IJmuiden Ver Alpha

Offshore Wind Farm

SUMMARY OF MEASURES TO MITIGATE ECOLOGICAL EFFECTS AND ENHANCE NATURAL HABITATS OF THE ECOSYSTEM

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sse apg

Introduction

Building a nature-inclusive offshore wind farm in the Netherlands

Dutch pension fund ABP, through its pension investor APG, and SSE plc through its subsidiary renewables business, SSE Renewables, have joined forces in a 50:50 consortium to generate large-scale wind energy in the North Sea, with a minimal ecological footprint and a positive impact on biodiversity.

This is SSE's first award in the established Dutch offshore wind market. SSE sees significant and sustainable growth potential in the Netherlands which is a complementary and adjacent market to SSE's existing North Sea offshore projects.

For ABP/APG, is a first-time participation in an offshore wind project. ABP aims to invest in projects that yield an attractive long-term return for its beneficiaries, and next to that contribute to society (as by helping to ensure a stable energy supply).

Clean energy from and for the Netherlands

In 2024, the consortium secured the rights to develop the 2 GW IJmuiden Ver Alpha offshore wind site in the IJmuiden Ver wind farm zone. In the bid process, the Dutch government had asked bidders to propose measures to enhance the biodiversity of the surrounding ecosystem. In line with this. the Alpha offshore wind farm will help ensure offshore wind is developed in harmony with the surrounding ecosystem, while positively contributing to the Netherlands' decarbonisation and security of electricity supply.

The wind farm will be located in the North Sea, 62 km off the Dutch coast. With an installed capacity of approximately 2 GW, it will be capable of generating enough offshore wind energy each year to meet around 7% of current Dutch electricity demand. Subject to reaching a Final Investment Decision (FID), the wind farm would be expected to be commissioned by the end of the decade.

A site of ecological importance

The site and the surrounding area is home to a rich array of marine life. The benthic communities contain a range of keystone species such as the reef forming Ross Worm (Sabellaria spinulosa) and the predatory Atlantic cod (Gadus morhua). Further up the food chain, large numbers of marine mammals and seabirds use the area as a key foraging ground. The southern part of the wind farm site borders the Natura 2000 site 'Bruine Bank'.

Our protective measures

The project is committed to building a wind farm that, in addition to producing green electricity, reduces and mitigates ecological impact, while strengthening the North Sea's biodiversity. A suite of measures is planned to protect birds, marine mammals and benthic and fish species during and after construction. These measures include live biodiversity monitoring by Naturalis Biodiversity Centre, installation of artificial reef structures, and a carefully planned layout that avoids placing turbines in the corner bordering the Bruine Bank protected area. By building a living lab together with Naturalis Biodiversity Center, data and insights will be gathered into the effect of the measures and of the full picture of the ecosystem in and around the wind farm. This data will provide a great opportunity to support further development of offshore wind projects in the Netherlands. The ecological measures and monitoring plans are currently being refined to ensure they are ready for implementation once the wind farm becomes operational (while some of them will be implemented before start of operations) Some monitoring technologies will be deployed pre-construction to collect baseline data on the local ecosystem. This work involves collaboration with the supply chain and continual refinement and update of the plans as new technologies become available.

1.0 Birds

To minimise the impact of the wind farm on seabirds, 6 mitigative measures are planned.

Increased tip clearance

To protect seabirds in their flights as much as possible, turbines will be designed with increased distance between the lowest point of the blade tip and the sea level. Since seabirds tend to fly close to the water's surface, this space helps to keep their flight paths clear of rotating blades. .

Coloured blades for improved visibility

A pilot programme will be set up to explore if painting the rotor blades will make them more visible to birds, thus reducing collisions. The goal is to test different blade designs on at least 10% of the turbines, subject to approval from the authorities. Results will be shared with the sector, the government and other interested parties.

Increased turbine spacing

The objective of the project is for birds to continue using the area as much as possible. That's why the wind turbines are planned to be as far apart as possible. This is expected to help seabirds continue to use the site with minimal disruption and improve accessibility to important areas such as the Bruine Bank Natura 2000 site.

No turbines in the south west corner

In the south west corner of the site, no structures will be installed and vessel traffic to and from the wind farm will be kept to a minimum. This part of the site has been selected because it lies close to the Bruine Bank Natura 2000 site: an important location for seabird foraging activity.

Restriction of light at night

An Aircraft Detection and Lighting System (ADLS) capability is planned to be installed on all wind turbines. This smart system turns aviation warning lights on only when it detects aircraft are present; for the remaining hours of darkness the lights will be off. This measure will help to reduce additional risks for birds in flight and also to cut down light pollution.

Monitoring plan

To monitor the effect of these measures on birds, digital aerial surveys combined with bird observation technologies mounted to structures will be used. This two-pronged approach will enable us to make ornithological observations from the air and at sea. Data at multiple scales will be generated, ranging from micro-flight responses around individual turbines to bird distributional patterns spanning areas of sea far greater than Site Alpha itself.

The aerial survey area includes Site Alpha and extends into Site Beta and the Bruine Bank Natura 2000 site. These surveys will take place at regular intervals for eight years to capture any changes to distribution and abundance of birds between the pre-construction, construction and operational phases of the wind farm.

The bird observation devices will be deployed on the turbines at Site Alpha for the first five years of operation. A combination of radar, camera and acoustic technologies will provide imagery and audio recordings of bird / turbine interactions within the array and surrounding areas, day and night.

2.0 Marine mammals

The following measures are planned to reduce disturbance of marine mammals and specifically harbour porpoise: The use of combined mitigation approaches to reduce piling noise propagation during wind farm construction, and the use of vessels designed to minimise noise generation and operating at reduced speeds to reduce disturbance during wind farm operations

Harbour porpoise are a small and shy marine mammal species distributed widely throughout the North-East Atlantic. The southern North Sea in particular represents a key area for this population. Harbour porpoise are very sensitive to disturbance impacts such as underwater noise from construction activities and from vessel movements.

Hydraulic hammers used during percussive piling operations to install wind turbine monopile foundations produce impulsive sounds that can travel large distances in the water column. This has the potential to cause impacts to noise sensitive marine species and particularly to harbour porpoise, for example disrupting foraging and causing displacement from key feeding areas. Underwater noise generated by vessels has also been observed to impact harbour porpoises, with the level of disturbance also related to the vessel's speed.

Piling noise reduction

A suite of noise reduction measures will be used to significantly reduce piling noise impact. This is expected to comprise a damped pile hammer, a near field pile sleeve and /or a bubble curtain. Detailed underwater noise modelling studies have been undertaken to establish that the implementation of such measures will enable the required thresholds for impulsive noise and the disturbance of harbour porpoise to be met. We will measure the effectiveness of the mitigation measures in reducing noise generation during piling activities. This will provide valuable data to validate and improve predictive modelling of piling noise propagation for future wind farm studies.

Minimising disturbance from vessels

During wind farm operations, maintenance of the wind turbines and associated infrastructure will rely on various vessels regularly accessing the site. The project will seek to reduce vessel related disturbance of harbour porpoise during the wind farm operations phase through implementing a Service Operations (SOV) led strategy. The vessel will remain on site for extended durations between supply base visits, minimising transits. The SOV will be commissioned with features to minimise noise generation, such as the propulsion system, and will operate at lower speed than a conventional crew transfer vessel. Advanced optimisation methodologies will also be used to drive operational efficiencies and reduce vessel movements within the wind farm site.

Monitoring plan

The effectiveness of these measures will be investigated through a long-term study, recording the presence and behaviour of harbour porpoise and the noise levels within the wind farm site. This will involve deployment of an array of passive acoustic monitoring systems across the wind farm site, before and during construction and during 5 years of operations. This will contribute to understanding the effectiveness of the planned measures in reducing disturbance resulting from underwater noise. The output from this research will provide valuable insights that can inform the planned rapid expansion of offshore wind farms in the North Sea and the continued focus on harbour porpoise, a protected species particularly vulnerable to changes within the environment that have potential to affect foraging behaviour.

3.0 Fish and benthos

The Ross worm and Atlantic Cod play a major role in the southern North Sea. The Ross Worm is a habitat-forming species, and Atlantic cod is an important apex predator and a commercially important fish species. Wind farms can play a role in enhancing marine biodiversity by excluding bottom trawling and by adding hard substrate to the predominantly sandy sediment habitat of the Dutch North Sea ecosystem.

Artificial reef structures

Hard substrate provides settlement opportunities for Ross worms and shelter, nursery areas and feeding opportunities (due to increased prey density) for Atlantic cod. Artificial reefs can add more three-dimensional complexity and surface texture compared to conventional scour protection, and therefore support increased diversity of reef dwelling and reef-building species. Three designs have been developed to achieve these goals:

1. Reef pyramids: these are large structures primarily designed as a habitat enhancement measure for adult cod.
2. Reef cubes: adding a layer of various sized cubes to the scour protection will create more diverse and small-scale habitat complexity for smaller fish, such as juvenile cod.
3. Ramp collar: this is a novel, tailor-made structure intended to improve the settlement opportunities of Ross worm and kickstart reef formation.

These designs are currently indicative of the type of measures to be deployed but any final design of the measures will be market driven through a competitive tendering process. However, the project will look to install these at up to 75% of the WTGs in five different configurations, including a control configuration (standard filter and armour layers with no enhancement measures).

Monitoring plan

The effectiveness of the measures will be monitored using remote techniques with surveys planned in advance of construction and five years post construction. The techniques to be employed include baited remote underwater video (BRUV), sonar, video and hyper-spectral imaging. After these years of intensive monitoring, the techniques will be evaluated on their efficacy and the site will be monitored on a less frequent basis until decommissioning to provide long term data on the underwater ecology within the wind farm. .

4.0 Electromagnetic Fields (EMF)

Research on the effects of EMFs on marine life is currently limited and inconclusive, preventing accurate impact assessment and development of mitigation measures.

It has been postulated that EMFs from subsea cables could affect the behaviour, migration, physiology and development of cartilaginous and flatfish species. Stranding events due to deviations in the magnetic field suggests that harbour porpoise (Phocoena phocoena) may also have a geomagnetic sensitivity. We plan to undertake assessments to better understand what EMF levels are emitted from infield cables and how marine animals may be affected by these.

Multidimensional measurements

We plan a holistic approach undertaking high-resolution, three-dimensional EMF measurements around different cable configurations, while also monitoring animal behaviour in and around cables in the field and laboratory.

Stationary EMF sensor platforms will be deployed at 90% of different infield cable configurations to collect continuous data at a range of wind speeds. These multi-sensor EMF platforms will generate a multi-year time series of innovative multidimensional measurements of EMFs, including gathering abiotic factors (e.g. real-time energy transmission, atmospheric and sea conditions, burial depth). Combined with in-situ EMF measurements, these data can be used to validate and improve EMF models. Sensors will also be towed along 50% of the infield cable extent to collect data over a larger spatial area.

Additionally, target fish species will be tagged, and hydrophones will be set up in such a way to allow for the monitoring of fish and harbour porpoise movements within the vicinity of the infield cables.

Laboratory studies

Laboratory studies will expose the target species (cartilaginous and flatfish species) to different EMF and induced electric (iE) field levels. These levels will be taken directly from those measured during the first year of the wind farm's operational phase. Applying the measurements in these experiments will make the results relevant and transferable to future offshore wind farm developments.

5.0 Naturalis Biodiversity Centre: The Living Lab

In addition to the monitoring plans, we have established a unique partnership with Naturalis Biodiversity Centre to develop a 'Living Lab' study, which will look at changes at spatial, temporal and taxonomic levels at the wind farm site.

From benthic to pelagic and from producers to top predators, responses to the effects of climate change and to the presence of the wind farm will be investigated.

The partnership with Naturalis is a key part of the project's approach to innovation in ecological monitoring. The planned monitoring across these different areas will help to generate a holistic view of the ecosystem contributing to a framework that can be used to assess the health of the environment across all trophic levels.

This work will support the monitoring plans the project are undertaken to ensure that both workstreams will support the generation of long term datasets to feed into research and inform future monitoring efforts.

The project's partnership with Naturalis will also be key in ensuring the data and information gathered from both monitoring programmes can be communicated and shared as widely as possible.

6.0 There's more

Environmental protection interwoven

Apart from specific ecological measures, IJmuiden Ver Alpha has incorporated environmental considerations into every step of the development of the wind farm. A few examples are: Planned rotor speed reduction for the protection of bats, ensuring no nitrogen deposition in vulnerable Natura 2000 areas and careful analysis of recyclable and raw material usage. The project is committed to protecting the environment through as many ways as feasibly possible.

Independent advisory panels

Two independent panels will be established to provide oversight of the design of the monitoring programmes and to help disseminate the results. The first of these will be an independent scientific advisory panel. Key scientific and regulatory stakeholders will be invited to join the panel and provide peer reviews of our work. The aim is to ensure the data is of best use to the scientific community.

The second stakeholder panel will consist of representatives of NGOs, the offshore wind industry, policymakers and the Dutch public. This panel will oversee the dissemination and discuss the results and conclusions of the ecological research. This will ensure that the ecological measures at the wind farm make an effective contribution to science and to a broader understanding of the ecological impact of wind farms among environmental advocates, policymakers, the wind industry, and the public.

Cooperation with national research programmes

The consortium will work closely with researchers from MONS and Wozep throughout the construction and operation of the wind farm and will coordinate with Maritime Information Provision Service Point (MIVSP). This is to ensure matching data formats and avoid redundant duplication of sensors. In accordance with the permit, the project will also make a financial contribution of €20 million to the Ministry of Agriculture, Fisheries, Food Security and Nature for the 'North Sea Nature Enhancement Programme' (PNN in Dutch). PNN measures are aimed at restoring species that are compromised, including fish, marine mammals, sharks and rays, but also birds and bats. Our contribution to PNN will help with nature reinforcement in and around wind farms.