# Environmental Impact Assessments for Offshore Wind Farms

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*Gunfleet Sands Offshore Wind Farm is a 172 MW wind farm about 7 KM off the Clacton-on-Sea coast in the Northern Thames Estuary.*



Wind power has proven itself to be a viable component of renewable energy portfolios. Installations – ranging from single small residential turbines that produce a few kilowatts, to wind farms consisting of dozens of megawatt turbines covering hundreds of acres – are sprouting up around the world. Unfortunately, wind power is not without its drawbacks. Utility-scale turbines inevitably have an impact on their environment. This is obvious with onshore turbines, where nearby residents may view them as noisy eyesores that reduce property values, but the effects are less apparent with offshore turbines, where they are out of sight and out of mind.

Measuring and mitigating the effects of offshore wind farms requires comprehensive environmental impact assessments. How are such assessments carried out and what should they cover?

## Timing Is Everything

Environmental impact assessments begin long before the turbines start spinning. In order to accurately predict how a wind farm may affect the local environment, we need a clear picture of the environment first. Painting such a picture takes time. It's not enough to take a one-time count of local bird and fish species. Populations vary over the course of a year as animals migrate, as they reproduce, and as their food supply changes.

Even a full year is not enough to establish a solid baseline for a valid assessment. Weather patterns are rarely identical year to year, and may cause variations in animal behavior and populations. After the construction of a wind farm, the population of a specific species of sea bird may be lower than that observed the year before construction. But was that observation typical? Was the previous year unusually high? Or unusually low? We need data collected over several years before we can arrive at an accurate answer.

This is especially true of offshore wind farms compared to onshore farms. Nancy McLean, Head of Offshore for renewable energy consulting firm Natural Power, explains, "With onshore projects you get a continuity of the use of an area year upon year. For example, important bird species come back to the same sites most years. You might have some nest failings and some really successful years when you get loads of fledglings leaving the nest, but you know roughly what's happening and where it's happening within your area of interest. With offshore environments, you get higher levels of variability. You may get large-scale nest failures because of a storm coming in and washing all the chicks off. So you need at least two years to work out whether you're looking at a peak or a trough."

Wind turbine technology is advancing so quickly that in the time it takes to do the assessment, technology might change to the point you need to revise the assessment to account for larger turbines.

McLean notes, "In our design envelope concept, we might have a large number of smaller machines, say the 6 megawatt machines that we know are available to build out now, but we're not quite sure what technology is going to be available when we want to build out our project. We want to use the biggest turbines we can because they're more cost effective and will give us a lower cost of energy. Therefore we also do our assessments for the 10 and 12 megawatt class machines that we might be able to build the project out with in 3 or 4 years time."

Once data is collected, it's fed into computer models to make predictions about the impact of the wind farm on the local ecology. Even then, monitoring doesn't end once construction is finished. McLean notes that "surveys have to continue to determine whether or not the construction has impacted the ecology in the way that was predicted by the assessment."

## More Than Just Counting

Conducting an accurate environmental impact assessment involves more than just counting birds or fish. It requires knowing as precisely as possible where those birds and fish are at

any given time, where they're going, and what they're doing. It means understanding how those birds and fish interact with each other and with other species.

How is this data gathered? Much of it comes from direct observation, watching birds from a boat, or fish from beneath the water. Surveys may also employ weather and military radar — although these are often configured to ignore flocks of birds — as well as thermal imaging.

*Sometimes the best way to track bird activity around an offshore wind turbine is to get out in a boat and count.*
© Natural Power

Birds may be attracted to the superstructure of turbines as nesting sites or rest stops on their migration. Otherwise, migrating birds usually give turbines a wide berth, at least in daylight hours. If they don't, the altitude at which they fly, above or below rotating turbines, is obviously significant. Night-flying birds are known to collide with stationary objects in their trajectory, both at land and at sea, and of course spinning turbines pose an additional hazard. It may seem that a simple solution would be to add illumination. However, lights may actually attract birds, or insects on which birds feed.

Fish species may benefit from offshore wind farms … or not. The moorings of floating turbines provide a foundation for corals and mussels, and may attract fish species previously absent from the area, or increase the population of indigenous species. But this may in turn attract birds who feed on these fish.

Environmental assessments of offshore wind turbines also need to consider onshore factors, such as power transmission lines, as well as other offshore turbines. This is because there may be cumulative effects between sites. As birds increase the length of their migration to avoid obstacles, their energy requirements go up. If they then need to avoid additional obstacles, their energy requirements may exceed their reserves. If that happens, their mortality rate will likely increase.

## What's Important And What's Not?

A critical aspect of conducting an environmental impact assessment for an offshore wind farm – or for any similar project – is determining what's important. Does every animal species receive equal consideration? How much impact is too much? And who makes that determination?

McLean comments, "It's a societal point of view; society needs to decide why we care and how much we care. We have to assess the magnitude of an impact – are we displacing lots of birds or a few birds – against the sensitivity of those birds to displacement. So are they just going to go somewhere else to feed or are we displacing them from a primary feeding habitat?"

These decisions depend, not just on the species under consideration, but on its location as well. And with each region, country, state, and even municipality imposing its own standards, each location may be covered by multiple levels of regulations.

For example, over 18 percent of Europe's land area and almost 6 percent of its marine territory is covered by Natura 2000, an agreement of the European Commission designed to protect core breeding and resting sites for rare and threatened species. So a proposed wind farm site off the coast of Scotland may meet Scottish Environmental Impact Assessment regulations, but still run afoul of Natura 2000 regulations. Firms like Natural Power that conduct environmental impact and Natura 2000 compliant assessments need to be aware of each set of regulations and how they interact.

## The Butterfly Effect

Given the time and expense necessary to conduct a thorough environmental impact assessment, we could ask, is it really worth it? Is it such a problem if a few birds have to fly around a wind farm, or if they fail to fly around it and get caught in the turbines? Is it such a problem if a turbine's pilings create an artificial reef, attracting more fish?

All living things are interconnected. Individual birds contribute to flocks; flocks contribute to species; species contribute to a balanced ecosystem. Even if the species directly influenced by offshore wind farms are not seriously affected, they may disrupt other species, including those that are already endangered. This can lead to severe consequences for humans as well. Consider …

A flock of migrating birds has to fly farther to avoid a wind farm. Some of the birds don't make it. With their reduced numbers, there are fewer birds to feed on a certain species of insect.

These insects reproduce uncontrolled and displace other insects which would otherwise pollinate food crops.  Fewer pollinators lead to reduced harvests, leading to food shortages.

The problem is, we can't account for every possibility.  We can't proceed as if the worst case scenario will always come to pass.  If we did, we'd never proceed at all; we'd still be living in the stone age.  Instead, we need to determine which risks are acceptable and which aren't, which consequences we can live with, and which consequences we must avoid.

Although environmental impact assessments are costly and time-consuming, they are essential for our own advantage and that of our environment.  This is why many countries pursuing renewable energy projects, including both onshore and offshore wind turbines, have established laws requiring such studies.  The more in-depth assessments we conduct, the greater our understanding of our environment, and the more success we'll have in working with our world, instead of against it.

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