, a total of 31 different vessels operated in the project area. Most of the catches within the project area can be ascribed to 4-6 trawlers from Standby catching sprat. According to the local coastal fishing association, Nordjyllands Kystfiskerforening, the project area is not regarded as being important to part-time commercial fishermen (using nets). A ban on fishing within the area of the turbines is assessed to have an impact on fisheries in the area, mainly for the 4-6 trawlers from Strandby and to a lesser extent for other fishermen.

Protection zones around export cables will be a nuisance for fishermen using bottom trawling. This will partly be because they will not have access to the up to 650 metre wide non-fishing zone, and partly because there will be a negative effect on fishing efficiency when tools must be "lifted" every time the cables are passed. However, mapping of fisheries shows that trawling in the areas around the export cables is very limited.

With a fishing ban and protection zones, the impact on fisheries is therefore assessed to be moderate.

6.2 Outdoor activities

Locally based leisure activities such as pleasure boating, rowing, windsurfing, diving, swimming, etc. may be briefly affected during the construction phase. In the operation phase recreational interests in the areas around Sæby are not assessed to be affected by the existence of the offshore wind farm, expect for the changed visual perception of the landscape (see above). The area where the actual offshore wind farm is established will be open for recreational coastal activities and will hence not cause any barrier effects or area restrictions that will limit outdoor activities. Overall, the impact on marine recreational interests is assessed to be insignificant.

7 Navigational conditions

Navigational conditions in the area have been described primarily on the basis of an analysis of AIS data for the period from December 2012 to November 2013. AIS data (Automatic Identification System) is collected from vessels equipped with AIS transponders for automatic identification and registration of ships. Furthermore, information from the Danish Maritime Authority and guidelines from the IMO (International Maritime Organization) have been used for calculations and assessments.

The following 7 ship routes exist in the investigation area:

- Route 1: Main route B
- Route 2: Traffic sailing east/west to/from Frederikshavn. Primarily the ferry to Gothenburg
- Route 3: Traffic sailing east/west to/from Frederikshavn
- Route 4: Traffic between Frederikshavn and Læsø. Dominated by the Læsø ferry
- Route 5: Traffic to/from Frederikshavn sailing through the study area
- Route 6: Traffic to/from Frederikshavn, north of Frederikshavn. Includes the ferry to Oslo
- Route 7: Traffic to/from Sæby

Figure 7-1 shows the seven routes, indicated in blue, and the sailing intensity, black indicating the highest intensity.

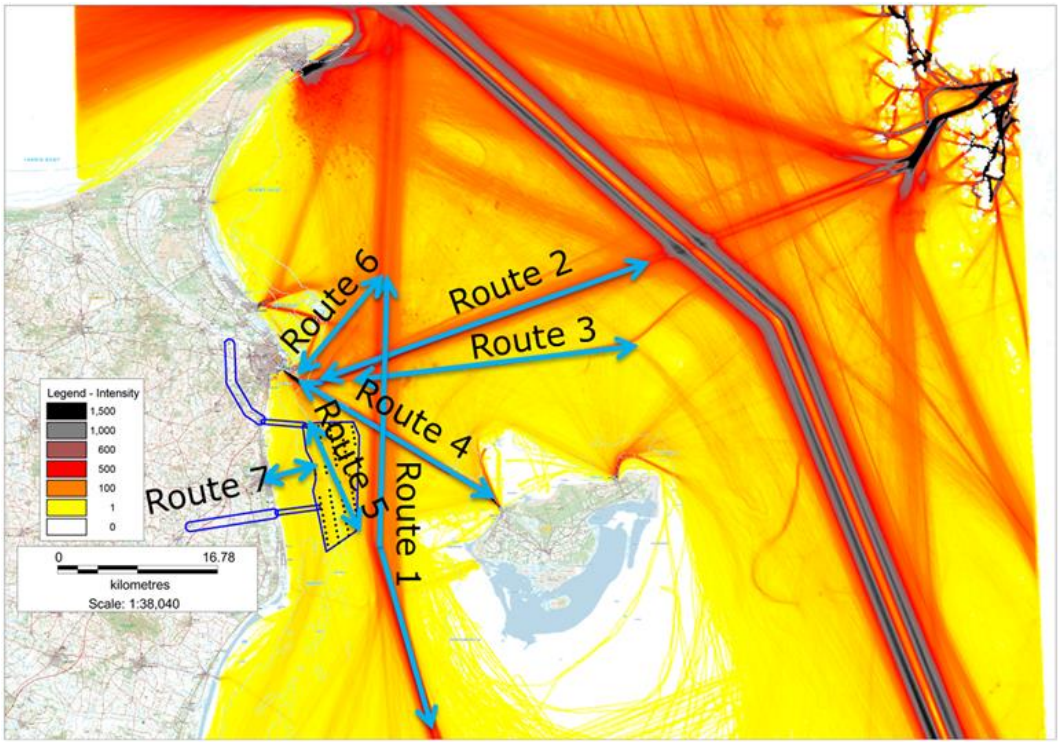


Figure 7-1 Sailing routes at Sæby Offshore Wind Farm

Route 1, which is located in a north-south direction east of the study area, is dominated by freight ships and tankers. Routes 2, 3 and 4, which are located north of the study area, are dominated by passenger ships (ferries). Routes 5, 6 and 7, which are located in, west of and north of the study area, are used by various vessel types, including fishing vessels, passenger ships and pleasure boats. Depending on the final layout of the offshore wind farm, some of the routes will be affected and will have to be changed.

Conditions for pleasure boats, local fishing vessels and commercial traffic may be affected by the offshore wind farm. The offshore wind farm will be provided with markings in accordance with applicable rules. Hence, it is assessed that the impact will generally be insignificant.

8 Cumulative effects

Cumulative effects comprise impacts from the Sæby Offshore Wind Farm project in interaction with impacts from other projects.

Potential cumulative effects have been found in relation to the following:

- Enlargement of the Port of Frederikshavn, including new breakwaters, basins, quays and a deeper fairway. The status of this project is that the EIA process has been initiated.
- Frederikshavn test turbines, establishment of 6 test turbines. This project has been approved by the Danish Energy Agency.

If construction activities relating to Sæby Offshore Wind Farm and the Port of Frederikshavn take place at the same time, and the projects use the same port of loading, there could be cumulative impacts on other commercial and non-commercial shipping activities in that port.

There could be cumulative impacts on the radar systems of the Danish Armed Forces. In areas with offshore wind farms, increased signal processing is required in radars, which may affect the capacity of the individual radar to search its entire range. Likewise, overall radar surveillance of both Danish territorial waters and air space could potentially be negatively affected as more wind turbines are installed, and at some point it may reach a level that is critical for the Danish Armed Forces. If it is decided to establish an offshore wind farm at Sæby, specific assessments will be made of the effect on the Danish Armed Forces' radar surveillance, and existing radar systems will be updated and supplemented as required.

The cumulative displacement of birds caused by Sæby Offshore Windfarm in combination with other large wind farms in Danish Waters and Smålandsfarvandet Wind Farm is assessed in section 4.1.1.

Other cumulative effects (e.g. marine mammals, visual conditions, currents and waves, etc.) are assessed to be limited and unproblematic.

9 Mitigation measures

Mitigation measures are steps and activities aimed at preventing or reducing environmental impacts otherwise resulting from the construction, operation and decommissioning of Sæby Offshore Wind Farm.

Environmental impacts can be mitigated in several ways depending on their significance to different receptors. This means that it is possible to take the most critical impacts into account when designing the offshore wind farm or choosing construction methods.

In connection with the approval of the installation (issued by the Danish Energy Agency), framework terms and conditions will be laid down, specifying any steps to be taken to reduce or mitigate potential environmental effects.

Measures to mitigate significant impacts on the marine environment relate to marine mammals, birds and radar surveillance.

9.1 Marine mammals

The primary potential impact on marine mammals in the construction phase relates to noise from pile driving activities if monopiles are chosen for the wind turbine foundations. Potential mitigation measures include:

- Choosing a foundation that does not involve noise from pile driving, e.g. a gravity-based foundation.
- Air bubble curtains that can reduce the noise impact in connection with pile driving.
- Planning the construction work so that pile driving takes place in the winter months, when the number of marine mammals is expected to be at its lowest.

9.2 Birds

The primary potential impact on birds in connection with Sæby Offshore Wind Farm relates to non-breeding waterbirds, especially common scoters, eiders and divers, that use the areas for food searches. Disturbance to these species is of long duration and potential mitigation measures would require adjustments in terms of both the location and design of the wind farm. The planned offshore wind farm is located in an area where the common scoter and other species are assessed potentially to be exposed to moderate impacts in the operation phase. It is assessed that this will also be the case if the offshore turbines are placed in the southern part of the area.

Since the impact on the common scoter and other birds is highly seasonal, it is possible to implement mitigation measures in the construction and decommissioning phases by taking into account the periods when the birds are mainly found in this area.

9.3 Radar surveillance

The extent of impacts and the need for and types of mitigation measures in relation to the Danish Armed Forces' radar surveillance cannot be described at present as the layout of the offshore wind farm is not known.

Mitigation measures in relation to the radars at Frederikshavn, Læsø and Skagen, respectively, are to be defined when the final project is known, i.e. during the project design of the offshore wind farm itself. It is necessary to determine the locations and heights of the turbines, their number and distances between them before a specific assessment can be made of their potential impact and the mitigation measures to be taken. It will be necessary to involve the Naval Staff in the consideration of mitigation measures. The Danish Armed Forces have stated that there are no plans to update/replace the existing radar systems.

In addition, it may be necessary to implement mitigation measures in relation to ship radars that could also be affected by the offshore wind farm.

9.4 Navigational conditions

In relation to navigational conditions, it is recommended that the following mitigation measures be implemented:

- It must be possible for sailing ships to navigate through the study area. It is recommended that an east/west corridor of 1 nautical mile be established to ensure that ships can pass through the study area. It is not sufficient to use the corridor around existing cables, as this corridor runs south-west/north-east through the area.
- The layout should be designed in such a way that the eastern row of offshore turbines is placed parallel with sailing routes (route 1).
- Coordination of facility-related maritime traffic should be established.
- A separate corridor should be established for project-related maritime traffic in the construction and decommissioning phases.
- The construction work should be planned so as to ensure that cables are installed during a period with a minimum of pleasure boats in the area.
- Further markings should be established on the boundaries of the construction area and at "Dvalen" in order to facilitate navigation for pleasure boats.

Procedures for risk scenarios, e.g. closure of offshore turbines in the event of drifting ships, will be described in the contingency plans for the offshore wind farm.

9.5 Marine archaeology

The need for any mitigation measures in relation to marine archaeological finds cannot be determined until the actual locations (turbine positions and cable lines) have been determined and a decision has been made concerning the need for any supplementary geophysical investigations with subsequent marine archaeological studies of data, and the possible need for surveys (ROV and divers).

9.6 Visual factors

Landscapes in the near, medium and distant zones around the offshore wind farm will be affected to varying degrees, ranging from small to significant. Hence, the following mitigation measures must be implemented:

- The offshore turbines must be installed in an easily perceivable geometric pattern and appear as a well-defined group in the landscape.
- Turbines of only one height, appearance and type may be erected within the area.

In addition, Part 3 of this EIA report describes a number of potential mitigation measures for both the offshore wind farm and the onshore facilities.

10 Conclusion

Construction, operation and decommissioning of Sæby Offshore Wind Farm and the related export cables and onshore facilities will affect the environment.

During the preparation of this EIA report, no defined project has existed, as an offshore wind farm at Sæby will be designed by a future concession holder after the establishment permit has been granted. Therefore the report has been based on a worst-case scenario, i.e. on assessment of the worst impact imaginable within a technical framework with various potential solutions for the project.

Selected impacts are outlined below. For in-depth descriptions, see Part 2 (the marine environment) and Part 3 (environmental conditions on shore) of this EIA report.

10.1 Construction phase

Impacts during the construction phase relate primarily to noise stemming from driving of monopiles if this is the foundation type chosen for the offshore turbines. This noise will affect any fish and marine mammals found in the area around the pile driving activities. It is assessed that the impacts can be reduced by using mitigation measures. The use of other foundation types, such as gravity-based foundations or bucket foundations, will not have any significant noise impact either.

10.2 Operation phase

Impacts during the operation phase relate primarily to the presence of the offshore turbines. These impacts will occur throughout the life of the offshore wind farm (estimated at approx. 30 years).

In terms of population, these impacts relate mainly to a changed visual perception of the landscapes around Sæby. Hence, the offshore wind farm is assessed to have a significant visual effect in the coastal areas around the study area for offshore turbines. There are generally many built-up areas along the coast facing the study area, in the form of towns as well as areas with summer cottages, and along most of the coast there are good bathing beaches and recreational areas, from which many people will notice the planned offshore turbines.

As regards commercial activities, it is assessed that fisheries in the area may be affected to a moderate extent due to a potential fishing ban and designation of protection zones around offshore turbines and cables.

Potential impacts may also be seen on the Danish Armed Forces' radar systems used for surveillance of Danish waters and registration of aircraft in Danish territory. The nearest radars are at Frederikshavn, on Læsø and at Skagen, all of which could potentially be affected by an offshore wind farm at Sæby. However, this must be investigated further when the layout of the offshore wind farm is known.

In terms of fauna, the impacts relate primarily to displacement of birds, in the case of Sæby Offshore Wind Farm mainly Common Scoters. Since the displacement is assessed to be somewhat below the PBR threshold value, the impact is assessed to be moderate despite its long duration. For divers, the displacement effect is also below the PBR threshold value, but the impact on the birds is assessed to be moderate since the Red-throated Diver is comprised by international conservation provisions. It is also assessed that the impact will be moderate in connection with e.g. a more southerly location of the turbines.

Sæby Offshore Wind Farm in combination with existing wind farms may cause wind farm related impacts being displacement related mortality in the nearby SPAs (F112, F10 and F2) and causing additive mortality of Common Scoter, Common Eider and Velvet Scoter, which however can be sustained by the current populations. If Smålandsfarvandet Offshore Wind Farm, the cumulative impact will be amplified for Common Scoter i.e. in case of a declining population at a level which is unsustainable, and for a stable population is close to the critical level. For Velvet Scoter and Common Eider the increased cumulative mortality is expected to be compensated by current flyway-populations.

The advantage of implementing the project is that in the long term CO_2 emissions will be reduced, so that the project will contribute to meeting energy policy targets and thereby to combatting global climate change.

10.3 Decommissioning phase

If foundations or other structures are left permanently on the seabed, they may be a nuisance to bottom trawlers. Whether this will be the case will depend entirely on the design of such structures. On the other hand, if it is possible to trawl across/between the structures, this may be to the benefit of fisheries – as is typically the case for fisheries around wrecks and other offshore structures.

Other impacts during the decommissioning phase are generally assessed to correspond to the impacts during the construction phase, except that there will not be any pile driving activity.

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