

WP1 - Experiences learnt and requirements

D1.4: Requirements to develop NEMOSHIP modular BESS- Public Summary:

The ambition of the NEMOSHIP project is to develop, test and demonstrate innovative technologies, methodologies and guidelines to accelerate the deployment and optimal exploitation of large battery energy storage systems (BESS) by 2030 for both hybrid and fully electric vessels.

To achieve this ambition, NEMOSHIP will develop a modular and standardised battery energy storage solution capable of integrating heterogeneous storage units, as well as a cloud-based digital platform enabling data-driven, optimised and safe operation. The project will demonstrate the maturity of these innovations at TRL 7 for hybrid vessels and assess their adaptability to fully electric ships.

In particular, the modular 1 MWh NEMOSHIP BESS will be installed as a retrofit solution on a vessel operated by project partner Solstad.

The present deliverable was prepared as part of Task 1.4 and focuses on the requirements applicable to the NEMOSHIP BESS, including the heterogeneous battery pack and its dedicated Battery Power Management System (BPMS). It forms part of WP1, “Experiences learnt and requirements”, which establishes the foundations for the subsequent technical developments of the NEMOSHIP project.

The report first provides a literature review of marine BESS technologies and an overview of the modular NEMOSHIP BESS. It then details the requirements relating to operational services, system integration, safety and applicable standards, as well as testing and validation.

The NEMOSHIP modular BESS will be containerised and will have the following main characteristics:

Innovation: The NEMOSHIP BESS will be based on off-the-shelf battery and power conversion components. Innovation will therefore focus on the electrical architecture and its optimal operation through dedicated power management algorithms. The battery modules will be supplied by project partner Corvus.

Modular architecture: The use of standardised components and interfaces will facilitate rapid installation, maintenance and module replacement, thereby reducing vessel downtime. This modular design will simplify system management and improve overall operational efficiency.

Scalability: Although the demonstrated BESS will have a capacity of 1 MWh, it will be designed to accommodate changing energy requirements. Its capacity will therefore be

expandable or reducible, ensuring that the system remains flexible and adaptable to future vessel needs.

Advanced control and management capabilities: Real-time monitoring and predictive analytics will support the optimisation of energy storage, charging and discharging processes. These advanced control capabilities will contribute to maximising the efficiency, safety and performance of the BESS.

Safety certifications: The BESS will be required to obtain the relevant safety certifications in order to comply with applicable standards and mitigate potential hazards. Safety is a critical requirement for ensuring reliable and secure system operation.

Grid and microgrid interoperability: The BESS will comply with requirements relating to voltage and frequency regulation, power quality and electrical system stability. This will enable its seamless integration into the vessel's internal microgrid and with other onboard energy sources.

Operational modes: The BESS will supply energy during vessel operation while also contributing to the management of the ship's internal microgrid. Its role will depend on the vessel's specific demand profile and on the required power quality and reliability services.

The operational requirements have been classified into three categories of BESS services: energy management, power supply quality and reliability, and backup services. These services have also been linked to the BESS operating modes identified in Deliverable D1.3.

The requirements presented in this report will provide the foundation for the development of the 1 MWh NEMOSHIP modular BESS in WP3, "Modular BESS design, integration and testing".

Once installed onboard the Solstad vessel, the NEMOSHIP BESS will be demonstrated during a two-year programme under WP5, "Modular BESS demonstration and optimisation for the Solstad retrofitted hybrid vessel". This demonstration phase will support the improvement and validation of the proposed concept.

