

Offshore wind and biodiversity

SUMMARY

- *Maritime Spatial Planning can improve cross-sectoral cooperation and multi-use of the sea space.*
- *The offshore wind sector is committed to environmental protection.*
- *Wind energy can contribute to and coexist with nature conservation and restoration objectives.*
- *Offshore wind brings opportunities to restore ecosystems and enhance positive effects on biodiversity.*

Maritime Spatial Planning and co-location

Increased activities in Europe's marine waters have led to growing spatial demands and therefore growing competition between sea users. **Maritime Spatial Planning (MSP) is key to enhancing offshore wind (OW) development and improving cross-sectoral cooperation** with nature, aquaculture, fishing, energy, military, tourism, and transport – and thus minimising spatial conflicts. Furthermore, Governments can allow different activities to carry on alongside wind farms, including nature protection and restoration.

In 2022 EU Member States have submitted their first round of Maritime Spatial Plans (MSP) as mandated under the MSP Directive (2014/89/EU). Altogether **these plans have allocated more than 220 GW of OW capacity across 16 Member States¹**, enough to reach Europe's current 2030 offshore wind ambitions.

However, many uses for OW farms are still not spelt out explicitly in most of the MSPs, except for Belgium, Germany, and the Netherlands. **All Member States will revise their MSPs before 2030.** They will have to confirm the current areas and start screening others for the post-2030 phase. This should be done in parallel to the definition of Maritime Protected Areas (30% of the sea under protection rules, according to the Biodiversity Strategy) and nature restoration areas. To this end, **Member States should prioritise exploring co-location and multi-use options** to solve spatial conflicts and increase the functionality of the sea.

¹ "[Offshore Wind in EU maritime Spatial Plans](#)", WindEurope (September 2022)

Maritime planning should boost synergies across activities at sea, rather than creating a patchwork of single-use areas.

Offshore wind coexisting with biodiversity

Wind farms can have both positive and negative impacts on the environment. They can offer multiple avenues to protect and restore ecosystems and to enhance biodiversity. Their adverse impacts need to be carefully avoided, mitigated, or compensated during the permitting phase, through to construction, operation and decommissioning.

According to EU nature legislation, **wind energy can be developed in or next to Maritime Protected Areas**, provided that the Appropriate Assessment is done in line with European and national legislation and there are no significant impacts on the local ecosystems.

The European Commission's guidance document "[Wind energy developments and EU Nature Legislation](#)"² helps to interpret the EU Birds and Habitats Directive. It gives practical examples of how project approval can be facilitated - without compromising nature protection needs - through strategic planning, using solid environmental data, and suitable mitigation measures, among others. In addition, **offshore wind farms can become restoration areas** when designed to include active restoration measures.

² The guidance document was published with the EC's Offshore Renewable Energy Strategy (and it's available [HERE](#))

Environmental protection

The MSP Directive has worked well already to de-risk projects and ensure environmental impacts are taken into account in the early planning stage of projects. In fact, the Directive requires all plans to undergo a **Strategic Environmental Assessment (SEA)**, which is a macro-environmental, economic, and social assessment of all activities at sea. The SEA supports regulators by providing a preliminary indication of the potential impacts and mitigation approaches.

Each wind farm then has to undergo a site-specific Environmental Impact Assessment (EIA), which lays out the potential negative impacts and how to avoid, mitigate, or compensate for them. **The population-based approach to species protection mandated by EU legislation is critical to finding the best mitigation and compensation measures for large offshore wind projects.** In fact, this approach is vital when considering the cumulative impacts of multiple offshore wind projects and allowing for off-site compensation measures, which might be most effective. **The goal is to have projects delivered successfully and with limited permitting risk while ensuring a positive impact on the species population.**

The EIA usually takes two years and, in most countries, is the responsibility of project developers. Furthermore, the wind industry takes an active part in researching the environmental impacts of its wind farms together with local authorities and scientists, and often makes results publicly available. Examples include research on [birds](#), [fish communities](#), [dolphins](#), and [harbour porpoise](#). This experience allows the industry to develop advanced [models for assessing population effects](#) of any disturbances on biodiversity.

During construction offshore wind farm developers can use different technologies, e.g., bubble curtains, to limit sound emissions generated from piling, helping to mitigate disturbances to marine life. Innovative alternatives known as Gentle Pile Driving are being developed to further lower sound levels. Any disruption during construction is temporary and the fish often return to wind farms in greater numbers as the wind farms act as an artificial reef.

This has been demonstrated through long-term monitoring programmes, for example [in Denmark](#) and [in Belgium](#).

Wind project developers also take extra measures, where needed, to protect biodiversity during wind farm operation. They use technology to detect and deter birds and bats; and in some cases, even stopping the turbines from spinning at certain times to prevent collisions. **During this phase, environmental impacts must be carefully monitored**, as per by the EIA Directive. This allows operators to manage potential negative impacts and ensure compliance with environmental permits. Monitoring can be done separately for each wind farm, where project owners perform their own analysis. For example, Orsted and DHI developed a detailed [“Bat and Bird monitoring guidance”](#) (2023) that has diverse geographical applications. Monitoring can also be centralised, where a Government authority carries out this task for all wind farms. This is the case with Belgium’ Offshore Wind Monitoring Programme, [WinMon.be](#).

Biodiversity enhancement

Once built each wind turbine can support up to [4 metric tons of shellfish](#) that attract other marine wildlife. This leads to a healthy marine ecosystem that may not have been as abundant or productive pre-construction. As a result, larger sea mammals including seals and Harbour Porpoise can thrive in offshore wind farms.³ A Dutch study found more porpoise activity in the operational wind farm area than in reference areas outside the wind farm, which is most likely linked to **increased food availability, the exclusion of fisheries, and reduced vessel traffic**⁴.

However, **there are a several measures today that can enhance these positive impacts and can help seabed and local ecosystems recover even more quickly.** When these are combined with all necessary avoidance, mitigation, and compensation measures, wind farms can deliver **net-positive impacts for biodiversity**. For example, the sector is involved in eco-designing scour protection systems and other offshore infrastructure (e.g., cables) that support benthic and reef ecosystems.

³ Examples in the Dutch North Sea for seals ([link](#)) and harbour porpoise ([link](#) and [link](#)). And UK and Germany ([link](#))

⁴ Lindeboom et al. (2011) [Short-term ecological effects of an offshore wind farm in the Dutch coastal zone](#)

These **Nature Inclusive Designs (NID)** act as a catalyst for biodiversity. But positive impacts can go beyond the wind turbine-level, e.g., when natural reef structures are placed between turbines. When these options are implemented with the objective of protecting, sustainably managing, and restoring nature, they are called **Nature Based Solutions (NbS)**.

For example, **oyster reef cultures actively improve seabed conditions, increase water quality through filtration and boost local ecosystem services**, including food production⁵. These solutions are being tested in the Dutch North Sea, where flat oysters were once abundant but very scarce today due to overfishing. [The Rich North Sea](#) has several oyster-related projects ongoing including at the [Eneco Luchterduinen](#), [Gemini](#), and [Blauwwind](#) offshore wind farms. And commercial aquaculture applications of oyster reef's regeneration are also promising. The [UNITED project](#), with the support of Ghent University and other partners, has tested, among others, flat oyster aquaculture. Other applications include **blue mussels and seaweed cultures**. The latter is particularly promising, including for sequester CO2 from the atmosphere. The [first commercial project](#), a collaboration of Amazon Right Now Climate Fund and North Sea Farmers in the Netherlands, invested €1.5 M to construct a 10-hectare seaweed farm, which is expected to produce at least 6,000 kg of fresh seaweed in its first year (2024).

There are also promising solutions for more complex species. The Rich North Sea is testing [fish hotels](#) attached to Hollandse Kust Noord high voltage station. These allow small fish to enter keeping predatory fish out, thus providing shelter and safe foraging for small fish. And Orsted is planning to build [artificial nesting structures for kittiwake](#), a vulnerable bird species, on the coast of North East England and East Suffolk. Each structure will have approximately 500 nesting spaces to introduce new chicks into the population. Another example is Vattenfall's Ray wind farm, where measures for restoring blanket bog habitats helped to boost the Merlin (*Falco columbarius*) population: [23 chicks have fledged at Ray Wind Farm since 2017](#).

Conclusions

Scientific research can support regulators in dealing with the knowledge gaps in the permitting processes of offshore wind. Sound evidence on environmental impacts resulting from real life monitoring or research programmes would allow regulators to take a different approach to applying the precautionary principle and to propose measures that are cost-effective and tailored to site-specific conditions.

Positive effects and synergies between wind farms developments and national conservation strategies should be promoted and integrated into offshore wind auctions through non-price criteria. Ecological criteria reward companies for the investments they've already made in biodiversity protection and that they want to make. And they incentivise innovation in biodiversity protection. **They show that renewables and biodiversity protection go hand in hand.**

Coexistence with nature should be done in accordance with environmental principles and following a sound cumulative impact assessment. The industry is ready to deploy these solutions at commercial scale and some **major wind farm developers have already committed to deploy net-positive biodiversity wind farms by 2030.**

National plans must spell which options are possible, based on dialogue with stakeholders and socio-economic aspects. **Governments should facilitate and encourage dialogue between sectors** with the aim of encouraging synergies among different sectors.

More collaboration would result in a better understanding of which solutions apply across countries with different cultures, traditions, and geographies.

⁵ Wallis B. et al (2018) [Offshore Wind Farms as Potential Locations for Flat Oyster Restoration in the Dutch NS](#).