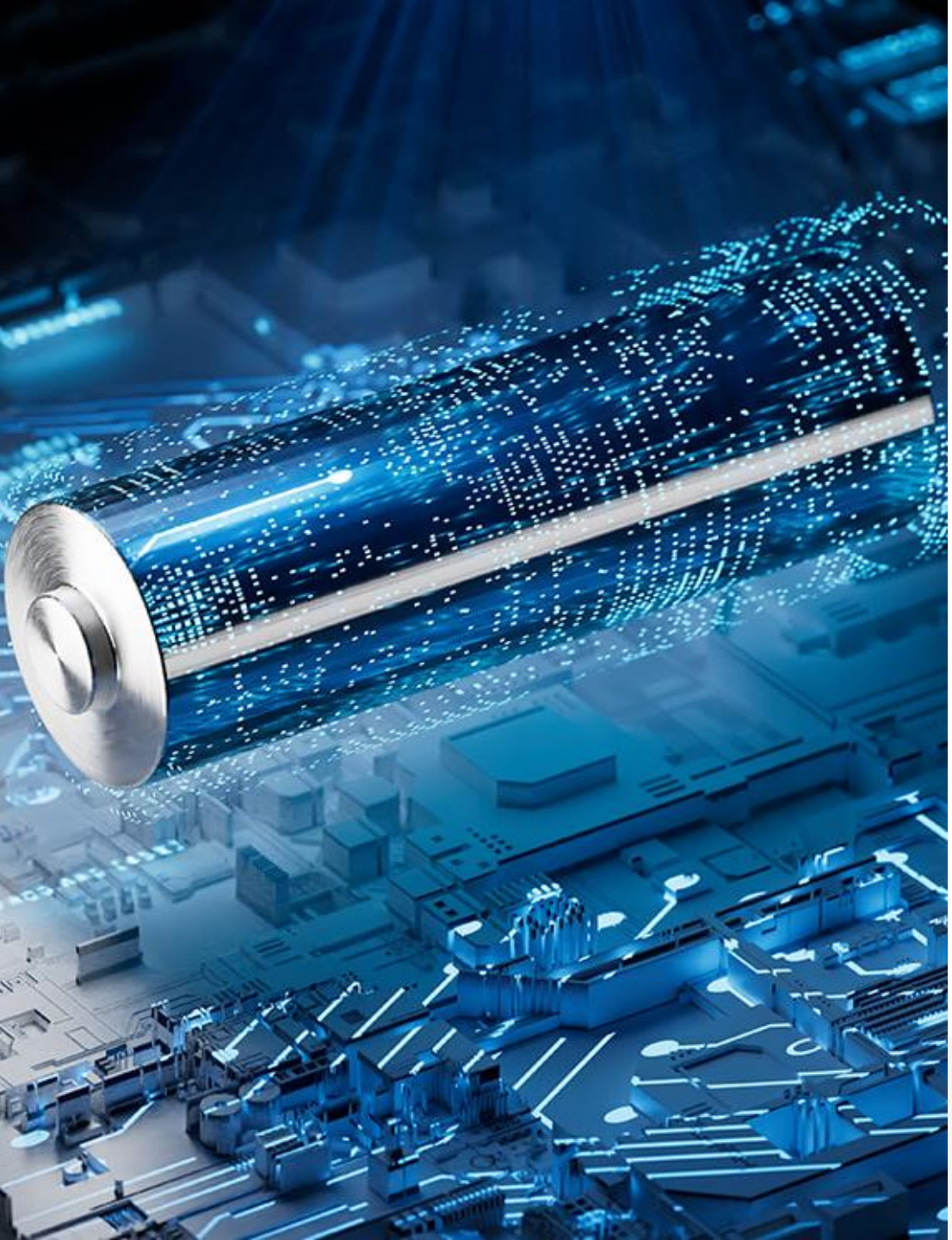


Batteries reuse and direct production of high performances cathodic and anodic materials and other raw materials from batteries recycling using low cost and environmentally friendly technologies

Brussels, Belgium

14 November 2022

Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

Project overview

Grant agreement no: 101069685

Coordinator: Fundación Tecnalia Research & Innovation

Participants:

16 partners from **9** countries:

Spain, Germany, France, Belgium, Norway, Sweden, Italy, Turkey and United Kingdom

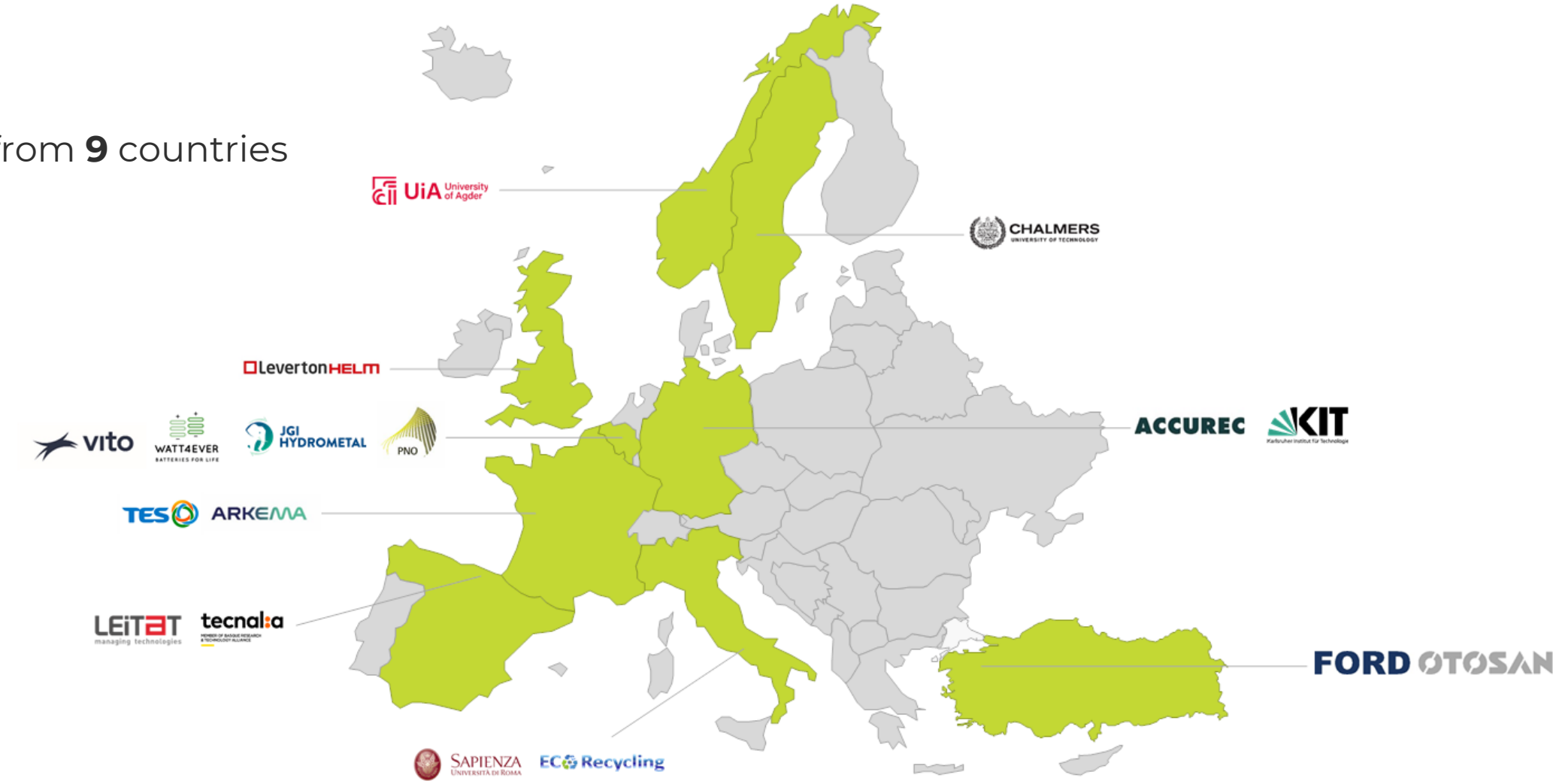
Duration: 1 September 2022 to 30 August 2026

Project budget: EUR 8.9 Million

Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

Participants

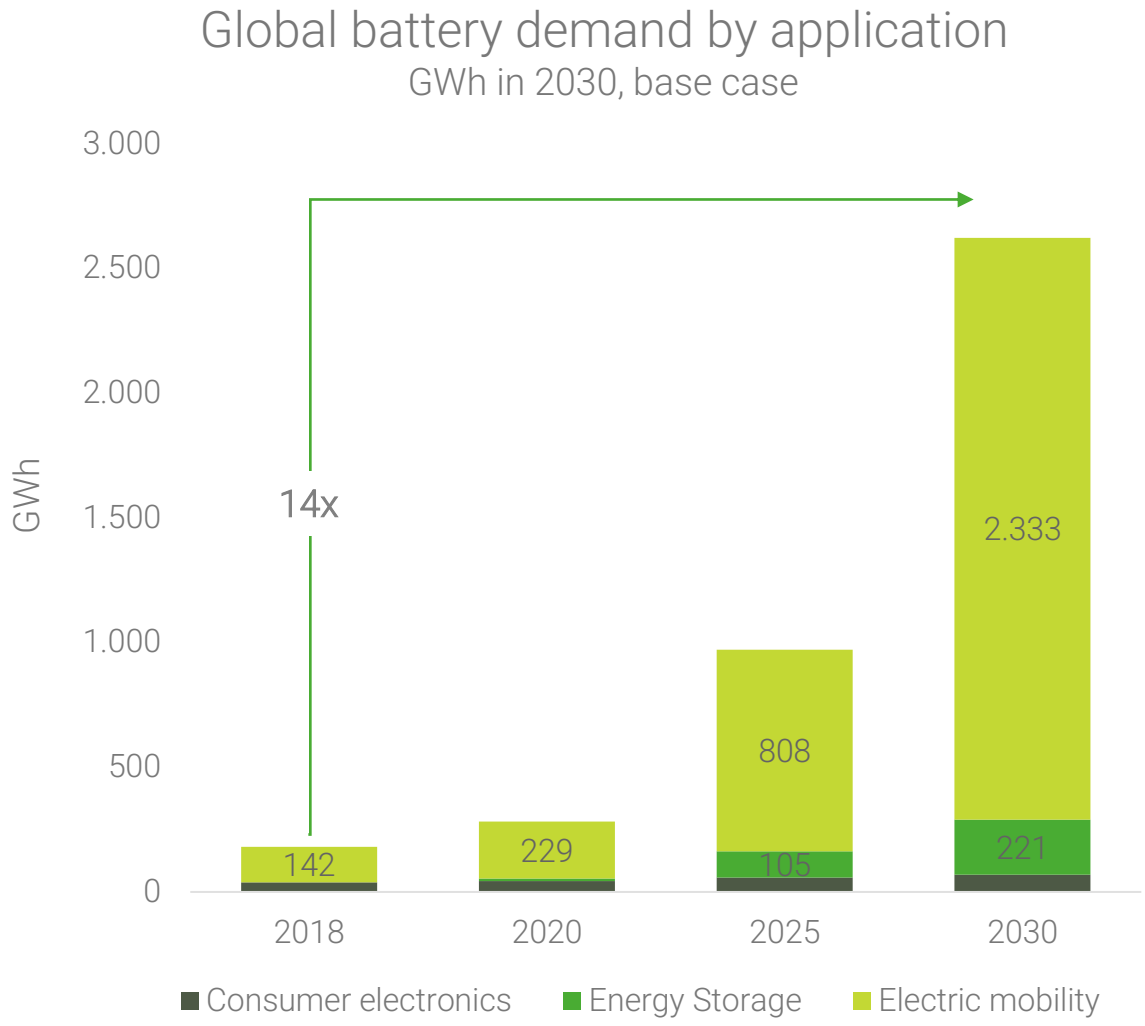
16 partners from **9** countries



Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

Motivation

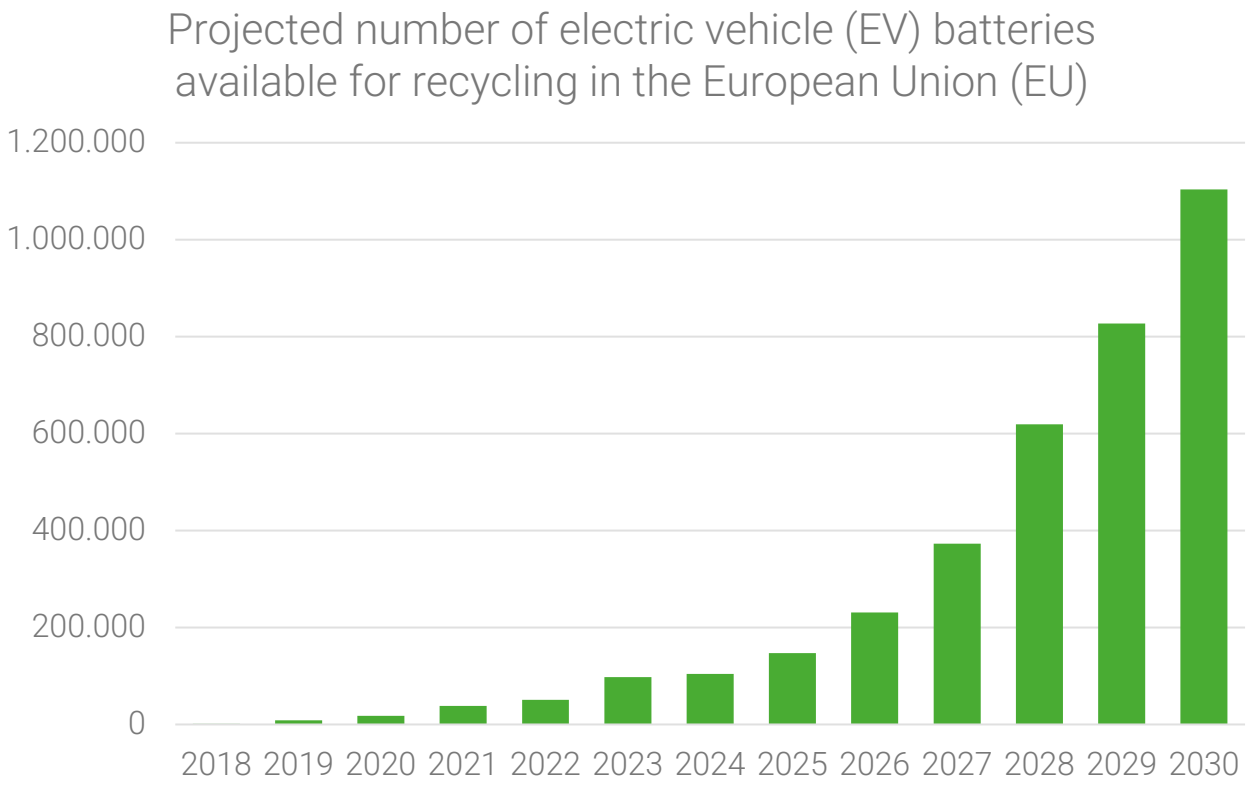
- Battery market €250 billion a year by 2025
- Total of 25 new Li-ion factories in Europe
- Total cumulative capacity of 500 GWh by 2030
- From 2030, battery production expected to rise 300 GWH/year



Source: World Economic Forum & Global Battery Alliance (2019)

Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

Opportunities



Source: Projected number of electric vehicle (EV) batteries available for recycling in the European Union (EU) between 2018 and 2030, Statista 2021 (URL)

- More than 1 M EV batteries will be available for recycling in the EU by 2030
- Need for efficient re-use and recycling processes of End-of-Life LIBs
- Production of battery grade materials at competitive prices
- Decrease dependency on the imports of CRM

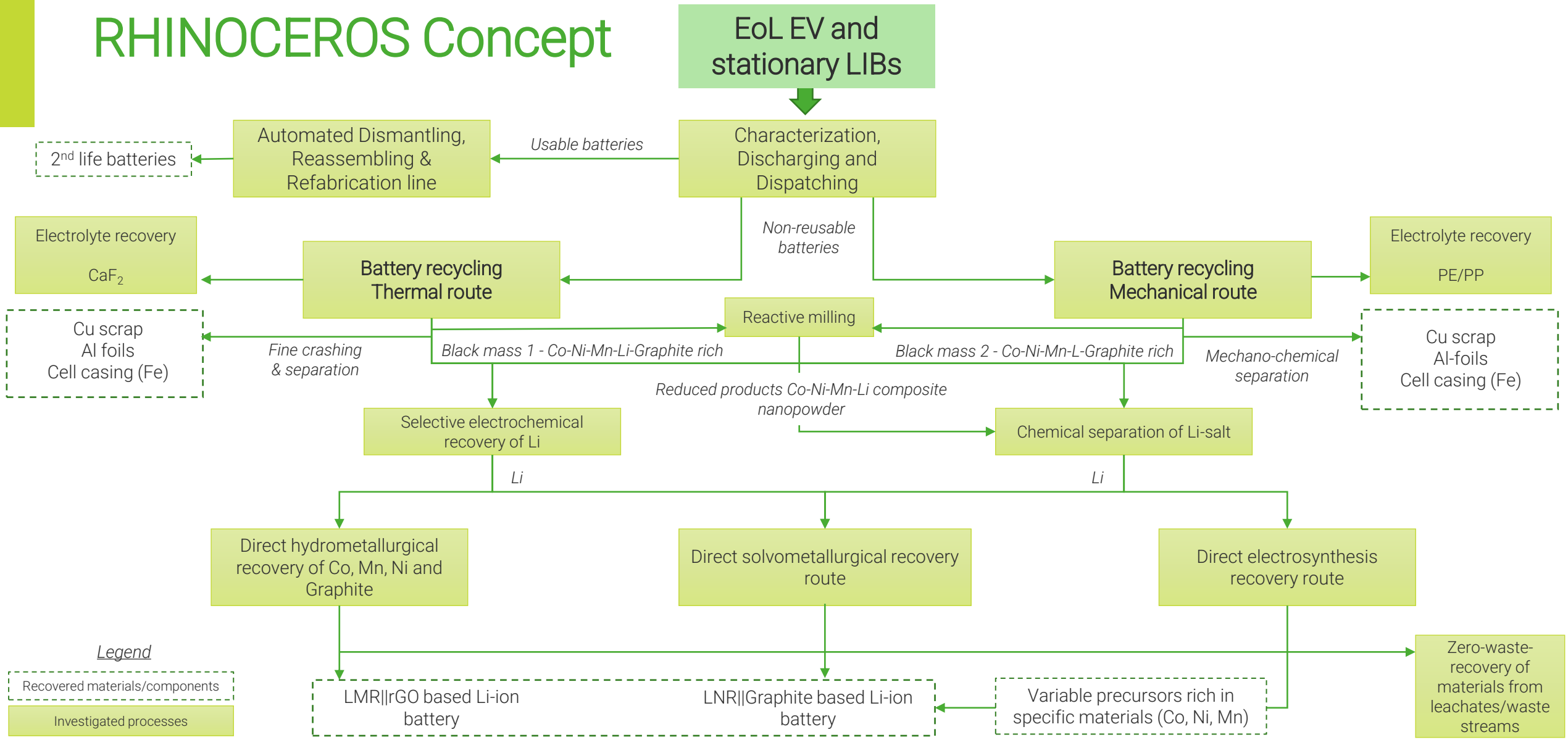
Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

RHINOCEROS Objective

- The objective of Rhinoceros is to develop, improve, and demonstrate, in an industrially relevant environment, an economically and environmentally viable route for re-using, and recycling End-of-Life (EoL) Electric Vehicles (EV) and stationary energy storage Lithium-Ion Batteries (LIBs).

Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

RHINOCEROS Concept



Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

Work Plan

Year 1: M1 – M12	Year 2: M12 – M24	Year 3: M25 – M36	Year 4: M37 – M48
Research & Development		Selection & Validation	Upscaling in Industrial Environment

WP 1 - TEC: Project Management

WP 2 – ACC	WP 3 – UiA	WP 4 – ACC	WP 5 – VITO	WP 6 – JGI-HM	WP 7 - TEC
Selection, characterization and supply	Automated sorting and dismantling of LIBs and reuse of batteries for second life applications	Pre-treatment	Materials extraction and direct routes for the synthesis of electrodic materials	Upscaling of the most promising technologies	Qualification of materials for high performance batteries

WP 8 - TEC: Sustainability assessment

WP9 - PNO: Development of Communication, Dissemination, Exploitation and Clustering activities

Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

Main Specific objectives

- To develop a smart system for automated classification, dismantling and reassembling of LIBs
- To propose and validate novel solutions for the reuse and repurpose of batteries for second life applications with 60% gain in disassembly/assembly time compared to SoA manual operations, and automating the current manual operations by up to 75%.
- To develop a set of cost efficient, flexible and environmentally friendly routes targeting the recycling of all materials present in LIBs – target >95% of active materials and base metals and >90% electrolyte, PE/PP and fluorinated compounds
- To identify and address health risks, environmental impacts, safety hazards and new safety practices
- To validate the recovered materials through the synthesis of new high-performance electrodes and elements for next generations batteries able to satisfy the targeted 2030 battery performances for EV batteries
- To validate the most promising process at pilot level (TRL upgrading to TRL6)- 10kg electrode materials/day, 1Kg/day electrolyte, fluorinated compounds and polymers

Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

Main Expected Impacts

- Improve access to battery materials and strengthened European raw material independency by recovering all materials in EoL EV and stationary LIBs.

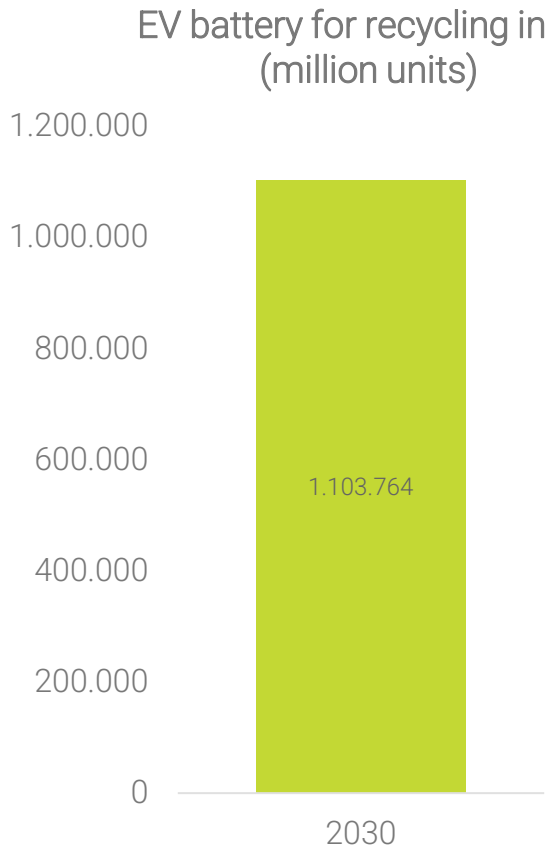
- Successful repurposing of batteries can have up to ~75% environmental impact reduction, and some of the recycling routes proposed could reduce CO_2 emission by ~80% compared to SoA pyrometallurgical processes for recycling of battery grade materials. Zero-waste process.

- Significant reduction in cost (~50%) to produce cathodes at same performances than their SoA counterparts

- High-performance materials, able to satisfy the targeted 2030 battery performances for EV batteries

Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

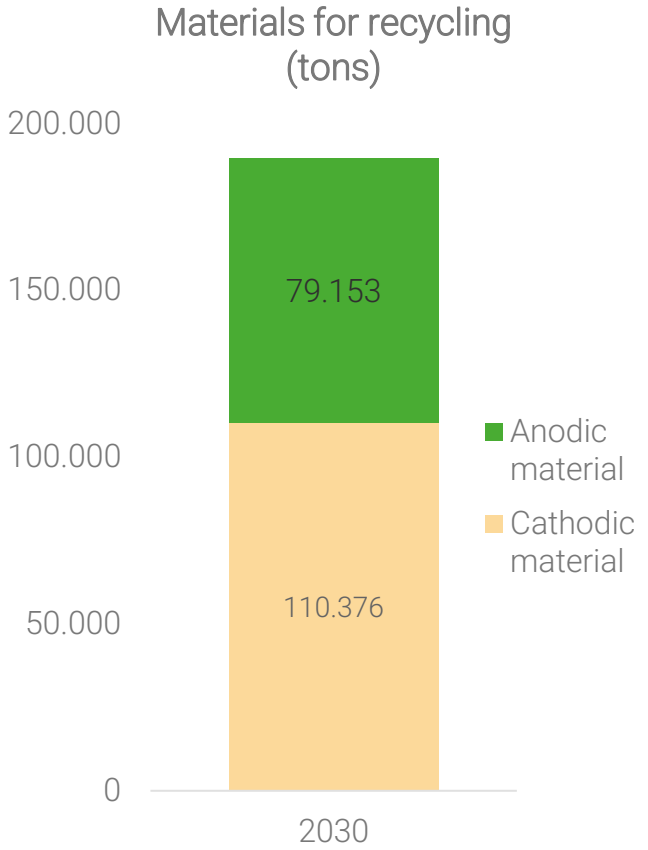
Expected Impacts



1 EV Battery

Anode
~70kg, 15€/kg

Cathode
~100kg, ~20€/kg



€3 Billion
business by 2030

Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

Contact

RHINOCEROS Coordinators

Dr. Amal Siriwardana (Tecnalia)

Email: Amal.siriwardana@tecnalia.com

Dr. Lourdes Yurramendi (Tecnalia)

Email: lourdes.yurramendi@tecnalia.com

WP9 Dissemination, Communication Exploitation and clustering , Overall coordinator

Dr. Nader Akil (PNO Innovation)

Email: nader.akil@pnoconsultants.com

WP9, Task leader

Alan Gonzalez Morales (PNO Innovation)

Email: alan.gonzalez@pnoconsultants.com

www.rhinoceros-project.eu
Coming soon

@EuRhinoceros #RHINOCEROS

RHINOCEROS EU project

Funded by the European Union under Grant Agreement No 101069685. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.