



Saubermacher – for an environment worth living

Closing the loop: unlocking the green
potential of Li-Ion Batteries through
proper life-cycle management

Our mission



We take responsibility

- +for people
- +for the environment
- +for the company

We help to shape the future

- +for society
- +the regions
- +and ecology



Our vision of recycling – zero waste

The goal is to leave no waste behind and to make all material recyclable.





680

specialised vehicles

42,000

customers

Key figures

1979

founding year

€ 425

million turnover p.a.*

3,600

employees

77

recycling plants

3,5

million tons of waste p.a.

73

participations

Saubermacher

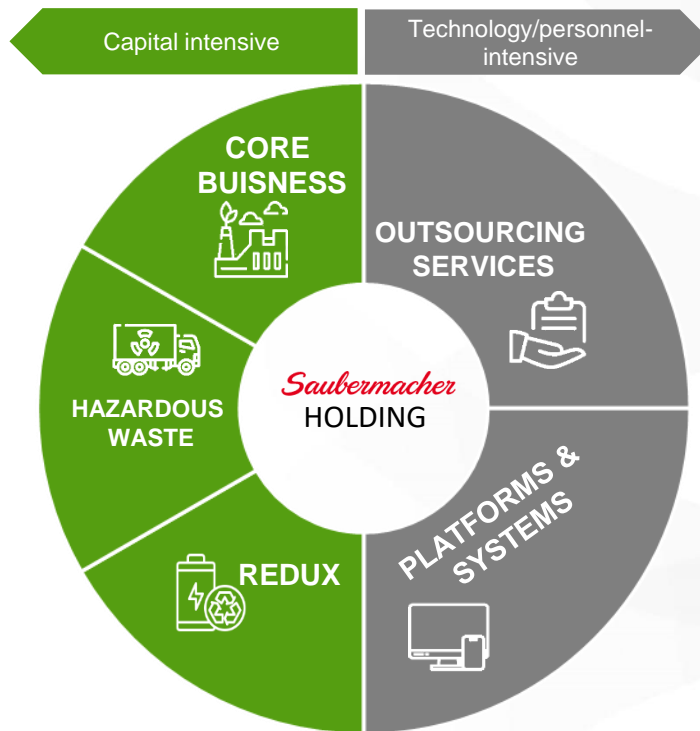
* 31/12/2022

Locations in 7 countries





Main Business Segments



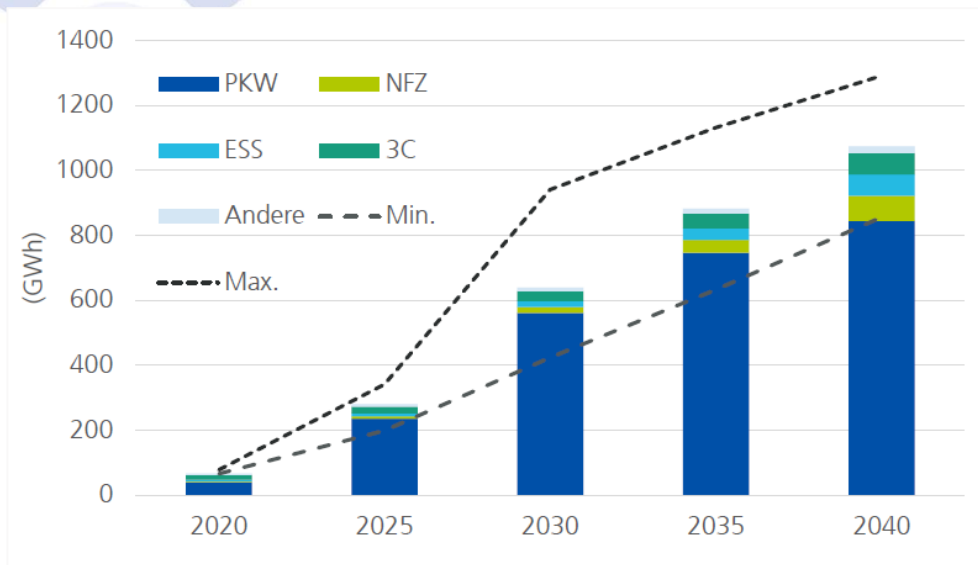


Why get involved in battery recycling?





Does recycling make sense?



3C: Computing, consumer, communication

NFZ: commercial vehicles

ESS: stationary storage

„Green Deal“

- 2040: “climate-neutral” transport sector in Austria
- 2050: EU and USA → climate-neutral

Battery lifespan

- 3C: ~2-3 years (up to 8 years)*
- Motorcycle: ~ 3-4 years**
- E-bike: ~8 years***
- Automotive: > 10 years*

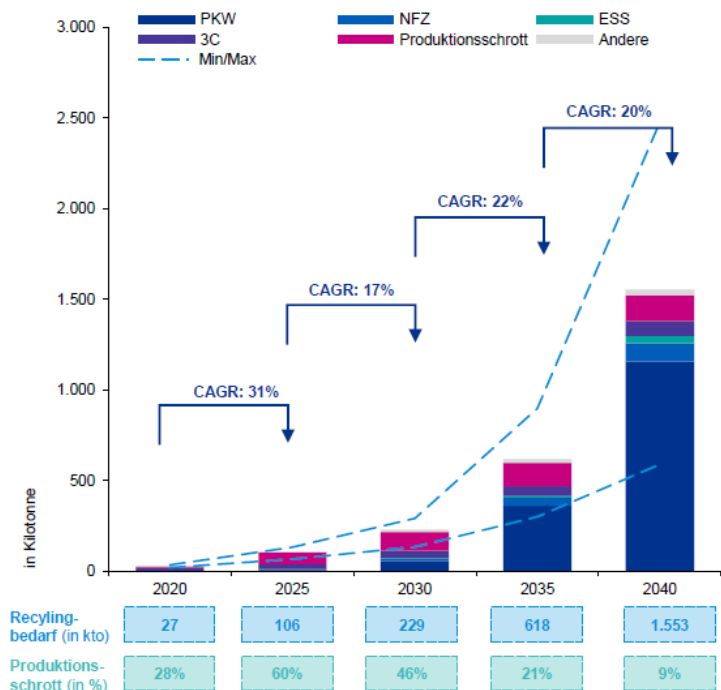
*Recycling von Lithium-Ionen-Batterien: Chancen und Herausforderungen für den Maschinen- und Anlagenbau, Fraunhofer Institut für System- und Innovationsforschung ISI, November 2021, S. 21

** KTM, ICBR 2022

*** Robert Bosch GmbH, ICBR 2022: eMobility and Circularity – Learnings from EPACs, Gunter Flinspach



Predicted return flow of batteries



Quelle: Fraunhofer-Institut für System- und Innovationsforschung ISI



Production scrap

In the medium term, production waste will make up a large part of the LIB return volumes, particularly during the start-up phase of the new production facilities.



End-of-Life Batteries

In the long term, EoL will represent the majority of returns; EV batteries are expected to have an average life of 13 to 15 years.



Efficiency gains

Efficiency increases are expected for the production and recycling of LIBs, among other things, through improved process technologies and automation.



2nd Life

Experts expect the use of EV batteries in a secondary application for 10-20% of the vehicles and additional service life of 6 years.

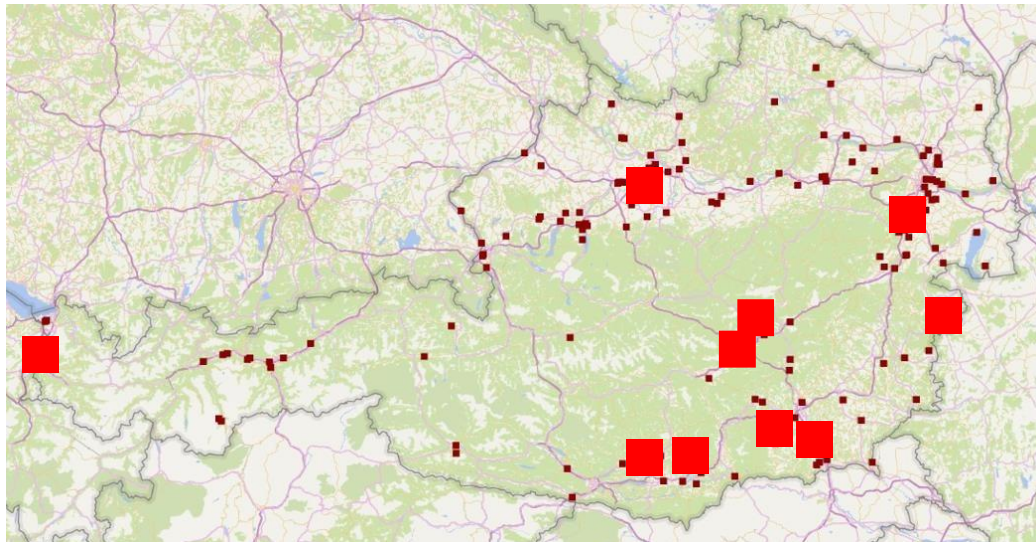


New suspects - safety hazard





Rising number of battery related fires



■ Major fires

The Washington Post

Mostly sunny 82/64 • Tomorrow: Sunny 93/72 B6 Democracy Dies in Darkness TUESDAY, MAY

The explosive problem with recycling iPads, iPhones and other gadgets: They literally catch fire.

Old devices end up in trouble when we throw them in the trash, stick them in the recycling bin, or even responsibly bring them to an e-waste center. There isn't [official data on these fires](#), but [the anecdotal evidence is stark](#). Since the spring of 2018 alone, batteries have been suspected as the cause of recycling fires in [New York](#), [Arizona](#), [Florida](#), [Wisconsin](#), [Indiana](#), [Idaho](#), [Scotland](#), [Australia](#) and [New Zealand](#). In California, a [recent survey of waste management facilities](#) found 83 percent had at least one fire over the last two years, of which 40 percent were caused by lithium-ion batteries.

Only the major fires make it into the news



In the last 5 years **30 Mio. in Fire damage**

Market growth: +10%/a

Fire damage €/a

Causes

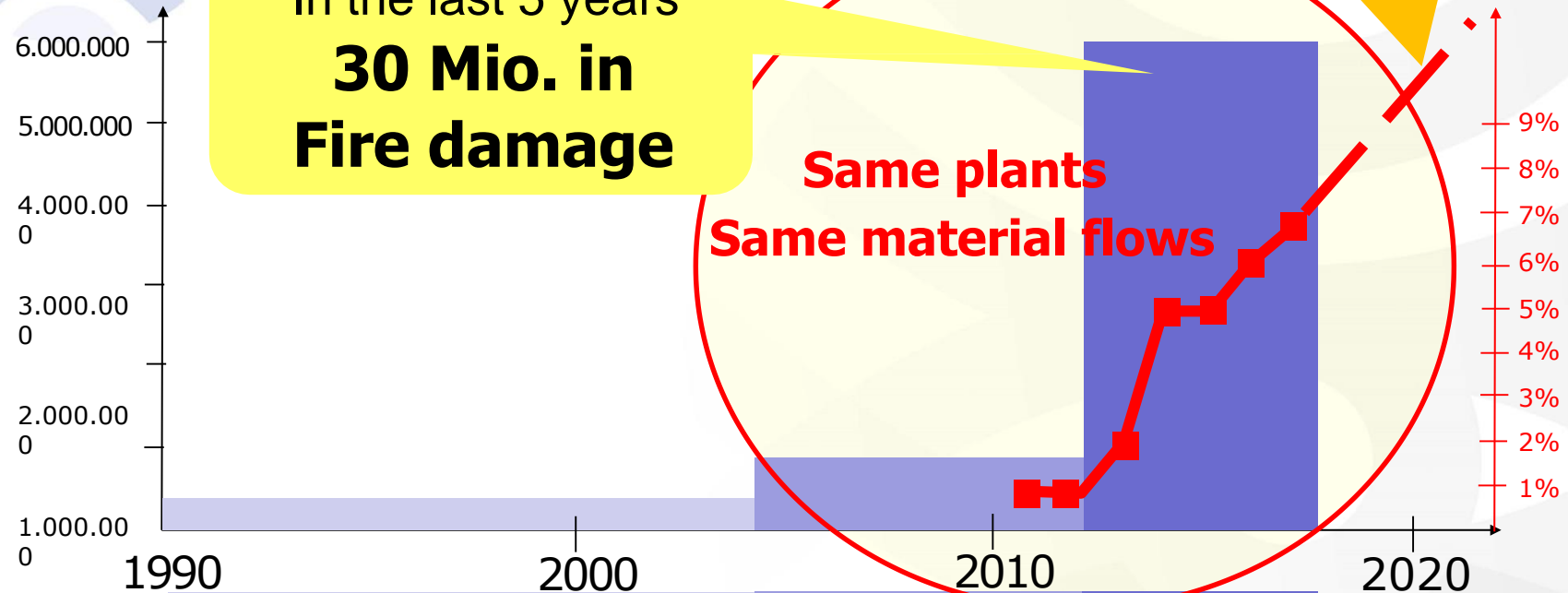
Landfill fires
Hazardous waste storage

Interim storage
Refuse-derived fuel

Recycling- +
Mechanical plants

Same plants
Same material flows

Share of Li-Ion Batteries in collected quantity





Fire hazard electric vehicle – what to do?

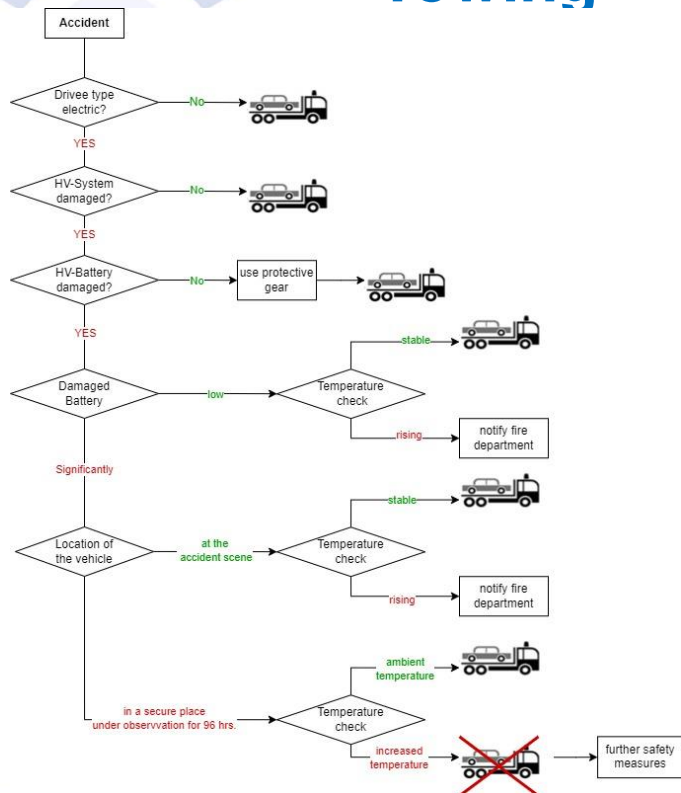




Towing – Yes or No



Guideline for handling damaged e-vehicles (Annex H)



Accident damaged e-vehicles

Uncertainties in the adoption of electric vehicles by towing organizations

Guidelines for towing (H.1.1.1)

Before a vehicle can be loaded and transported, information about the type of engine as well as the technical condition of the vehicle must be obtained.

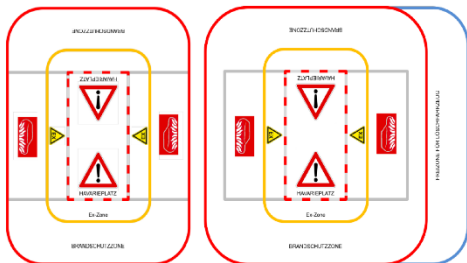


Storage of accident damaged e-vehicles

- ➔ Storage in a safe place for min. 96 hours observation time (OVE-R19 appendix G)
- ➔ Establishment of a quarantine/hazardous location necessary

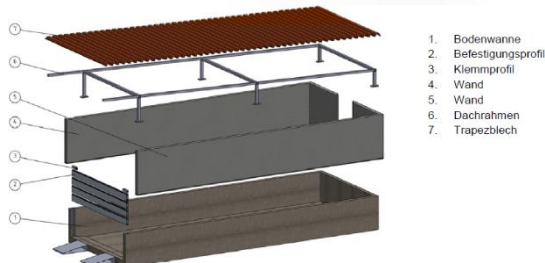
Parking the vehicle in an open area (OVE R-19 G.1).

The vehicle must be parked at a sufficient distance from other vehicles and buildings.



Possibilities of structural protection measures(OVE R-19 G.2)

A suitable parking space can also be built with the necessary fire protection equipment.



Storage of removed modules and packs

Battery Ordinance NEW Art. 49 (3) [expected to be implemented mid-2023]:

Prescribes the provision of an appropriate collection infrastructure for spent batteries that meets applicable safety requirements.



Solution for accident damaged e-vehicles : Saubermacher Batteries



Safety containers without integrated tank with or without lid (MPV, pick-up and LCV).

- + Integrated temperature sensors incl. pre-warning system
- + Smoke detector and video recorder optional
- + Watertight compartment
- + External water supply
- + Extinguishing water is pumped out after use



24/7 Alarm und
Notfallhotline



Express delivery within
4h Austria-wide



EU regulatory framework – targets for waste batteries

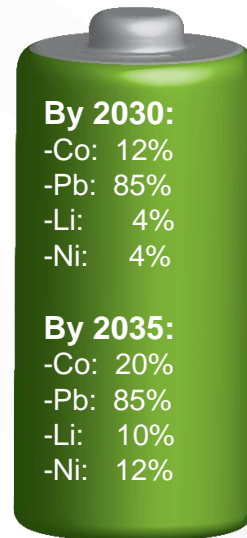
Recycling Efficiency



Recovery Rate



Recycled Content

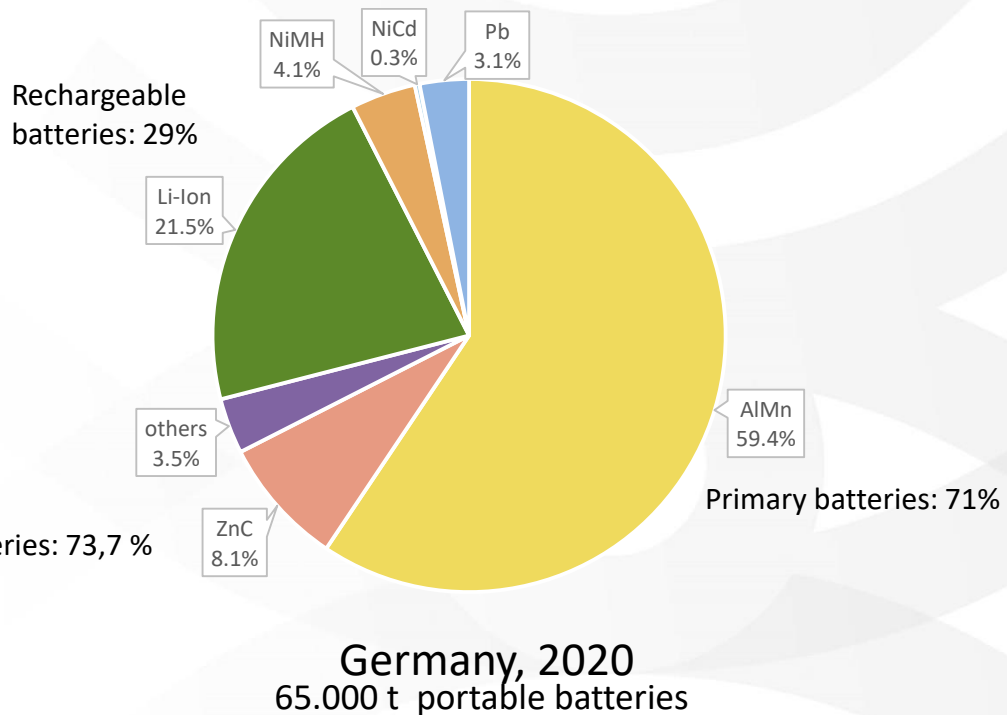
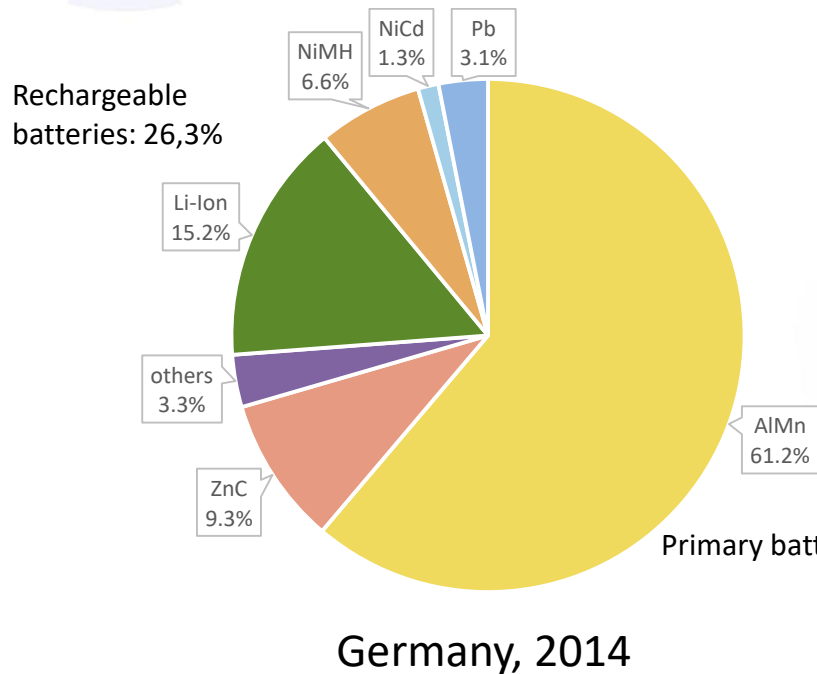


Collection Rate (portable batteries)



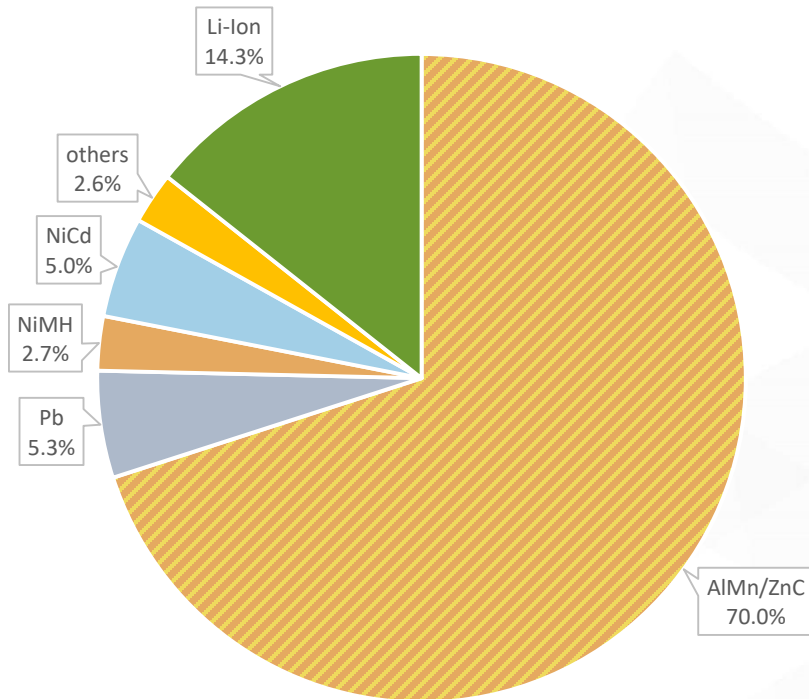


Portable batteries placed on the market





Return flow of portable batteries

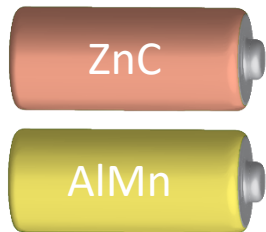


Germany

30.670 t portable batteries returned



Different battery types





Different battery types





Different battery types





Different battery types





Composition of the main elements



C:	40%
Ni:	13%
Cu:	6%
Co:	5%
Mn:	4%
Al:	4%
Li:	2%



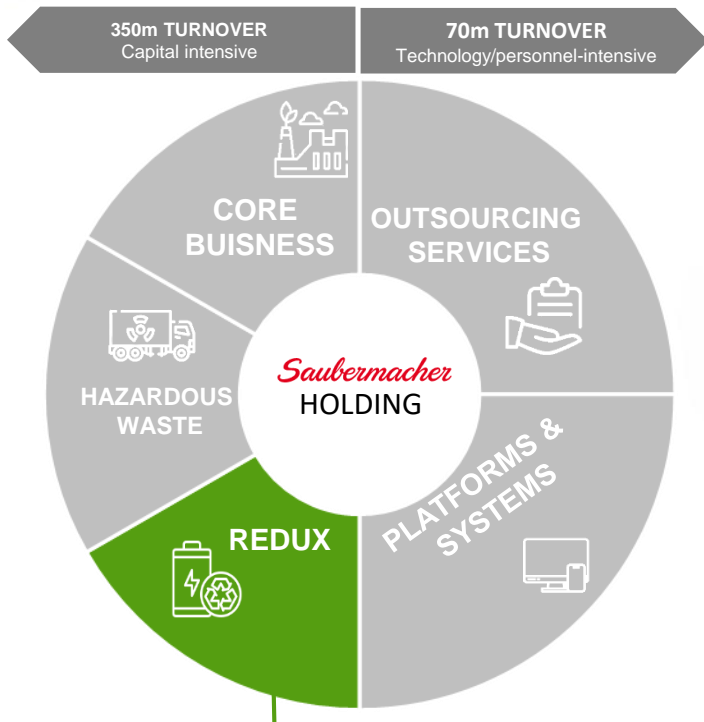
Ni:	38%
Fe:	23%
Rare earth:	9%
Co:	3,5%



Mn:	36%
Zn:	14%
Fe:	21%



Redux – Smart Battery Recycling

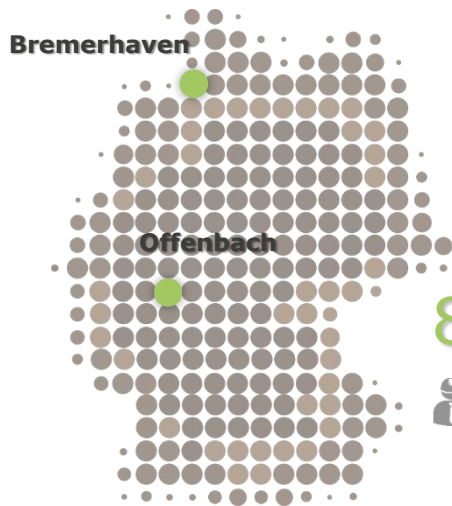


● Operating Figures

- >20 years of expertise, leading battery recycling company in Europe
- 4 production sites
- 110 employees
- >200.000 tons of recycled batteries



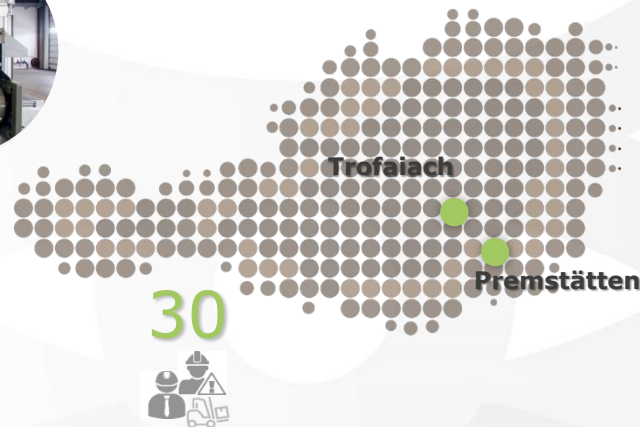
Battery recycling sites



80



Sites in Germany



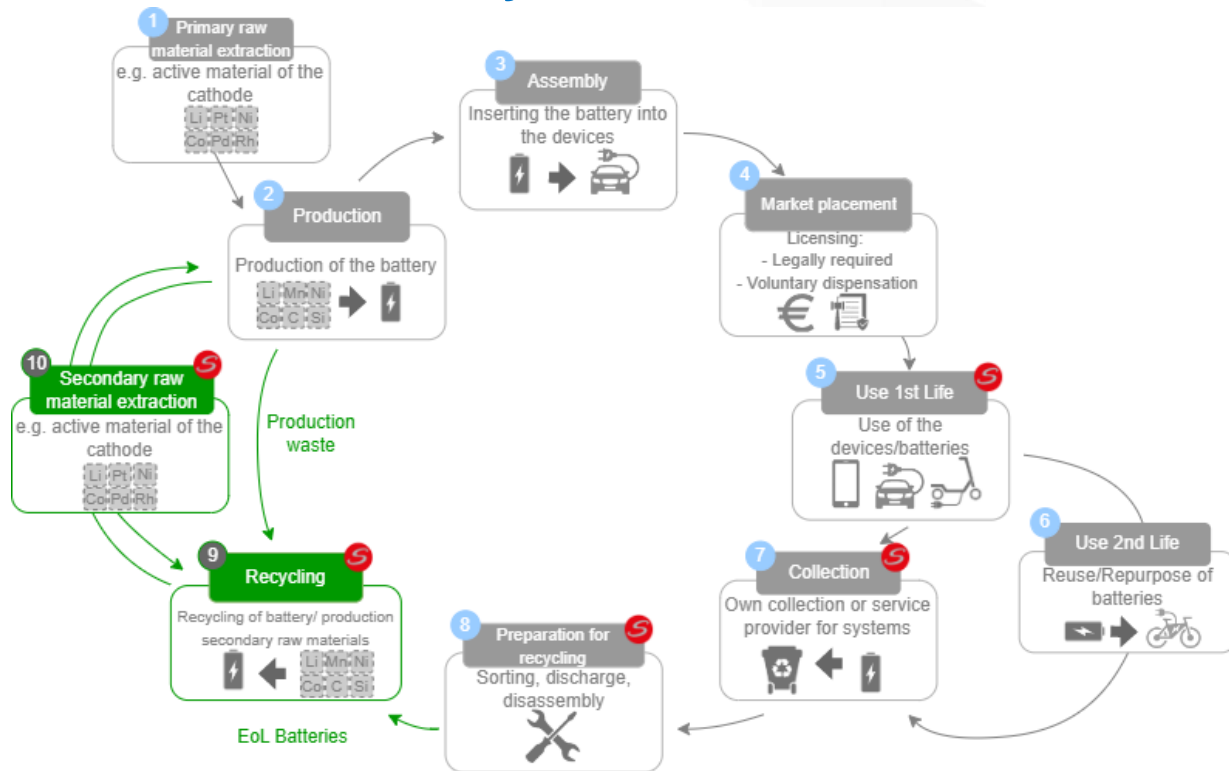
30



Sites in Austria

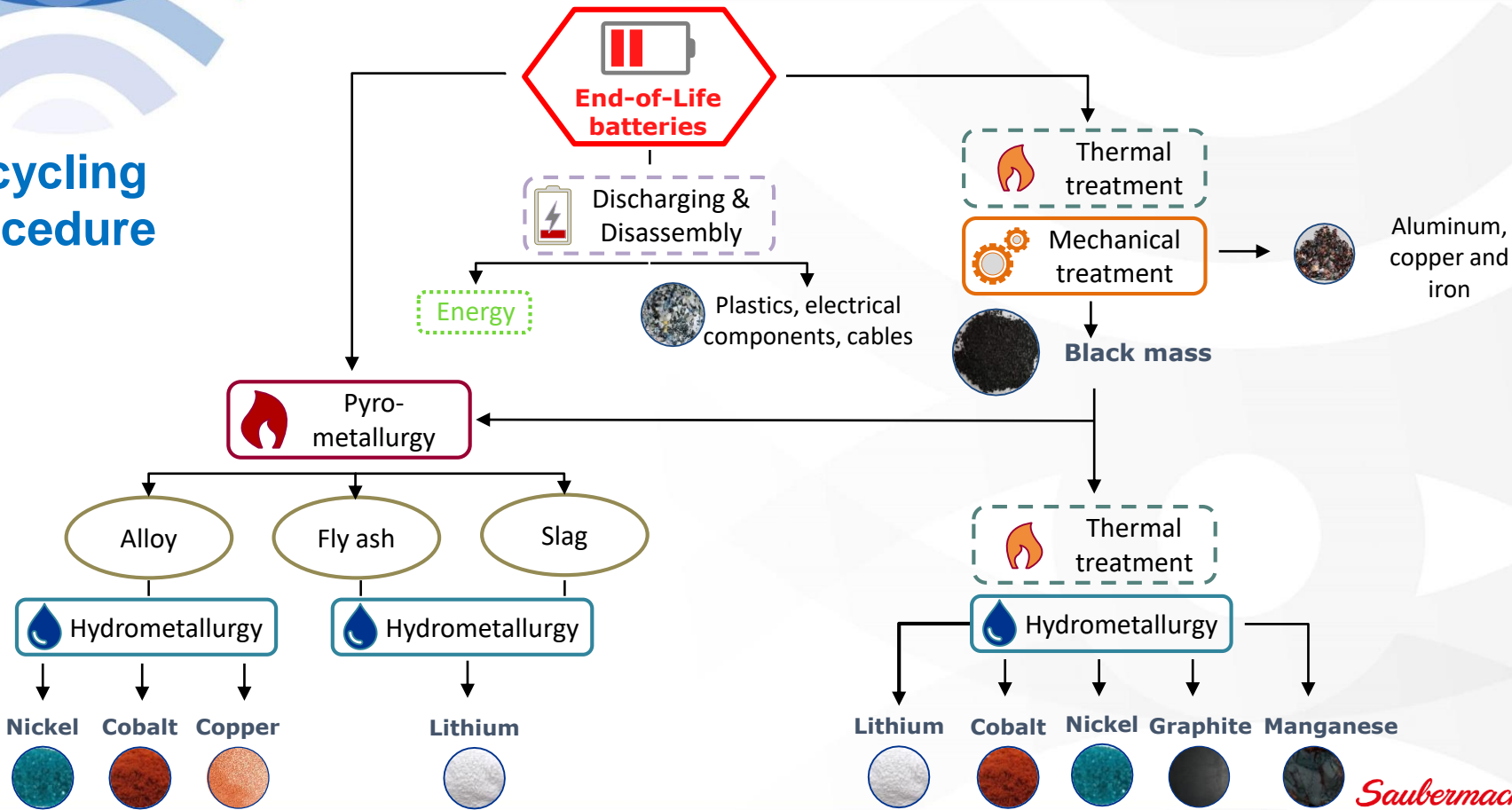


Redux- Circular system of Li-Ion Batteries



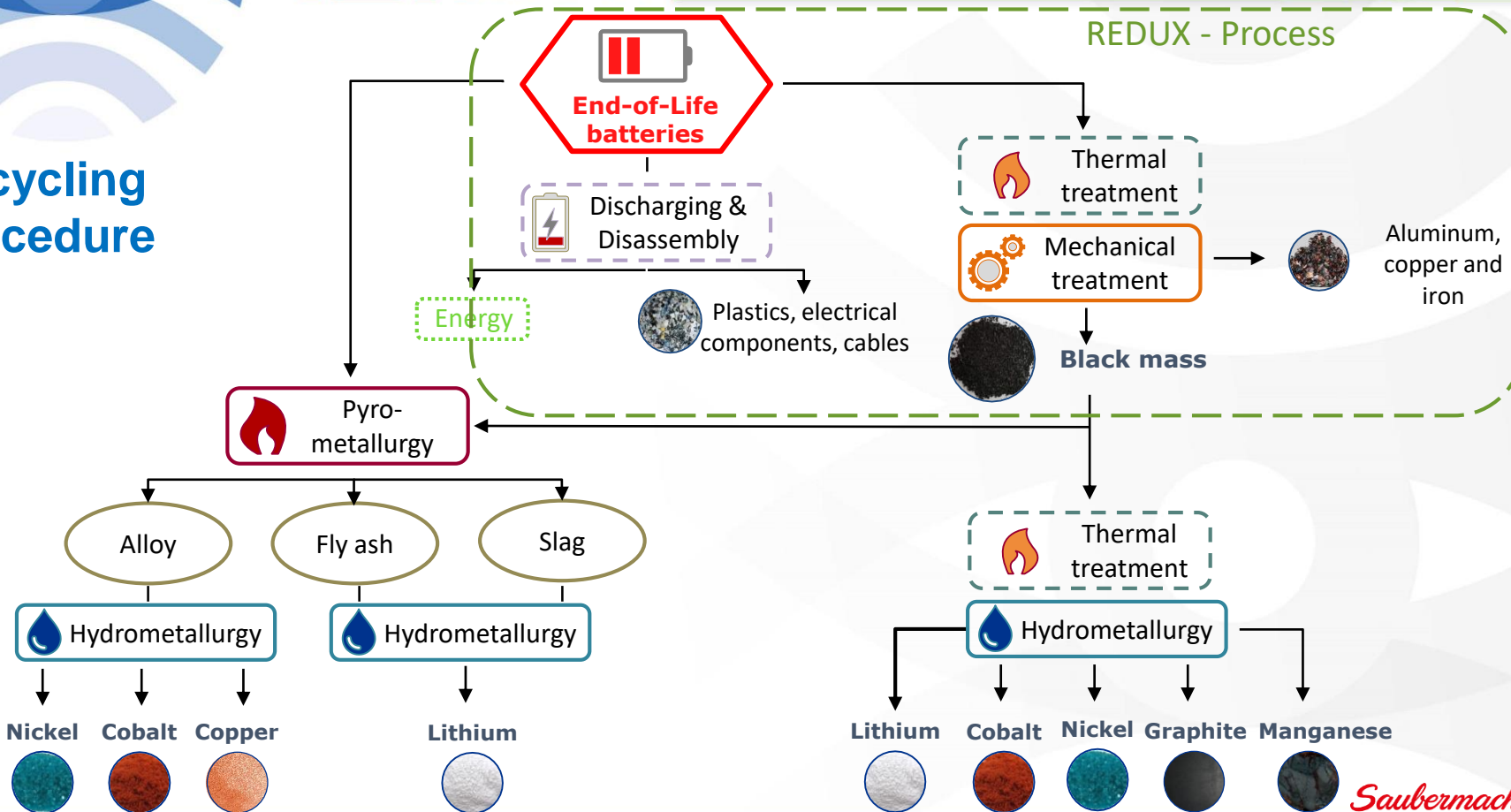


Recycling procedure





Recycling procedure





Saubermacher – for an environment worth living

Closing the loop: unlocking the green
potential of Li-Ion Batteries through
proper life-cycle management