EVERGI

INNOVATING THE ENERGY TRANSITION

Second Life from a Life Cycle Assessment perspective

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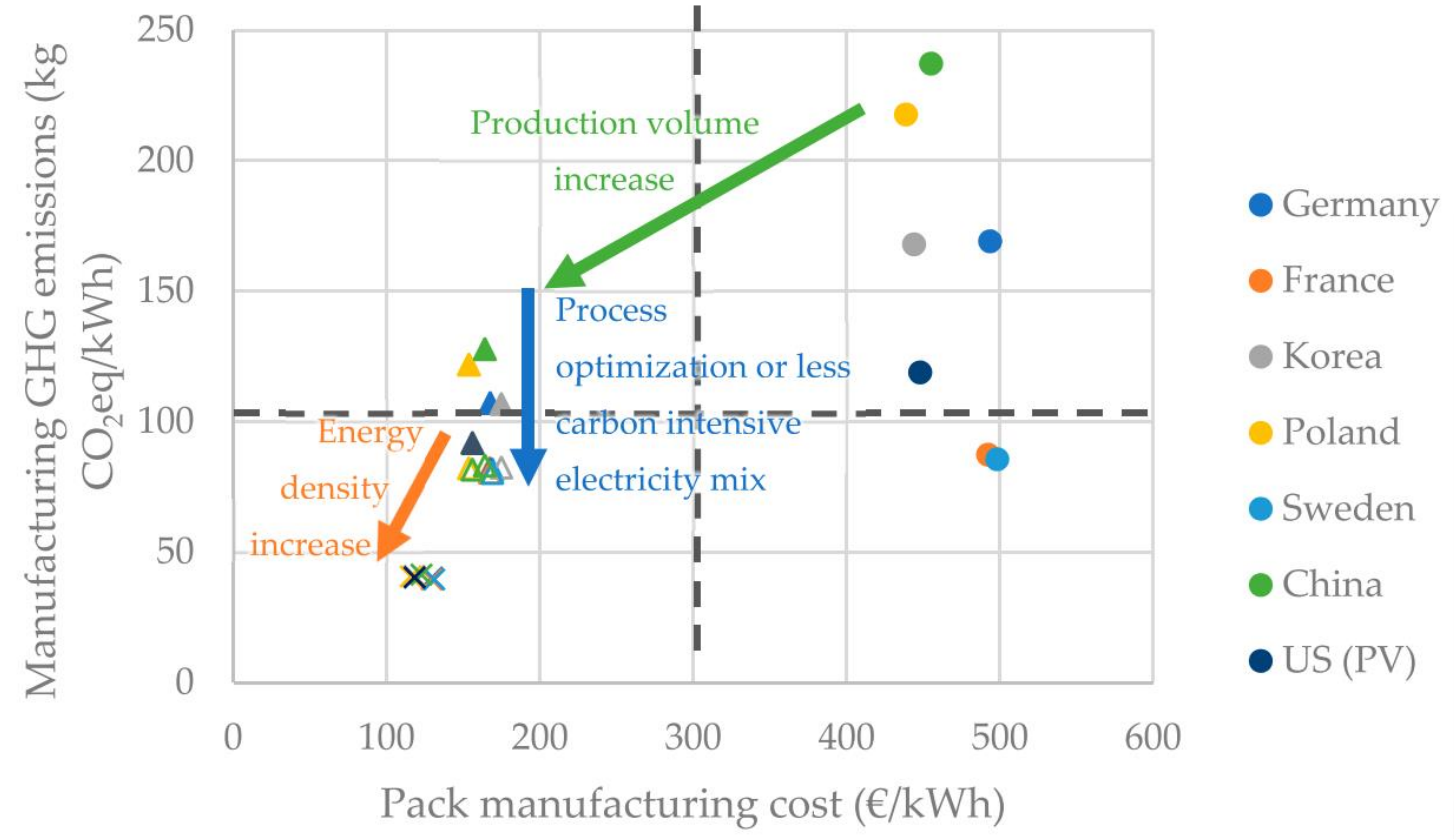
ENVIRONMENTAL IMPACTS OF BATTERIES

Manufacturing stage is key for several environmental impacts

Circular economy

New battery regulation

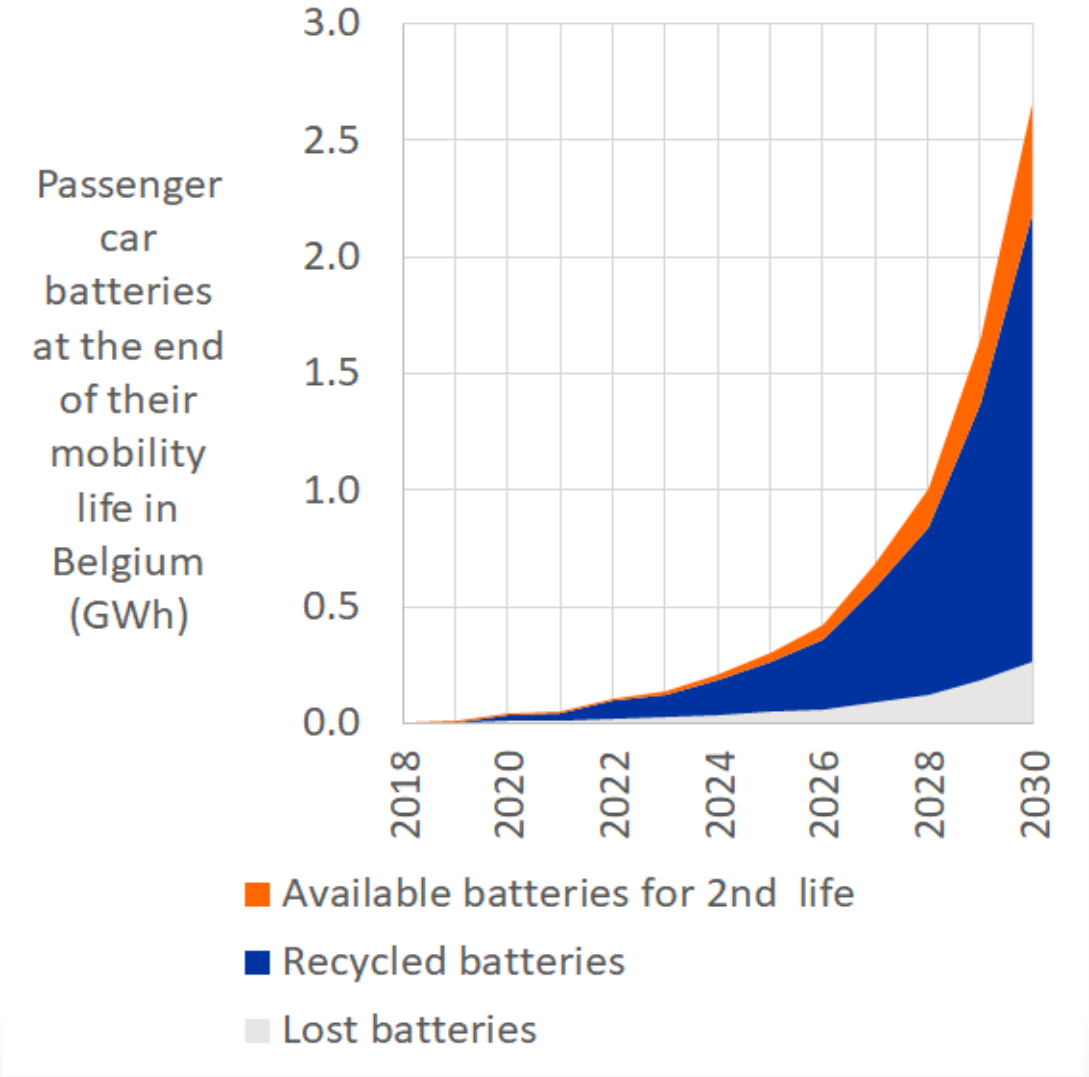


2ND LIFE BATTERIES

IN BELGIUM

in 2025 between 0.6GWh and 2.4GWh 2nd life batteries in Europe

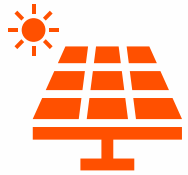
Year	2020	2030
Lost batteries (missing cars)	22%	10%
Batteries for repurposing	12%	20%
Batteries to recycling from collection	88%	80%
Batteries to recycling from repurposing	1%	2%



Based on Bobba S, Mathieux F, Blengini GA. How will second-use of batteries affect stocks and flows in the EU? A model for traction Li-ion batteries. Resour Conserv Recycl 2019;145:279–91. doi:10.1016/j.resconrec.2019.02.022

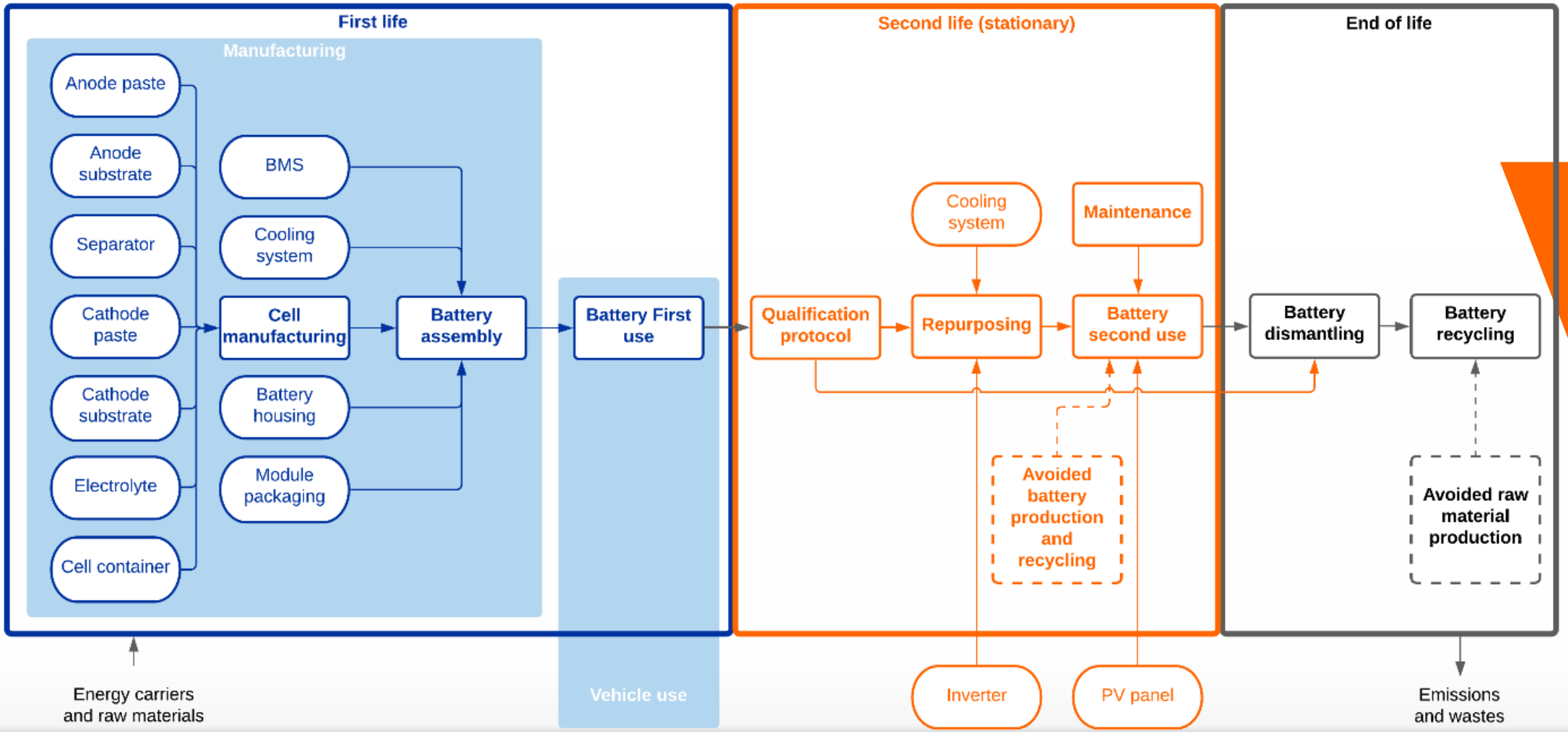
SERVICES 2ND LIFE BATTERIES CAN PROVIDE

Energy arbitrage	Price taker or price maker
Capacity Credit	Transmission and distribution deferral
	Transmission congestion relief
	Resource adequacy
	Utility scale peak shaving
Ancillary services	Voltage regulation
	Frequency regulation
	Load demand
	Spinning and non-spinning reserves
	Black start
Customer side benefits	Electricity bill reduction
	Increase of PV self-consumption
	Back-up power
Mobility services	EV charging
	Reuse in an EV (any vehicle from bicycle to heavy duty, even electric forklifts)



BELGIAN CASE STUDY

Functional unit: 1 kWh delivered by the battery over its entire life



FIRST LIFE

Innovative battery pack designed for dismantling

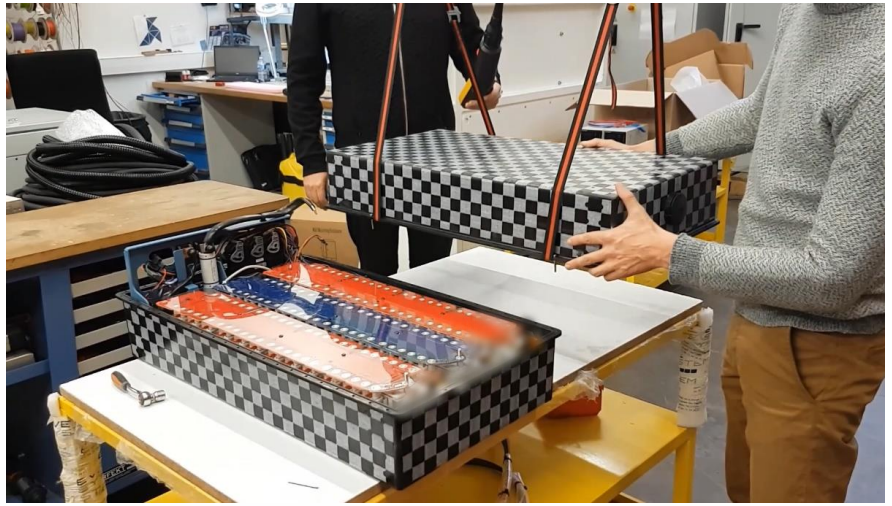
23Ah Toshiba NMC622-LTO cells

Ageing tests

In Belgium 9.05 years

17 232 kWh delivered energy

115.3kg



SECOND LIFE

Qualification protocol and yearly maintenance = 5 full charge/discharge cycles

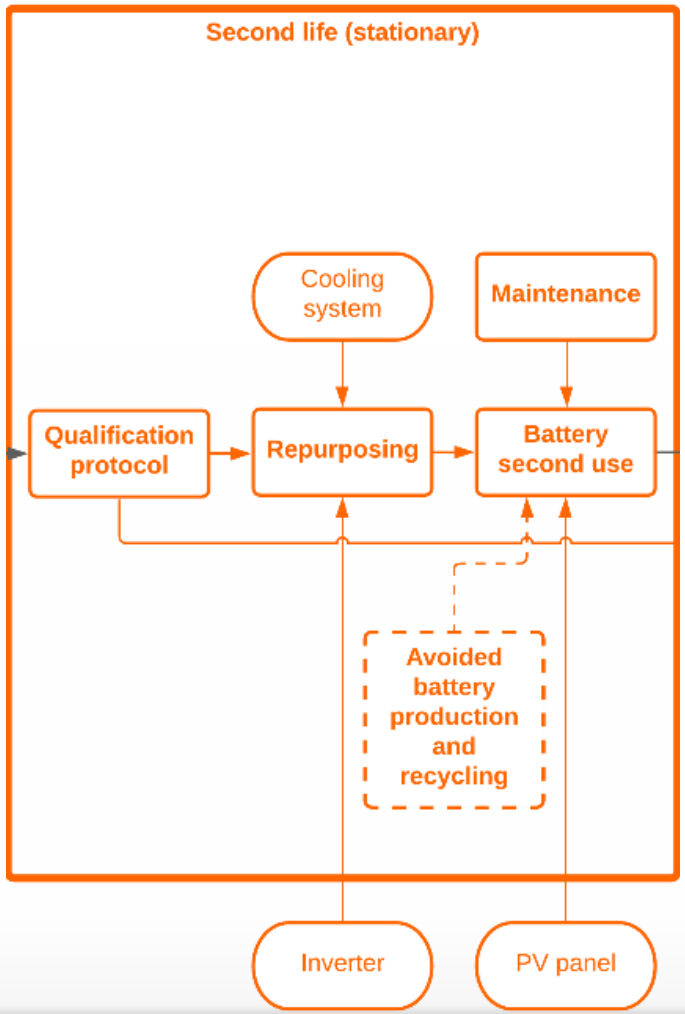
Domestic photovoltaic installation 4 kWp

Aged cells are tested

In Belgium 5 years

7 493 kWh delivered energy

Avoided battery: 34.4kg

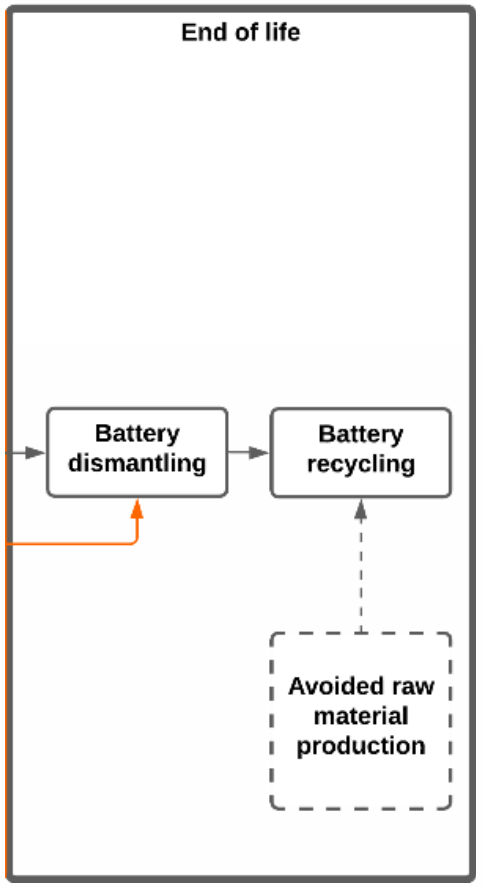


END OF LIFE

Primary data for dismantling

1. Pyrometallurgical step to recover Cobalt, Nickel and Copper
2. Hydrometallurgical step to recover Lithium

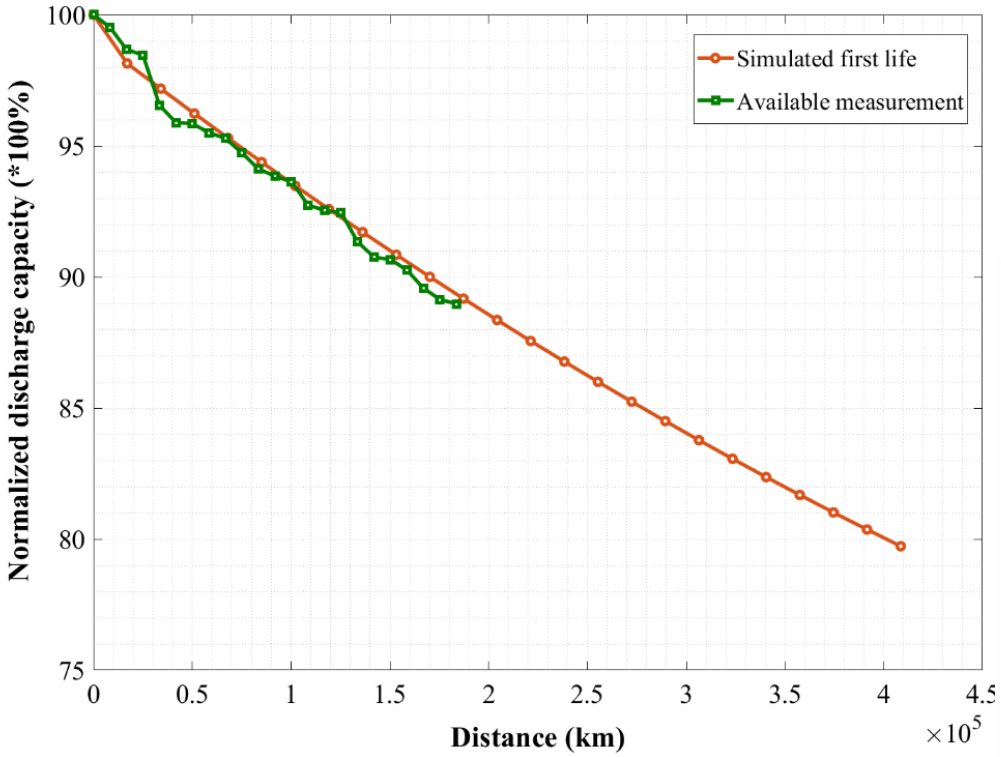
Material	Recycling rates
Cobalt	95%
Nickel	95%
Lithium	70%
Copper	95%



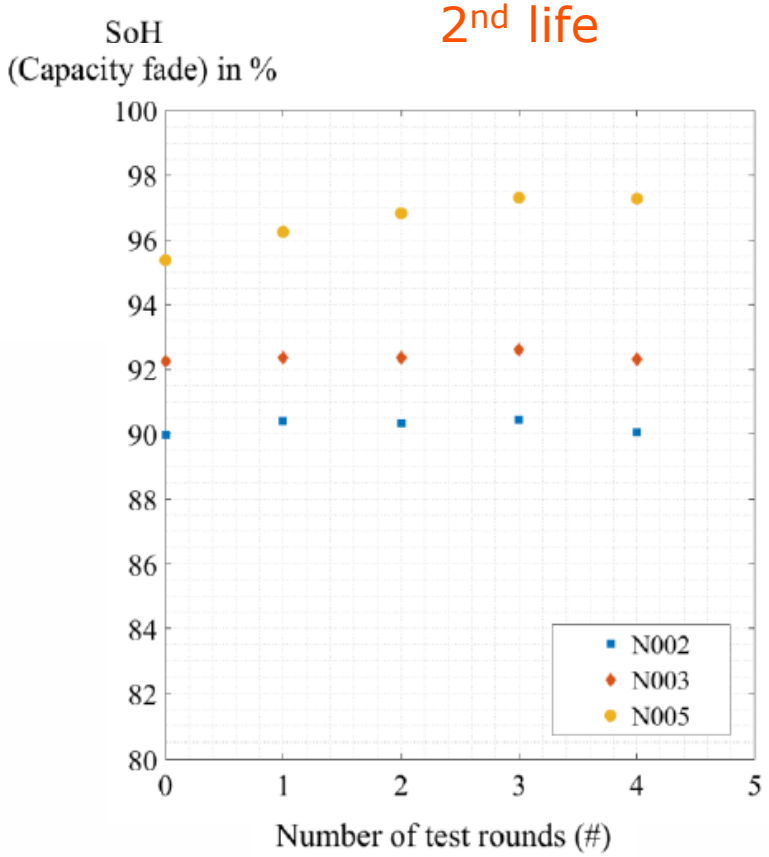
RESULTS

CELL TESTS

1st life



2nd life



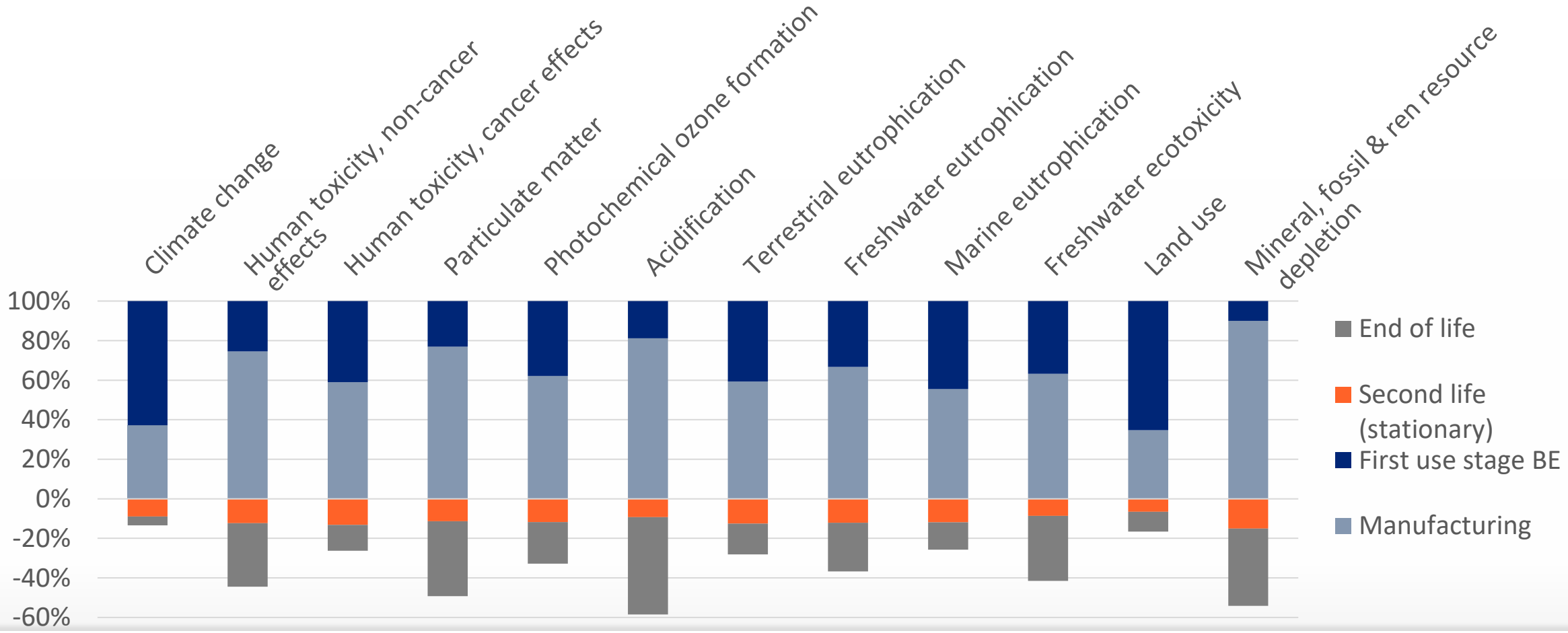
Capacity at end of 1st life: 90%

Capacity at end of 2nd life: 88%

Test procedure: Hosen MS, et al. Twin-model framework development for a comprehensive battery lifetime prediction validated with a realistic driving profile. Energy Sci Eng 2021. doi:10.1002/ESE3.973

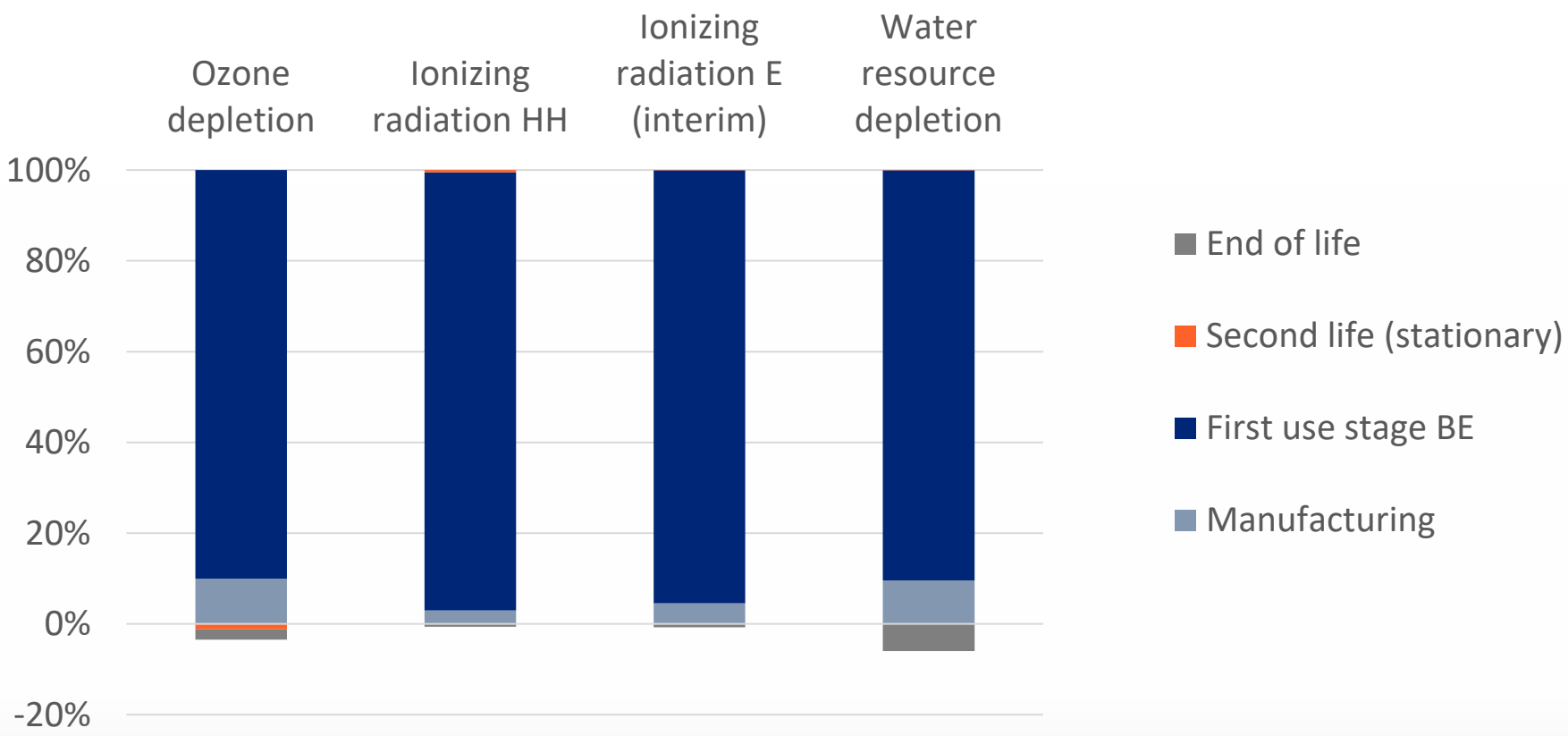
RESULTS

12 ENVIRONMENTAL IMPACTS BENEFIT FROM 2ND LIFE



RESULTS

4 ENVIRONMENTAL IMPACTS ARE DRIVEN BY 1ST USE STAGE



SECOND LIFE FROM A LIFE CYCLE ASSESSMENT PERSPECTIVE

CAN SECOND LIFE LOWER THE ENVIRONMENTAL IMPACTS OF BATTERIES?

- Yes, but not all impact categories benefit from 2nd life
- Results specific to the country electricity mix
- Key parameters: 2nd life duration and share of qualified batteries
- Test batteries for second life → demonstration of potential

To find out more, read our upcoming publication on this topic!

THANK YOU

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