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BEYOND

INTERREG ITALY-CROATIA
PROGRAMME 2021 – 2027

BEYOND - Blue Economy sYnergies fOr sustainable Development

D.1.4.3 – BES synergies - best practice review

INTERREG ITALY-CROATIA PROGRAMME 2021 – 2027

Standard Call for Proposals

Programme priority: Sustainable growth in the blue economy

Specific objective: 1.1: Developing and enhancing research and innovation capacities and the uptake of advanced technologies

Project: BEYOND - Blue Economy sYnergies fOr sustainable Development

Activity:	D.1.4.3 BES synergies - best practice review
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Sommario

1 Executive summary

This deliverable presents a **catalogue of best-practice examples** integrating offshore wind farms (OWFs) with other Blue Economy Sectors (BES). It is produced under **Activity 1.4** of the Interreg Italy–Croatia Project **BEYOND (Blue Economy sYnergies fOr sustainable Development)**, whose overarching goal is to demonstrate how OWFs can move beyond purely grid-connected power generation to create multi-faceted, sustainable impacts in marine areas. By reviewing cases from outside the Italy–Croatia programme area—particularly in established and front-runner regions such as the North Sea—this document offers insights into practical approaches, challenges, and solutions that can inform the design of integrated OWFs in the Adriatic.

The best practices highlighted here serve as a reference for:

1. **Showcasing Real-World Synergies**
   - The examples illustrate how OWFs have successfully co-located with aquaculture, tourism, advanced floating technologies, and other marine resource uses, maximizing space and infrastructure while protecting marine ecosystems.
2. **Guiding the BEYOND Model Development**
   - Insights from these best practices help project partners adapt synergy approaches and address potential barriers—regulatory, technical, financial—when piloting novel uses of offshore wind infrastructure in the four Adriatic pilot regions.
3. **Engaging and Informing Stakeholders**
   - The catalogue demonstrates concrete benefits (e.g., job creation, diversified revenue streams, improved acceptance through community co-ownership) and highlights lessons learned, thus facilitating informed discussions within SBE labs and wider stakeholder networks.

Through this best-practice review, the BEYOND partnership gains concrete reference points to shape its model of **multifaceted offshore wind infrastructure**. By drawing on these lessons—particularly regarding stakeholder involvement, technical resilience, and regulatory harmonization—project partners will be positioned to drive **marine spatial efficiency**, **economic growth**, and **environmental well-being** in the Adriatic

1.1 Key Best-Practice Examples

The examples presented collectively demonstrate that **OWFs can be a catalyst for diversified marine economies**, balancing energy production with environmental stewardship and socio-economic development. For Adriatic regions, many of these principles—stakeholder collaboration, regulatory simplification, and pilot-scale innovation—are key to unlocking new revenue streams, improving marine biodiversity, and bolstering public support. The lessons gathered here feed directly into the BEYOND project's broader aim of establishing integrated OWFs that yield tangible benefits for fishing, aquaculture, tourism, and potential future applications such as green hydrogen production.

1. **North Sea Aquaculture Integration**
   - Demonstrates the successful deployment of submersible mussel farms within an offshore wind farm. It provides a model for integrating low-trophic aquaculture to optimize space and enhance sustainable seafood production.
2. **Hywind Scotland**
   - As the world's first commercial-scale floating offshore wind farm, Hywind proves the feasibility of wind power generation in deep waters. Its pioneering status paves the way for multi-use initiatives in regions unsuitable for fixed-bottom foundations.
3. **Middelgrunden Offshore Wind Farm**
   - Renowned for its community ownership model and integration with tourism. Proximity to Copenhagen enables educational tours, bringing the public closer to the realities of renewable energy production and fostering broad social acceptance.
4. **Saint Nazaire Offshore Wind Farm**
   - Illustrates how OWFs can be embedded in local socio-economic fabric. Through boat tours, maintenance-base visits, and cooperation with regional stakeholders, Saint Nazaire covers 20% of Loire-Atlantique's electricity consumption while simultaneously boosting employment and public engagement.
5. **Saint Brieuc Offshore Wind Farm**
   - Highlights the role of local economic development programs (IBReizh) and environmental impact management. Close collaboration with fishermen and other local actors has reduced conflict, contributed to job creation, and maintained marine biodiversity.
6. **Wier & Wind Pilot Project**
   - Demonstrates large-scale, automated seaweed cultivation in the North Sea. With an innovative mechanized harvesting system, it showcases how co-located offshore aquaculture can provide both economic and environmental benefits by leveraging existing OWF infrastructure.

1.2 Common Success Factors and Lessons Learned

- **Strong Stakeholder Engagement**: Early, transparent communication with local communities, fishers, regulators, and research institutions fosters acceptance, reduces conflict, and promotes synergies.
- **Robust Regulatory and Policy Support**: Streamlined permitting processes and maritime spatial planning frameworks enable co-location of multiple marine uses within the same area.
- **Adaptive Management**: Continuous monitoring of environmental and operational indicators ensures that negative impacts are mitigated quickly and positive outcomes are amplified.
- **Technological Innovation**: Submersible farming equipment, floating turbine foundations, and automated harvesting systems open the door to new synergy opportunities, especially in harsh or deep-water environments.
- **Economic and Social Benefits**: Co-owned models and strong community ties often lead to higher social acceptance, while job creation and local supply chains expand the socio-economic impact of offshore wind.

2 Introduction

2.1 Background and Context

Project **BEYOND (Blue Economy sYnergies fOr sustainable Development)** is part of the Interreg Italy–Croatia Programme 2021–2027 and aims to demonstrate alternative uses of Offshore Wind Farms (OWFs) beyond their traditional role of providing grid-connected electricity. Specifically, it seeks to:

- Enhance synergies with other Blue Economy Sectors (BES) such as fishing, aquaculture, and emerging renewable energy forms (e.g., green hydrogen production).
- Improve the quality of marine ecosystems by supporting responsible multi-use of maritime space.
- Increase stakeholder engagement across regions, fostering innovation and shared best practices.

Within **Work Package 1 (WP1)**, which establishes the knowledge base for offshore wind energy use in four pilot regions, **Activity 1.4** focuses on analyzing and demonstrating potential synergies between OWFs and other BES. This best-practice review—**Deliverable D1.4.3**—is intended to showcase examples from outside the Italy–Croatia programme area, especially from front-runner regions in the North Sea and beyond. By examining real-world success stories, challenges, and lessons learned, this catalogue provides a reference for partners and stakeholders to envision how similar approaches can be adapted or replicated in the Adriatic regions.

2.2 Purpose and Goals of This Deliverable

This document serves as:

1. **A Catalogue of Synergy Best Practices**: Highlighting OWF projects that successfully integrate other BES (e.g., aquaculture, tourism, seaweed cultivation, floating wind structures, etc.) to optimize marine space and resources.
2. **A Reference for the BEYOND Model**: Offering concrete, real-world insights that can guide partners in developing or refining their own multi-use strategies for offshore wind.
3. **Stakeholder Engagement Tool**: Providing evidence of feasibility, benefits, and lessons learned to encourage participation and support from regional authorities, industry, and local communities.

In keeping with Activity 1.4, the review does not only focus on **positive aspects** but also discusses **potential risks or negative experiences**—thereby contributing to a balanced overview.

2.3 Link to the Overall Project

- **Baseline Scenario**: The earlier deliverables under WP1 establish a "business as usual" scenario, evaluating maximum potential for different blue economy sectors without cross-sectoral synergies.
- **Added Value of Synergies**: The best-practice examples in this catalogue illustrate how joint development of OWFs and BES can unlock added value—ranging from shared infrastructure to biodiversity benefits—ultimately informing subsequent tasks and pilot designs in the BEYOND project.
- **Future Steps**: Insights from these best-practice examples will feed into the development of the BEYOND integrated OWF model and inform policy recommendations, capacity-building activities, and stakeholder workshops (e.g., the **SBE labs**).

2.3.1 How This Document Supports Activity 1.4 and WP1

- **Activity 1.4** calls for an overview of best practices in regions outside the programme area to contrast and improve upon "business as usual" scenarios.
- **WP1** emphasizes establishing a solid knowledge base for current offshore wind energy use and exploring potential for synergy. This catalogue helps close information gaps by illustrating how multi-use solutions have been realized in practice.

- **Feedback Loop**: The deliverable will feed into stakeholder discussions, especially within the **SBE labs**, guiding participants as they co-design synergy approaches for the four pilot regions.

Best Practices Catalogue

3 North Sea Aquaculture Integration

3.1 General Information

3.1.1 Proposing Organization:

Wageningen University & Research (WUR) in collaboration with the North Sea Farm Foundation and industry partners.

3.1.2 Sector of Application:

Offshore wind farms (OWF) and low-trophic aquaculture.

3.1.3 Location:

Dutch North Sea, specifically within the Borssele offshore wind farm.

3.1.4 Context and Objective:

The project aims to integrate low-trophic aquaculture, such as mussel and seaweed farming, within offshore wind farms to optimize space utilization, enhance sustainable seafood production, and contribute to a circular blue economy.

WUR

3.2 Description of the Best Practice

3.2.1 Summary of the Practice:

The initiative involves deploying submersible mussel farms within the Borssele OWF. By co-locating aquaculture systems with wind energy infrastructure, the project seeks to create synergies that benefit both sectors.

PMaritime Spatial Planning

3.2.2 Unique or Innovative Approach:

This practice pioneers the multi-use of marine spaces by combining renewable energy production with sustainable aquaculture. The use of submersible longline systems for mussel cultivation is tailored to withstand offshore conditions, representing a novel application in the North Sea context.

CORE

3.2.3 Stakeholder Involvement:

The project is a collaborative effort among academic institutions, industry partners, and governmental bodies. Stakeholders include WUR, the North Sea Farm Foundation, aquaculture enterprises, and offshore wind farm operators.

WUR

3.3 Challenges and Solutions

3.3.1 Key Risks or Identified Challenges:

- Technical challenges related to the deployment and maintenance of aquaculture systems in high-energy offshore environments.
- Regulatory and permitting hurdles associated with multi-use of marine spaces.
- Potential ecological impacts, including interactions with existing marine ecosystems.

3.3.2 Mitigation Measures Adopted:

- Development of robust, submersible aquaculture structures designed to endure offshore conditions.
- Engagement with regulatory agencies to navigate and streamline permitting processes.
- Comprehensive environmental impact assessments to monitor and mitigate ecological effects.

3.3.3 Lessons Learned:

- Early and continuous stakeholder engagement is crucial for addressing concerns and ensuring project alignment.
- Adaptive management strategies are essential to respond to technical and environmental challenges.

3.4 Results and Benefits

3.4.1 Achieved Results

- Successful installation and operation of submersible mussel farming systems within the Borssele OWF.
- Demonstrated feasibility of co-locating aquaculture with offshore wind infrastructure.

3.4.2 Benefits for the Community or Environment:

- Enhanced sustainable seafood production contributing to food security.
- Efficient use of marine space supporting both energy and food sectors.
- Potential positive ecological effects, such as habitat provision and increased biodiversity.

3.4.3 Success Indicators:

- Operational submersible mussel farms producing marketable yields.
- Positive stakeholder feedback and interest in scaling the approach.

3.5 Applicability and Scalability

3.5.1 Success Factors:

- Strong collaboration between research institutions, industry, and government.
- Innovative technological solutions tailored to offshore conditions.

3.5.2 Challenges Addressed

- Overcoming technical and regulatory barriers to multi-use of marine spaces.
- Ensuring economic viability and environmental sustainability.

3.5.3 Replication or Scalability Potential:

- High potential for replication in other offshore wind farms, particularly in regions with suitable conditions for low-trophic aquaculture.
- Scalability depends on continued technological advancements and supportive regulatory frameworks.

3.6 References and Contacts

3.6.1 Documentation and Supporting Sources:

- Wageningen University & Research - Offshore Wind Energy: Opportunities for Aquaculture and Passive Gear Fisheries. WUR
- Submersible Mussel Farms in Offshore Wind Farms - European MSP Platform. Maritime Spatial Planning
- Business Case for Mussel Aquaculture in Offshore Wind Farms in the Dutch North Sea. CORE

3.6.2 Contact for Further Information:

- **Name:** Dr. Marnix Poelman
- **Email:** marnix.poelman@wur.nl
- **Phone:** +31 317 487 418

4 Hywind Scotland – World's First Floating Offshore Wind Farm

4.1 General Information

4.1.1 Proposing Organization:

Equinor (formerly Statoil) in partnership with Masdar.

4.1.2 Sector of Application:

Renewable Energy – Offshore Wind.

4.1.3 Location:

Approximately 25 kilometers off the coast of Peterhead, Scotland, in the North Sea.

4.1.4 Context and Objective:

Hywind Scotland is the world's first commercial-scale floating offshore wind farm, aiming to demonstrate the feasibility and scalability of floating wind technology in deepwater locations unsuitable for traditional fixed-bottom turbines.

Equinor

4.2 Description of the Best Practice

4.2.1 Summary of the Practice:

Commissioned in 2017, Hywind Scotland consists of five 6 MW Siemens Gamesa turbines mounted on floating spar-buoy structures, with a total installed capacity of 30 MW. The project showcases the potential for deploying wind turbines in deeper waters, expanding the geographical reach of offshore wind energy.

Equinor

4.2.2 Unique or Innovative Approach:

The floating design allows turbines to be installed in waters up to 120 meters deep, where traditional fixed-bottom structures are impractical. This innovation opens new areas for wind energy development, particularly in regions with deep coastal waters.

Equinor

4.2.3 Stakeholder Involvement:

The project is a collaboration between Equinor and Masdar, with support from the Scottish Government and various industry partners, highlighting the importance of public-private partnerships in advancing renewable energy technologies.

4.3 Challenges and Solutions

4.3.1 Key Risks or Identified Challenges:

- Technical challenges associated with floating structures in harsh marine environments.
- Grid integration and energy transmission from offshore locations.
- High initial capital expenditure compared to traditional offshore wind farms.

4.3.2 Mitigation Measures Adopted:

- Extensive testing and modeling to ensure structural stability and durability.
- Implementation of advanced anchoring systems and dynamic cables to accommodate movement.
- Strategic site selection near existing infrastructure to facilitate grid connection.

4.3.3 Lessons Learned:

- Floating wind technology can achieve high-capacity factors, demonstrating reliability and efficiency.

- Early engagement with stakeholders and thorough environmental assessments are crucial for project success.

4.4 Results and Benefits

4.4.1 Achieved Results:

- Hywind Scotland has consistently achieved high capacity factors, reaching 57.1% in its first two years of operation, outperforming traditional offshore wind farms. Equinor
- The project generates enough electricity to power approximately 20,000 households, contributing significantly to Scotland's renewable energy targets. Nexans

4.4.2 Benefits for the Community or Environment:

- Reduction in greenhouse gas emissions by providing clean, renewable energy.
- Creation of jobs and stimulation of the local economy through construction and maintenance activities.
- Advancement of technology that minimizes visual and environmental impacts compared to onshore wind farms.

4.4.3 Success Indicators:

- High and consistent capacity factors indicating efficient energy production.
- Positive environmental impact assessments and minimal disruption to marine ecosystems.
- Recognition and awards within the renewable energy industry for innovation and performance.

4.5 Applicability and Scalability

4.5.1 Success Factors:

- Innovative engineering solutions enabling deployment in deep waters.
- Strong partnerships between industry leaders and government bodies.
- Commitment to research and development to overcome technical challenges.

4.5.2 Challenges Addressed:

- Overcoming the limitations of traditional offshore wind installations restricted to shallow waters.
- Demonstrating the commercial viability of floating wind technology to attract investment.

4.5.3 Replication or Scalability Potential:

- The success of Hywind Scotland paves the way for larger floating wind farms globally, particularly in regions with deep coastal waters.
- Ongoing projects, such as Hywind Tampen in Norway, are scaling up the technology to further reduce costs and enhance performance. Wikipedia

4.6 References and Contacts

4.6.1 Documentation and Supporting Sources:

- Equinor – Hywind Scotland: Equinor
- Wikipedia – Hywind Scotland: Wikipedia
- Equinor – Hywind Scotland Facts: Equinor
- Nexans – Hywind Project: Nexans
- Equinor – Hywind Scotland Performance: Equinor

4.7 Contact for Further Information:

- **Name:** Equinor Press Office
- **Email:** info@equinor.com
- **Phone:** +47 51 99 00 00

5 Middelgrunden Offshore Wind Farm – Integrating Renewable Energy with Tourism

5.1 General Information

5.1.1 Proposing Organization:

Middelgrunden Wind Turbine Cooperative in partnership with Copenhagen Energy (now HOFOR).

5.1.2 Sector of Application:

Renewable Energy – Offshore Wind; Tourism.

5.1.3 Location:

Approximately 3.5 kilometers off the coast of Copenhagen, Denmark, in the Øresund Strait.

5.1.4 Context and Objective:

Middelgrunden Offshore Wind Farm was established to provide sustainable energy to Copenhagen while serving as a landmark that promotes public engagement and tourism, demonstrating the harmonious coexistence of renewable energy infrastructure and recreational activities.

Maritime Spatial Planning

5.2 Description of the Best Practice

5.2.1 Summary of the Practice:

Operational since 2000, Middelgrunden consists of 20 wind turbines, each with a capacity of 2 MW, totaling 40 MW. The wind farm is co-owned by a cooperative of over 8,500 members and the local utility company. Its proximity to Copenhagen has made it accessible for educational tours and boat trips, integrating renewable energy production with tourism and public outreach.

Maritime Spatial Planning

5.2.2 Unique or Innovative Approach:

The cooperative ownership model fosters community involvement and acceptance. The wind farm's design and location near a major city make it a visible symbol of sustainable development, attracting visitors and educational groups interested in renewable energy.

H2020 United

5.2.3 Stakeholder Involvement:

Stakeholders include the Middelgrunden Wind Turbine Cooperative, HOFOR (Copenhagen's utility company), local residents, tourists, educational institutions, and environmental organizations. The cooperative model ensures active participation and investment from the community.

H2020 United

5.3 3. Challenges and Solutions

5.3.1 Key Risks or Identified Challenges:

- Ensuring safety and accessibility for tourists visiting an operational offshore wind farm.
- Balancing energy production activities with tourism and educational visits.

- Maintaining public interest and engagement over time.

5.3.2 Mitigation Measures Adopted:

- Organizing guided boat tours with safety briefings and appropriate measures to ensure visitor safety.
- Scheduling visits during periods that do not interfere with maintenance or operational activities.
- Developing educational materials and programs to keep the public informed and engaged.

5.3.3 Lessons Learned:

- Proximity to urban centers enhances public engagement and educational opportunities.
- Community ownership models can increase public acceptance and support for renewable energy projects.
- Integrating tourism with renewable energy infrastructure requires careful planning to ensure safety and operational efficiency.

5.4 Results and Benefits

5.4.1 Achieved Results:

- Middelgrunden supplies approximately 3% of Copenhagen's electricity consumption, contributing significantly to the city's renewable energy goals.
- The wind farm has become a notable landmark, attracting over 30 boat visits annually and serving as an educational site for schools and universities.

H2020 United

5.4.2 Benefits for the Community or Environment:

- Provides clean energy, reducing carbon emissions and environmental impact.
- Offers educational and recreational opportunities, raising awareness about renewable energy.
- Strengthens community involvement through cooperative ownership, fostering a sense of pride and responsibility.

5.4.3 Success Indicators:

- High levels of community investment and participation in the cooperative.
- Consistent visitor numbers for tours and educational programs.
- Stable and efficient energy production meeting projected outputs.

5.5 Applicability and Scalability

5.5.1 Success Factors:

- Strategic location near a major city enhances visibility and accessibility.
- Community ownership fosters public support and engagement.
- Integration of tourism and education with energy production promotes broader acceptance of renewable energy projects.

5.5.2 Challenges Addressed:

- Overcoming public resistance through cooperative ownership and transparency.
- Ensuring the safety of visitors in an operational industrial setting.
- Balancing multiple uses of the site without compromising energy production efficiency.

5.5.3 Replication or Scalability Potential:

- The model is replicable in other coastal cities with suitable offshore wind resources.
- Success depends on community engagement, safety considerations, and proximity to urban centers to attract visitors.
- Scalability may be influenced by local regulations, maritime conditions, and public interest.

5.6 References and Contacts

5.6.1 Documentation and Supporting Sources:

- European MSP Platform – Visiting Middelgrunden Wind Farm: Maritime Spatial Planning
- H2020 UNITED – Offshore Wind and Tourism in Denmark: H2020 United

5.6.2 Contact for Further Information:

- **Name:** Hans Christian Sørensen
- **Email:** hans.christian.sorensen@spoek.dk
- **Phone:** +45 33 93 07 00

6 Saint Nazaire Offshore Wind Farm – Integrating Renewable Energy with Tourism

6.1 General Information

6.1.1 Proposing Organization:

Consortium led by EDF Renouvelables and including Enbridge Inc. and General Electric.

6.1.2 Sector of Application:

Renewable Energy – Offshore Wind; Tourism.

6.1.3 Location:

Between 12 and 20 km off the coast of Loire-Atlantique, France

6.1.4 Context and Objective:

Saint Nazaire Offshore Wind Farm was established to provide sustainable energy to Loire-Atlantique, covering the equivalent of 20% of the electricity consumption of the region, while serving as a landmark that promotes public engagement and tourism, demonstrating the harmonious coexistence of renewable energy infrastructure and recreational activities.

Maritime Spatial Planning

6.2 Description of the Best Practice

6.2.1 Summary of the Practice:

Saint-Nazaire offshore wind parc has been in operation since the end of 2022. The wind farm includes 80 offshore wind turbines, each with a capacity of 6 megawatts (MW), for a total output of 480 MW.

The site is accessible for educational tours and boat trips, integrating renewable energy production with tourism and public outreach.

Different visits to the OWF infrastructure are available:

- the maintenance base can be visited during school holidays and provides to visitors a “behind-the-scenes” look at the operation and maintenance of the wind farm;
- the offshore wind farm installation can be visited through the boat operator Navix.

Maritime Spatial Planning

6.2.2 Unique or Innovative Approach:

Organizing activities like meetings, workshops, carerr days fosters community involvement and acceptance. The wind farm's design and location near an highly developed region make it a visible symbol of sustainable development, attracting visitors and educational groups interested in renewable energy.

[Visites du parc éolien en mer de Saint-Nazaire avec NAVIX]

[Visitez EOL Centre éolien – 1er lieu de visite en France dédié à l'éolien en mer]

6.2.3 Stakeholder Involvement:

Stakeholders include EDF Renouvelables and including Enbridge Inc. and General Electric, local residents, tourists, educational institutions, and environmental organizations. The cooperative model ensures active participation and investment from the community.

6.3 3. Challenges and Solutions

6.3.1 Key Risks or Identified Challenges:

- Ensuring safety and accessibility for tourists visiting an operational offshore wind farm
- Balancing energy production activities with tourism and educational visits
- Maintaining public interest and engagement over time
- Ensuring Loire-Atlantique region to benefit from economic development, mainly in terms of creating new jobs

6.3.2 Mitigation Measures Adopted:

- Organizing guided boat tours with safety briefings and appropriate measures to ensure visitor safety
- Scheduling visits during periods that do not interfere with maintenance or operational activities
- Developing educational materials and programs to keep the public informed and engaged
- Participating in regional and local events to promote seafaring professions

6.3.3 Lessons Learned:

- Proximity to urban centres enhances public engagement and educational opportunities
- Community involvement can increase public acceptance and support for renewable energy projects

- Integrating tourism with renewable energy infrastructure requires careful planning to ensure safety and operational efficiency
- Informing the public on offshore wind energy professions leads community to better understand how it can benefit from the project

6.4 Results and Benefits

6.4.1 Achieved Results:

- Saint-Nazaire covers the equivalent of 20% of the electricity consumption of Loire-Atlantique region, contributing significantly to the area's renewable energy goals
- The wind farm has become a notable landmark, attracting over 19 boat visits annually and serving as an educational site for schools and universities.

Visites du parc éolien en mer de Saint-Nazaire avec NAVIX

Visitez EOL Centre éolien – 1er lieu de visite en France dédié à l'éolien en mer

6.4.2 Benefits for the Community or Environment:

- Provides clean energy, reducing carbon emissions and environmental impact
- Offers educational and recreational opportunities, raising awareness about renewable energy
- Strengthens community involvement through, fostering a sense of pride and responsibility.

6.4.3 Success Indicators:

- High levels of community investment and participation in the cooperative
- Consistent visitor numbers for tours and educational programs
- Collaboration with EOL Wind Energy Centre, the first site dedicated to the offshore wind adventure offering interactive tours and activities
- Stable and efficient energy production meeting projected outputs
- A team in charge of port, industrial and territorial relations has been set up and is working closely with local companies to support them in the offshore wind market
- The project owner has entrusted 5% of the total volume of hours necessary for the construction and operation of the park to people who are far from employment

6.5 Applicability and Scalability

6.5.1 Success Factors:

- Strategic location near a highly developed region enhances visibility and accessibility
- Relations with local actors in employment, training and integration promotes a clearer understanding of how the entire community can economically benefit from the project
- Actions to inform companies and socio-economic actors about the industrial needs of the project and the opportunities for the creation of associated activities creates a strong bond with local community
- Integration of tourism and education with energy production promotes broader acceptance of renewable energy projects
- Environmentally conscious project

6.5.2 Challenges Addressed:

- Overcoming public resistance through participation in forums, conferences and information meetings for students, job seekers or professionals in retraining
- Ensuring the safety of visitors in an operational industrial setting
- Balancing multiple uses of the site without compromising energy production efficiency
- Developing a project in line with local environmental issues (animal and plant biodiversity, quality of the aquatic environment, visual impact, professional fishing, maritime safety)
-

6.5.3 Replication or Scalability Potential:

- The model is replicable in other coastal regions with suitable offshore wind resources
- Success depends on community engagement, safety considerations, and proximity to urban centers to attract visitors
- Scalability may be influenced by local regulations, maritime conditions, and public interest

6.6 References and Contacts

6.6.1 Documentation and Supporting Sources:

- European MSP Platform – Visiting to the Offshore Wind Farms in Saint-Nazaire: Maritime Spatial Planning
- Parc éolien en mer de St-Nazaire - Parc éolien en mer de St-Nazaire
- Navix – Boat Visits to the Parc éolien en mer de Saint-Nazaire: Visites du parc éolien en mer de Saint-Nazaire avec NAVIX
- EOL Wind Energy Centre: Visitez EOL Centre éolien – 1er lieu de visite en France dédié à l'éolien en mer

7 Saint Brieuc Offshore Wind Farm – Integrating Renewable Energy with Tourism

7.1 General Information

7.1.1 Proposing Organization:

The project was developed by Ailes Marines, a company 100% owned by the energy company IBERDROLA

7.1.2 Sector of Application:

Renewable Energy – Offshore Wind; Tourism

7.1.3 Location:

Located 16 km off the French coast, in Saint-Brieuc bay (Brittany)

7.1.4 Context and Objective:

Saint-Brieuc Offshore Wind Farm produces 25% of the electricity consumption of the Breton population (850,000 inhabitants), while serving as a landmark that promotes public engagement and tourism, demonstrating the harmonious coexistence of renewable energy infrastructure and recreational activities.

Maritime Spatial Planning

7.2 Description of the Best Practice

7.2.1 Summary of the Practice:

Started in early 2021, the offshore wind farm of Saint-Brieuc is composed of 62 turbines of 8MW each, with a total capacity of 496 MW. The turbines cover an area of 75 km^2.

The site is accessible for educational tours and boat trips, integrating renewable energy production with tourism and public outreach.

In June 2023 the boat company Les Vedettes de Bréhat organized the first tours around the offshore wind farm. A 2h30 boat trip, during which the operator provides information (previously validated by the wind farm operator) about the wind farm to the visitors. This emerging “industrial tourism” also aims to inform citizens about the offshore wind farm. Given the success of the initiative, the boat company has decided to increase its offer by proposing further tours in future years.

In parallel with the deployment of the offshore wind farm in the bay of Saint-Brieuc, Ailes Marines has initiated the IBReizh economic development programme, designed to support projects designed by local operators in Brittany. Led by Ailes Marines and co-piloted by the Brittany Region, this 7-year programme aims to support actions related to the sea and renewable energies by relying on key players committed to local dynamics. Four areas of intervention have been identified in connection with energy and the sea: economic development, support for the fishing sector, environment/biodiversity and tourism. The programme is managed, for each theme, by local network heads who act as an interface with project leaders within the framework of specific calls for projects or collections. Local network heads include:

- Allies Marines
  A sustainable and integrated aquaculture farm within the Saint-Brieuc offshore wind farm. - Ailes Marines aquaculture

- Région Bretagne

  Les énergies marines en Bretagne · Région Bretagne

- Pole Mer
  Pôle Mer Bretagne Atlantique

- France Energies Marines
  France Énergies Marines - The institute for energy transition dedicated to offshore wind

- CCI de Bretagne
  [MARITIME] The I BREIZH | CCI of Brittany

The IBReizh Program - Marine Wings

Maritime Spatial Planning

7.2.2 Unique or Innovative Approach:

As seen in the previous paragraph, Ailes Marines has initiated the IBReizh economic development programme, designed to support projects designed by local operators in Brittany. Led by Ailes

Marines and co-piloted by the Brittany Region, this 7-year programme aims to support actions related to the sea and renewable energies by relying on key players committed to local dynamics.

Ailes marines put in place many measures aimed at reducing the impact of the wind farm involving the marine environment and fishing:

- Reduction and Avoidance measures: noise reduction measures, reduction of photoattraction;
- Compensation measures: improvement of the tranquillity of marine mammals, restoration project for some species;
- Accompanying measures: experimentation with a collision avoidance system, noise impact study, turbidity modelling.

The wind farm's design and location near a highly developed region make it a visible symbol of sustainable development, attracting visitors and educational groups interested in renewable energy.

The IBReizh Program - Marine Wings

The measures put in place - Ailes Marines

A visit to the heart of the park - Ailes Marines

Visit to the heart of the wind farm - Vedettes de Bréhat

7.2.3 Stakeholder Involvement:

Stakeholders include Allies Marines (IBERDROLA), Région Bretagne, Pole Mer, France Energies Marines, CCI de Bretagne, local residents, tourists, educational institutions, and environmental organizations.

Cooperation between different actors to protect the environment and develop local economy ensures active participation and investment from the community.

7.3 3. Challenges and Solutions

7.3.1 Key Risks or Identified Challenges:

- Ensuring safety and accessibility for tourists visiting an operational offshore wind farm
- Balancing energy production activities with tourism and educational visits
- Maintaining public interest and engagement over time
- Ensuring Brétagne region to benefit from economic development
- Protecting the marine environment and fishing

7.3.2 Mitigation Measures Adopted:

- Organizing guided boat tours with safety briefings and appropriate measures to ensure visitor safety
- Scheduling visits during periods that do not interfere with maintenance or operational activities
- Developing educational materials and programs to keep the public informed and engaged
- Participating in regional and local events to promote seafaring professions
- Adopting Reduction, compensation and accompanying measures
- Conducting environmental studies to assess the impacts of the wind farm on the marine environment

7.3.3 Lessons Learned:

- Proximity to urban centres enhances public engagement and educational opportunities
- Community involvement can increase public acceptance and support for renewable energy projects
- Integrating tourism with renewable energy infrastructure requires careful planning to ensure safety and operational efficiency
- Collaborating with professional fishermen to facilitate the coexistence of the wind farm with fishing activities

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7.4 Results and Benefits

7.4.1 Achieved Results:

- Its 62 masts produce 25% of the electricity consumption of the Breton population (850,000 inhabitants), contributing significantly to the area's renewable energy goals
- The wind farm has become a notable landmark, attracting over 50 boat visits annually and serving as an educational site for schools and universities.

A visit to the heart of the park - Ailes Marines

Visit to the heart of the wind farm - Vedettes de Bréhat

7.4.2 Benefits for the Community or Environment:

- Provides clean energy, reducing carbon emissions and environmental impact
- Offers educational and recreational opportunities, raising awareness about renewable energy

- Strengthens community involvement through, fostering a sense of pride and responsibility

7.4.3 Success Indicators:

- High levels of community investment and participation
- Consistent visitor numbers for tours and educational programs
- Collaboration with partner companies and institutions
- Stable and efficient energy production meeting projected outputs

7.5 Applicability and Scalability

7.5.1 Success Factors:

- Strategic location near a highly developed region enhances visibility and accessibility
- Relations with local actors in employment, training and integration promotes a clearer understanding of how the entire community can economically benefit from the project
- Actions to inform companies and socio-economic actors about the industrial needs of the project and the opportunities for the creation of associated activities creates a strong bond with local community
- Integration of tourism and education with energy production promotes broader acceptance of renewable energy projects
- Environmentally conscious project

7.5.2 Challenges Addressed:

- Overcoming public resistance through participation in forums, conferences and information meetings for students, job seekers or professionals in retraining
- Ensuring the safety of visitors in an operational industrial setting
- Balancing multiple uses of the site without compromising energy production efficiency
- Developing a project in line with local environmental issues (animal and plant biodiversity**,** quality of the aquatic environment, visual impact, professional fishing, maritime safety)

7.5.3 Replication or Scalability Potential:

- The model is replicable in other coastal regions with suitable offshore wind resources
- Success depends on community engagement, safety considerations, and proximity to urban centres to attract visitors
- Scalability may be influenced by local regulations, maritime conditions, and public interest

7.6 References and Contacts

7.6.1 Documentation and Supporting Sources:

- European MSP Platform - Boat tours in Saint-Brieuc offshore wind farm: Maritime Spatial Planning
- Saint-Brieuc - Iberdrola's first large-scale offshore wind power project in Brittany: Saint-Brieuc offshore wind farm - Iberdrola
- Vedettes de Bréhat - Visit to the heart of the windfarm: Visit to the heart of the wind farm - Vedettes de Bréhat
- Ailes Marines - The wind farm off the bay of Saint-Brieuc: Ailes Marines - Offshore wind farm in the bay of Saint-Brieuc
- Région Bretagne - Brittany and marine energies: Marine energies in Brittany · Brittany Region
- Pole Mer - Brittany and the Atlantic coast boost innovation: Pôle Mer Bretagne Atlantique
- France Energies Marines - Floating offshore wind :Floating offshore wind: French know-how driven by dynamic R&D is on the upswing
- CCI de Bretagne - The I BREIZH Programme: [MARITIME] The I BREIZH | CCI of Brittany

8 Wier & Wind pilot project: A successful demonstration of offshore seaweed cultivation

8.1 General Information

8.1.1 Proposing Organization:

Interreg Vlaanderen-Nederland Europees Fond voor Regionale Ontwikkeling - **Project Wier&Wind.**

The partners that participated in Wier&Wind **-** The Seaweed Company; Murre Technologies B.V.; HZ University of Applied Sciences; GeoXYZ, Ghent University.

8.1.2 Sector of Application:

The development of a large-scale, automated seaweed production system that is safe, sustainable, ecologically sound and offshore-proof, suitable for functioning within offshore wind farms.

8.1.3 Location:

North Sea Farmers (NSF) Offshore Test site.

8.1.4 Context and Objective:

The aim of Wier&Wind was to develop a large-scale and automated seaweed production system, that is safe, sustainable and offshore-proof. A system that is reliable at sea and can be used within the many wind farms in the North Sea. Moreover, the system can be made economically viable by applying automation in order to reduce labour costs, increase offshore production speed and thus reducing vessel cost.

8.2 Description of the Best Practice

8.2.1 Summary of the Practice:

- The Wier&Wind project has led to a successful demonstration of the Wier&Wind seaweed farming concept.
- It showcased several seeding methods, seaweed cultivation and growth on net-substates as well as mechanised harvesting of the produced seaweed.
- All in offshore conditions similar to the wind farms in the Dutch and Belgian North Sea.
- A multi-use procedure for both the Dutch and Belgian parts of the North Sea

8.2.2 Unique or Innovative Approach:

During Wier&Wind, the first automated harvesting operation ever, took place on the North Sea during this project. The fully automated harvesting machine was developed and built by project partner Murre Technologies, it was installed on the mussel ship YE32 and tested on the Offshore Test Site.

The 'Easyfarm' machine has a unique approach where it is lifted overboard and deployed over the operational seaweed growing system. This way, no removal or modification of the seaweed growing system is required making it a fast and controlled seaweed harvest operation.

The test demonstrated that the seaweed can indeed be successfully and swiftly harvested when the seaweed system is lifted just above the water line, whilst removing almost all of the seaweed and keeping this in good quality.

8.2.3 Stakeholder Involvement:

The Seaweed Company, Murre Technologies, HZ University of Applied Sciences, University Gent, GEOxyz and North Sea Farmers participated in the project.

8.3 Challenges and Solutions

8.3.1 Key Risks or Identified Challenges:

- Risk of impacting the ecological impact of the wind farm: make an assessment up-front of the potential impact of the multi-Use activities on the presence of birds and marine life. If this presence would increase than it could impact the ecological impact studies of the wind farm.
- Financial risk or consequential financial risk: causing damage to each other's assets is an unfortunate event and usually can be adequately addressed with a suitable insurance.

MUP_RiskRegister

8.3.2 Mitigation Measures Adopted:

- For this pilot four different net structures have been integrated to test attachment strength of the seaweed on these different substrates, with different seeding techniques. This combination provided improved insight in the seeding & net combinations.
- The different nurseries and various net types led to a variety in seaweed growth during the experiment.

8.3.3 Lessons Learned:

- Whether it is for seaweed, solar energy, nature development or any other type of innovative "blue economy" activity, it is worth considering a multi-use setup in offshore wind farms:
- Using the otherwise unavailabe or unused areas between wind turbine structures keeps areas outside the wind farms available for other stakeholders on the North Sea. And within the current and planned wind farms there is significant scale-up potential;
- Most blue economy activities are anchored floating systems, not extending far above the water line and therefore generally badly visible for any ship traffic. On the other hand, wind farms are mostly not open for ship traffic and are easy to recognise for anyone in almost all-weather conditions. Therefore, operating a for instance a seaweed or solar farm within the wind farm, will significantly reduce the risk of an accidental collision with a ship;
- Over time there will be more multi-use project with larger scale. This will also lead to more synergies with adjacent multi-users and with the wind farm operations (vessels, harbour facilities, personnel, etc.

8.4 Results and Benefits

8.4.1 Achieved Results

- The Wier&Wind project has led to a successful demonstration of the Wier&Wind seaweed farming concept. It showcased several seeding methods, seaweed cultivation and growth on net-substates as well as mechanised harvesting of the produced seaweed. All in offshore conditions similar to the wind farms in the Dutch and Belgian North Sea.

8.4.2 Benefits for the Community or Environment:

- With its own local farms that produce reliable seaweed volumes in a nature-inclusive way, Europe would become more self-reliant. And if the disposal of these seaweed-based products is done sensibly, it creates the potential to close nutrient cycles towards a truly sustainable society. Seaweed-based solutions can offer a valuable contribution in addressing today's challenges such as climate change, food availability and finding alternatives to fossil-based value chains.
- Anchored installations will add value to the wind farm area. They will provide local sustainable energy and sustainable biomass but most will also:

– Provide valuable eco-system services like increased biodiversity,
– Promote nature development (on the seabed);
– Engage and support local (coastal) communities with the North Sea;
– Accelerate the transition to a fossil free and circular economy

8.4.3 Success Indicators:

- Successful demonstration of the Wier&Wind seaweed farming concept
- Many stakeholders support the concept of multi-use and they are willing to help

8.5 Applicability and Scalability

8.5.1 Success Factors:

- Innovative technological solutions tailored to offshore conditions.
- Pilot seaweed farming system that was harvested with an innovative harvesting machine.

8.5.2 Challenges Addressed

- Automatic harvesting at Wier&Wind During Wier&Wind, the first automated harvesting operation ever, took place on the North Sea during this project. The fully automated harvesting machine was developed and built by project partner Murre Technologies, it was installed on the mussel ship YE32 and tested on the Offshore Test Site. The 'Easyfarm' machine has a unique approach where it is lifted overboard and deployed over the operational seaweed growing system. This way, no removal or modification of the seaweed growing system is required making it a fast and controlled seaweed harvest operation.

- The test demonstrated that the seaweed can indeed be successfully and swiftly harvested when the seaweed system is lifted just above the water line, whilst removing almost all of the seaweed and keeping this in good quality

8.5.3 Replication or Scalability Potential:

- High potential for replication in the many existing and planned offshore wind farms where there is more than enough space to produce the required high volumes of seaweed.

8.6 References and Contacts

8.6.1 Documentation and Supporting Sources:

- North Sea Farmers NSF
- Interreg Vlaanderen-Nederland
- Multi-Use Procedure - North Sea Farmers
- Offshore Test Site - North Sea Farmers

8.6.2 Contact for Further Information:

- **Name:** North Sea Farmers
- **Adress:** Zeestraat 84 2518 AD Den Haag
- **Email:** info@northseafarmers.org
- **Phone:** +31 (0)70 31 84 444

9 Comparative Analysis

This section briefly compares the six best-practice examples presented in the catalogue, highlighting commonalities and differences related to synergy focus, location and physical context, stakeholder involvement, key challenges, solutions adopted, and scalability. Understanding these dimensions can help BEYOND partners identify which approaches might transfer most effectively to the Adriatic context.

9.1 Synergy Focus and Primary Objective

- **North Sea Aquaculture Integration** (Dutch North Sea)
  - **Synergy**: Co-location of submersible mussel farms within offshore wind infrastructure.
  - **Primary Objective**: Maximize marine space efficiency by integrating renewable energy and sustainable seafood production.
- **Hywind Scotland** (North Sea, off the coast of Scotland)
  - **Synergy**: Floating wind technology; no direct multi-use with other Blue Economy Sectors, but paves the way for integration in deepwater sites.
  - **Primary Objective**: Demonstrate feasibility and scalability of floating wind farms in areas unsuitable for fixed-bottom turbines.
- **Middelgrunden** (Øresund Strait, near Copenhagen, Denmark)
  - **Synergy**: Offshore wind farm coupled with tourism and community co-ownership.
  - **Primary Objective**: Provide clean energy while fostering public engagement and shared ownership, using tourism as a vehicle for awareness.
- **Saint Nazaire** (Loire-Atlantique, France)
  - **Synergy**: Offshore wind farm with integrated tourism (boat tours, maintenance-base visits) and strong community outreach.
  - **Primary Objective**: Meet regional energy demand (20% of Loire-Atlantique's consumption) and enhance local socio-economic benefits (job creation, skill development).
- **Saint Brieuc** (Brittany, France)
  - **Synergy**: Offshore wind farm integrated with tourism, local economic development (IBReizh program), and environmental conservation measures.
  - **Primary Objective**: Supply 25% of regional electricity needs while safeguarding marine ecosystems and supporting local businesses (fisheries, tourism).
- **Wier & Wind Pilot Project** (Dutch/Belgian North Sea)
  - **Synergy**: Automated seaweed cultivation (and harvesting) within offshore wind farms.

   - **Primary Objective**: Demonstrate large-scale, offshore-proof seaweed production that leverages existing OWF space and logistics.

9.1.1 Key Observations

- **Aquaculture Focus**: North Sea Aquaculture Integration and Wier & Wind both prioritize farming (mussels, seaweed).
- **Tourism & Community**: Middelgrunden, Saint Nazaire, and Saint Brieuc emphasize public engagement, educational tours, and community benefits.
- **Technological Innovation**: Hywind Scotland introduces floating foundations, broadening potential sites for synergy.

9.2 Location and Physical Context

- **Shallow vs. Deep Waters**: Projects like Middelgrunden (relatively shallow waters close to urban centers) differ from Hywind Scotland's floating turbines (deeper waters up to 120 m).
- **Exposure to Harsh Conditions**: Both the North Sea Aquaculture Integration and Wier & Wind pilot operate in high-energy environments, testing the resilience of submersible and floating infrastructure.
- **Proximity to Shore**: Middelgrunden, Saint Nazaire, and Saint Brieuc are all close enough to facilitate easy boat tours and day trips, whereas Hywind Scotland is farther offshore (25 km), with less focus on tourism.

9.2.1 Key Observations

- Projects near populated coasts have found it easier to integrate tourism and educational visits.
- Deeper offshore sites (Hywind Scotland) or high-energy environments (North Sea) must invest more heavily in robust anchoring and engineering solutions.

9.3 Stakeholder Involvement

- **Community Co-Ownership**: Middelgrunden's cooperative model stands out for direct public investment.

- **Public-Private Partnerships**: Hywind Scotland (Equinor and Masdar) and Wier & Wind (interreg-funded consortium) rely on multi-actor collaborations, blending industry, research, and government.
- **Regional Focus**: Saint Nazaire and Saint Brieuc integrate job creation, local training programs, and environmental measures through regionally driven initiatives (e.g., IBReizh).
- **Research Institutions**: North Sea Aquaculture Integration (WUR) and Wier & Wind (universities, specialized companies) illustrate the crucial R&D role in pilot testing advanced technologies.

9.3.1 Key Observations

- Early and transparent stakeholder engagement consistently appears as a success factor, regardless of the primary synergy.
- Community ownership or involvement (Middelgrunden, Saint Nazaire, Saint Brieuc) tends to increase acceptance and local economic benefits.

9.4 Key Challenges and Solutions Adopted

Challenge	How It Manifested	Example of Solution
Technical Constraints	Maintaining aquaculture systems in high-energy waters (North Sea Aquaculture, Wier & Wind) or floating wind structures (Hywind Scotland)	Submersible longlines, automated harvesting, advanced anchoring, dynamic cables
Regulatory Complexities	Multi-use permits and maritime spatial planning (all projects)	Early engagement with national/regional authorities, dedicated multi-use licensing frameworks
Community Acceptance	Concerns about visual impact, access restrictions, or environmental damage (Middelgrunden, Saint Brieuc)	Cooperative ownership, educational boat tours, transparent communication
Economic Viability	High CAPEX and uncertain ROI for innovative technologies (Hywind Scotland)	PPP funding, demonstration pilots, phased scaling

Environmental Concerns	Potential habitat disturbance, biodiversity impacts (Saint Brieuc, North Sea aquaculture)	Environmental impact assessments, adaptive management (noise reduction measures, dedicated biodiversity initiatives)

9.4.1 Key Observations

- **Adaptive Management**: Projects that set up continuous monitoring and flexible operations (e.g., Wier & Wind) respond more effectively to unforeseen environmental or technical issues.
- **Policy Support**: Streamlined processes and supportive policies facilitate synergy adoption but often require targeted advocacy from project proponents.

9.5 Results, Benefits, and Scalability

- **Operational Performance**:
  - **Hywind Scotland** regularly achieves capacity factors exceeding 50%, showcasing floating wind's high efficiency.
  - **Middelgrunden** meets ~3% of Copenhagen's electricity demand and draws steady tourism revenue.
- **Social and Environmental Benefits**:
  - **North Sea Aquaculture Integration** demonstrates enhanced seafood production without additional spatial footprint.
  - **Saint Brieuc** invests in local economic development (IBReizh), ensuring that fishermen and tourism operators share in the benefits.
- **Market and Sector Growth**:
  - **Wier & Wind** highlights new value chains for seaweed-based products (food, materials, biochemicals).
  - **Saint Nazaire** invests in training and job-creation programs, setting a precedent for other coastal wind projects.

9.5.1 Scalability Potential

- **High Replicability**: Co-location of aquaculture (mussels, seaweed) in offshore wind farms can be scaled wherever marine conditions allow, especially as engineering solutions improve.
- **Tourism Components**: Replicable primarily in projects near coastal hubs; relies on local interest, safe transit routes, and supportive infrastructure.
- **Floating Wind**: Expands viable sites worldwide (deeper waters), but still requires further cost-reduction to become mainstream.

9.6 Lessons for BEYOND

By comparing these diverse examples side by side, the BEYOND project can draw on proven strategies and tailor them to the Adriatic context, focusing on synergy models that offer the most promise for environmental sustainability, socio-economic benefits, and technological feasibility in the region.

1. **Match Synergy to Local Context**: Tourism thrives near urban centers and accessible waters; aquaculture requires suitable oceanographic conditions (nutrients, wave regimes).
2. **Innovate with Caution**: Pilots and R&D partnerships are essential when testing new tech (floating foundations, automated harvesting) to mitigate risk.
3. **Prioritize Inclusivity**: Projects that meaningfully engage local stakeholders—whether through cooperatives or transparent planning—tend to enjoy stronger social license and yield more equitable benefits.
4. **Plan for Regulatory Alignment**: Multi-use permitting processes remain complex. Successful projects pre-empt challenges by involving regulators from the earliest stages.

10 Recommendations and Conclusions

10.1 Recommendations

1. **Encourage Early and Continuous Stakeholder Engagement**

- **Why**: Success in multi-use projects depends heavily on buy-in from fishermen, local communities, environmental agencies, and regulatory bodies.
- **How**: Establish dedicated multi-stakeholder forums (e.g., SBE labs) to solicit feedback from project conception through implementation. Organize workshops, public consultations, and targeted outreach to ensure broad representation and shared ownership of the process.

2. **Streamline Policy and Regulatory Frameworks**
   - **Why**: Complex maritime spatial planning (MSP) regulations and fragmented permitting processes can hinder co-location initiatives.
   - **How**: Advocate for clear, harmonized guidelines that recognize and support multiple uses within the same marine area. Develop integrated permitting models that reduce administrative burdens for projects combining offshore wind with other Blue Economy activities.
3. **Adopt Adaptive Management and Monitoring**
   - **Why**: Synergy projects carry higher uncertainty due to additional variables—e.g., aquaculture yields, ecological interactions, or public visitation in offshore sites.
   - **How**: Implement robust monitoring of both environmental and socio-economic indicators. Use real-time data to adjust operations quickly—such as changing mooring configurations or access rules—to address issues before they escalate.
4. **Invest in Technology and Innovation**
   - **Why**: Successful synergy often hinges on specialized infrastructure (e.g., submersible aquaculture systems, floating turbines, automated seaweed-harvesting machines).
   - **How**: Support research and development through public-private partnerships (PPPs). Encourage piloting of cutting-edge technologies that enhance efficiency, reduce maintenance costs, and improve environmental performance.
5. **Foster Local Economic Development and Skills Training**
   - **Why**: Integrating multiple sectors provides a unique opportunity for job creation, local business development, and community buy-in.
   - **How**: Develop targeted training programs that build capacity for new maritime professions. Involve local educational institutions and workforce agencies to ensure local residents can fill emerging roles in offshore wind O&M (operation and maintenance), aquaculture, or eco-tourism services.
6. **Maintain Transparent Communication and Benefit-Sharing**

- **Why**: Negative perceptions or conflicts often arise when local communities do not clearly see how they benefit from large-scale offshore developments.
- **How**: Establish fair revenue-sharing mechanisms, community-led projects (e.g., cooperatives for partial ownership of turbines or aquaculture plots), and frequent updates on project milestones, environmental performance, and economic outcomes.

10.2 Conclusions

The best-practice cases reviewed in this deliverable demonstrate that **multi-use of marine space is both feasible and beneficial**. Whether through co-located aquaculture (North Sea Aquaculture Integration, Wier & Wind pilot), community-based tourism initiatives (Middelgrunden, Saint Nazaire, Saint Brieuc), or the development of innovative floating turbines (Hywind Scotland), these examples confirm that shared infrastructure can maximize the potential of offshore wind while creating added value for other Blue Economy Sectors.

Crucially, the **coexistence of sectors** demands early and ongoing collaboration among project developers, regulators, environmental stakeholders, and local communities. By proactively addressing both technical and social challenges—ranging from equipment durability in high-energy environments to local acceptance and equitable benefit-sharing—multi-use projects can deliver significant gains: reduced spatial conflicts, increased biodiversity, greener economic growth, and stronger local ownership.

For the BEYOND project, these findings reinforce the importance of **embedding synergy considerations** into the planning and operation of offshore wind farms from the outset. Moving beyond single-minded energy production toward a holistic, inclusive, and sustainable approach holds great promise in the Adriatic region and beyond. By drawing on the insights captured here—and adopting the recommended strategies—partners can accelerate innovation, reduce implementation risks, and realize the broader vision of a Blue Economy that thrives on collaboration, resilient ecosystems, and shared prosperity.