NEMO

NExt-generation MOdels for advanced battery electronics

Co-funded by the European Union

CHALLENGE

A whole new class of models and algorithms

Efficiency and safety are vital for battery operations in **e-vehicles** and **stationary storage.** However, existing battery management systems (**BMS**) often rely on a small amount of observed data and on simplified models.

This **scarcity of knowledge** regarding the **battery's overall state** when it is in use leads to **suboptimal utilisation.**

- With NEMO, we aim to leverage **in-situ and in-operando electrochemical impedance spectroscopy (EIS) sensing**, along with **active cell switching** for balancing at cell-level and sufficient computing power to execute **real-time advanced models and algorithms.**
- Our consortium provides **efficient software and hardware** to apply and coordinate these approaches within **high-end local processors and cloud computing.** Our new concepts exploit sensor information and help identify different **electrochemical processes** inside battery cells. These processes are then tracked over time. The availability of such diverse physical information for onboard battery cells, makes room for developing **cutting-edge performance**, **lifetime**, and **safety battery models** and state estimators within NEMO, and validating them on two different BMS configurations.
- Physics-based performance model parameters continuously get updated as the battery ages, so that performance and safety state indicators **maintain the least possible error.** The data-driven approaches exploit mathematical algorithms to be trained upon the large datasets made available from historical or laboratory generated battery information.
- Combinations of coupled **physics-based and data-driven** approaches are also foreseen to be implemented within NEMO as another **innovation** of the project to propose next-generation BMS.

OBJECTIVES

We are raising the bar for batteries

- **Complete avoidance** of foreseeable **critical safety issues** unrelated to severe mechanical impacts.
- **Extension of the first-life battery lifetime by at least 20%** and will capture failure mode with **100% accuracy.**

IMPACT

Reshaping the battery sector

Our solutions will **reshape the battery sector** and position the **European BMS industry at the forefront** of digital battery management innovations. These performance improvements will further increase social acceptance and uptake of the electrification of the European energy system.

Our project especially contributes to:

- Accelerate **roll out of electrified mobility** through increased attractiveness regarding improvements of e-vehicle operation.
- Improved **Life Cycle Assessment** of the final product segment of the battery value chain and **accelerated roll-out of circular designs** though innovations that allow for a straight-forward second life usage with economic guarantees.
- Increased **exploitation and reliability of batteries** through demonstration of innovative use cases of battery integration in stationary energy storage and e-vehicles.

NEMO

We are paving the way for a brighter, more sustainable energy future.

Discover more at:

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