Horizon Europe Work Programme

BIG LEAP

Next Generation of Battery Management Systems to increase Interoperability, bridge the Gap between 1st and SL-BESS, Extend Adaptability and emPower battery value chains

D3.2 - Development of data-driven SoX and RUL algorithms for increase BMS interoperability

1st period report

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Date: 30/06/2025

Doc. Version: 1

Co-funded by the European Union

Project funded by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

Co-funded by the European Union under grant agreement 101137815. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

PROJECT DETAILS			
Project name	Next Generation of Battery Management Systems to increase Interoperability, bridge the Gap between 1st and SL-BESS, Extend Adaptability and emPower battery value chains		
Start	01/01/2024	**Duration**	42M
Project acronym	BIG LEAP	**GA number**	101137815
Topic identifier	HORIZON-CL5-2023-D2-01-04	**Call identifier**	HORIZON-CL5-2023-D2-01
Type of Action	Horizon IA	**Coordinator**	BRING
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DELIVERABLE DETAILS			
Number	3.2		
Title	Development of data-driven SoX and RUL algorithms for increase BMS interoperability (1st period report)		
Short description	Report on the specifications, development, and validation (in local environment) of the SoX and RUL Algorithms stated in the task. The 1st period report will focus on the first functional version of the algorithms, prior to their integration in the multi-operational BMS.		
Work Package	WP3	**Task**	T3.2
Dissemination level	SEN - Sensitive		
Due date (M)	M18	**Submission date (M)**	30/06/2025
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DOCUMENT HISTORY			
Date	**Version**	**Name**	**Changes**
28/10/2024	0.0.1	20241028_BIGLEAP_D3.2_v0.0.1	Frist draft version of the document, only battery models section added.
12/05/2025	0.1	20250320_BIGLEAP_D3.2_v0.1	First complete draft version of the document.
02/06/2025	0.2	20250602_BIGLEAP_D3.2_v0.2	Version reviewed after internal review process
30/06/2025	1	20250629_BIGLEAP_D3.2_v1	Version for submission after external review

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Executive Summary

Deliverable D3.2 of BIG LEAP project presents the development of the State of X (SoX) and Remaining Useful Life (RUL) algorithms of BIG LEAP, which have been addressed in Task 3.2 of the project. Additionally, the battery models required for the Digital Twin platform of BIG LEAP are also developed within this deliverable.

On the one hand, SoX and RUL algorithms are regarded as the main outcome of Task 3.2. These algorithms are critical for a safe, reliable, and optimized battery operation, as they provide internal states and estimations that are not directly measurable in a battery. To do so, these algorithms are embedded into Battery Management Systems (BMS), the electronic components in charge of monitoring the operation of the battery.

SoX and RUL algorithms require of a tailored parametrization process, due to the varying physical, chemical, and electrical performances of different battery products. In other words, SoX and RUL algorithms parametrized for a specific battery might not obtain accurate results when implemented with different batteries. In order to advance into more transversal and interoperable BMSs (which is aligned with BIG LEAP project objectives 2 and 3), this deliverable presents novel methodologies to ensure easier adaptability of SoX and RUL algorithms between different battery products. To do so, first novel designs of the SoX and RUL algorithms are provided, and then they are adapted to different scenarios. The results obtained for each of the algorithms demonstrate that the proposed methods are efficient to advance into a transversal and interoperable BMS.

On the other hand, battery models allow simulating the performance of the device under different operational conditions, which eventually allows optimizing the design or performance of the battery. The battery models developed within BIG LEAP are based on an Equivalent Circuit Modelling (ECM) approach and are crucial for the Digital Twin platform of the project. Specifically, four different models for LFP, LCO, NMC, and NCA chemistries are presented.