

M3.1 BUSINESS BRIEFS

DANISH PILOT



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OBJECTIVE OF THE PILOT

The aim of the Danish (DK) pilot was to expand the existing tourism activities and the creation of new attractions that results from shared sea space, joint on-and offshore infrastructure and operational activities.

Expansion of tourism activities was done by opening opportunities to attract new target groups, and eventually, to be part of the tourism offer in Copenhagen and its region.

CONTEXT OF THE PILOT

The pilot was developed in the year 2000 at the reef south of the Middelgrunden Island. The pilot is established 3.5 km outside of Copenhagen harbour and combines two main activities: the production of Offshore Wind Energy, and tourism activities related to visiting the Offshore Wind Farm (see below illustration).



Technological readiness level (TRL)

The pilot features 20 wind turbines with a combined capacity of 40 MW. It generates around 100 GWh of electricity annually, meeting nearly 3% of Copenhagen's electricity needs. Additionally, the pilot offers tourism activities, including educational lectures on wind energy and guided boat tours to the turbines, allowing visitors to explore them from the inside.

Over the course of the project the pilot evolved into a commercially sound business with a TRL of 9, through the expansion of the program both on site and virtually and the establishment of a safety and security framework as well as the development of a guide for tour guides to provide technical insights about the tours.

The combination of offshore wind energy with tourism activity is expected to have a good effect on the Danish pilot to scale up and reach TRL 8. The Middelgrunden Windfarm is one of only a few wind farms where visitors can visit a wind turbine and climb the nacelle. The combination of offshore wind turbines and tourism can generate long-term benefits for local communities by encouraging innovation and entrepreneurship and generating job growth. Particularly rural areas in need of economic boosts through tourism can benefit from this. The expansion of tourism related to the offshore wind farm in the Copenhagen area and beyond will help the Danish pilot to reach the targeted TRL.

Legal characterisation

The Danish Marine Spatial Planning (MSP) was developed and came into effect in 2021. However, the plan neither explicitly included nor excluded multi-use activities. In Denmark, there is no established procedure for multi-use permits, so different concessions and permits are necessary for various activities, each falling under different regulatory frameworks.

While obtaining a permit from the Danish Energy Agency is required for offshore wind farm (OWF) installations, additional activities require permission from the concession holder, which, in the case of the Danish pilot, is the OWF operator. The wind park operators have the discretion to grant or deny access to other users, irrespective of whether the intended activity requires a permit or not.

Property rights and environmental standards are overseen by Danish authorities. The Danish pilot is located in Denmark's Exclusive Economic Zone, and the location was leased from the Danish government for 25 years, starting in 2000 when the OWF was constructed. Currently, discussions are underway between the cooperative operating the OWF and the Danish government regarding the renewal of this lease.

As for insurance matters, there have been no reported issues thus far. For the planned tourism activities involving the wind turbines, the tourism operator will secure additional insurance to cover potential damage to both tourists and the turbines.





Environmental characterization

The Environmental Impact Assessment (EIA) for the Middelgrunden OWF took place in 1999. It examined the effects of the OWF on various aspects, including visual impact, noise propagation, water dynamics, plant and animal life, and fishing. This assessment included alternative site considerations and production techniques, along with measures to reduce the OWF's environmental impact.

The EIA revealed that the operational phase of the pilot had a minimal impact on the surrounding water. The environmental impact resulting from an increased level of multi-use activity (involving two or three daily boat tours) is considered insignificant compared to the traffic from the nearby port. Moreover, when assessing other activities like scuba diving, it was found that they have no significant environmental impact. Consequently, the multi-use activities associated with the pilot are not expected to notably affect the marine environment.

Finally, no significant environmental impact was reported in the EIA due to dredging activities and the presence of OWF. On the contrary, the EIA showed that the foundations of the OWF were expected to function as an artificial reef, creating a habitat for benthic organisms and increasing fish populations in the area, ultimately benefiting fishing.

Socio-economic characterization

Copenhagen is considered a tourist attraction city, it reached the 73rd place of world's most popular cities with 3.19 million visitors in 2019. The revenues from tourism activity amounts for 7.7 billion EUR (2018) and corresponds to 2.5% of the GDP of Denmark. The revenue generated from tourism activity in Copenhagen was estimated at 847 million EUR (2018).

Considering the pilot related tourism activity, the number of boat tours fluctuated during past years, reaching 75 annual trips (2022) with a turnover of 102 k EUR (2022). The boats are operated by two people and the standard fee for tourist guides in Copenhagen is applied. Moreover, an non ordinary tourist guide is present with the group visiting the OWF. During the project 2 guides have been trained, so in total there are 4 trained guides, who can open the wind turbines.

Considering the OWF, there are currently 341 OWF in Denmark with an overall installed capacity of 855 MW. The Middelgrunden OWF has an installed capacity of 40 MW representing 4.7% of the overall installed capacity for the OWF in the country. The annual production of the OWF is estimated at 100 GWh per year. Electricity production is sold on the Nord Pool market. Electricity prices varied from one year to another. It is expected that the electricity price in the coming year to increase and reach 54 EUR per MWh. Consequently, the profit from selling electricity can be estimated at 5.4 million EUR per year.

BUSINESS ANALYSIS

Business Model Canvas Results

The business model canvas shows similarities and differences in both activities of the Danish pilot.

Firstly, regarding similarities, it is worth noting that certain commonalities between the two activities of the Danish pilot have resulted in various synergies that contribute to cost reduction. One notable synergy is the shared use of the same vessel for both maintaining the offshore wind farm (OWF) and conducting tourism activity tours. So far, this is the sole synergy that has been identified. Consequently, the amalgamation of these two activities yields advantages for all parties involved. These cost savings translate into financial benefits.

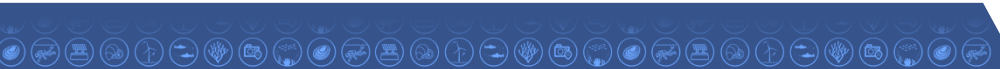
On the other hand, there are numerous distinctions between the activities of the Danish pilot. These differences manifest across all components of the business model. Therefore, the pilot combines diverse key activities, offers distinct value propositions, and targets dissimilar customer segments. Moreover, the cost and revenue structures of both activities diverge. These disparities are viewed as a source of enrichment for the pilot, particularly when it comes to reaching distinct customer segments, which allows for a diversity of customers and consequently diverse revenue streams.

From this perspective, it can be deduced that the Danish pilot is effectively generating, capturing, and delivering value from both of its activities.

SWOT Analysis for multi-use set up in the Danish pilot.

The success of the pilot is influenced by several external and internal factors.

Technological advancement can lead to a development in the pilot activities, particularly to the development of energy production and eventually to the development of tourism activities. The development of energy production activities could in turn attract more tourists interested in learning about solar energy, wave energy, and wind energy. Other positive influences are related to the social acceptance of the pilot which facilitates the development of the pilot activities and might ensure its continuity. The main threat is related to political and legal factors where non-renewal of the lease to the location of the pilot leads to an immediate end of the operations, which will also cause a loss related to transport (boat) companies and tourist guides working within the pilot.





The main strength of the pilot is the absence of competition: no other places or pilots exist that offer the same services through the combination of similar single activities.

<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> • No other places or pilots are offering the same activity • Unique boat tours and lectures on the Middelgrunden Wind Farm 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> • Dependence on the boat providers
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • Introducing incentives for repowering offshore wind giving a safer feasibility • A faster development of introducing battery storage system in the individual turbine improving feasibility • Introducing new technologies such as floating solar PV platform and wave energy harness 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> • Political rules against prolongation of the sea lease would end the work in the project • No tourism activities due to Covid restrictions • Dependence on weather conditions

POTENTIAL FINANCIAL AND ECONOMIC IMPACTS AND ADDED VALUE.

The following table summarizes the multiuse impact analysis results of the DK pilot.

Economic impact	Definition	Scale
Substitution of non-renewable energy, energy provision, in-dependence, and security	<p>With an installed capacity of 40 MW, the OWF has the capacity to produce 100 GWh of electricity per year providing an important source of electricity for 33 000 Danish households.</p> <p>Unlike traditional energy production technologies, the OWF is more sustainable, producing energy from renewable sources, reducing reliance on traditional energy provision technologies and stabilizing prices.</p> <p>The use of OWF allows for efficient and consistent energy production, making the OWF a dependable source of power.</p> <p>The increase in tourism activity is not anticipated to impact the operation of the OWF.</p>	Low; Positive.
Reduction in GHG	<p>Compared to alternative fossil fuel energy sources, the OWF contributes to avoiding 187.5 tons of Sulphur dioxide, 175 tons of nitrogen oxides, 101 250 tons of carbon dioxide, and 6 500 tons of dust and clinker per year (data from 1998 on a production of 100 GWh).</p> <p>No additional emissions from an increase in tourism activity are expected. Boat operators have been certified as green. This means that the pollution coming from these boats is negligible</p>	Low; Positive.
Benefits for local economy	<p>The OWF energy production activity will remain constant, while the number of tours for tourism activities is expected to rise to 75 annual trips from the current 40. The increase in the number of trips can have positive impacts on the tourism sector in Copenhagen, contributing to the increase in jobs, increase in turnover for boats and tourist offices, increase in the number of stays in hotels, etc.</p> <p>Estimating the direct and indirect impacts is challenging since tourists are already present in Copenhagen, but the heightened exposure is prompting them to visit the OWF.</p> <p>The pilot has gained significant attention in recent years due to various communication efforts by the UNITED project, journal articles, and television coverage.</p> <p>This exposure has encouraged more tourists to visit the pilot site.</p>	Medium; Positive





<p>Habitat and fish stock improvement</p>	<p>During the construction phase, fishing and vessel traffic were prohibited in the OWF area. But after the OWF was installed, fishing activity and vessel traffic resumed, except for trawling, which was still banned. The OWF had a positive impact on biodiversity as the foundations created a new habitat for various fish species, resulting in improved fish stock health and eventually, better catch for fishing activity.</p> <p>The increase in tourism activity will not have any significant impact on the habitat and fish stock.</p>	<p>Low; Positive.</p>
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OUTLOOK AND RECOMMENDATIONS

The analysis showed compelling arguments that can inform discussions pertaining to the future of Maritime Spatial Planning and the role of tourism related activities in a multi-use context, particularly when utilizing existing marine infrastructure, such as OWF. The core necessity lies in establishing and maintaining consistency and a long-term regulatory vision, encompassing rules and planning permissions.

Promoting the combination of multi-use could serve as a strategic tool to support the ongoing economic growth in blue economy in Europe. This holds significant relevance; especially as novel policy measures are being developed to encourage investment in the blue economy sectors. A multi-use framework, coupled with tourism activities may present a viable approach to address local acceptability, a key obstacle to the sector’s expansion in numerous coastal areas. Nevertheless, it is essential to conduct further research to quantify the extent of this potential positive impact. Exploring methods that capture public preferences could be valuable in future research on this project.





**Discover United
follow-up project:
ULFARMS**



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