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POLICY BRIEF

Key Findings and recommendations for Pilots in terms of Operation and Maintenance.

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INTRODUCTION

POLICY BRIEF FRAME

In recent years, the concept of Ocean Multi-Use (MU) has gained attention as a means of optimizing the utilization of our ocean spaces. This innovative approach involves the simultaneous and coordinated use of these spaces for various activities, such as aquaculture, renewable energy generation, and nature restoration. While MU offers promising opportunities for economic growth and environmental sustainability, it also presents unique challenges, particularly in the realms of operation and maintenance. Because the concept of Ocean Multi-Use (MU) is changing the way ocean space is being utilized an understanding of the associated challenges and the required improvements in operation and maintenance practices is necessary to ensure a successful and enduring operation of MU sites.

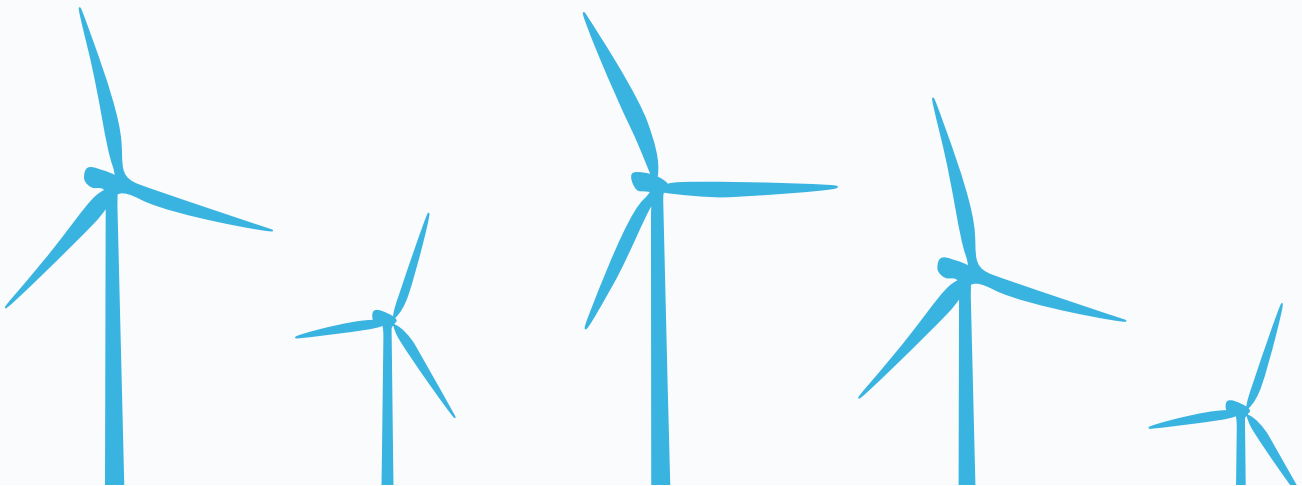
In this context, the UNITED project emerges as an important initiative aimed at promoting sustainable aquaculture and blue growth in remote and offshore regions throughout Europe. As part of the project, pilot tests were conducted in five European countries.

OUR ANALYSIS

UNITED conducted an analysis of the operation and maintenance procedures for five different pilot projects.

- **Germany:** blue mussels and seaweed cultivation with offshore wind energy
- **Belgium:** flat oyster aquaculture, restoration, and seaweed cultivation with offshore wind energy
- **The Netherlands:** offshore seaweed cultivation combined with floating solar energy
- **Denmark:** tourism with offshore wind energy
- **Greece:** fish-aquaculture with tourism

This policy brief aims to summarize the key findings and recommendations derived from the experiences and insights gathered during the implementation of these pilot projects. By analyzing the operation and maintenance strategies applied in these regions, it highlights valuable lessons and best practices that can guide the evolving landscape of ocean multi-use on a broader scale.



DEVELOPMENT

The methodology involved a comprehensive exploration of five distinct pilot projects, accompanied by interviews with pilot leads who are directly involved in each pilot's implementation.

UNITED research has generated a comprehensive list of key findings and recommendations for the operation and maintenance of ocean multi-use (MU) projects, both in a general context and within the specific combinations demonstrated in the pilot projects. **The policy brief provides a concise summary of these insights, making them easily accessible to policymakers and stakeholders for informed decision-making.**

Recommendations are suggested based on the MU combinations represented in the different UNITED pilots.

- **Block 1 Pilots**

These pilots are characterized by **combinations of Offshore Renewable Energy (ORE) with aquaculture** (these included different aquaculture types: mussels, oysters, and seaweed). This is found in the DE, BE and NL UNITED pilots.

- **Block 2 Pilots**

These pilots are characterized by a **combination of tourism with other marine uses** (Offshore Wind Farms (OWF), aquaculture). These combinations are represented in the DK and GR pilots.

KEY FINDINGS

The following key findings for the operation and maintenance of MU projects were identified:

- **Logistic and maintenance requirements become more challenging to meet** due to the location of the projects. This is particularly relevant for projects located far offshore, such as the DE and the BE pilots. Long travel times to the pilot site demand stable weather conditions to ensure safe working conditions on-site. This can lead to long stand-by times or even the cancelation of trips on short notice. Therefore, excellent communication and flexibility of all parties involved is required.

- **Regular inspections and maintenance** of offshore structures are crucial to ensure their optimal performance, longevity and safety. In the DE pilot this includes maintenance of seasonal equipment, such as mussel and algae farming gear. For the DK pilot that means, for example, regularly inspecting safety equipment. Finally, for the BE pilot the emphasis is on maintaining the submerged infrastructure such as oyster restoration tables to allow for successful oyster population recovery.

- **Proper coordination and safety measures** are essential for the success of MU projects. (Local) regulations should be strictly followed by the operators. This can particularly be noted for MU combinations allowing visitors on the operation site such as in the GR and DK pilots.

- **Remote monitoring is crucial,** to ensure the continuous monitoring of water quality parameters, including temperature, salinity, nutrient levels, SPM, and pH values to track the health, behavior, biomass estimation and growth of the organisms, in the case of aquaculture (see DE, BE, GR, NL). The Data can, furthermore, be utilized to assess fundamental environmental and conditions for the whole MU setup. In the case of ORE, remote monitoring can be used to ensure safety and economic viability (NL).

- **Decision support systems** that produce alerts and suggestions can be useful to optimize feeding, harvesting, disease prevention and planning processes of the MU, if aquaculture is involved. A decision support system was successfully integrated into the operation of the Greek pilot, combining aquaculture and diving excursions.

- **Synergies can be identified in shared logistics** for operation and maintenance, (remote) monitoring, offshore communication hub, surveillance of the area as a whole, and deployment of personnel, experience and knowledge. Utilizing synergies can be especially attractive where the remote location strongly increases the cost of operation, such as in the DE and BE projects.

- **Integrating tourism activities with ORE or aquaculture,** as done in the DK and GR pilot, enhances the visitor's understanding of the activity's technology and its sustainability impact and increases the population's acceptance. The development of informative and educational content is crucial to have a lasting influence on visitors.

KEY FINDINGS

Nevertheless, despite the challenges, the MU combinations analyzed are viewed as a promising approach to support the adoption of sustainable practices in the blue economy in the years ahead. These pilot initiatives have played a role in advancing the growth of their respective blue economy sectors.

The successful implementation and management of blue mussel and algae cultivation in offshore wind parks require strategic actions. Establishing a dedicated maintenance team, implementing advanced remote sensing technologies, and fostering collaboration with offshore wind park operators are crucial steps towards realizing the full potential of this environmentally friendly approach. By following these recommendations, policymakers can create a favorable environment for sustainable offshore aquaculture development, leading to economic growth and ecological preservation.

RECOMMENDATIONS

Block 1 – ORE and Aquaculture (BE, NL, DE)

- **Implement regular monitoring** of organism growth, health and water quality parameters.

  a. Establish a dedicated maintenance team consisting of aquaculture and offshore specialists.
  b. Vessels should be available all year around to perform the necessary tasks and allow for flexibility regarding the weather conditions.

- **Implement advanced remote sensing technologies** to monitor the growth and health of the organisms, as well as the installation as a whole. Energy generated offshore could be used to power these monitoring systems.

- **Improve harvesting techniques** both offshore and on land to optimize productivity, reduce environmental impact and ensure timely harvesting. This is particularly crucial for submerged mussel systems (DE pilot) but relevant also to other types of aquacultures as they spoil if not processed or cooled after harvest.

  a. Adequately equipped ships should be utilized to avoid loss of harvest on the long trips to shore. This is particularly important when the MU site is located far offshore, as represented by the DE pilot.
  b. Explore, test and acquire innovative technologies for automated harvesting and processing of the algae.
  c. Create a harbour site equipped for storage, processing, and distribution of the aquaculture product.

- **Collaboration between the different operators** within an MU project should already be established during the planning phase of a new site to ensure the compatibility, correct placement and protection of for example, aquaculture infrastructure and activities with wind farm operations (BE pilot). This should be added as a legal requirement to MU undertakings.

- **Extend collaboration to maintenance and operation activities** by sharing for example vessels, vessel time, other equipment, emergency operation.

- **Further explore synergies** of the different MU combinations, for example, the dampening effects of the offshore solar farm and its added value for the algae cultivation industry in the NL pilot.

- **Establish partnerships with research institutions** to study and optimize exploitation and growth techniques, which would be especially relevant for the oyster restoration efforts in the BE pilot.

RECOMMENDATIONS

Block 2 – Tourism and ORE/Aquaculture (GR, DK)

- **Develop comprehensive safety guidelines and protocols** for tourists during their visits at the ORE or aquaculture site.
- **Conduct regular maintenance on infrastructure** to ensure structural integrity.
- **Collaborate with local tourism authorities** to promote the tours and educate visitors about ORE/aquaculture.
- **Provide an extensive educational program** to the visitors, including videos, photos, site visits and lectures.
- **Implement a visitor management strategy** to prevent overcrowding, reduce environmental impact, and ensure a high-quality experience for tourists.

NEXT STEPS AND CONCLUSION

The pilot test sites in DE, NL, BE, GR, DK have provided valuable insights into the operation and maintenance aspects of MU projects.

Key findings emphasize the importance of regular infrastructure maintenance, water quality monitoring, efficient harvesting techniques, and visitor safety measures.
These findings can contribute to the development of best practices and policies for sustainable offshore renewable energy, aquaculture, and tourism in the EU and beyond, fostering economic growth and environmental conservation.
More particularly, **at the national level, these findings have the potential to inform licensing procedures for offshore MU projects, shape regulations governing their operation and maintenance, and influence strategies concerning financing and research initiatives for innovative harvesting and monitoring technologies.**

Furthermore, at the pilot level, **these discoveries and recommendations could contribute to maritime safety protocols, guidelines for offshore operations, as well as essential guidance and requirements related to aquaculture management and mitigation strategies**.

Regarding the **ORE sector, the recommendations presented in this policy brief could be taken into consideration when developing the guidance and requirements for user representation, engagement procedures throughout the various stages (from initial planning and construction to ongoing operation), the formulation of mitigation plans and the establishment of compensation mechanisms**.

As we proceed, it is crucial to prioritize efforts that facilitate the integrated, sustainable, and financially viable operation of multi-use projects.

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