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FACTSHEET: CAPACITY ESTIMATOR FOR CELLS AND SMALL MODULES

Funded by the European Union

Rapid Diagnostics for Repurposing Li-Ion Cylindrical Cells

About REBELION

REBELION addresses the waste management challenges of lithium-ion batteries from electric mobility, promoting recycling as a sustainable solution to recover valuable raw materials and support circular battery value chains.

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Key insight

Fast capacity estimation, supporting efficient sorting & repurposing assessment with a cost-effective, scalable hardware architecture.

CAPACITY ESTIMATION IN MINUTES

Estimates capacity in less than 4 minutes, enabling high-throughput screening of cylindrical cells and small modules.

SUPPORTS BATTERY REPURPOSING

Enables sorting, matching, and repurposing assessment of used Li-ion cells for second-life applications.

DUAL DIAGNOSTIC TESTS

EIS test, safe for degraded cells and performed under stationary conditions; ENA-CI test, applicable immediately after operation.

SCALABLE & INDUSTRIAL-READY

Modular architecture supports expansion to multiple test stations and integration into automated dismantling lines.

COST-EFFECTIVE

Uses cost-effective hardware.

Why it matters

Capacity is the key indicator of how much energy a lithium-ion cell can still store and deliver, and one of the first criteria for deciding whether to repurpose it for second-life use or send it to recycling.

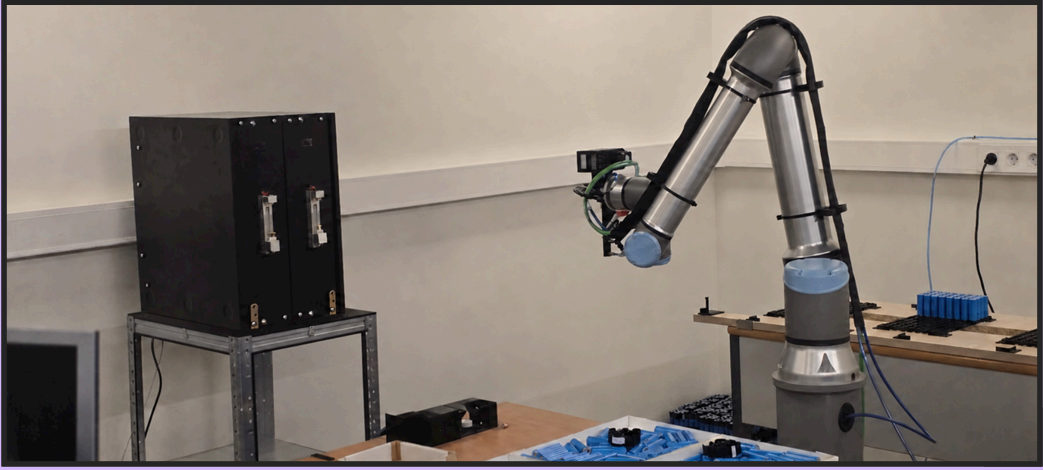
Rapid assessment enables efficient sorting, or direct placement in the final configuration for balancing battery groups, cutting testing time from hours to minutes.

Safety is essential when evaluating cells from used batteries, which may be severely degraded or damaged: the demonstrator includes an EIS-based test that can be safely applied to them.

Cost-efficient repurposing requires automation: the system syncs with robots that load, unload, and place cells according to diagnostic results, storing and transferring data to ensure full traceability via digital battery passport frameworks.

What are we developing

We’re developing a **modular hardware demonstrator** for rapid capacity estimation of lithium-ion cells and modules. It combines **two methods**, EIS, safe for degraded cells, and ENA-CI, on independent units linked to a shared mini-PC, where models estimate capacity from the signals. The system supports traceability via digital battery passports and syncs with robotic handling, and scales to multiple stations for industrial sorting and repurposing.



How it works

Dual-test diagnostics combined with AI-based capacity estimation, automation, and data traceability.

1

CELL OR MODULE LOADING

Insert a cylindrical cell or a small cylindrical-cell module into the dedicated test holder.

2

TEST SELECTION

Run either the EIS test or the ENA-CI test for capacity estimation.

3

SIGNAL ACQUISITION

Diagnostic electronics capture electrochemical signatures.

4

CAPACITY ESTIMATION

A mini-PC applies data-driven models to estimate cell or module capacity.

5

SORTING & TRACEABILITY

Results support automated sorting, and are stored locally or remotely.

Key benefits

Advanced diagnostics for lithium-ion cell second-life assessment, combining fast capacity estimation, safe testing, scalable deployment, and cost-efficient operation to maximise reuse value.

INDUSTRIAL

Fast and accurate capacity estimation of end-of-first-life cells, enabled by a scalable architecture for high-throughput multi-cell testing.

ENVIRONMENTAL

Extends battery lifetime and supports circular economy strategies by identifying cells suitable for second-life applications.

SAFETY

EIS diagnostics use low excitation signals to safely assess aged and degraded cells.

ECONOMIC

Lower testing costs through cost-effective hardware, faster diagnostics, autonomous operation, and higher-value reuse decisions.

Key figures

LOW HARDWARE COST

From €700 (EIS) or €1,600 (ENA-CI) per channel, plus one shared mini-PC (from €300).

RAPID TESTS

Less than 4 minutes (EIS) or 3 minutes (ENA-CI) per cell or module.

SAFETY

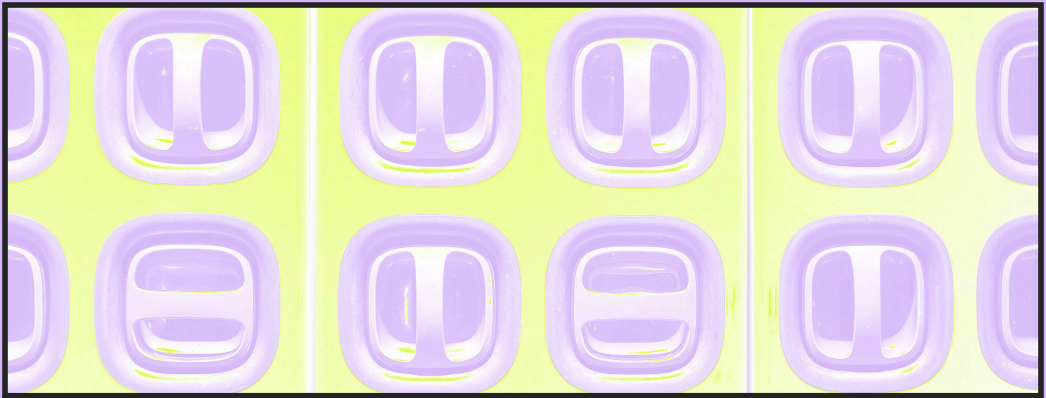
EIS test enables near-100% screening of non-functional cells.

SCALABLE AUTOMATION-READY ARCHITECTURE

Modular design supports multiple holders, single-PC control, and production-line integration.

DATA TRACEABILITY

Centralized, accessible test data enable battery traceability and algorithm-based decisions.



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Discover more at:
> REBELION-PROJECT.EU

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