project eWAVE

Efficient HV-electric modular battery and distribution systems for sustainable WAterborne VEssels

Deliverable D2.2: Requirements Architecture

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PROJECT ABSTRACT

The maritime sector faces challenges in transitioning to sustainable, all-electric vessels. Key obstacles include low energy density in current battery systems, safety concerns, and the need for durable, sustainable materials. Economic viability also remains a significant barrier for widespread adoption. To address these issues, the EU-funded eWAVE project brings together 18 experts from research, technology, and shipbuilding to advance high-voltage (HV) technology for electric vessels. By developing high-energy-density batteries, scalable modular systems, and an integrated safety concept, eWAVE aims to enhance the sustainability, safety, and efficiency of maritime transport. The project will also explore circularity through bio-based materials and recycling, supporting the EU's goal of reducing the environmental footprint of shipping.

Public Summary

The present ***eWAVE*** Requirements Architecture deliverable documents the collected, balanced, and structured requirements for the targeted research and development of HW & SW components and systems as well as methods and concepts (WP3–WP5), their reliable interaction in the integration and demonstration in the ***eWAVE*** demonstrator vessel (WP6), and the final comprehensive evaluation of ***eWAVE*** (WP7) in line with the project and call topic objectives. All 18 partners of the ***eWAVE*** actively contributed to this document.

The deliverable outlines:

1. **Methodology –** steps for requirement elicitation, requirement structure, and change management processes.
2. **Requirements –** organized according to the thematic focus of the ***eWAVE*** WPs, showing main goals and detailed tables of requirements (including acceptance criteria).

In particular, the requirements of the ***eWAVE*** Requirements Architecture focus on the following areas:

- **Project objectives** representing the main goals of ***eWAVE*** comprising 35 requirements
- **Battery System** with emphasis on high-energy density battery modules, scalable battery storage and modularity, robust battery control systems, advanced real-time algorithms and condition monitoring, and a wireless battery management system (BMS); comprising 271 requirements
- **HV distribution system & Overall system control** with emphasis on insulation materials, charging interfaces, onboard grid integration, and overall system control algorithms; comprising 47 requirements
- **System Architecture, Sustainability & Circularity** with emphasis on a scalable system architecture, Digital Twin development, voltage scaling beyond 1.5 kV DC, a maritime battery passport, second-life battery applications, Life Cycle Assessment (LCA), and integral safety systems; comprising 126 requirements
- **Implementation, Integration, and Demonstration** with emphasis on manufacturing and testing of battery string components, string scale-up and system integration, and onboard integration and demonstration; comprising 49 requirements
- **Techno-economic and ecological evaluation** with emphasis on the ***eWAVE*** evaluation framework, technology evaluation, economic evaluation, ecological evaluation and final recommendations; comprising 44 requirements

The ***eWAVE*** Requirements Architecture document serves as a foundation for all subsequent project activities, including development, integration, demonstration and evaluation, and also guides the requirements monitoring and risk management in ***eWAVE***.