At other countries' expense?

Lithium-Ion Batteries as Backbone of the Mobility Transition

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Demand for lithium-ion batteries (LIBs)

- Share of LIBs in EU vehicles forecast to rise to over 85% by 2030

Sources: Eurostat; Figure: Oeko-Institut 2019

(2) Eurostat; Figure: Oeko-Institut 2019
Material demand in the EU for LIB cell and pack production

- Aluminium accounts for the largest share of the demand
- Almost all materials are extracted to a large extent by mining
- The battery sector dominates the demand for lithium and cobalt
- The growth of the nickel and flake graphite market is driven by LIBs

(1) Bittner, Andreas; Flegler, Andreas; Neef, Christoph; Rostek, Leon; Stijepic, Denis; Tercero Espinoza, Luis Alberto; Thielmann, Axel (2021): Quantifizierung Batterierecycling. Edited by Fraunhofer. Karlsruhe.
Country overview for lithium mining

Challenges of lithium mining

- Hard rock mining (mainly Australia):
  - Mining of spodumene in open pits
  - Extraction followed by roasting and acid treatment
  - Related problems are
    - Heavy metal pollution
    - Acid mine drainage
    - Energy intensive processing
- Lithium rich brines in the Andes region
  - Evaporating water out of a hyper-saline solution in arid region leading to
    - Water scarcity, leading to social tensions
    - Dust evolution
- Refining mostly takes place in China
Lithium mining in Germany

- In Germany, there is a large lithium deposit in the Upper Rhine Valley.
- Extraction from thermal water, with simultaneous use of electricity and heat
- Less water consumption, short transport distances
- Currently only pilot operation
- Planned production of over 4,000 t/a of Li in 2024, over 11,500 t/a in 2025
  - World lithium production in 2020 was 82,500 t/a
- Further deposit in Eastern Germany (Zinnwald) with over 1,500 t/a Li planned for the future
Sustainable Mining

• Minimizing the impact of mining by choosing the right spots and maximizing the sustainability during production

• Several important aspects to improve mining, for example:
  • Free prior and informed consent
  • Good working conditions
  • Minimizing ecological impact and circularize production
  • Use of renewable energy for mining and processing
  • Remediation of abandoned mines
  • Formalization of artisanal and small scale mining (ASM) sector (especially for cobalt)

## Standards for the lithium-ion battery value chain

### Mining & Mineral Processing
- IFC EHS Guidelines
- LME
- EITI
- Extractive Waste Directive
- TSM / TSM
- IRMA
- Global Tailings Review
- CTC
- China Responsible Mineral Supply Chain Due Diligence Management Guide

### Production
- CIRAF
- OECD Due Diligence Guidelines
- ARM
- ICMM Mining Principles
- Responsible Minerals Initiative
- ERMA
- Fair Cobalt Alliance
- World Bank Climate-Smart Mining Initiative
- Responsible Cobalt Initiative

### Disposal & Recycling
- ELV Directive
- Basel Convention
- WEEE European Standard

### Mobility / Battery-Specific Standards and Initiatives

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**Colour:** **Mandatory regulation:** mandatory standard; voluntary standard: guiding principle; initiative

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Many standards - strong standards?

- Example IRMA (Initiative for Responsible Mining Assurance)
- Important points:
  - Covering all industrial mined materials
  - Governed equitably by a diverse set of stakeholders (NGOs have a seat at the table)
  - Developed through public consultation
  - Step by step improvement system
  - Independent audits including on-site visits
  - Audit reports are published


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Reduction of resource demand

• Sufficiency (behavioral change for sustainability)
  • Less individual transport with own car (car sharing instead)
  • More transport on foot, by bicycle or public transport
• Substitution
  • e.g., cobalt-free lithium-ion battery cells (LFP)
• Material efficiency + innovation
  • Less inactive materials, more energy per mass and volume
• Recycling
  • High collection rates
  • High recycling efficiency
Role of recycling to satisfy resource demand

Growing markets with long-life products (EVs) will take time before large volumes are recycled and resources are returned.

Forecast traction batteries PoM and EoL in the EU 27 in tonnes

- Traction batteries PoM
- Traction batteries EoL
Concluding remarks

• If motorized individual transport is desired, batteries for electromobility are needed
• Measures to flatten the demand for resources are important
• Recycling of batteries is crucial, but not sufficient
  • Mining will play a role for the foreseeable future
  • The impact of resource supply through recycling will increase over time
• High, mandatory standards (Mandatory Due Diligence).
  • Not only for battery raw materials, but also for crude oil!!!
  • Until then, support strong voluntary standards like IRMA
• Promote European mining, provided high environmental and social standards are met
• Compare resource requirements of electric vehicles and cars with combustion engines:
  • Crude oil cannot be recycled
  • Once the share of electric cars rises to 100%, the peak of resource consumption in this sector will be reached
Thank you very much!

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