

From European waves to Pan-American shores: derisking, demonstrating, and educating to advance marine energy: Insights from European Projects

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I. INTRODUCTION

The world faces increasing energy demands and the urgent need to transition towards sustainable and low-carbon energy sources to mitigate climate change impacts. Both Europe and the Pan-American region are endowed with vast marine energy resources, offering a promising pathway to achieve these goals. Recognizing this potential, Bluespring has initiated four strategic projects, funded through European programmes and aimed at advancing marine energy technologies, promoting collaboration, and addressing key challenges in the sector. This paper provides a comprehensive overview of these projects, focusing on their methodologies, results, conclusions, and the potential for knowledge transfer to support marine energy development in the Pan-American region.

- 1) OTP: Assessment of the impact of tidal power extraction from the Eastern Scheldt Storm Surge Barrier through the evaluation of a pilot plant [1],
- 2) ENCORE: Energising coast with offshore renewable energy focussed on de-risking four solutions: tidal stream, river current, offshore solar and wave energy [2, 3, 4],
- 3) OFFSHORE FOR SURE is a new project, that builds on ENCORE and aims to integrate technologies in offshore wind farms, adding energy storage and smart maintenance strategies to tidal, wave and offshore solar solutions,
- 4) SEAWORTHY is a project lead by offshore test facilities and research institutes. The main goal is to implement certification services through a series of test campaigns at six locations in Europe to validate test capabilities of test facilities to de-risk solutions for multi-use.

The first two projects have been wrapped up and the latter two have recently started.

II. METHODOLOGY

A common methodology for advancing marine energy development can be identified from the four projects. It includes:

- 1) Comprehensive assessment to evaluate the feasibility and impact of marine energy technologies, using advanced modelling techniques and real data analysis.
- 2) Environmental monitoring with focus on studies on impact on sea mammals, sea bed morphology and underwater noise.
- 3) Stakeholder engagement: raise acceptance for marine energy solutions through involvement of observers and NGOs.
- 4) Testing and certification in order to validate the performance, reliability, and compliance of marine energy technologies using technical Specifications developed under IEC.
- 5) Knowledge Transfer and collaboration between research institutes, industry partners, investors, and policymakers facilitated the transfer of best practices and lessons learned in the marine energy sector.
- 6) Policy and financing support: The importance of supportive policies and innovative financing mechanisms was recognized to accelerate the adoption of marine energy solutions.
- 7) Education and capacity building: Online courses, training programs, and knowledge dissemination platforms enhanced understanding and skills related to marine energy technologies.

By adopting this methodology, the Pan-American region can benefit from the experiences and insights of the

European projects. It provides a holistic approach to derisking, demonstrating, and educating for marine energy development, ensuring successful technology deployment in the region.

III. RESULTS

1) Eastern Scheldt Storm Surge Barrier

The assessment of tidal power extraction from the Eastern Scheldt Storm Surge Barrier (Fig. 1) demonstrated the technical feasibility of harnessing tidal energy. The project provided valuable data on power generation potential, indicating a significant contribution to the region's renewable energy goals. Environmental monitoring revealed that the pilot plant had minimal impact on marine ecosystems, with sea mammal passage and seabed stability remaining unaffected. The project's success in demonstrating the viability of tidal energy extraction sets a positive precedent for similar projects globally. The OTP project was funded through the ERDF OP-Zuid programme

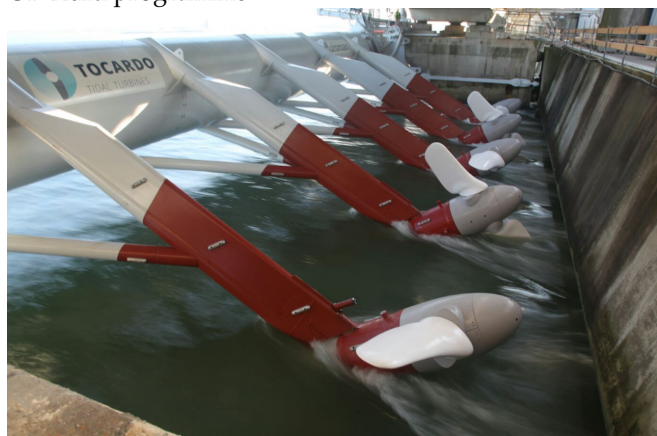


Fig. 1. Tocardo' array of 5 turbines, rated 1.2MW in the Eastern Scheldt Storm surge barrier.

2) ENCORE: Energising Coast with Offshore Renewable Energy

The ENCORE project, with a budget of 8.5m€ and funded through the INTERREG 2SEAS programme, advanced four offshore renewable energy solutions and supported their commercial uptake. The project applied international standards to validate the performance of pilot projects and mitigate risks. Learnings from the project were captured to develop a route-to-market strategy and online learning courses for young professionals entering the sector. Service Providers supported technology developers in various aspects, including design, manufacturing, and commercial support. Water2Energy installed a 100kW tidal turbine in Flushing (Fig. 2), Teamwork Technology tested the Symphony Wave Power in Portugal and the Netherlands in controlled conditions, Oceans of Energy deployed a 200kW pilot off the coast of Scheveningen (Fig. 3), and EEL-Energy tested a 30kW prototype off the coast of Brest.



Fig. 2. 50kW turbine by Water2Energy demonstrated in the port of Flushing



Fig. 3. 200kW offshore floating solar by Oceans of Energy

Economic assessments indicated the potential for significant job creation and economic growth associated with the development of coastal offshore energy projects. Environmental impact analyses highlighted the importance of sustainable siting practices, ecosystem protection, and minimizing potential conflicts with other marine activities. Another major output of the project was a framework for adaptive policy interventions.

3) OFFSHORE FOR SURE

The recently kicked-off OFFSHORE FOR SURE project builds on the ENCORE project, adding energy storage and smart maintenance to the mix of technologies. The objective is to demonstrate and assess five novel solutions for multi-source integration in offshore wind farms, and identify launching markets such as for islands, ports and remote power supply. The project is funded through the INTERREG Flanders/Netherlands programme and will also build a collaboration between education partners across the border in order to educate the next generation with content collected during the project.

4) SEAWORTHY

The SEAWORTHY (funded through INTERREG North Sea Region) aims to accelerate the adoption of insurable, bankable, and nature-inclusive solutions at sea, especially

at planned offshore wind farms. Pilot actions are planned to de-risk nature-inclusive solutions for multi-use. Test facilities and research institutes will jointly implement standardized testing methods, supporting third-party certification and enhancing investor confidence. The development of innovative financing mechanisms and policy interventions created a conducive environment for investment and regulatory acceptance. SEAWORTHY will also develop an Online User Portal open to other test centres globally, enhancing the international visibility and accessibility of test facilities, creating targeted matches based on self-assessments and parameter filters, aiming for efficient utilization of resources.

IV. DISCUSSION

Collectively, these four projects address key challenges in marine energy development, including technology assessment, spatial planning, stakeholder engagement, certification, and financing. By sharing experiences, best practices, and lessons learned, the European projects can provide valuable insights for the Pan-American context.

For example, the methodologies used to set-up projects, covering several holistic topics, can be adapted to Pan-American regions with similar themes in cross-border and trans-national collaborative projects.

The lessons learned in business case validation, stakeholder engagement, and adaptive policy interventions can inform the development of effective frameworks and strategies in the Pan-American context.

Furthermore, the collaboration between test facilities can inspire Pan-American test facilities to enhance their own capabilities in the field of certification service and consider joining the new Online User Portal to increase their visibility.

Based on the findings and experiences from these projects, several key recommendations can be made:

1. Foster collaboration: Encourage collaboration among various stakeholders, including government agencies, industry players, research institutions, and local communities. Collaborative efforts can enhance knowledge sharing, resource optimization, and regulatory alignment.

2. Establish test sites: Create dedicated offshore test sites or utilize existing coastal infrastructures to facilitate the demonstration and validation of marine energy technologies. These test sites should provide a range of conditions and support the evaluation of different technologies and their performance.

3. Enhance certification processes: Develop standardized testing and certification protocols to ensure

the reliability, safety, and performance of marine energy technologies. Establishing clear guidelines and certification processes will instill confidence among investors, regulators, and other stakeholders.

4. Promote public awareness and education: Increase public awareness about the potential of marine energy and its benefits for sustainable development. Educate communities, policymakers, and students through targeted awareness campaigns, online courses, and training programs to foster a better understanding of marine energy technologies.

5. Facilitate financing mechanisms: Explore innovative financing mechanisms, such as public-private partnerships, subsidies, and investment incentives, to attract private investments and support the scaling up of marine energy projects. Collaborate with financial institutions to develop tailored financing solutions for marine energy ventures.

6. Prioritize environmental impact assessment: Conduct thorough environmental impact assessments to ensure the sustainable deployment of marine energy technologies. Take into account results from existing projects, apply risk retirement and mitigating measures

In conclusion, by embracing the insights and experiences gained from these European initiatives, the Pan-American region can unlock its vast marine energy potential and contribute to a more sustainable and diversified energy mix. The time is ripe for collaboration, knowledge transfer, and the adoption of best practices to drive the advancement of marine energy in the Pan-American region. Let us embark on this journey together and harness the power of our oceans for a greener future.

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