Marine Biodiversity and the Development of a North Sea Offshore Powerhouse

White Paper

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Ecofys, a Navigant company, spoke to stakeholders from around the North Sea, including the European Commission services and national authorities, transmission system operators (TSOs) and offshore wind developers, nongovernmental organisations (NGOs), and fishery associations. The team asked for their opinions on the implications of the large number of projected offshore wind turbines in the North Sea and their level of involvement, what they believed the key knowledge gaps and anticipated ecological effects and benefits could be, and about how they had been engaged with as stakeholders. Finally, the team analysed stakeholders' reaction to a set of provocative hypotheses that included accelerating offshore wind rollout and maximising ecological benefits versus a rigid focus on impact mitigation.

The analysis has been anonymised and respondents have been given the opportunity to comment on the draft version of this paper before publication.

The following organisations were contacted in writing this white paper:

- European Commission, DG Environment
- European Commission, DG Maritime Affairs and Fisheries
- Marine Management Organisation, UK
- Ministry of Infrastructure and Water Management, The Netherlands
- National Federation of Fishermen's Organisations
- Nederlandse Vissersbond
- North Sea Foundation
- Renewables Grid Initiative
- RSPB (UK Partner of Birdlife International)
- TenneT
- Vattenfall
- VisNed

DISCLAIMER

The content of this paper does not necessarily reflect the official opinion of some of the consulted organisations or institutions. Responsibility for the information and views expressed therein lies entirely with the author(s). The organisations or institutions cannot be held responsible for any use which may be made of the information contained therein.

PURPOSE OF THIS WHITE PAPER

To support consensus and alignment around a sustainable North Sea renewable energy system, Ecofys, a Navigant company, set out to explore the potential for North Sea renewable energy development to increase marine biodiversity. It does not set out a full assessment of ecological risks and opportunities. This paper is the third in a series of thought leadership pieces on the potential of a North Sea Offshore Powerhouse. The first and second pieces are *A Potential North Sea Grid Powerhouse* and *The North Sea as a Hub for Renewable Energy, Sustainable Economies, and Biodiversity*.

Ecofys, a Navigant company, has a long track record in advising and working with many of the stakeholders involved in developing the North Sea renewable energy system. This work is independent and not funded by a third party. It is undertaken as part of the company's contribution to the growth of the industry.

Importance of focusing on marine biodiversity

The future North Sea renewable energy system (with up to 180 GW offshore wind[1]) presents a wide range of ecological risks and opportunities. When these are adequately addressed, the offshore energy transition could bring a new balance to the North Sea ecosystem and provide a great opportunity to improve marine biodiversity. More than a century ago large parts of the North Sea contained more hard substrate (e.g., stones and oyster beds) than it does today.[2] Benthic organisms could grow on the hard substrate, and crevices provided refuge and nesting sites for crustaceans (lobsters and crabs) and large fish (cod and rays). Currently, the seabed mainly consists of sandy substrate, leaving a less suitable habitat for hard substrate-dependent species. Review of environmental data from post-consent monitoring (based on license conditions) of existing offshore wind farms has shown that biodiversity increases dramatically when wind farm foundations are introduced on a sandy seabed. When placed in these locations they act as a new type of habitat where additional marine life can settle. This provides an opportunity to increase biodiversity and enrich the existing North Sea ecosystem.

If the need to deliver improvements to marine biodiversity was integrated in planning decisions, marine ecosystems could be enriched and provide multiple services. Apart from achieving national and international conservation objectives (e.g., UN sustainable development goals), this could bring substantial benefits in terms of fishery, recreation and tourism, climate change mitigation and adaptation, shoreline dynamics control, and disaster prevention. An ecosystem-based spatial planning approach could contribute to the effective management of marine activities and the sustainable use and development of marine and coastal resources by creating a framework for consistent, transparent, sustainable, and evidence-based decision-making.

[1] Ecofys, a Navigant company, *Translate COP21: 2045 Outlook and Implications for Offshore Wind in the North Seas*, TenneT and Energinet.dk, 2017, https://www.ecofys.com/en/publications/translate-cop21/.

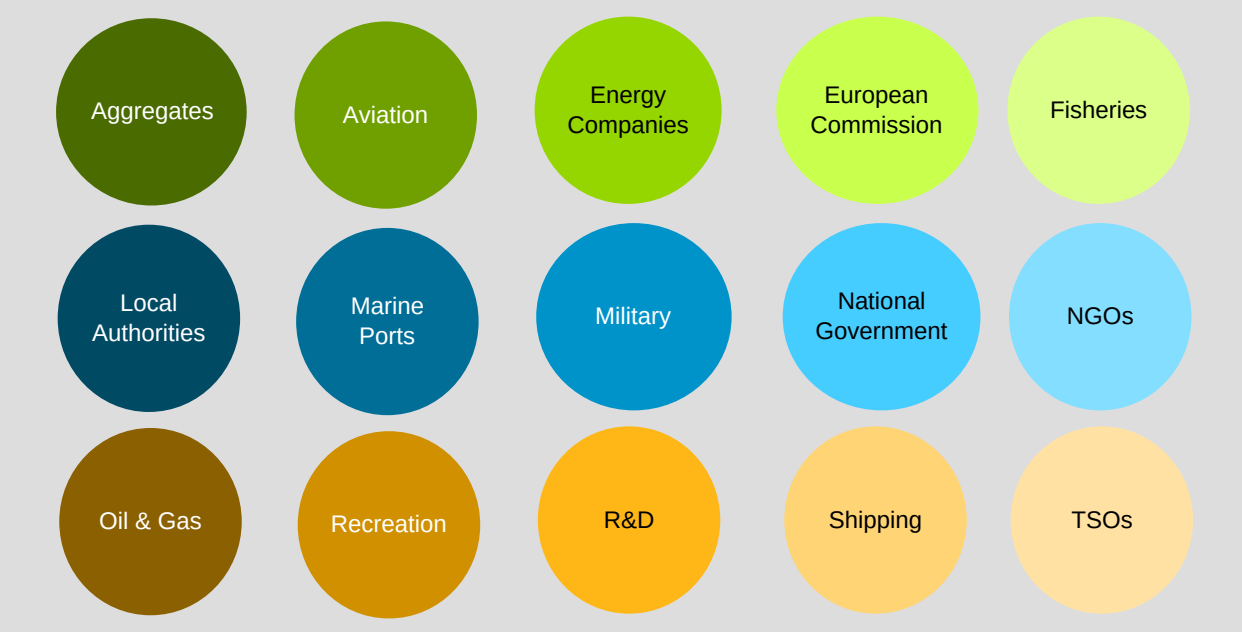
[2] J.W.P. Coolen, "North Sea Reefs: Benthic biodiversity of artificial and rocky reefs in the Southern North Sea" (PhD thesis, Wageningen University, 2017), https://www.wur.nl/upload_mm/5/d/a/2a8d7051-1dfc-46ee-89c0-fd3fab143b3b_PhD_thesis_Joop_W.P._Coolen_North_Sea_Reefs.pdf.

SURVEY FINDINGS

The North Sea has a colourful stakeholder palette

The North Sea is one of the most intensely used seas in the world. It is used by a variety of stakeholder groups and governed on a European, national, and regional scale. Figure 1 details key stakeholder groups from the offshore wind perspective. Appendix A provides a more detailed overview of stakeholder groups and activities.

Figure 1. The North Sea stakeholder palette



Fishing, transport (shipping), and safety (military) are the most important historical anthropogenic factors in the North Sea, and in the 1960s, commercial oil & gas discoveries and exploitation joined them. In Danish territorial waters in 1991, the first successful offshore wind generation project began the renewable energy transformation of the North Sea. As human pressure on the North Sea's ecosystem steadily increases, the need for environmental management and resource protection has never been more important.

Table 1 shows the structuring of stakeholder groups, which was used to facilitate stakeholder interviews for this paper (e.g., questionnaires were tailored to each group). Policy, authority, transport, and safety are large influential stakeholder groups from a regulatory and national safety and security perspective. The other stakeholder groups can be categorised around natural resources; conversion (e.g., offshore wind, hydrogen), extraction (e.g., oil & gas), and protection (e.g., nature conservation). All stakeholders have spatial claims in the North Sea region, a selection of which have additional spatial claims inside wind farm areas (e.g., nature, fisheries, aquaculture, technology innovation, etc.).

Table 1. Categorising North Sea stakeholders to facilitate engagement and consultation

Policy and Authority	Transport and Safety	Natural Resource Conversion	Natural Resource Extraction	Natural Resource Protection
• European Commission • National governments • Local authorities	• Aviation • Military • Shipping • Marine ports	• Energy companies* • R&D companies* • TSOs*	• Aggregates • Fisheries* • Oil & gas	• Nature conservation* • Nature restoration*

*Stakeholders with (potential) claims for co-use inside wind farm areas.

Note: Appendix A provides a stakeholder list including a description of activities.

Engagement is fragmented and does not reach all stakeholders

Engagement occurs on a national level through government agencies, associations, and local authorities. Regional engagement is organised through platforms such as the North Sea's Energy Forum, the political declaration group, the North Sea Advisory Council, and the North Sea Wind Power Hub project.[3] These platforms do not reach all stakeholder groups. Some within the NGO sector felt excluded from the work and initiatives undertaken by the political declaration groups and suggested the groups broaden their scope and outreach.

When asked for their opinion on the level of engagement in North Sea spatial planning (offshore wind in particular), the majority of stakeholders considered that although a high level understanding of stakeholder interests exists, they had not always been adequately engaged. Stakeholder consultations are often organised on a national level, where some policymakers feel they are doing their best to include all stakeholders. However, it was mentioned that spatial planning is a balancing act of interests and that stakeholders cannot always be satisfied. There seemed to be consensus that there is room for improvement in the consultation processes (e.g., increased transparency, better communication, better structure and focus, and clear deliverables), which could lead to a better understanding between stakeholders and decision makers.

There have been many discussions on the future of offshore wind and the North Sea Grid (e.g., North Seas Countries' Offshore Grid Initiative, North Seas Energy Forum) but with limited results, as the concepts were often too abstract with relatively little concrete actions for moving forward. Stakeholders recognised that the North Sea Wind Power Hub joint fact-finding process[4] is the first real attempt at consultation of a concrete project on a regional scale. Respondents have high hopes for the NGO fact-finding process; however, most have commented that there has been no follow-up after a first consultation session and the process going forward is not clear. Some stakeholder groups feel left out and believe that more efforts should be made to include all relevant stakeholders in a consultation process. However, there are often multiple views within stakeholder groups, which makes it difficult to channel discussions and properly organise the process.

[3] TenneT Netherlands, TenneT Germany, Energinet, Gasunie, and Port of Rotterdam joined forces to develop a large-scale European electricity system for offshore wind in the North Sea. By developing the North Sea Wind Power Hub project, the consortium endeavours to make the energy transition both feasible and affordable. Central to the vision is the construction of one or more hubs (potentially including an artificial island) at a suitable location in the North Sea with interconnectors to bordering North Sea countries.

[4] North Sea Wind Power Hub, "Stakeholder engagement on first findings and key questions," report from the WindEurope November 2017 consultation session, slides 34-43. https://northseawindpowerhub.eu/wp-content/uploads/2017/12/Consultation-session-NSWPH-301117.pdf.

Some stakeholders believe that the TSO-led consortium should increase its leadership in discussions around this topic—for example, inviting other major stakeholders to the table to develop a creative process to come up with joint (cross-stakeholder group) solutions. They argue that governments have many discussions behind closed doors and that the process is often not transparent.

Offshore wind potential is a great opportunity to redesign the North Sea and potentially increase marine biodiversity

There is a clear case to expand offshore renewables—particularly offshore wind—in the Northern Seas. In several scenarios, the high number of turbines considered were questioned by some respondents.[5, 6, 7, 8, 9] Respondents voiced serious concerns over the potential cumulative effects on populations of marine species—i.e., the combined effect of multiple offshore wind farms together with other anthropogenic impacts. If offshore wind is expanded on a large scale, cumulative effects must be avoided and mitigated as much as possible. For some pressure-effect relations there is already a need for mitigating effects at this moment. Large-scale developments could be curtailed because of potential unacceptable ecological effects. Most stakeholders believed there is not enough information available to adequately understand spatial planning implications as a basis for good marine environmental protection.

Despite the risks, a radical redesign of the North Sea could provide an opportunity to increase marine biodiversity. In terms of water depth and wind resources, the North Sea is a valuable area for offshore wind. Deeper water areas present opportunities to commercialise floating wind turbines. Large commercial fisheries might avoid wind farm areas due to the incompatibility of fishing gear and turbine spacing (or if access is prohibited), which could create an opportunity for nature recovery and restoration (e.g., oyster beds). Marine species can benefit from new hard substrate that can transform the ecosystem. As such, large wind farm areas may contribute to biodiversity. With a good integral spatial planning strategy and approach, biodiversity can increase. The goal should be to work towards a net-positive result of offshore wind developments. However, it is important to prevent a subjective comparison between benefits and negative effects on species that are under pressure, like birds, bats, and marine mammals. It is equally important to provide benefits and support for the sustainable transition of other stakeholder groups, like fisheries.

Critical knowledge gaps remain

When asked for their opinion about the most important knowledge gaps, stakeholders agreed that there is still much to be learned about the effects of offshore wind. The marine environment is a

[5] WWF, Ecofys, and the Office for Metropolitan Architecture (OMA), *The Energy Report: 100% Renewable Energy by 2050*, 2011, https://www.ecofys.com/files/files/ecofys-wwf-2011-the-energy-report.pdf.

[6] Fraunhofer ISI, *Tangible ways towards climate protection in the European Union*, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2011, https://www.isi.fraunhofer.de/content/dam/isi/dokumente/ccx/2011/Final_Report_EU-Long-term-scenarios-2050.pdf.

[7] WindEurope, Wind energy in Europe: Scenarios for 2030, 2017, https://windeurope.org/wp-content/uploads/files/about-wind/reports/Wind-energy-in-Europe-Scenarios-for-2030.pdf.

[8] E3M-Lab of the Institute of Communication and Computer Systems at the National Technical University of Athens (ICCS-NTUA), International Institute for Applied Systems Analysis (IIASA), and Euro-CARE, *EU Reference Scenario 2016: Energy, transport and GHG emissions - Trends to 2050*, European Commission, 2016, https://ec.europa.eu/energy/sites/ener/files/documents/20160713%20draft_publication_REF2016_v13.pdf.

[9] Ecofys, a Navigant company, *Translate COP21: 2045 Outlook and Implications for Offshore Wind in the North Seas*, TenneT and Energinet.dk, 2017, https://www.ecofys.com/en/publications/translate-cop21/.

complex, dynamic environment and it takes a lot of time and money to investigate systematic impacts properly.

One of the most important ecological knowledge gaps is the cumulative effect on foraging seabirds (opposed to most migrating birds). Sea bird populations are influenced by climate change; therefore, offshore wind can contribute to a broad-scale benefit. However, it remains unknown to what extent a multitude of turbines in the North Sea will affect certain populations of seabirds and to what extent these effects can be mitigated. Several specific knowledge gaps related to the movement of foraging seabirds and various weather conditions remain, including:

- **In the air:** The interaction of birds with windfarms (e.g., avoidance)
- **In wind farms:** Behaviour change and interaction with wind turbines (e.g., collision)
- **Underwater:** Diving behaviour of birds and the effect on species under the surface

The potential cumulative impact of underwater noise from pile driving, detonations of unexploded ordnance, seismic surveys, and shipping is a rising concern among stakeholders. Therefore, the effectiveness of technological developments and mitigation measures needs to be understood for offshore wind on a larger scale. The importance of having a good understanding of population-level dynamics of affected species in a wider area should remain a high priority. Stakeholders recognise that underwater sound from piling is currently an issue, but that technological innovations may be able to mitigate these effects, such as blue piling (i.e., using water instead of a hydraulic impact hammer).[10]

Other relevant knowledge gaps include:

- Currents may change in wind farms, which could result in sand displacement
- Displacement (increasing effort elsewhere) of fishing activity
- Compatibility of various fishing techniques and turbine spacing
- Potential effect of cables and electromagnetic fields on fish populations should be better understood on a North Sea regional scale and with an increasing power rating of wind turbines

Utilise available data to improve common understanding and broaden knowledge base on cumulative effects in the medium-term rollout

Europe has a total installed offshore wind capacity of 15 GW, which corresponds to about 4,000 wind turbines across 11 countries.[11] Most of these wind farm operators have collected valuable data to comply with local legislation and monitoring requirements. Large amounts of this data have yet to be unlocked and analysed. This should be a first step in filling some important existing knowledge gaps; however, it will also be a costly process that will require the full cooperation of the industry. It is important to understand how monitoring efforts can be harmonised, combined, and scaled up to a regional approach in the future. Available data will provide validation of assumptions and valuable new insights.

[10] Carbon Trust, "Carbon Trust Offshore Wind Accelerator Launches New Project to Reduce Costs and Underwater Noise in Offshore Wind Construction," 13 March 2018, https://www.carbontrust.com/news/2018/03/offshore-wind-accelerator-blue-pilot/.
[11] WindEurope, *Offshore Wind in Europe: Key trends and statistics 2017*, 2018, https://windeurope.org/about-wind/statistics/offshore/european-offshore-wind-industry-key-trends-statistics-2017/.

Urgent need to improve collaboration and understanding to facilitate the development of a net-positive approach towards the future offshore wind rollout

Most stakeholders are enthusiastic about the idea of a net-positive approach towards offshore wind rollout and biodiversity. Some say it is a great aspiration to have and that it is necessary to go above and beyond the current statutory requirements of mitigating potential impacts. A clear vision and plan is required to redesign the North Sea and facilitate all user functionalities in combination with large-scale offshore wind. The objectives of the Paris Climate Agreement have major consequences (translated into offshore wind it could be about 180 GW on the North Sea in 2050, more than 10 times the current installed capacity[12]), and the necessary changes in approach are drastic. Action is needed now to ensure multiple benefits for stakeholders. At the same time, monitoring and stakeholder collaboration must improve to increase understanding of environmental effects and to accelerate the offshore wind development and spatial planning processes. However, many still favour the precautionary approach towards impact assessment because of its status in the legal framework and uncertainties such as:

- How to improve understanding on key ecological effects of offshore wind?
- What is the definition of positive in a net-positive approach towards further development of offshore wind and marine biodiversity?
- Is it possible to make a fair comparison between negative and positive impacts?
- What are the risks of a net-positive approach?
- How can stakeholders better work together to facilitate the transition for all North Sea users?

[12] Ecofys, a Navigant company, *Translate COP21: 2045 Outlook and Implications for Offshore Wind in the North Seas*, 2017, https://www.ecofys.com/en/publications/translate-cop21/.

MOVING FORWARD

The energy transition offers an opportunity to rethink North Sea use and spatial planning and to unlock the opportunity of improving marine biodiversity (in line with the EU biodiversity strategy and Marine Strategy Framework Directive) for multiple stakeholder benefits. Biodiversity and the ecological status of the North Sea could be increased if the offshore renewable energy system is expanded through an ecosystem approach that integrates consideration of the potential environmental risks while exploring the environmental benefits and by including relevant users (see Appendix A). The expansion should be based on a strategic approach that includes all ecological topics (e.g., seabirds, underwater noise, and hard substrate) and should designate space for sustainable fisheries outside ecologically sensitive areas. A more efficient regional marine planning system (or at least better coordination, more coherent planning of the different countries) that strategically includes the most important fishing grounds is likely to minimise the scope for disruption or conflict at a later stage.

Interviews with key stakeholders confirmed that the evolution of the renewable energy system in the North Sea is generally seen as an opportunity to increase biodiversity. However, this requires vision, leadership, and a change in mindset. It will also require the involvement and dedication of leading offshore wind developers by going the extra mile and actively working on improving biodiversity. Offshore wind developments are benchmarked against cost reduction, but it is time to start looking at integral benefits as well. An internationally coordinated rollout of offshore wind clusters and a change in regulatory frameworks to include clear marine biodiversity and co-use targets (e.g. in tenders, site decisions) would facilitate this.

These interviews reveal the possibility for a large-scale initiative led by a consortium of industry partners and participation from all other stakeholders towards an all-inclusive approach for the rollout of future offshore wind farms in the North Sea. The political declaration group of North Sea countries can play a crucial supporting role; they are currently taking the first steps towards cross-border cooperation in knowledge gathering.

National governments and industry leaders should act now to shape a transparent and all-inclusive decision-making framework towards North Sea spatial planning on a regional level—or at least national with a good level of international coordination. Such a framework should be embedded into national strategies (e.g., roadmap 2030 in the Netherlands) to guide the process for necessary changes in national regulatory frameworks by 2023, before ramping up the offshore wind installation rate to meet the Paris climate goals.[13] Based on the findings in this stakeholder survey, there are three major workstreams that need urgent attention:

1. **Improve collaboration and understanding**

   Focus on improving harmonisation, availability, and utilisation of ecological monitoring data with buy-in and leadership from decision makers and governments and strong involvement and commitment from leading offshore wind developers.

2. **Develop a regional spatial planning approach**

   Consider North Sea spatial planning on a regional scale, in combination with an offshore wind deployment scenario in which every step is valuable. Based on adaptive management, subsequent rollout steps can be planned optionally based on a robust monitoring system.

[13] Ecofys, a Navigant company, *Translate COP21: 2045 Outlook and Implications for Offshore Wind in the North Seas*, 2017, https://www.ecofys.com/en/publications/translate-cop21/.

3. **Actively engage with all stakeholder groups through a managed stakeholder process**

   To facilitate this process and to create a multiple benefit strategy based on a net-positive approach for the roll out of large amounts of offshore wind, it is essential to:

   - Generate a constructive and supporting attitude among all stakeholder groups for a net-positive approach towards offshore wind developments
   - Create regional consensus (or at least national with international alignment) on a net-positive methodology
   - Follow a structured and focused process with clear milestones and deliverables
   - Be as transparent as possible and create a readily available decision trail
   - Agree upfront on a decision-making framework that will be used to define clusters and implement offshore wind

APPENDIX A. OVERVIEW OF NORTH SEA STAKEHOLDERS AND ACTIVITIES

Stakeholder group	Key activities in relation to North Sea spatial planning
Aggregates	Sand and gravel extraction Dredging
Aviation	Offshore helicopter operations Civil aviation
Energy Companies*	Renewable energy generation Energy storage
European Commission	Proposes legislative acts pertaining to the Integrated Maritime Policy and the Common Fisheries Policy Coordinate environmental protection in line with EU legislation
Fisheries*	Demersal and pelagic trawling Gill nets, pots, and baskets Angling
Marine Ports	Oil and Energy Industry Logistics Shipping
Military	Exercises Low flying Mine clearing Shooting
Governments and Local Authorities	Policy Consenting Enforcement
NGOs*	Nature conservation Nature restauration
Oil & Gas	Hydrocarbon extraction Transport of oil & gas
Recreation*	Sailing Scuba diving Recreational fisheries
R&D Companies*	Aquaculture (e.g. seaweed, mussels) Technology innovation
Shipping	Merchant Navy Military Ferries
TSOs*	Offshore grid development Transport of electricity

*With (potential) claims for co-use inside wind farm areas