North Sea Energy
offshore system integration

NSE Nature-inclusive hub design
Workshop 1 - report

November 14th, 2023, 9:00 – 13:00
Location: Arcadis Office, Delftse Poort, Weena 505, Rotterdam
Participants: see appendix.

Please note that this is a generalized report focusing on the discussions during the workshop. For an overview of the presentations, please see the slide deck (separate attachment).

Welcome, introduction to NSE, and ecological impacts

Anne-Mette Jørgensen (MSG, Ecology Work Package lead for NSE5) welcomes the participants. After a quick introductory round, she introduces the programme and goals of the day (see the attached slides).
Joris Koornneef (TNO, Program Manager NSE5) introduces the North Sea Energy Program (NSE). Remco Groenenberg (TNO, Energy Hub Work Package lead for NSE5) outlines what NSE means by an energy hub and what the current expectations are for the three hubs for which NSE is currently developing spatial blueprints (see the attached slides).
Isabel Gerritsma (Deltares) introduces the work that the NSE team has already done to identify potential ecological impacts of energy technologies associated with the energy hubs (see the attached slides).

Questions and comments on this part of the program:

- When discussing the ecological impacts of a hub, we need to look at the cumulative impacts of the hub activities in combination with the planned wind farms. The cumulative impact of the wind farms in themselves might already be too high for specific species (e.g., birds).
- Most structures on the North Sea attract marine life. As such, a nature-inclusive design should go beyond the positive impact of this basic attraction.
- Next to new innovations and designs, it is necessary to consider the pressure from fishery on the ecosystem.
- What are the ecological advantages of hubs? Why do we need them? From an energy perspective, hubs are necessary for unlocking large volumes of carbon-neutral energy efficiently and robustly. Efficiency means lower costs, but also less energy infrastructure and a smaller spatial claim. Thus, the cumulative ecological footprint is (expected to be) smaller.
- Centralised hydrogen production can take place on either islands or platforms. What are the ecological implications of this choice? A range of impacts is different. Especially the construction and decommissioning phases are different: for islands lots of sand is needed, the extraction of which will have a direct impact on North Sea nature. For platforms, where steel is the primary material, the disturbance of the seabed will be smaller. Also sand islands are assumed to be permanent, unlike platforms. Depending on the number of platforms, both islands and platforms may have an impact on abiotic factors like stratification. The differences also depend on the location and scale of developments. This choice can be further discussed during the design in workshop 2.
- Ecological impacts are very scale dependent. What impacts are relevant substantially differs between 10 and 100 platforms in an area. This makes it difficult to assess the significance of specific potential impacts without knowing the location of a hub and the (scale of) activities related to the technologies inside it. For this reason, we postponed the ‘ranking’ of potential ecological impacts to a later stage.
- Will the hub design consider the impacts in the operational phase only or also in other phases? The primary focus will be on the operational phase, but we will also be looking at impacts in the preparation/construction, operational and decommissioning(/reuse) phases.

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Introduction to Seawilding

Roos Bol introduces the Seawilding Approach developed by ARK Rewilding, which will be used to design a nature-inclusive hub in workshop 2 (see the attached slides).
Questions and comments:

- Rewilding has been developed as a terrestial approach. Marine ecology is different, as the sea is much more connected – in fact most ‘nature’ in the North Sea is ‘self-willed’ in the sense that mobile species can move freely under water and settle wherever they want to, incl. on man-made structures. Of course, for some species mobility is limited in distance (e.g. larvae) and for some, especially birds, man-made structures may form a real barrier, but generally speaking this is much less so than for terrestrial environments. That means that nature restoration or rewilding in the North Sea primarily requires the creation of enabling conditions (mainly in the form of reduced fishery) for existing patches of self-willed nature to expand and grow. This 'self-willed' system behaviour could make (perhaps even passive) restoration without clear-cut pre-set goals effective.
- Should ‘poor’ nature always be improved according to the seawilding approach? Naturally, ecosystems differ in complexity. Seawilding does not dictate a certain level of complexity, but focuses on creating robust systems (which are often relatively complex).
- Seawilding may run into regulatory challenges: nature restoration projects require clear objectives and monitoring of the intended outcomes, which may be at odds with the approach of self-willed nature and unfolding outcomes.
- For the next workshop: Atlantic bluefin tuna is a relevant, protected species foraging in and around the three hubs.
- Can human-made ecosystems be more valuable than natural ones? Humans are a part of nature. As such, human-made is difficult to define. In rewilding, the goal is to give space to self-willed nature, not to specifically include or exclude human activities. However, part of the approach is also to think about what an ecosystem could be like in the future under the right conditions (‘dreaming’), considering what ecosystems in that area have been like in the (pre-historic) past. Interventions may be identified that aim to recreate elements of such historical ecosystems in combination with/making use of human activities.
- When looking at rewilding opportunities, we will need to make certain assumptions about the future state of the ecosystem, e.g., with respect to rising temperatures. With climate change, future ecosystems will be different from the ones we have today.

Dilemmas of nature-inclusive hub design

Walter Sieval (Van Oord) gives a presentation emphasizing the fact that humans *will* have a significant impact on marine nature if we want to achieve the current high ambitions for renewable offshore energy - no matter what we do. The question is what kind of nature would we like to promote/develop and what actions to we undertake to mitigate risks of negative impacts? We need to define clear project goals: e.g. what kind of nature are we striving to achieve, what is the (socio-economic) value of that nature? This may help to legitimize additional costs of a nature-inclusive hub versus a ‘standard’ hub. He proceeds to discussing what it could mean to go beyond an approach of minimizing impacts of energy hubs towards an approach of maximizing positive impacts, including out-of-the-box solutions. Focus is on the potentials for new nature that might be provided by the creation of permanent (wad) island(s) as an alternative to platforms.
Questions and comments:

- There is a difference between rewilding and “gardening”, meaning the active creation of new, non-self-willed nature.
- What would be the advantages of new (wad) islands for coastal protection? And what are and how can we estimates (potential/long-term) effects on the Wadden Sea?
- One challenge to any plan for an artificial island is the attraction of birds. Most likely, it would have to be declared a Natura2000 area because of this.
- What does it take to restore North Sea ecosystems? One view is large interventions aimed at positive impacts, like discussed in the presentation. Another view is that it mainly requires reduction of currently

damaging activities (e.g. seabed-disturbing (fishing) practices) and mitigation of new negative impacts, due to the inherent connectivity of the sea.

Discussion of opportunities and risks by hub

Ivo de Klerk (MSG) presents the considerations the NSE team has so far identified that play a role in the choice of which hub-location is most interesting for the nature-inclusive design, with input from experts participating in the survey leading up to the workshop (see the attached slides). The participants then split into sub-groups to discuss the hubs.

Hub West

Important considerations mentioned for Hub West are:

Technologies & timeline

- The tenders for wind farms in this area will be relatively soon (Nederwiek: ±2026). This means the results could directly tie into the discussion on the tender criteria, although they might also be too late.
- Looking at the planning of wind farms, it seems the area will be developed in phases. The south-west (Nederwiek) will be developed before 2031, the areas in the north and east are planned later and some are currently uncertain.
- The hub includes a lot of potential technologies, making a design interesting.
- This area includes many activities, making it important how these fit in the nature-inclusive design.
- The area includes a lot of current oil and gas production. Information and data from these existing platforms could be used to better understand what the effects of man-made structures are in this area.
- There is a multi-use opportunity in relation to the decommissioning that will take place in this area.

Ecology and morphology

- This is a highly dynamic (seabed) area compared to the others.
- Variations in depths and morphology might create opportunities for the design.
- Parts of the area have been severely disturbed by bottom trawling fisheries.
- Some of the current disturbances might not be possible to address in the design. This is important for the spatial design.
- The area is relatively close to shore, meaning less transport infrastructure and shorter vessel trips are needed.
- The south already includes (planned) artificial areas in the form of wind farms. The relation to these and possibilities for corridors/stepping stones would be a relevant consideration for the design.
- Based on the North Sea Agreement, the Frisian Front will be completely closed for bottom-trawling fisheries and have 100 km^2 of oyster reefs being actively restored.
- If the hub will be mainly or fully electric, the impacts of cables and cable crossings are an important topic to consider.
- The area intersects major bird migration routes. A nature-inclusive design should consider measures that concern light pollution (which can distract migrating birds) and the creation of corridors.
- The accessibility of the Frisian Front and Brown Ridge to auks (*alken*) and common guillemots (*zeekoeten*) is important to consider. These are shy species.
- Migration from the Frisian Front to the Cleaver Bank is important to consider.
- The position between three protected areas makes connectivity an important consideration (e.g., the creation of stepping stones).
- When considering hard vs. soft substrate, the originality of the (soft-bottom) environment should be considered.
- This area used to include the ‘Texels stones’, many of which have been fished out of the sea. In some areas, they might remain.
- Nature-inclusive decommissioning or re-use for ecological purposes is important in this area.
- Due to the proximity to the coast, a nature-inclusive design could consider how ecological challenges in the coastal area can be addressed.

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Hub North

Important considerations mentioned for Hub North are:

Technologies & timeline

- As this area will be developed relatively far in the future, now would be the time to investigate what is there and what could be there.
- As this area will be developed relatively far in the future, demos that are currently being developed could be used to refine the design in the future.
- Direct current could be used to transport large volumes of electricity. This might be an alternative to H2-production offshore, but would require large convertor stations.
- (Existing and future) Pipelines or cables towards the coast may be connected to hub-activities and cables/pipelines in the south.

Ecology and morphology

- The seabed in the area is quite muddy with some gravel and relatively deep.
- Seabed is relatively stable (low level of dynamics) compared to e.g. West (no sand waves).
- High level of stratification in waters.
- Limited fishing/bottom-trawling in the area?
- This area (south of the MSFD area (Oyster Grounds)) is very valuable in itself – high biodiversity and long-living species - and different from the MSFD area. Historically this is the area where the flat oyster banks were (not in the current MSFD Oyster Grounds area).
- Long-living species are important to consider.
- Oyster restoration on scour protection is an important opportunity to consider.
- Skates and sharks will be able to lay eggs in the gravel here.
- The development of the hub will definitely have negative effects on a slow, stratified system with long-living species.
- This area is especially interesting for mitigation measures (because of the relatively undisturbed condition), recreation and excluding fishing.
- The effects of large-scale hydrogen production are an important consideration for this area.
- What amounts of brine would be produced by the large-scale hydrogen production and could it be reinjected?
- Cooling water effluents are important to consider in a design.
- The area is not suitable for a sand/caisson island (due to the depth and muddy seabed), meaning platforms would be most logical.
- The wave intensity and transport vessel intensity around this area increase the risk of environmental disasters due to ship collisions.
- The (long-lasting) construction activities create a risk of high turbidity resulting from disturbance of the muddy seabed. This would be a serious disturbance as currently the waters are relatively clear, allowing sun light to reach relatively deep in the waters.
- Minimizing the number of cables in the sea should be a consideration (reducing seabed disturbance and minimizing electric fields).
- Tunas in the area need more fish to feed on: measures to increase fish biomass in the area would be beneficial.

Hub East

Important considerations mentioned for Hub East are:

Technologies & timeline

- Diverse types of technological activities in this hub, positive in terms of research scope and opportunities for how to translate a nature-inclusive design for this hub to other hubs.
- Wide coverage of the area by shipping lanes limits the opportunities for adding new structures (true for a hub in general, not just a nature-inclusive hub).

- Timeline for developments is quite diverse; some in between those of hub West and hub North, some further away and even more uncertain than for hub North (wind farm area 4).
- (Part of the) Area is heavily fished – potential conflicts with fisheries.

Ecology and morphology

- High biodiversity and ecological relevant area: interesting for a diversity of ecological designs (some Natura-2000 areas in the hub area)
- The Borkum Stone Reef currently has a high trophic complexity.
- In parts (southern part in any case) of the hub area, nature areas and surrounding areas will likely develop ecologically positive anyway (without significant human intervention). Thus, shouldn't the focus be on 'more difficult' areas than Hub East?
- The stratification regime could be interesting and challenging at the same time
- Less connectivity than other hubs
- Platforms are better than the alternatives in this area, given the limited availability of space.
- Oyster restoration may be an opportunity due to the already existing benthic habitat (Borkum stone reef).
- There are no large areas with strong sand wave dynamics, creating more opportunity for current NID practices (like flat oyster restoration).

General considerations

Some considerations mentioned for a specific hub are relevant for all of them:

- When looking at wind farms, their future reconstruction should also be considered. They will still be necessary after the end of life of the first generation of farms.
- Learning-by-doing and experiments should be considered. Examples are seeing what happens underneath floating installations and infrastructure and testing the use of different types of hard substrate. Small-scale developments (e.g. H2-production demos in hub West and East) should be used also to learn about the impact of H2-production in general and about potential mitigation measures.
- Marine protected areas should be excluded from the hub areas.

Conclusions

Anne-Mette thanks all the participants for their active engagement, their valuable input and the interesting discussions. The next steps are:

- The NSE team will develop a proposal for what hub to pick for the nature-inclusive design, based on the discussions during this workshop. The proposal will be shared for feedback.
- We are looking to organize the next workshop on 19 March 2024 at DMEC's office in Scheveningen. Please let us know if you would not be able to make it on this date.
- During this workshop, we will be co-creating the nature-inclusive design using the Seawilding Approach.
- In preparation for this workshop, we will be collecting background information about the ecology in the area and the characteristics of the baseline hub. Suggestions for what information is needed and especially for how to get this information is very welcome.

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Appendix: participants

- Anne-Mette Jørgensen (MSG)
- Antonios Emmanouil (Deltares)
- Bert Fokkema (Shell)
- Cas Dinjens (Arcadis)
- Debby Barbe (RWE)
- Ewa Spiesz (DMEC)
- Hein Sas (NORA)
- Isabel Gerritsma (Deltares)
- Ivo de Klerk (MSG)
- Jelle Rienstra (Deltares)
- Joris Koornneef (TNO)
- Jylles van der Vliet (MSG)
- Kees Stiggelbout (NWEA)
- Luca van Duren (Deltares)
- Maartje Hofker (Gasunie)
- Mart van der Linden (TNO)
- Nicolien Vrisou van Eck (EBN)
- Niels Verdoodt (DEME)
- Remco Groenenberg (TNO)
- Renate Olie (De Rijke Noordzee)
- Rien van Leeuwen (ARK Rewilding)
- Roos Bol (ARK Rewilding)
- Sarina Versteeg (Arcadis)
- Sophie de Reus (Stichting de Noordzee)
- Thomas Kerkhove (Instituut voor Natuurwetenschappen)
- Tim van Ooijen (Vogelbescherming)
- Tom van der Have (Bureau Waardenburg)
- Walter Sieval (Van Oord)
- Wouter van Broekhoven (Van Oord)