Showcasing the effectiveness of Ocean Multi-use practices in the North Sea and Baltic Sea.

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About the Pilot

The **FINO2 platform**, located 33 km north of Rügen in the southwestern **Baltic Sea,** is a key offshore research facility near major wind farms Baltic 2 and Kriegers Flak. Managed by DNV Energy Systems Germany GmbH since 2010, it supports research in meteorology, oceanography, ecology, and maritime traffic. As part of **ULTFARMS**, the Forschungs- und Entwicklungszentrum Fachhochschule Kiel GmbH, is pioneering offshore algae cultivation using a multipurpose system and exploring **Nature Inclusive Design (NID) to enhance biodiversity alongside aquaculture operations**, providing essential data for sustainable multi-use offshore projects.

Main Achievements

- **Modular, Multipurpose System Design:**

Adaptable, small frames allow for flexible usage, low-cost installation, maintenance, and transport using small vessels.

- **Novel Anchoring technique:**

A custom-designed anchoring system ensures the stability of macroalgae frames, NID structures, and monitoring cameras directly onto the FINO2 monopile. In house developed, tested both near and offshore, by a cooperation of the Forschungs- und Entwicklungszentrum Fachhochschule Kiel GmbH and the DNV Energy Systems Germany GmbH, it secures deployment on any monopile without compromising wind park safety and therefore harmonizing regulations.

- **Nature-Inclusive Design:**

A stainless steel frame integrates biodegradable habitat structures to support marine biodiversity, installed at FINO2.

- **Offshore Algae Strain:**

A regional green macroalgae Ulva sp. was selected, cultivated at the University of Gothenburg, and deployed at FINO2 for offshore testing.

- **Monitoring Systems:**

Underwater cameras at 5m and 10m depths with automated cleaning, as well as, light and temperature sensors provide continuous environmental data.

Main Challenges

- **Low Salinity Constraints:** Requires adapted aquaculture techniques for optimal growth.
- **Harsh Offshore Conditions:** Strong winds, storms, and short waves demand robust engineering.
- **Modular System Design:** Small, flexible algae modules optimize space in wind farms.
- **Wind Farm Integration:** Algae modules anchored to turbine monopiles, maximizing efficiency.
- **Sustainable & Resilient:** Reinforced structures ensure durability.
- **Nature-Inclusive Design:** Artificial reefs & shelters enhance marine biodiversity.

Sectors covered:

- Seaweed aquaculture
- Nature restauration
- Renewables

Piloted Solutions

Smart & Sustainable Wind Farm Integration
A modular system designed for efficiency, adaptability, and safety. It optimizes space, minimizes environmental impact, and ensures resilience against offshore conditions for a smarter, greener future.

Macroalgae Production
Algae modules anchored to wind turbine monopiles.

Nature-Inclusive Design
Incorporates artificial reefs and shelters to enhance biodiversity. Creates a multi-functional marine ecosystem.

Monitoring
Allows for stationary, underwater cameras and sensors directly at the monopile structure

Application

Scientific

- **Multi-Use & Co-Management:** Strategies for integrating offshore aquaculture into wind farms.
- **Mooring & Monitoring Solutions:** Novel anchoring systems for challenging environments and monitoring technologies, suitable for monopile structure.
- **Data Generation & Analysis:** Sampling campaign and generation of growth data for *Ulva*, as well as habitat monitoring (macrofauna samples & stationary cameras)
- **Economic & Environmental Modelling:** Data supports economic, technical, risk, and socio-economic assessments for offshore multi-use.
- **Synergy & Co-Design:** Tested co-management models showcasing successful multi-use integration.

Commercial

- **Optimized Vessel Design:** Advisory on safe, efficient vessels tailored for offshore aquaculture operations.
- **Aquaculture System Design** Expertise in custom system design.
- **Novel anchoring Technique:** Guidance on anchoring solutions for extreme offshore conditions.
- **Regulatory & Permitting Support:** Advice on offshore aquaculture permits to navigate complex legal and regulatory landscapes.