MODENERLANDS'25
CA20109 International Conference

Modular Energy Islands for Sustainability and Resilience

Book of Abstracts

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

September 03-05, 2025
Figueira-da-Foz, Portugal

Exploring the Offshore Wind and Wave Generation Complementarity in Portugal for a Sustainable and Resilient Power System

António Couto[1], Paulo Justino[1], Paula Costa[1], Teresa Simões[1], Ana Estanqueiro[1]

[1] Laboratório Nacional de Energia e Geologia, Lisboa, Portugal

*E-mail: antonio.couto@lneg.pt

Abstract. Exploring variable energy sources generation complementarity can, among several benefits, help in the reduction of the negative impacts of variability from individual sources, and lower the system's flexibility requirements. This study focuses on the complementarity between offshore wind and wave energy aiming to identify its overall value to the power system. Using Portugal as a case study, this work examines two offshore regions of the Plan for the Allocation of Offshore Renewable Energy in Portugal using standard approaches to assess the level of complementarity. The findings show a clear seasonal mismatch in the summer between wind and wave energy, which supports their complementary nature and helps smooth out seasonal fluctuations in offshore renewable generation. The results indicate that wave energy brings value to diversifying the offshore energy mix. When compared with onshore renewable generation, the combined use of offshore wind and wave power significantly enhances the stability of energy supply, reduces extreme events, which can contribute to decrease the need for additional system flexibility in future nearly 100% renewable-based power systems.