SPOWIND Newsletter #1 – May 2025

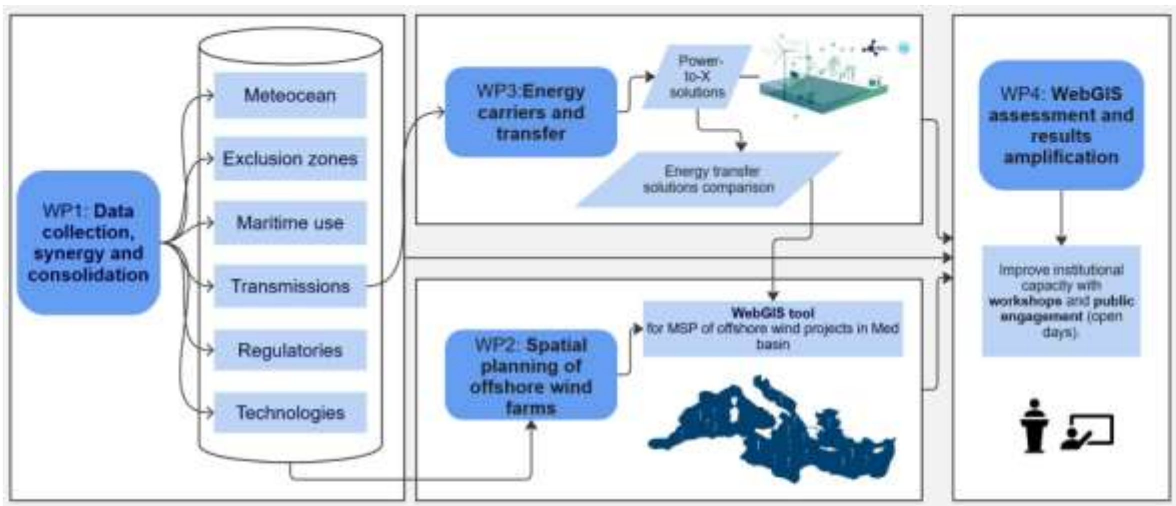
Introduction

Offshore wind energy is now a cornerstone of the renewable energy transition. This issue of our newsletter explores the importance of offshore wind and its benefits in addressing climate change and ensuring energy security.

Benefits of Offshore Wind:

- **Abundant Resource:** Offshore wind can generate vast amounts of electricity.
- **Reduced Emissions:** Cuts greenhouse-gas emissions.
- **Energy Security:** Lessens reliance on imported fossil fuels.
- **Economic Growth:** Creates jobs and boosts investment in coastal regions

SPOWIND Project Update



WP1: Data Foundations for Marine Spatial Planning

The SPOWIND project continues to make strong strides in laying the groundwork for the sustainable development of floating offshore wind in the Mediterranean. Work Package 1 (WP1) focuses on data collection, legislative mapping, and transmission planning—foundations, which are critical for effective marine spatial planning (MSP). Here's a roundup of the major developments.

A1.1: Consolidating Metocean and Spatial Data for Offshore Wind Planning

Key datasets from from MAESTRALE, ORECCA and EMODnet have been consolidated into a unified repository. These data underpin our multi-layered MSP strategy and power the upcoming WebGIS tool.

The collected data prioritize metocean variables—such as wind and wave conditions—that directly affect the viability of floating offshore wind turbines. A broad set of constraints has been accounted for, including:

- **Bathymetry**: 50–1000 m depth.
- **Environmental Protections**: Natura 2000, MPAs, UNESCO sites.
- **Jurisdiction & Logistics**: Within EEZs; key ports identified.
- **Human Activities**: <3 ships/h; ≥10 km buffer from coast.
- **Resource Potential**: A≥4 m/s baseline wind speed.

All collected datasets are publicly accessible via the Zenodo platform.

A1.2: Mapping Offshore Wind Legislation Across the Region

To support regional alignment and promote policy improvements, project partners conducted comprehensive mapping of offshore wind legislation. Key focus areas included:

- Marine Spatial Planning (MSP)
- National Energy and Climate Plans (NECP)
- Environmental regulations
- Transmission System Operator (TSO) development plans
- Concession and permitting processes

A detailed questionnaire on these areas was reviewed by all partners and will guide upcoming stakeholder interviews, ensuring accurate and localized legislative insights.

A1.3: Electricity Transmission Grid Data Integration

Transmission grid models for Croatia, Montenegro, Greece, Albania, Portugal, and Italy have been gathered and georeferenced for integration into the project's GIS platform. These models, also available on Zenodo, will support spatial and infrastructure planning. A draft public report outlining the methodology is under review, and a related scientific paper is currently under consideration.

A1.4: Data Management and Collaborative Synergies

All collected marine spatial planning data have been systematically categorized and published under Metocean Data and Non-Environmental Parameters on Zenodo. This open-access structure promotes transparency, reusability, and alignment with other regional initiatives.

🧭 WP2: Strategic Site Selection and Offshore Wind Technology Assessment

Work Package 2 (WP2) of the SPOWIND project plays a foundational role by bridging cutting-edge research, planning tools, and spatial analysis to identify the most viable locations for offshore wind energy in the Mediterranean. It focuses on the intersection of **marine spatial planning (MSP)**, **offshore wind technologies**, and **techno-economic evaluation** to guide evidence-based decision-making.

🌍 A2.1 – Knowledge Consolidation and Methodology Development

WP2 began with an extensive review of past and ongoing **Marine Spatial Planning (MSP)** initiatives such as **THAL-CHOR**, **MAESTRALE**, and **ORECCA**, which provided valuable insights into offshore renewable energy strategies across Europe.

Key achievements:

- A methodology for offshore wind site selection was developed, incorporating **environmental**, **regulatory**, **techno-economic**, and **social** constraints.
- Best practices and tools were gathered from the **EU MSP Platform**, emphasizing stakeholder engagement and ecosystem-based planning.
- Visual impact, wave activity, and wind potential were integrated into the criteria for suitable site identification.

⚓ A2.2 – Offshore Wind Technologies and Productivity Methods

This task presented a **state-of-the-art overview** of current offshore wind technologies, and provide **the methodology** for the productivity evaluation based on the floating power curve, wake effect and internal cable losses of the wind farm, including:

- **Fixed foundations** (monopile, jacket, gravity base, tripod)
- **Floating platforms** (spar, semi-submersible, barge, and Tension Leg Platforms)

Key insights:

- Floating turbines enable deployment in the **deep waters of the Mediterranean**, which are typically unsuitable for bottom-fixed structures.

- Technological readiness levels (TRLs) and global benchmarks were reviewed to guide design and investment decisions.
- Various **mooring systems** (taut-leg, catenary, semi-taut) were evaluated, along with anchor types and offshore substation setups.
- Wind turbine capacity trends show rapid innovation, with models reaching **up to 20 MW**, supporting fewer but more powerful installations.

💶 A2.3 – Techno-Economic Assessment of Offshore Wind Farms

A comprehensive **techno-economic model** was developed to evaluate both bottom-fixed and floating wind farm configurations, considering:

- **LCOE (Levelized Cost of Energy)**
- **NPV (Net Present Value)**
- **IRR (Internal Rate of Return)**
- **Capacity Factor**, including O&M and cable loss adjustments

Lifecycle cost analysis included:

- **DEVEX** – development expenditures (licensing, surveys)
- **CAPEX** – capital investments (turbines, foundations, cables)
- **OPEX** – operational costs (maintenance, logistics)
- **ABEX** – decommissioning and abandonment

Key takeaways:

- Current LCOE for floating turbines is around **€149/MWh**, higher than bottom-fixed systems but expected to decline with **learning rates up to 14.1%**.
- Detailed maintenance strategies (corrective, proactive, opportunistic) were assessed for both bottom-fixed and floating platforms.
- Port infrastructure, vessel use limitations, and grid connection needs were incorporated into feasibility calculations.

🔋 WP3: Advancing Offshore Power Transmission & Power-to-X

As offshore wind energy continues to evolve into a cornerstone of Europe's renewable energy strategy, **Work Package 3 (WP3)** of the SPOWIND project is driving key innovations in energy transfer and Power-to-X solutions. Here's an overview of the major activities and outcomes.

⚡ A3.1: Power Transmission Strategies for Offshore Wind Farms

A detailed literature review was conducted to assess available offshore wind farm collector and transmission systems, with an emphasis on cost-effectiveness, technical feasibility, and system efficiency. The review focused on evaluating **HVAC, HVDC**, and **hybrid transmission technologies**, considering their potential to support large-scale offshore deployment while minimizing grid congestion and ensuring voltage stability.

Key Findings:

- Offshore wind transmission infrastructure represents a major share of project costs.
- Smarter transmission strategies, including advanced power flow control and reactive power compensation, are vital to support increased renewable penetration.
- Insights will guide the upcoming cost analysis phase to refine economic models.

Outreach:

A dedicated **workshop with MED-TSOs** facilitated knowledge exchange and validation of findings with key grid stakeholders.

🧪 A3.2: Power-to-X Solutions for Offshore Wind Farms

To support sector coupling and energy flexibility, WP3 developed a dedicated **codebase for modeling Power-to-X (P2X) systems**, with a focus on offshore hydrogen and ammonia production. This tool enables Levelized Cost calculations for hydrogen (LCOH), ammonia (LCOA), and overall transfer systems (LCOT) for both pipeline and shipping transport scenarios.

Highlights:

- Initial models focused on **centralized offshore production**, with code now extended to onshore configurations for benchmarking.
- Despite challenges in modeling inter-array pipeline logistics, **LCOH results are promising**, falling below average literature values.
- Results from this task will be integrated with Task 3.1 to compare inter-array cable costs.

Conference Participation:

A scientific paper detailing this techno-economic analysis has been **submitted to the SDEWES Dubrovnik conference**, reinforcing the project's academic and practical contributions.

📊 A3.3: Comparative Assessment Methodology for Energy Transfer Solutions

A robust methodology is being developed to **compare P2X and traditional transmission systems** based on economic parameters. The ongoing focus is to:

- Finalize configurations for multiple transfer scenarios.
- Refine cost estimations, especially for hydrogen.
- Enable comprehensive comparison of **Levelized Costs** across all proposed energy transfer methods.

Over the next six months, the team will prioritize completing the analytical code and ensuring data accuracy for decision-making support.

📰 Research Spotlight: SPOWIND Study Published in Energies (MDPI)

We're excited to share that a research study connected to **SPOWIND Work Package 3** has been **published in the peer-reviewed journal *Energies* (MDPI)**.

📄 **Title: "Hydrogen and Ammonia Production and Transportation from Offshore Wind Farms: A Techno-Economic Analysis"**

This study presents a comprehensive model for assessing the **techno-economic feasibility** of producing **green hydrogen and ammonia** using offshore wind power. It evaluates multiple transport strategies—including **pipelines** and **ammonia shipping**—across varying scales and distances, offering valuable insights for energy system designers and policymakers.

Key highlights:

- Comparative analysis of hydrogen and ammonia transport options
- Cost modeling for offshore production facilities
- Integration with SPOWIND WP3 transmission and Power-to-X strategies

🔗 **Read the full paper here**

This publication marks a major milestone in SPOWIND's contribution to advancing offshore renewable energy and sector coupling solutions.

🌍 Looking Ahead

SPOWIND's data-driven, interdisciplinary approach continues to break ground in making offshore wind a viable, scalable solution for clean energy in the Mediterranean. With strong regional collaboration and open data practices, the project is shaping the future of offshore renewables.

We encourage all stakeholders to stay engaged as we progress through these activities. Your feedback will be invaluable as we refine our tools and methodologies.

Stay Connected

We will continue to provide updates on our progress and upcoming initiatives. For more information about the SPOWIND project, please visit our website or contact us directly. Thank you for your continued support as we work towards a sustainable offshore wind energy future in the Mediterranean Sea.

SPOWIND team