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## **innovActive ENERgy storage systems onboArd vessels**

### **Deliverable D 5.3**

Validation of the ship power system with downscaled  
PHIL platform

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## Public Summary

This document is a part of Task 5.3 in WP5 and is based directly on the simulation work carried out in D5.1 and the development of the downscaled PHIL platform in D5.2. The previous deliverables focused on modelling and preparing the laboratory setup, while real experimental testing perform in D5.3. In this task, the downscaled Power Hardware-in-the-Loop (PHIL) platform is used to test how the energy storage solutions, i.e., semi solid-state batteries (SSSB), supercapacitors (SC), and the hybrid SSSB–SC system behave using realistic shipboard operating conditions. The PHIL setup combines physical components such as ESS modules, a four-quadrant power amplifier, and programmable loads with real-time digital simulations of the ship power system. This allows the hardware to interact dynamically with a simulated shipboard environment, making it possible to observe real electrical behaviour, fast transients, control responses, and stability under different test scenarios.

In this deliverable, we describe how the tests were carried out, the operating conditions used for each use case, and the results obtained during laboratory testing. The work demonstrates that the downscaled PHIL platform created in D5.2 can accurately reproduce the relevant features of the shipboard power system at laboratory scale. It also confirms that the control strategies developed earlier in WP5 operate correctly when applied to converters interfacing ESS modules, and shipboard power system. Hence, the goals of this deliverable are to:

- Experimentally test the performance of the ESS modules in the three use cases using the downscaled PHIL setup,
- Validate the control and power management strategies developed in earlier tasks using real PHIL setup,
- Evaluate how well the ESS and converter designs meet key performance indicators (KPIs) such as dynamic behaviour, power quality, and stability.

The results presented in D5.3 complete the transition from simulation to real hardware testing and provide the experimental foundation.