

Sustainable Lithium-Ion Batteries for e-mobility

1

raw material extraction

Work towards a mining sector that respects social and ecological factors and our climate.

RECOMMENDATIONS

- Mining should take place under good governance (transparency, accountability, prevention of corruption, rule of law, participation)
- Protect human rights, rights of vulnerable groups, promote gender equality, and ensure occupational safety
- Reduce CO2 emissions, avoid pollution of soil, air and water and implement plans for ecological restoration and mine closure



7

recycling

Set-up take-back systems for recycling financed through extended producer responsibility.

RECOMMENDATIONS

- Support establishment of formal recycling infrastructure according to international standards
- Collect and send to formal recycling facilities
- If no local recycling infrastructure available, enable safe transport (e.g. in drums with sand) to appropriate facilities (around 30 companies in E-Asia, Europe, N-America)
- Establish financing options for the collection and recycling of Li-ion batteries, as recycling costs often exceed material value (e.g. Extended Producer Responsibility (EPR))



6

further use / second life

Extend the lifetime of batteries.

RECOMMENDATIONS

- Enable second life for vehicle batteries when 80% or less battery capacity is left
- Repurpose batteries for stationary energy storage or other applications where performance demands are lower, extending the life of batteries
- Identify (business) opportunities for making lithium-ion batteries usable again
- Develop and apply standards that ensure minimum quality, performance and safety requirements are met



5

battery use in e-mobility

Charge Li-Ion Batteries of EVs with renewable electricity for all transport modes to bring down emissions.

RECOMMENDATIONS

- Select vehicle technology based on external conditions (topography, climate) and operating hours
- Size the vehicle battery right based on the usage profile
- Aim for maximum utilisation of vehicles by using, batteries with priority for public transport, shared or autonomous vehicles
- Follow careful charging/discharging regime of batteries to reduce ageing of battery cells
- Adopt efficient driving behaviour (less stop-and-go, smooth acceleration processes) to reduce energy consumption and battery degradation.
- Increase battery utilisation (during parking) by feeding battery power to the electricity grid via vehicle to grid (V2G) integration



2

transport

Use sustainable transport modes to transport all battery materials along the life cycle.

RECOMMENDATIONS

- Avoid transport where possible (source & process locally)
- Shift to the most efficient means of transport (especially rail, inland waterways, etc.)
- Electrify transport routes and use renewable energy
- Consider transport externalities in and between all following process steps



3

raw material processing

Ensure fair and transparent processes throughout the entire supply chain.

RECOMMENDATIONS

- Reduce CO2 emissions through sustainable production methods and technologies e.g. the use of renewable energies in production
- Increase supply chain transparency
- Ensure fair working conditions
- Increase local value chain through processing locally



4

battery design & production

Design for durability and circularity.

RECOMMENDATIONS

- Design batteries for the circular economy, with durability, efficient raw material use, modularity, re-use and recyclability in mind.
- Maximise uptake of secondary raw material content from recycling
- Development of new battery types and compositions to use resources more efficiently and economically (e.g. without critical resources or less cobalt use)
- Reduce CO2 emissions, energy and water consumption in the production of batteries



On behalf of

Federal Ministry
for Economic Cooperation
and Development

Implemented by

giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

TUMI
Transformative Urban Mobility Initiative

Authors

GIZ Sector Project Sustainable Mobility

GIZ Extractives and Development Sector Programme

GIZ Sector Project on Concepts for Sustainable Waste
Management and Circular Economy

Status March 2022