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Environmental performance of end-of-life scenarios of Electric Vehicles batteries following a life cycle approach

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INTRODUCTION & OBJECTIVES

Electric vehicles (EVs) batteries play an important role in meeting the need for short short-term energy storage. The upstream environmental impacts of manufacturing and **end-of-life (EoL) management** is a drawback to the use of rechargeable batteries. EoL management, strictly related to the design phase, is of great importance since if the battery at EoL cannot be **repaired, reused, or recycled** due to an initial design constraint it will be disposable, leading to considerable environmental consequences. More **efficient use of resources, circularity of Critical Raw Materials (CRM)** and **sustainable recycling** processes are needed.

BATRAW aims to develop **innovative technologies for sustainable end-of-life management of EV batteries**. The specific objectives are:

1. Support on the selection of best materials and recycling processes and on an ecodesign guide
2. Assess the environmental impacts associated to BATRAW EoL scenarios. Comparison with conventional routes

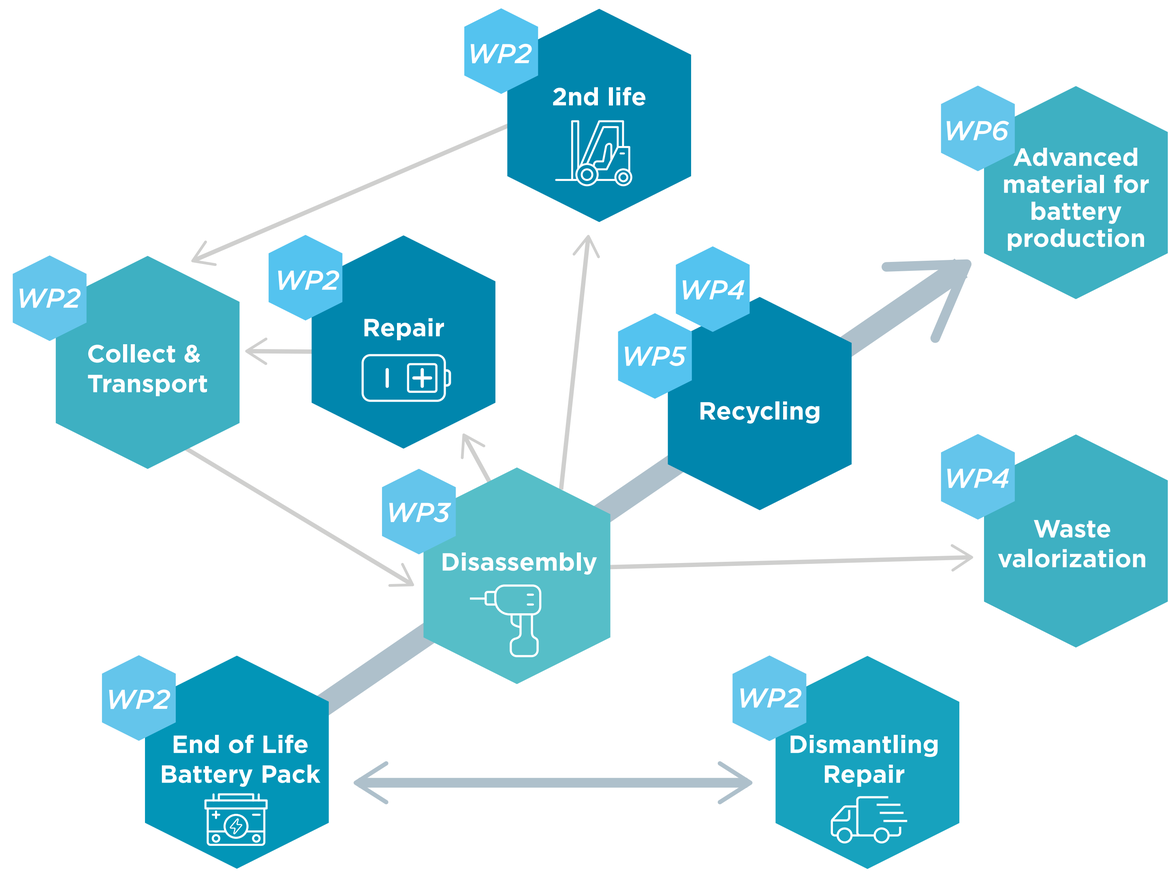

Fig 1. BATRAW concept showing the EoL scenarios, the circularity of the system and connections between WPs. Source: adapted from BATRAW Grant Agreement.

MATERIAL & METHODS

The following methodologies are being used: **Life Cycle Assessment (LCA)** following the **Safe and Sustainable by Design** framework

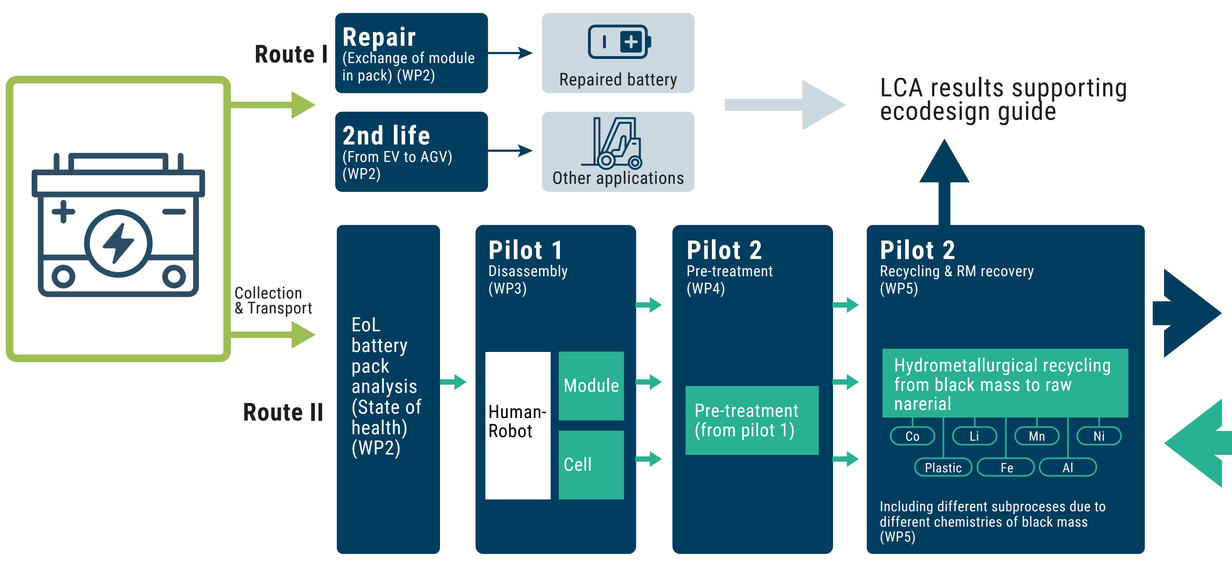

Fig 2. System Boundaries of BATRAW System

PRELIMINARY WORK & RESULTS

Goal and scope: To assess the environmental performance of the BATRAW system whose **function** is to i) repair/2nd life of a EV battery pack and ii) recover valuable materials from an EV battery

- **Functional Unit I**: 1 kWh of the total energy provided over the service life by the battery system
- **Functional Unit II**: Recycling of 1 ton of waste Li-ion battery packs with an NMC chemical composition from an electric vehicle
- **System boundaries** (Fig 2.): from collection and transport up repair & 2nd life, and ii) recycling

- **Scenarios established for comparison with BATRAW:**

Sc1) Conventional recycling systems (e .g. membranes instead liquid-liquid for separation of Co and Ni)
Sc2) Conventional pathway of mining extraction (extraction of Ni, Co, Mg from mining compared to recycling and circulate it)
Sc3) Turkish recycling processes (e.g. using different collection and transportation systems as well as recycling processes)
Sc4) Eco-designed battery pack versus conventional battery (applying ecodesign rules such as reduce amount of materials/type of energy)

NEXT STEPS

1. **Ongoing:** LCA screening guiding on the potential **best candidate materials and processes. Supporting Ecodesign rules** with preliminary LCA results
2. **LCA models at pilot scale** of EoL BATRAW technologies. **Inputs to Ecodesign guide**
3. **LCA models at industrial scale** of the entire BATRAW system and EoL scenarios. **Final recommendations to Ecodesign guide**
4. **Comparison of BATRAW technologies with conventional ones** identifying associated impacts and benefits.

Contact me

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