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Innovació en bateries i cicle de vida: cap a solucions més sostenibles i circulars

"innovant amb les empreses"

Violeta Vargas

05.03.2026

Innovació en bateries i cicle de vida

Cap a solucions més sostenibles i circulars

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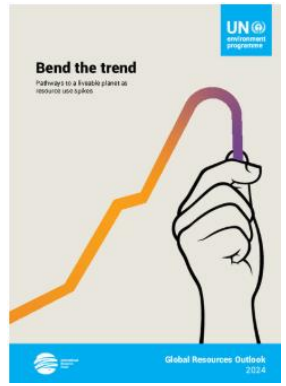
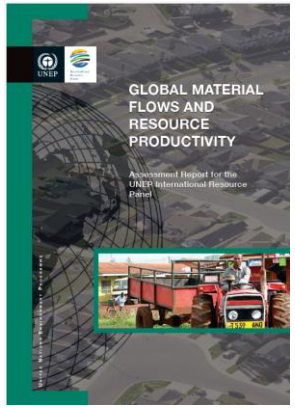
Tot el que fem té impacte. La pregunta és: quin, on i per què?

L'extracció de materials s'espera que augmenti un 60% d'aquí al 2060 i ja actualment contribueix amb un 35%de les emissions globals





La demanda de materials s'ha multiplicat des de 1970 (de ~22 a ~70 Gt/any fins 2010; i continua creixent).

El problema no és fer: és fer sense mirar l'impacte sencer

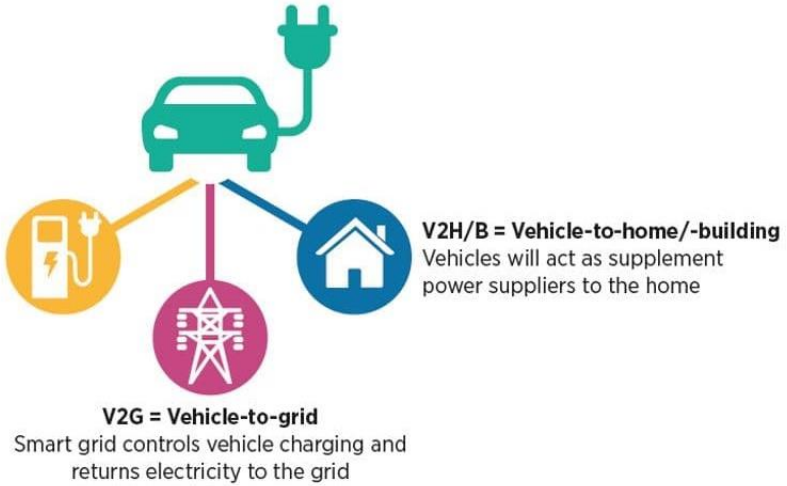
I això ens obliga a mirar el sistema sencer (ACV) i les palanques d'innovació.

On es materialitza la innovació?

Els 3 mons on aterra la innovació - On tenim palanques per reduir impacte i donar servei.

Image by freepik

Vehicle / mobilitat



IRENA - International Renewable Energy Agency

Xarxa / flexibilitat

Emmagatzematge local

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On es materialitza la innovació?

Els 3 mons on aterra la innovació - On tenim palanques per reduir impacte i donar servei.

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MARBEL

Vehicle / mobilitat

XL CONNECT

Xarxa / flexibilitat

Emmagatzematge local

RECIRCULATE

ACV (LCA)

Del bressol a la tomba (i més enllà)

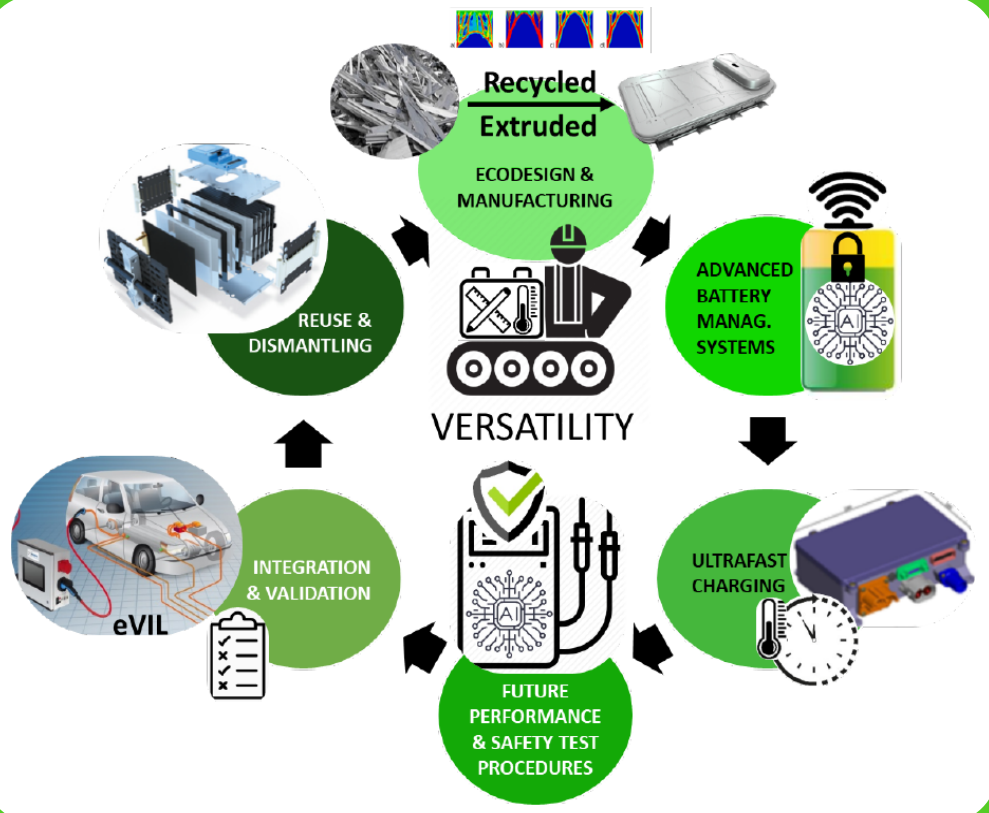
LCA is defined by the ISO 14040 as the compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle. Along the lines of this standard and with the main aim to support LCA practitioners in operationalizing LCA, other codes of practice have been developed.

L'ACV és una brúixola molt pràctica per decidir què comprem, com ho operem (perquè doni servei real) i com ho tanquem al final de vida, sense generar problemes futurs

H2020 – MARBEL PROJECT OVERVIEW

Manufacturing and Assembly of modular and Reusable EV Battery for Environment-friendly and Lightweight mobility

- > 20% weight reduction
- > 25% charging time reduction
- > 40% LCA improvement by using modularity
- Useful Battery life up to 300,000 km
- Easy & Safe (dis-)assembly automatization
- Reparability and 2nd life transition
- Adaptable to all cells & vehicles

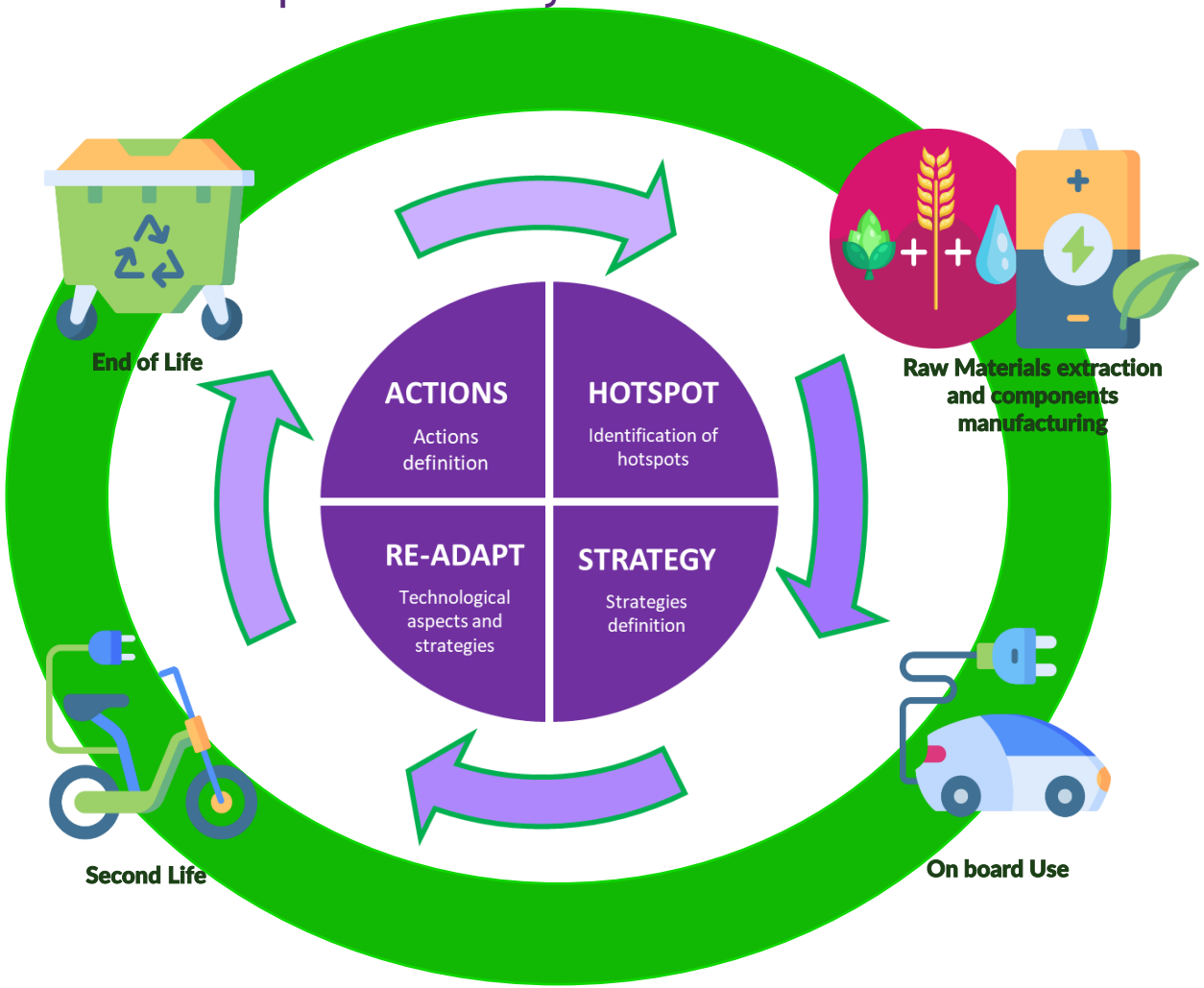


The project was coordinated by EURECAT

Palanques d'innovació que redueixen impacte

Ecodisseny i circularitat des de l'etapa de disseny

LCA helps identify key environmental hotspots



LCA provides data-driven insights to optimize the sustainability of batteries, guiding improvements in efficiency, recyclability, and circular economy integration

LCA evaluates the environmental footprint of the MARBEL EV BP, assessing impacts from raw material extraction to end-of-life management

Ecodesign Methodology

images: Flaticon.com'. These covers has been designed using resources from Flaticon.com

Palanques d'innovació que redueixen impacte

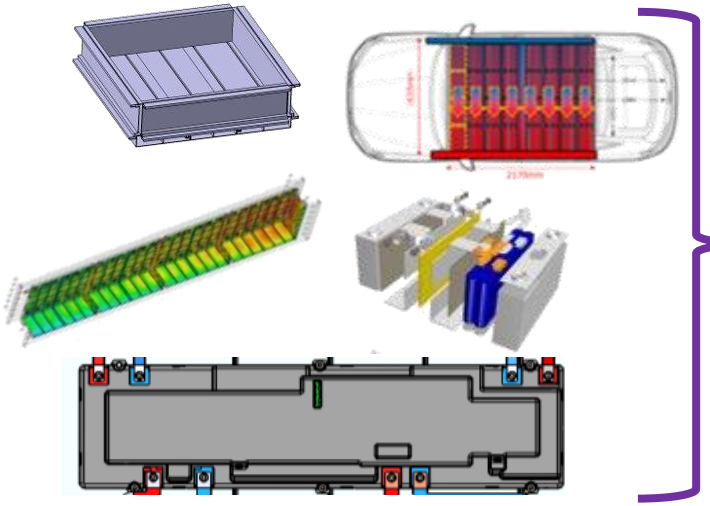
Ecodisseny i circularitat des de l'etapa de disseny

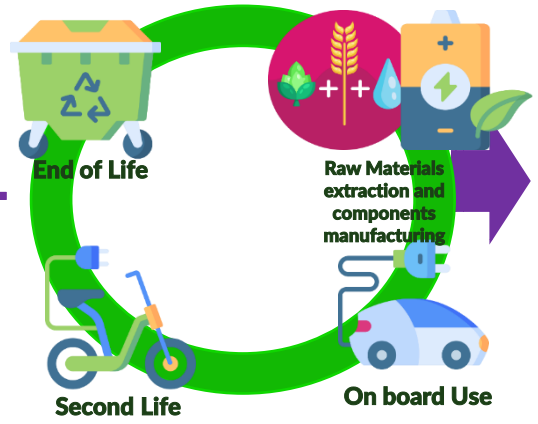
STEP 1: Identification of Hotspots and Life Cycle Stages

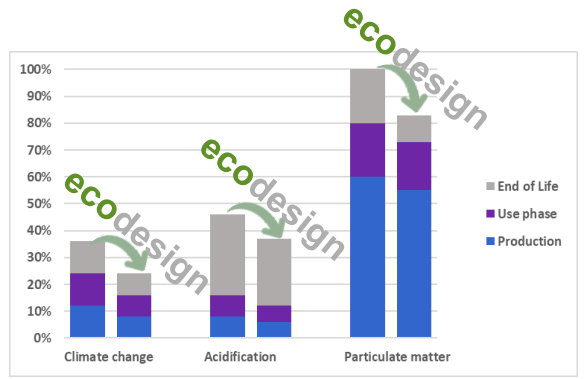
Based on a benchmark analysis. With the application of the LCA/LCC in a prospective manner at the beginning of the project or action.

STEP 2: Establishment of the most properly eco-design strategies based on STEP 1

Alignment between general objectives and technical actions developed.







STEP 4: Selection of concrete eco-design actions and Battery Conceptualized Design

From the strategy to action

STEP 3: Alignment of technological procedures to the selected strategies

Workshop where all parties involved begin to be familiarized with eco-design concepts

images: Flaticon.com'. These covers has been designed using resources from Flaticon.com

Palanques d'innovació que redueixen impacte

Ecodisseny i circularitat des de l'etapa de disseny

ECODESIGN STRATEGIES

- S1 Effective material usage: lightweighting
- S2 Effective material usage: nature
- S3 Enhancing smart charging options
- S4: Improve monitoring and state of cell and their capacity
- S5: Optimization of the driving conditions
- S6: Enhancing of the battery efficiency
- S7: Promotion of the second life from initial design
- S8: Design for EoL (End of life)
- S9: General structure optimization
- S10: Promote a design to allow repairing and refurbishment to enable reuse

Palanques d'innovació que redueixen impacte

Ecodisseny i circularitat des de l'etapa de disseny

Actions

Action 1: Use of recycled and recyclable materials, for example, in the extrusion of Aluminium profiles.

Action 2: Reduction of copper material needed for electronic components (cables, wirings, etc.)

Action 3: Adopt a "design for reuse, dismantling and recycling" approach by using easy recoverable and recyclable materials instead hybrid ones.

Action 4: Topological optimization of profiles to be used in the BP housing. This simulation will calculate the minimum material necessary to comply with the mechanical requirements.

Action 5: Reduce the quantities of soldering parts of the battery to minimize use of resources and facilitate end of use and second life operations.

Action 6: Use joining elements that can easily be removed to facilitate disassembly, as screws instead of glues to seal the battery pack /modules case.

Action 7: To define and include a protocol for the disassembly operations to assure safety conditions.

Action 8: Introduce a weldless connection to the cells to support disassembly, repairing, etc, options.

Action 9: Reduce whole weight of the battery by using lightweight materials in the casing elements (Al, Mg alloys,) and by choosing a high gravimetric energy chemistry in the electrodes composition that reduces the mass and keeps the energy capacity of the battery.

Action 10: An enhanced BMS that provides advanced degradation rate estimations to optimize battery usage in terms of an extended lifespan.

Action 11: Design a BMS with a multipurpose approach for both primary and second life options of the battery.

Action 12: To create a cloud connecting environment where data associated to the battery could be downloaded at any time during its lifetime and 2nd life extension.

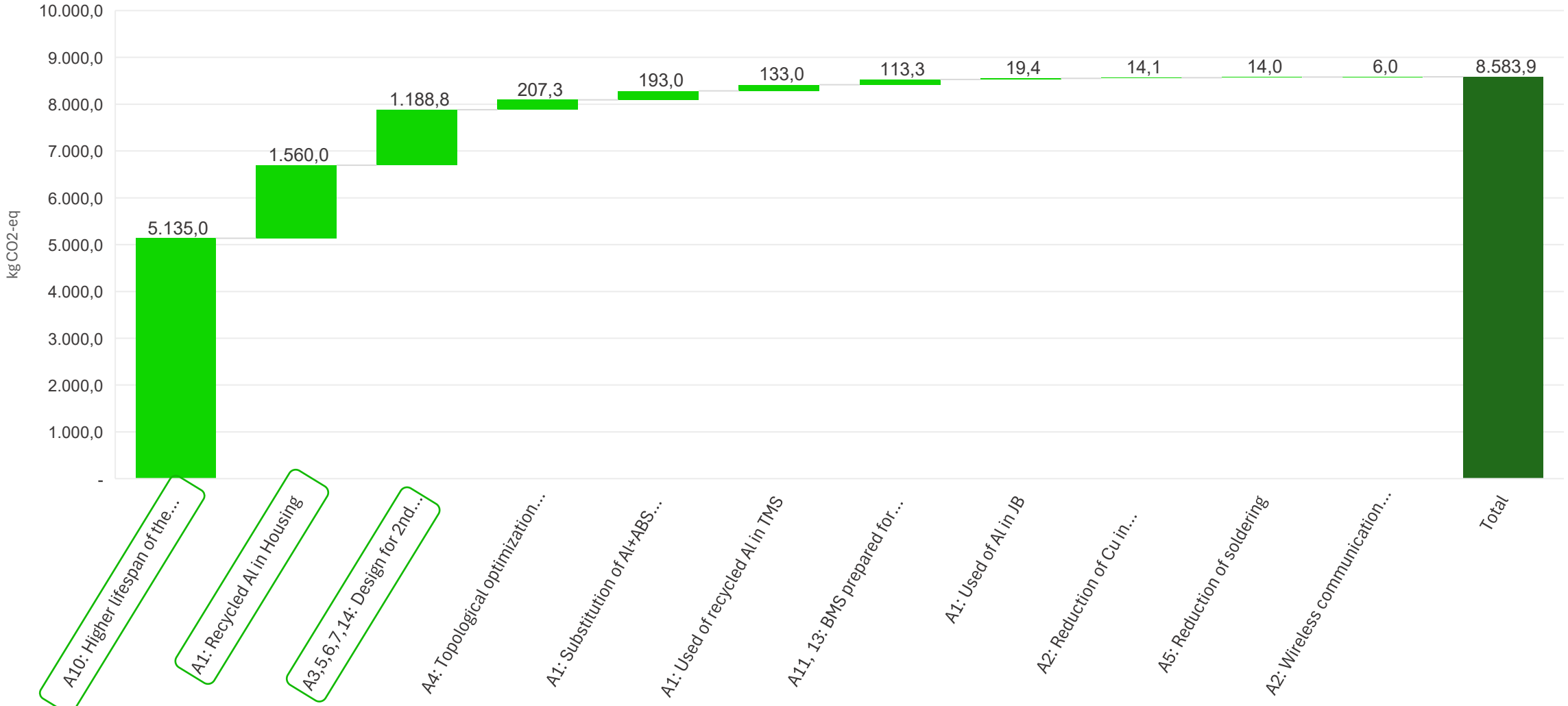
Action 13: Develop a BMS able to respond second life applications by connecting to 200 modules.

Action 14: Adopt a battery pack design able to be easily repaired, refurbished, and reused with limited interventions.

Resultats (LCA): què s'aconsegueix?

MARBEL Ecodesign results

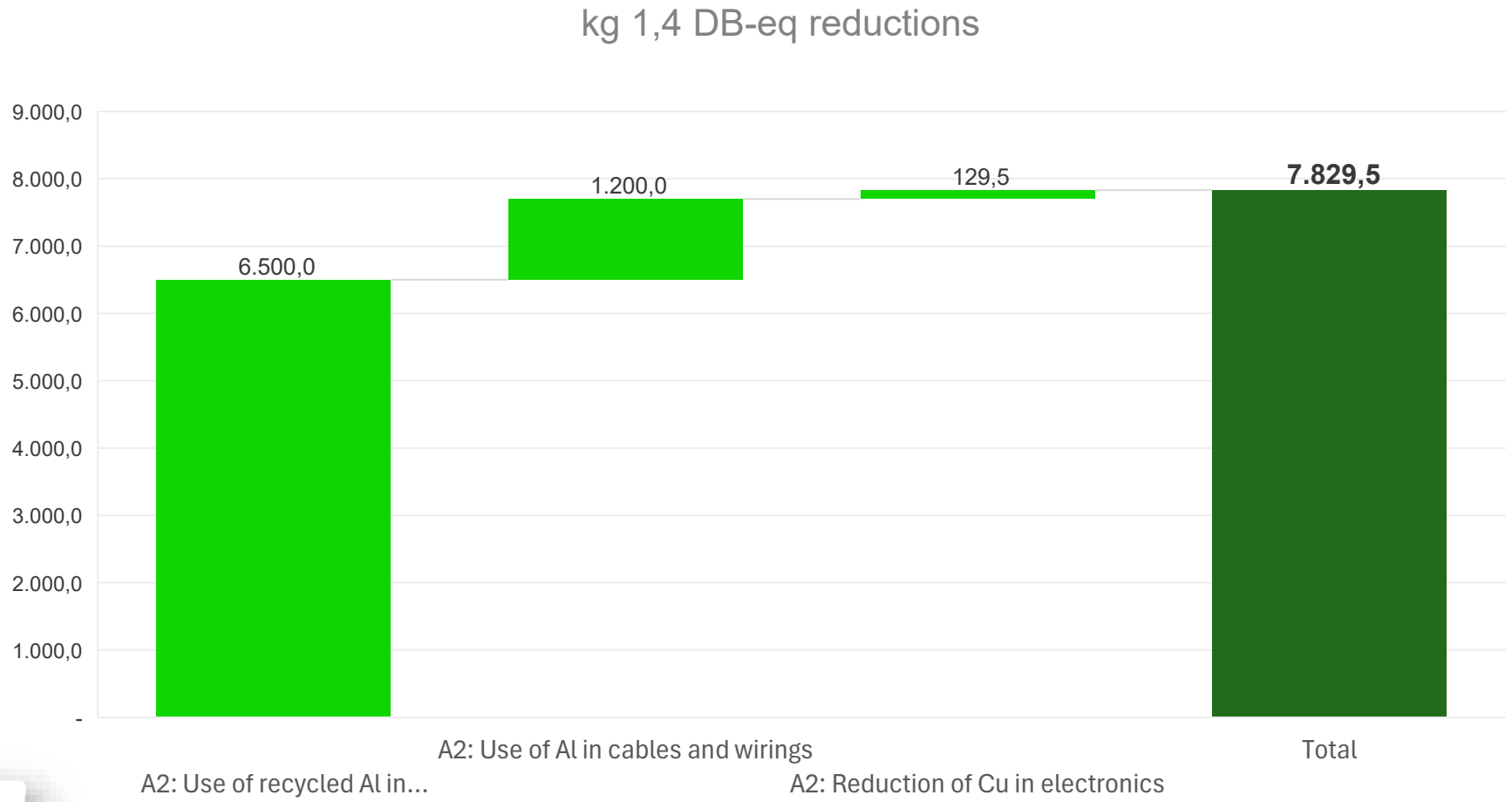
LCA quantifies the benefits of ecodesign actions (climate change)



Resultats (LCA): què s'aconsegueix?

MARBEL Ecodesign results

LCA quantifies the benefits of ecodesign actions (human toxicity)



Resultats (LCA): què s'aconsegueix?

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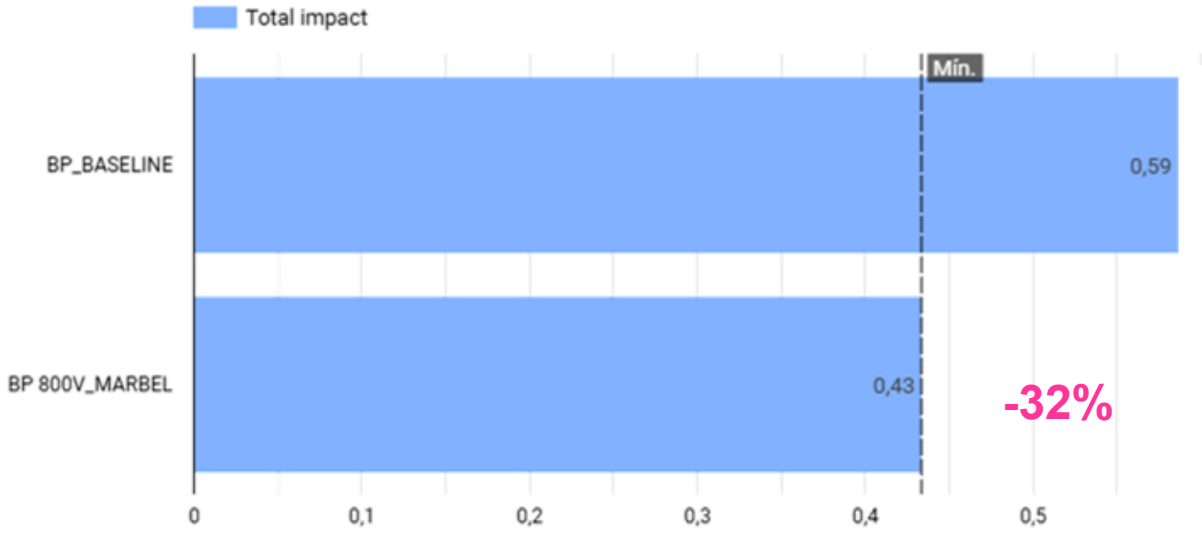
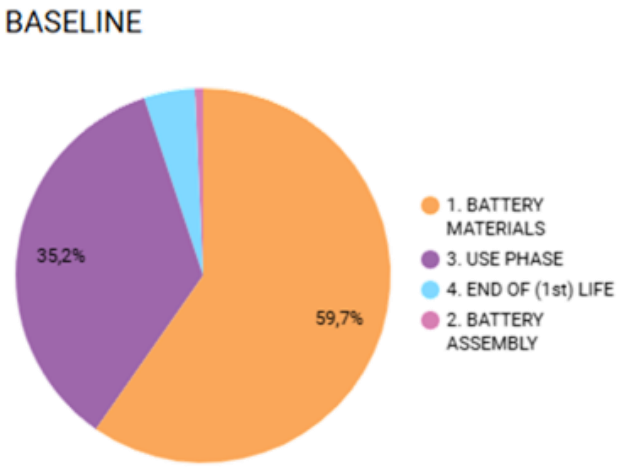
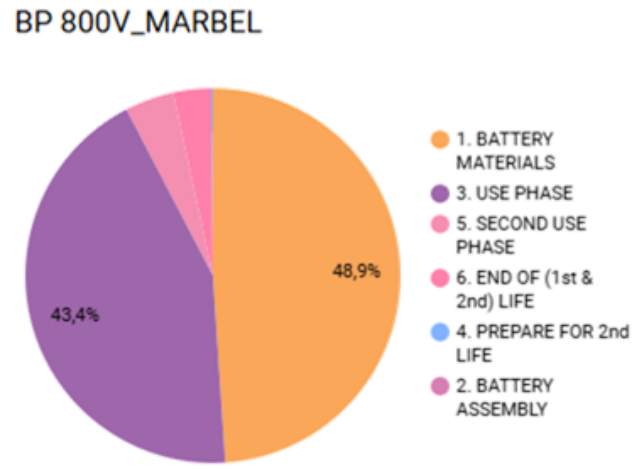
[LCA Results Snapshot →]

Comparison vs the Baseline Battery

Functional Unit: 1 kWh







MARBEL

Fi de vida, Segona vida i flexibilitat

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- 2a vida: del vehicle a l'ús estacionari
- Serveis locals: solar shifting • peak shaving • resiliència
- Condicions: SoH • seguretat • garanties

RECIRCULATE

The goal is extending Battery lifespans, giving them a seconf- and third-life application to maximize their value through innovative reuse strategies

Pilar 1

Fast, cost-effective, reliable SoX characterization

Pilar 2

Automated dismantling based on Artificial Intelligence (AI)

Pilar 3

Battery pack Repair, Reuse and Remanufacture

Pilar 4

Fast and accurate sorting for recycling

Pilar 5

Safe storage and transportation of the batteries

Pilar 6

Blockchain-based Battery Passports and Marketplace

csem FORD OTOSAN eurecat MINESPIDER libattion Smart Cycles ECOSTOR
iconiq YOUR PARTNER IN INNOVATION DHL PROBOT centria University of Applied Sciences ammattikorkeakoulu GELKOH GmbH Battery handling made safe

De la innovació al desplegament

Criteris clau cap a solucions més sostenibles

- Dades: LCA/EPD
- Disseny: desmuntatge, mantenibilitat i seguretat.
- Final de vida: logística, gestor, ruta

Tres idees per endur-se:

- **Decisions informades:** l'ACV evita desplaçar impactes i ajuda a definir criteris de compra i projecte.
- **Circularitat** no és un extra: ecodisseny, desmuntatge i final de vida són requisit per escalar amb menys risc..
- Flexibilitat i resiliència: bateries ben dimensionades i ben operades redueixen pics, maximitzen autoconsum i donen suport a equipaments crítics.

"innovant amb les empreses"

Gràcies

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