



Life cycle sustainability assessment of lithium-ion batteries

25th July 2025
Transensus-LCA Final Event




This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101069865. The output reflects the views only of the author(s), and the European Commission cannot be held responsible for any use which may be made of the information contained therein.



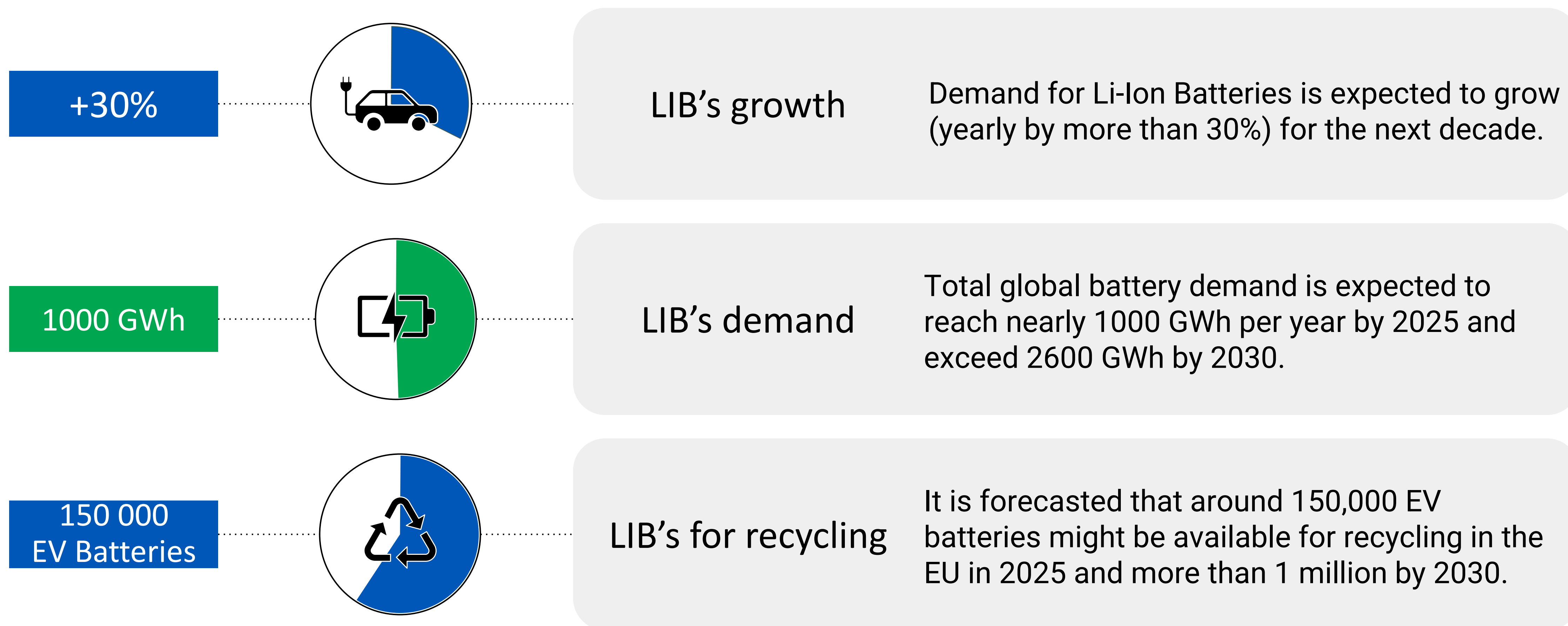
RESPECT numbers and figures

European Climate, Infrastructure and Environment Executive Agency
Project number: 101069865



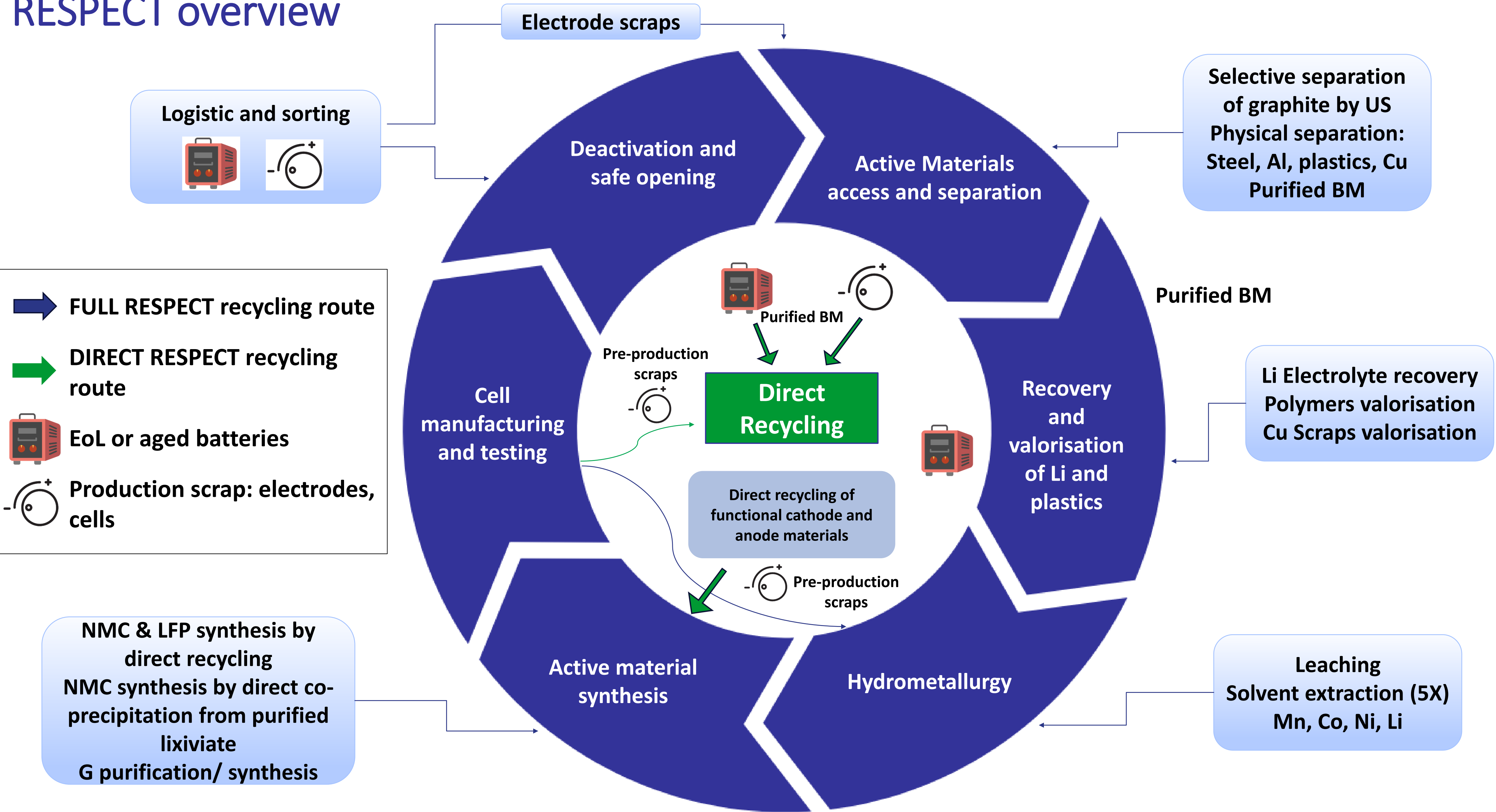
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Context and challenges of the recycling process



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RESPECT overview



Map of the partners

NORWAY

MORVON
Vianode

SWEDEN

 **CHALMERS**
UNIVERSITY OF TECHNOLOGY

FINLAND

A? Metso
Aalto University

UNITED KINGDOM

Addible

 **WMG**
THE UNIVERSITY OF WARWICK

BELGIUM

 **CLERENS**

 **CLEPA**
European Association of Automotive Suppliers

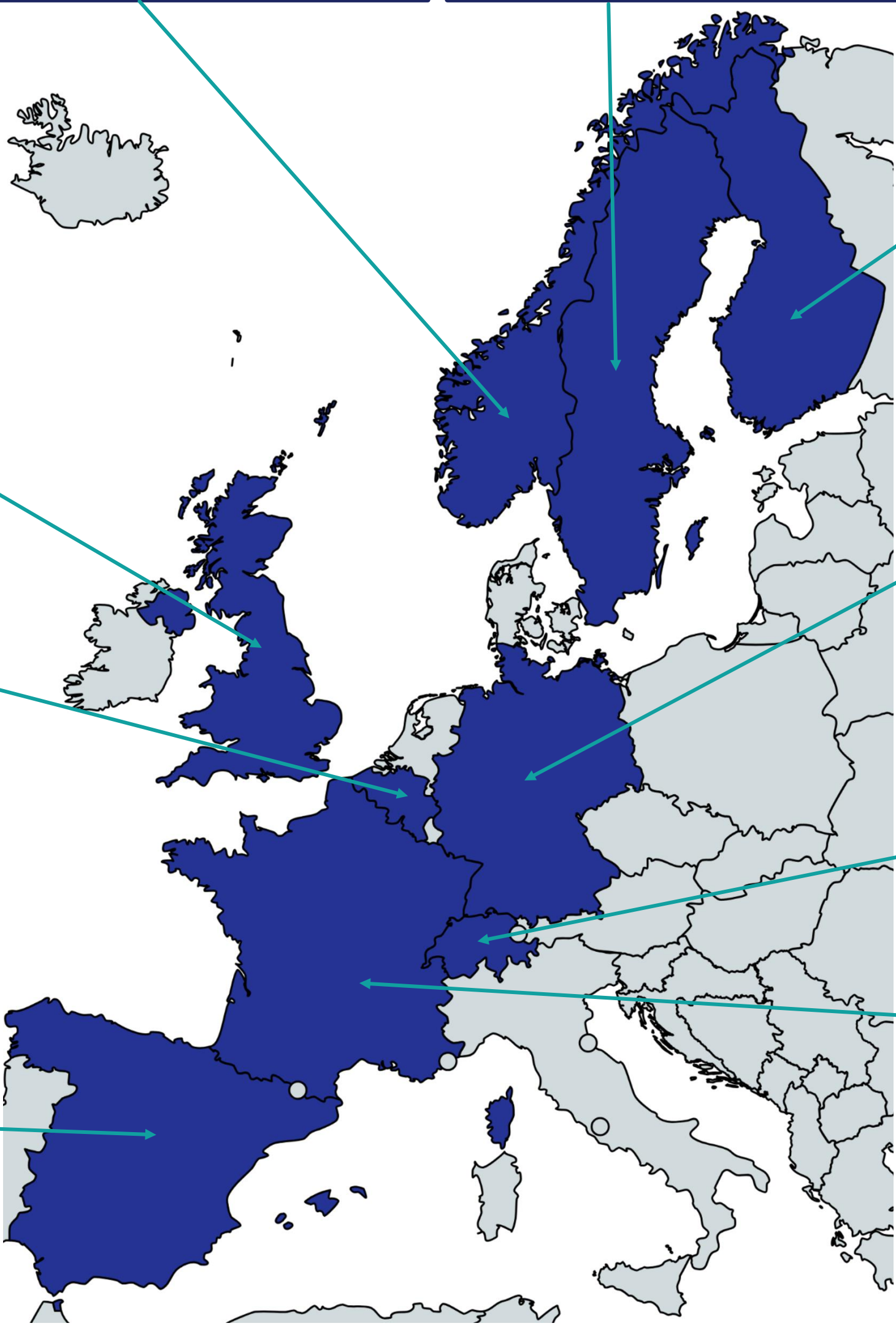
FRANCE

 **cea**

 **COUP'INDUS**

 **orano**

 **ceva**
LOGISTICS



GERMANY

 **Fraunhofer**
ISC

meet 

SWITZERLAND

 **KYBURZ**

SPAIN

 **LOMARTOV**
[Applied Innovation Engineering]

cidetec 
energy storage

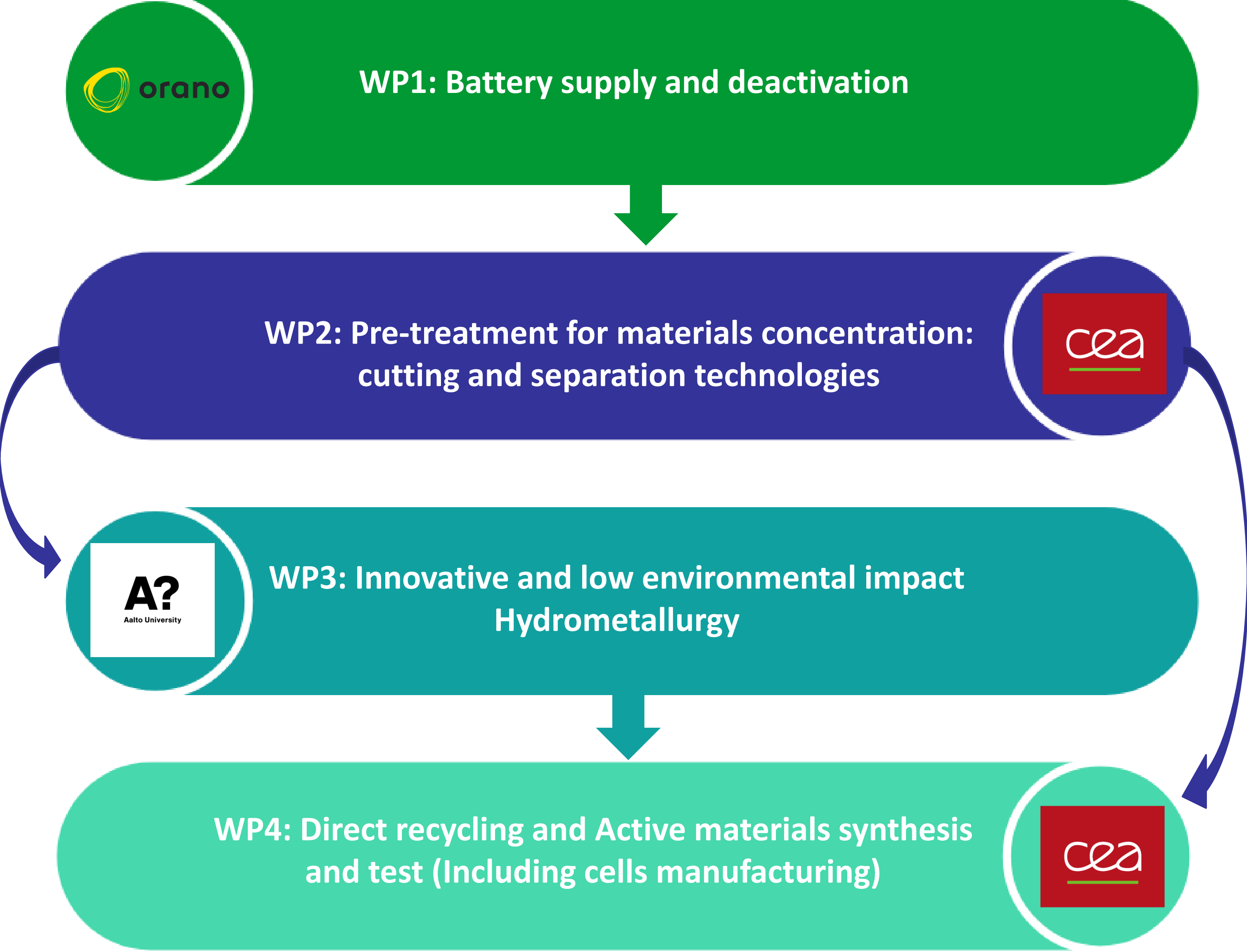
Project workplan



WP7: Project management

WP6: Dissemination and Exploitation, clustering
and cooperation with funded projects







WP5: Impacts on health, environment, safety and
circular economy: new practises related to
developed processes

Our WP5 objective







To demonstrate and optimize the **life cycle sustainability and safety of RESPECT** solution compared to conventional LIB waste treatment (baseline scenarios)



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Until now...

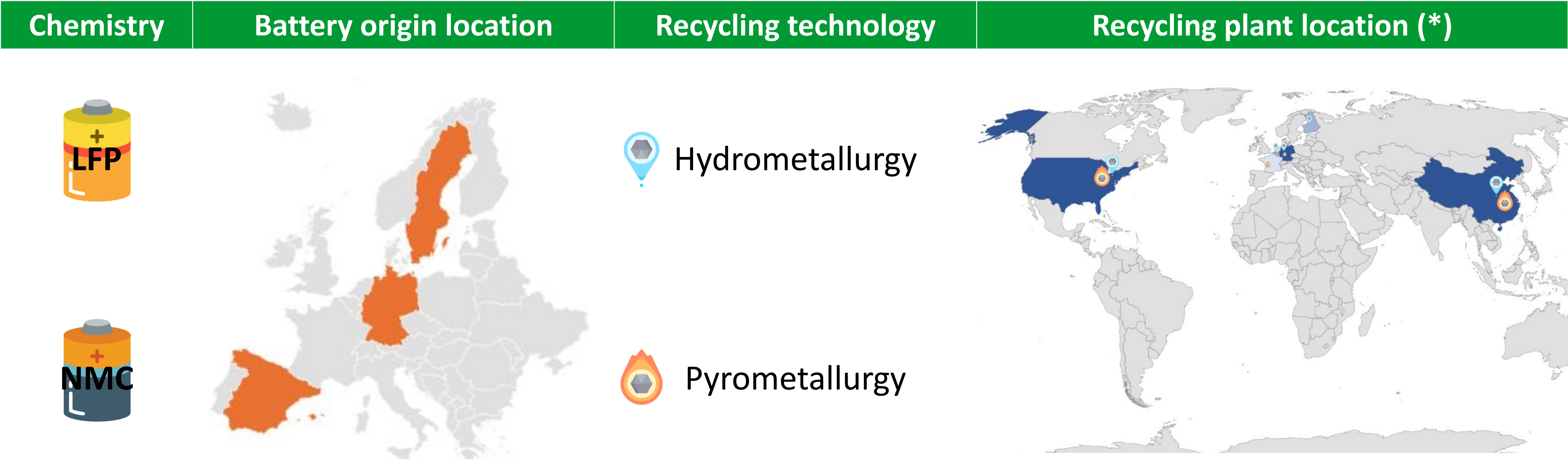
Environmental, economic and social impact assessment of conventional technologies:
LCA/LCC/S-LCA of baseline scenarios (36+18)

Chemistry	Battery origin location	Recycling technology	Recycling plant location (*)
		 Hydrometallurgy	
		 Pyrometallurgy	

(*)Based on real recycling plants from literature review. Throughput in tonnes/year considered as well to test **sensitivity of impacts to plant scale.**

Until now...

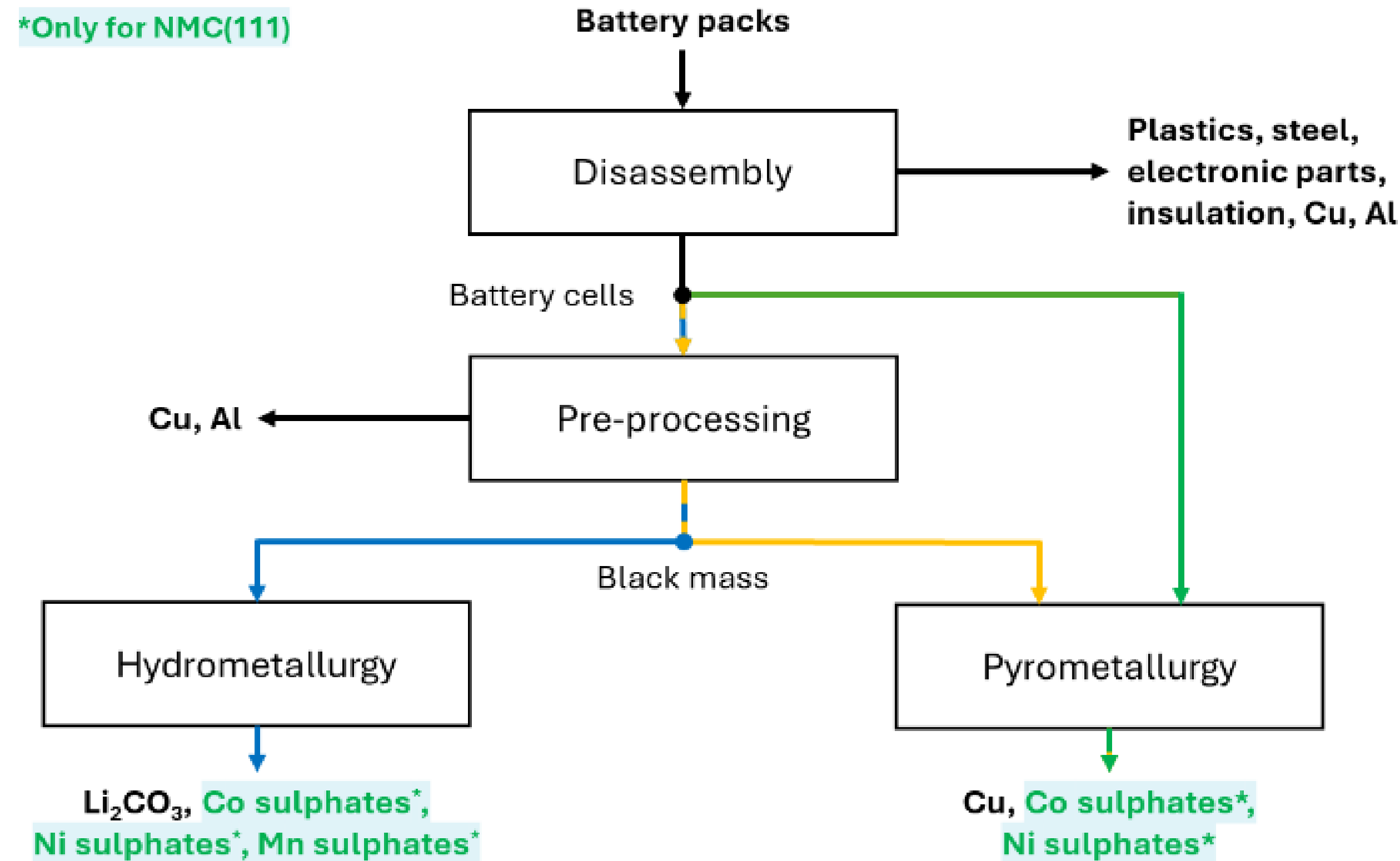
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Functional unit and system boundaries

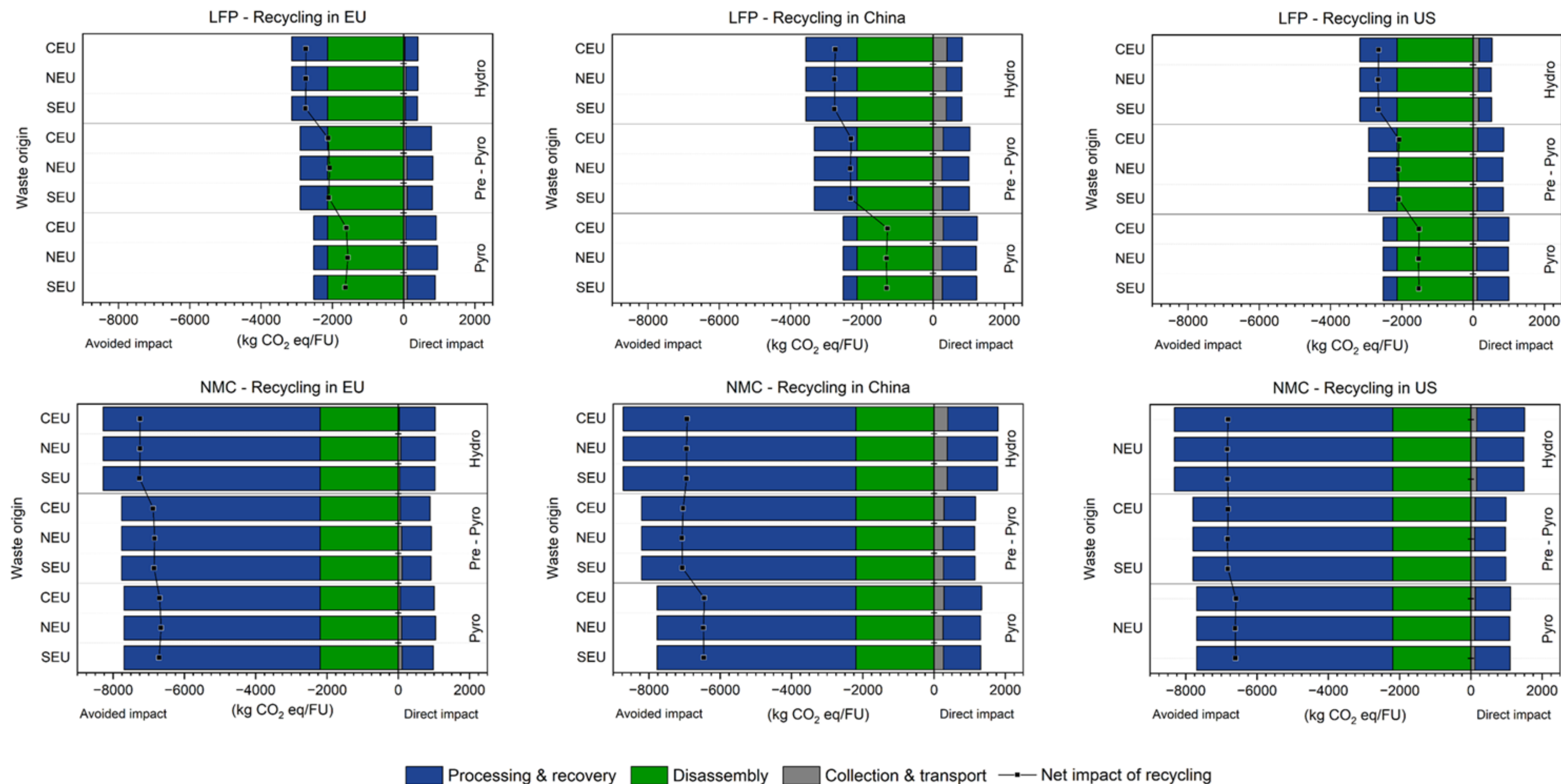
Direct and avoided impacts (credits from secondary raw materials) of the recycling process for 1 tonne of battery packs treated (=FU)



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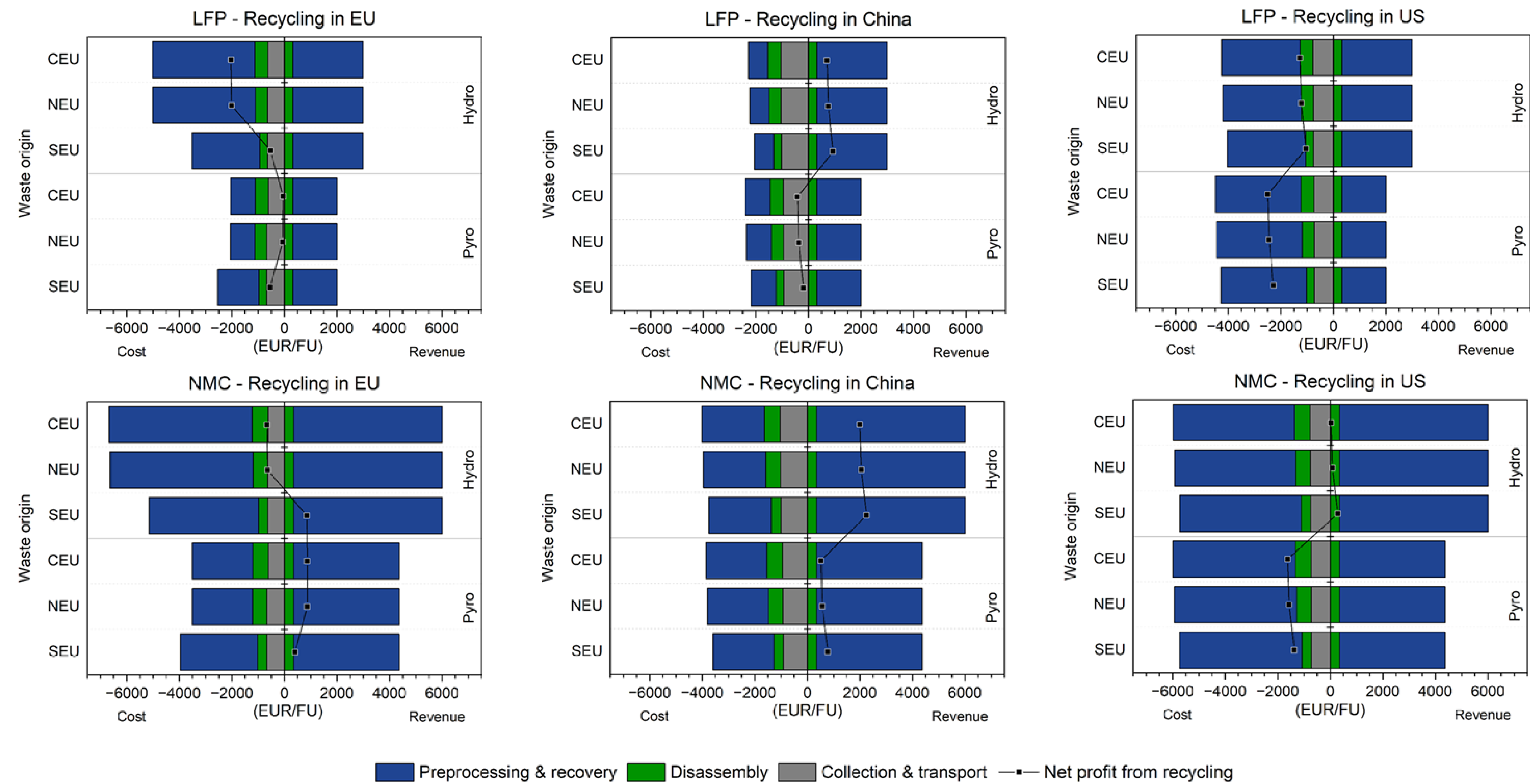
Environmental LCA of baseline scenarios

Carbon footprint per tonne of battery pack treated



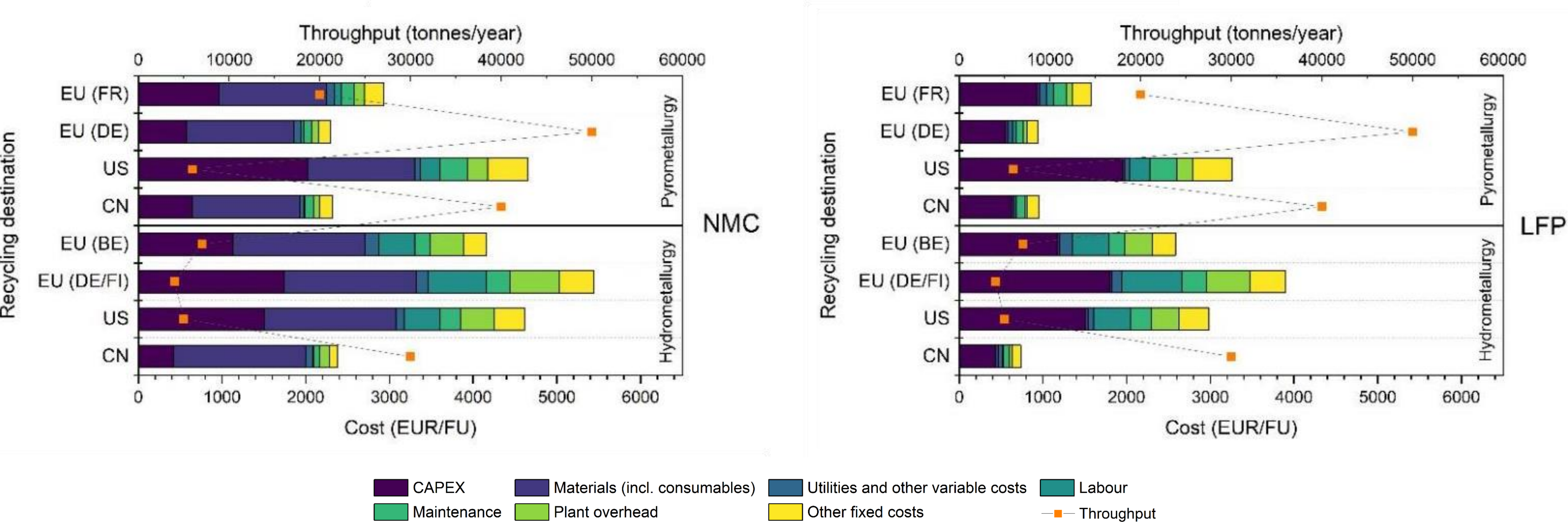
Economic LCC of baseline scenarios

Cost/revenue per tonne of battery pack treated



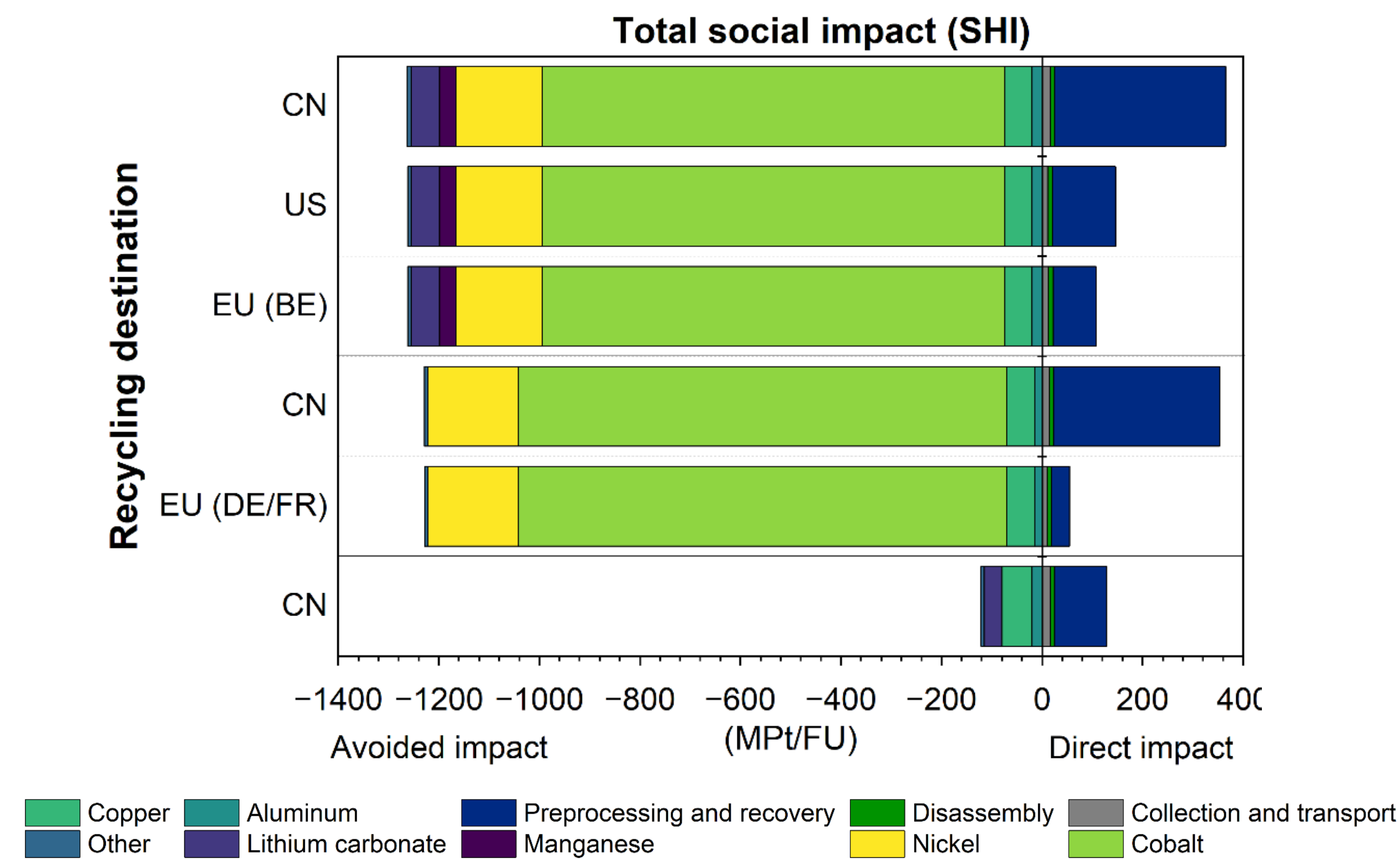
Economic LCC of baseline scenarios

Cost breakdown for preprocessing and recovery

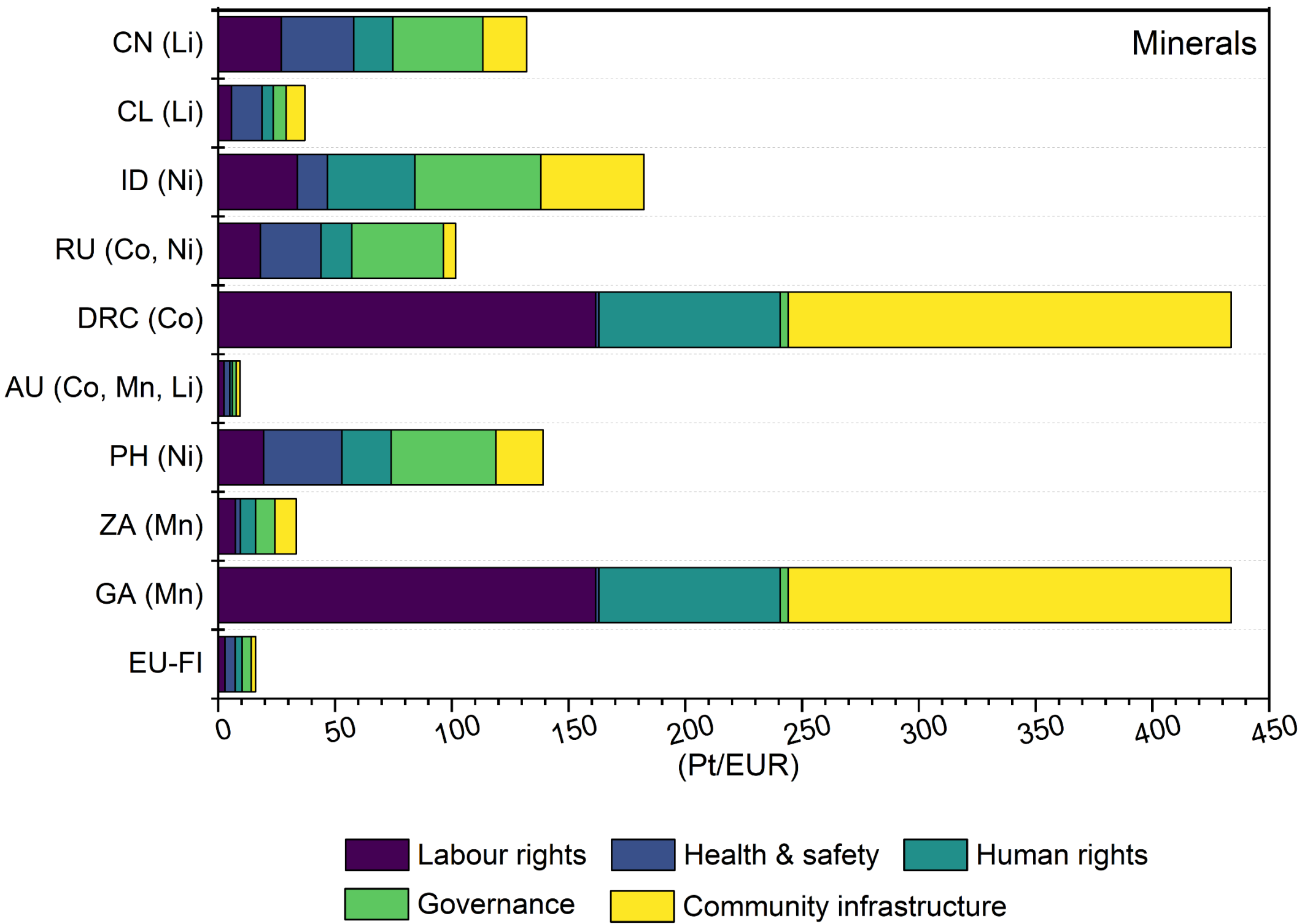


Social LCA of baseline scenarios

Social impacts per tonne of battery pack treated



Comparison of social impacts from minerals produced in different countries



Conclusions

- ▶ NMC recycling brings more sustainability benefits than LFP recycling
- ▶ Net environmental benefits in all scenarios (i.e., recycling has lower impacts than primary production)
- ▶ Recycling inside EU has the largest environmental benefits due to shorter transport distances
- ▶ Hydrometallurgical route provides larger profits than pyrometallurgical (only profitable for NMC)
- ▶ NMC recycling can be economically sustainable in all geographies, but most profitable in China
- ▶ Profitability depends largely on the plant throughput; e.g., NMC recycling in EU was profitable for 7 kt/yr
- ▶ The social impacts are the largest in China and the lowest in Europe
- ▶ Recovery of metals, such as Co and Ni, increases social sustainability by avoiding burdens from virgin raw materials extraction in countries like DR Congo, Indonesia or Gabon



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Social Media of RESPECT

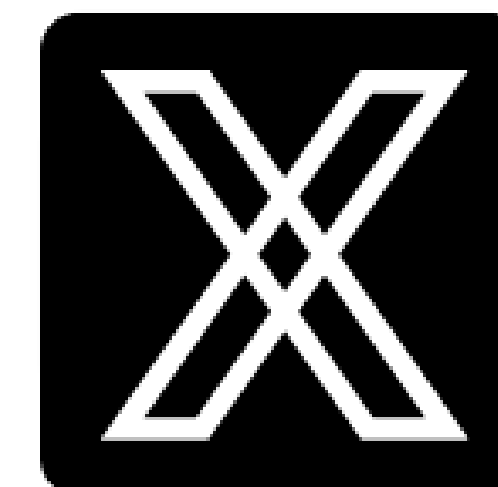
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THANK YOU!

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