Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

# At other countries' expense?

## Lithium-Ion Batteries as Backbone of the Mobility Transition

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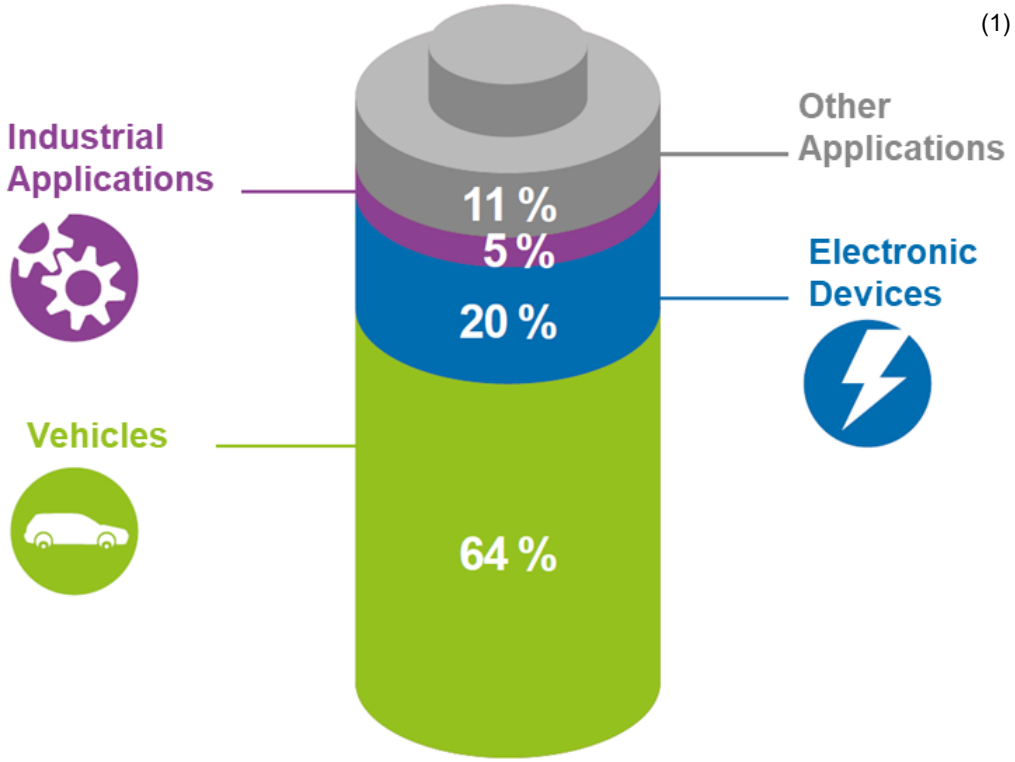
Jahrestagung des Öko-Instituts

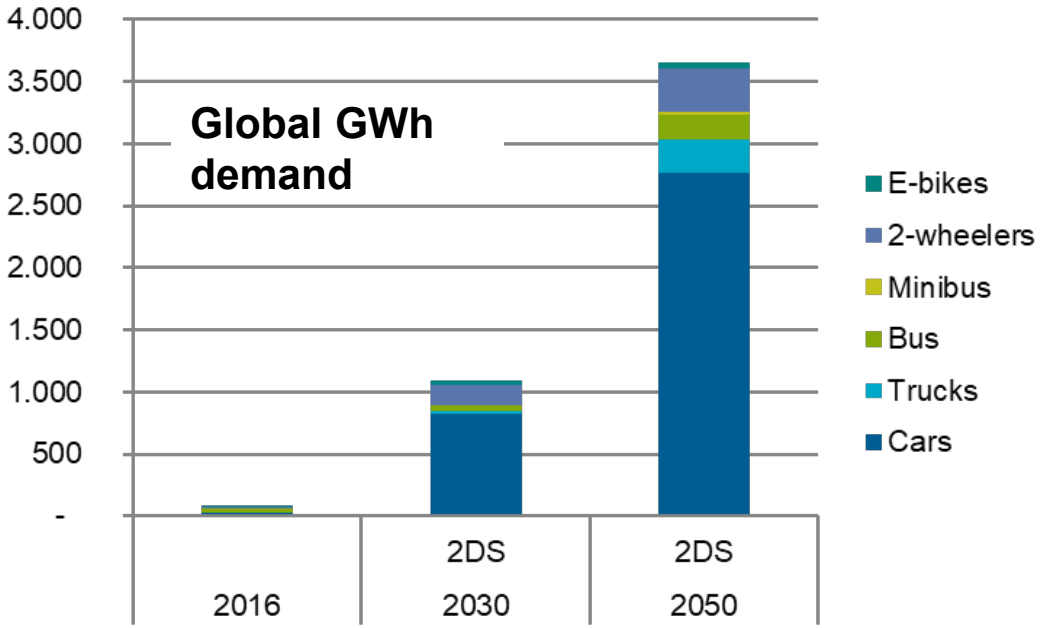
22. Juni 2022 dbb forum berlin

# Demand for lithium-ion batteries (LIBs)

(1)




(2)



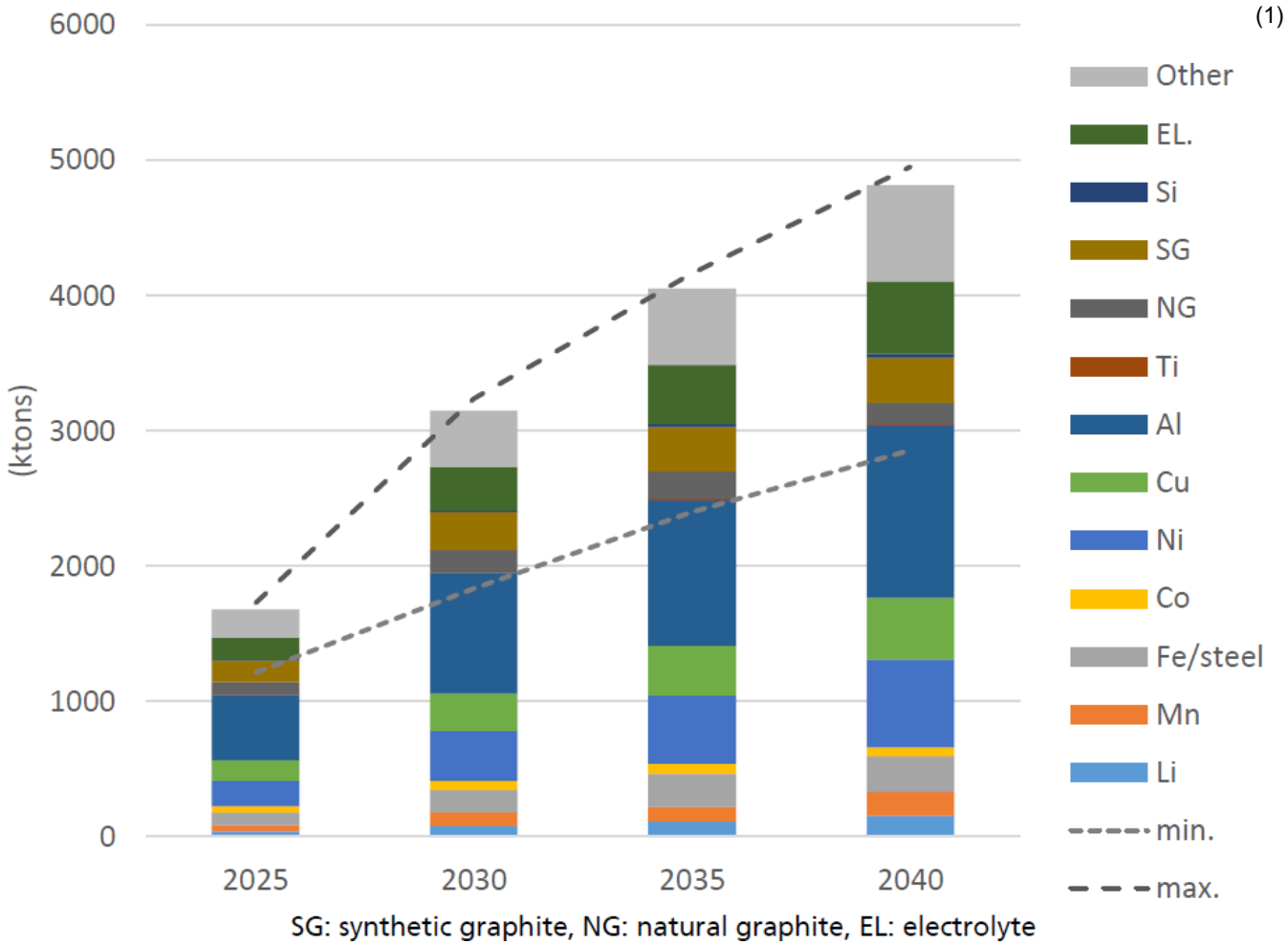

Sources: Eurostat; Figure: Oeko-Institut 2019

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



(1) The data refers to the year 2018. Source: Pillot, Christophe (2019): Impact of the xEV Market growth on Lithium-Ion Batteries and Raw Materials Supply 2018-2030 AABC: advanced automotive battery conference. 30 Januar 2019, Strasbourg, Frankreich https://bit.ly/3mq2oPV accessed on 5.6.2020
(2) Eurostat; Figure: Oeko-Institut 2019

# Material demand in the EU for LIB cell and pack production

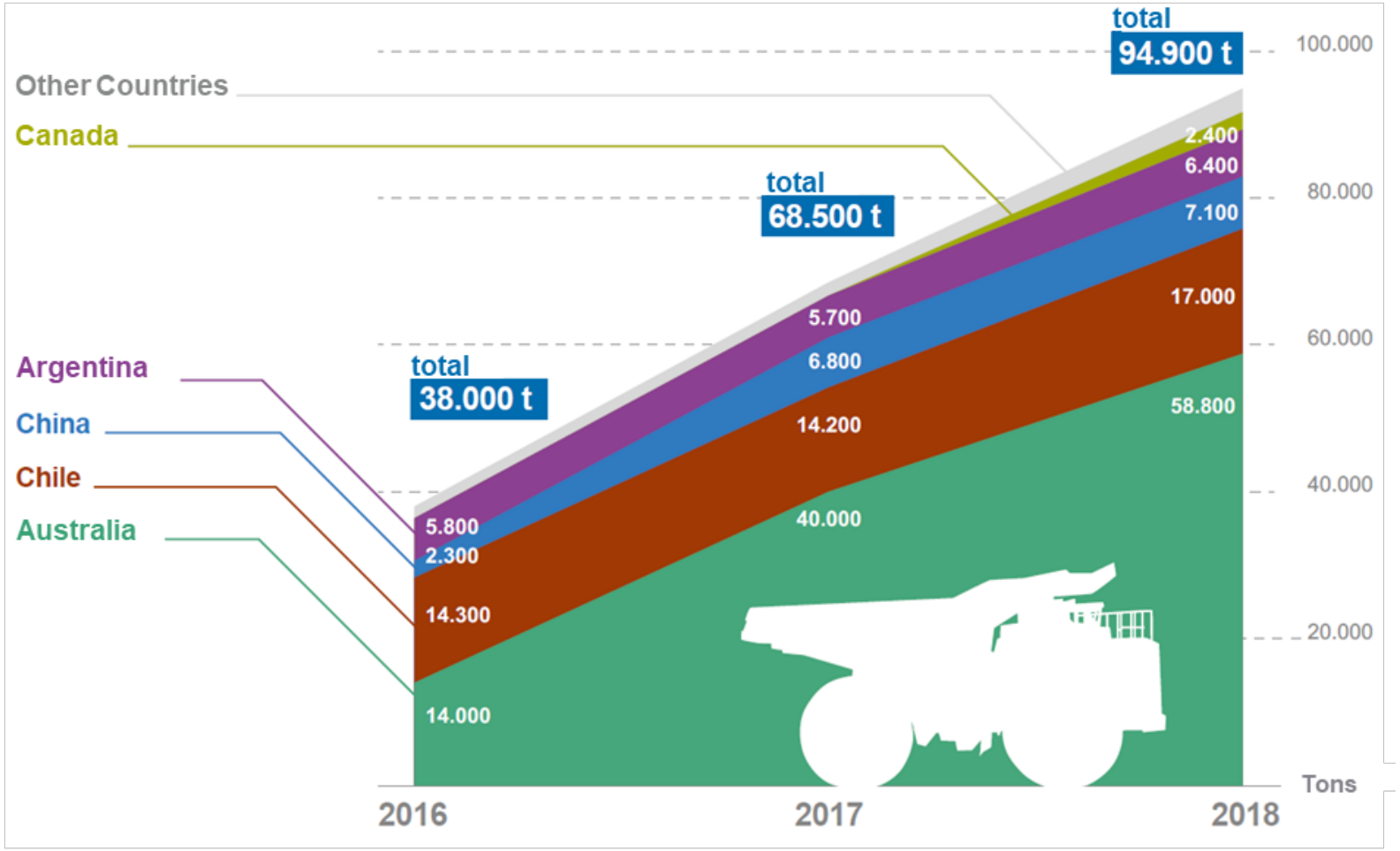



- Aluminium accounts for the largest share of the demand
- Almost all materials are extracted to a large extent by mining
- The battery sector dominates the demand for lithium and cobalt
- The growth of the nickel and flake graphite market is driven by LIBs



(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




Data source: USGS Mineral Commodity Summaries, 2018 (https://bit.ly/3mmezgB), 2019 (https://bit.ly/32xEnyB), 2020 (https://on.doi.gov/33paCil)

# 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



https://d2j21x2d72g5zn.cloudfront.net/Greenbushes_Australia.jpg-A.jpg (19.06.2022)

# Lithium mining in Germany

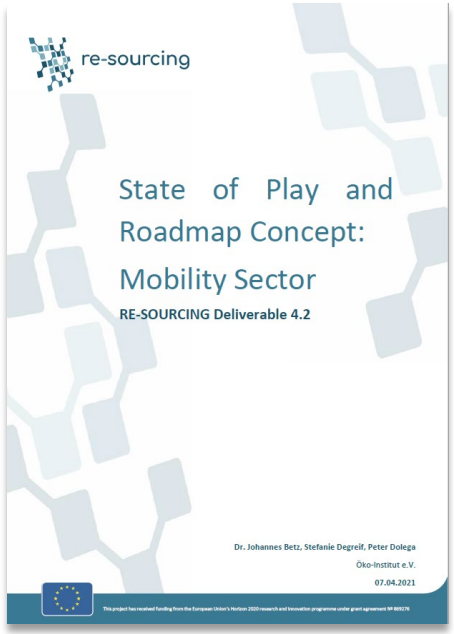
- In Germany, there is a large lithium deposit in the Upper Rhine Valley.
- Extraction from thermal water, with simultaneous use of electricity and heat
- Less water consumption, short transport distances
- Currently only pilot operation
- Planned production of over 4 000 t/a of Li in 2024, over 11 500 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



https://www.electrive.net/2022/01/04/vulcan-energy-erhaelt-fuenf-explorationslizenzen-im-oberrheingraben/ (19.06.2022)
http://www.deutschelithium.de/projekte/zinnwald-lithium-projekt/ (19.06.2022)

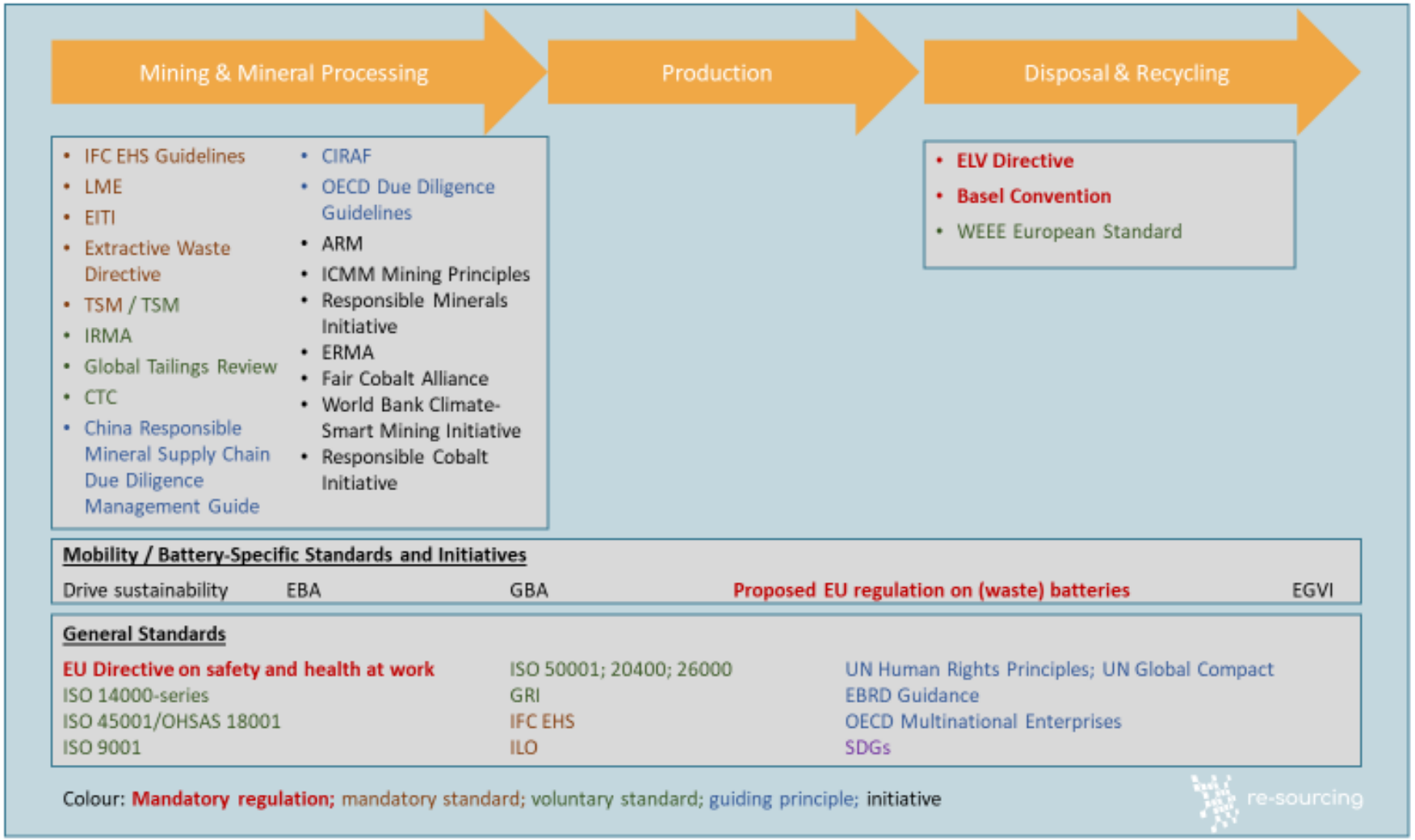
# Sustainable Mining

- 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)




Betz, J., Degreif, S., & Dolega, P. (2021). State of Play and Roadmap Concept: Mobility Sector: RE-SOURCING Deliverable 4.2. Darmstadt. Öko-Institut e.V. https://re-sourcing.eu/files/sop_mobility_sector.pdf

# Standards for the lithium-ion battery value chain

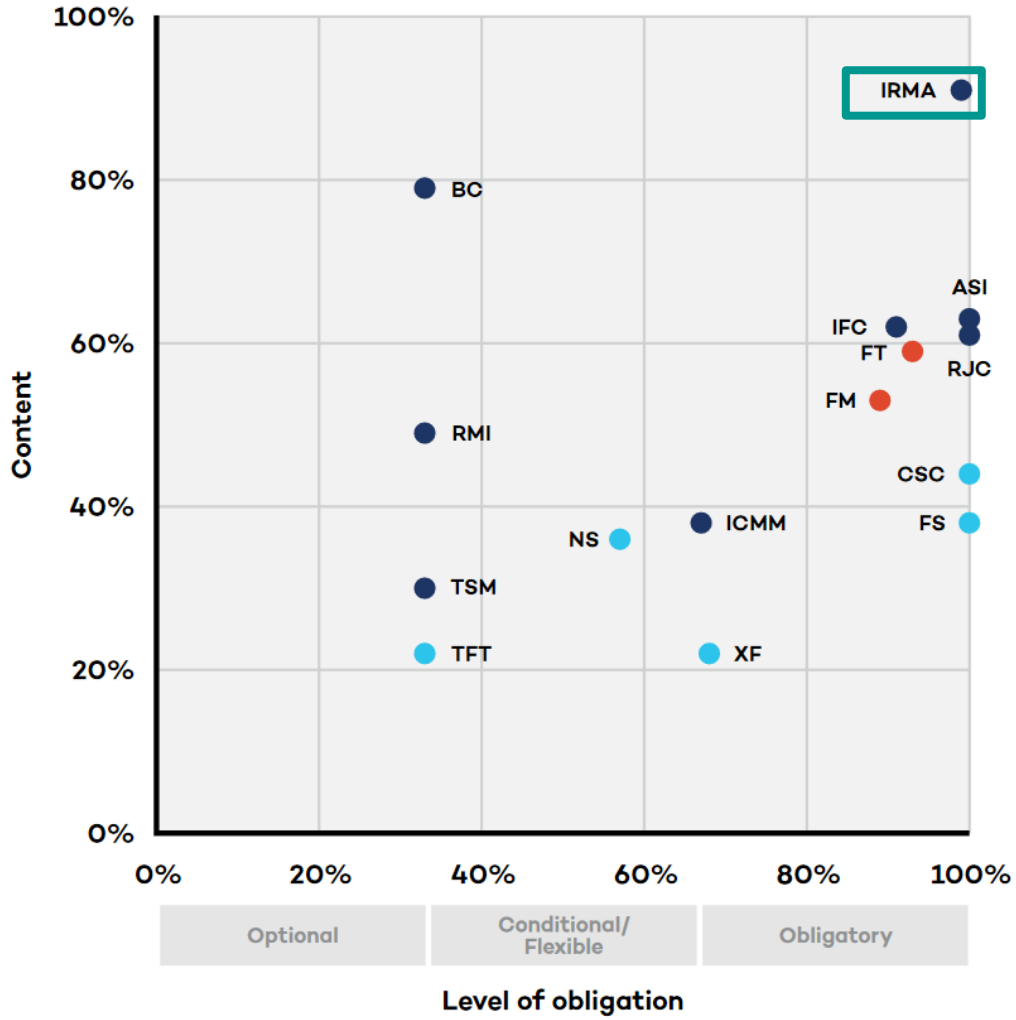





Betz, J., Degreif, S., & Dolega, P. (2021). State of Play and Roadmap Concept: Mobility Sector: RE-SOURCING Deliverable 4.2. Darmstadt. Öko-Institut e.V. https://re-sourcing.eu/files/sop_mobility_sector.pdf

# 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

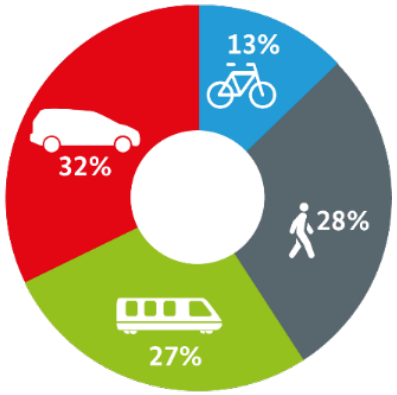





https://www.iisd.org/system/files/publications/igf-ssi-review-extractive-economy.pdf (19.06.2022)

# 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

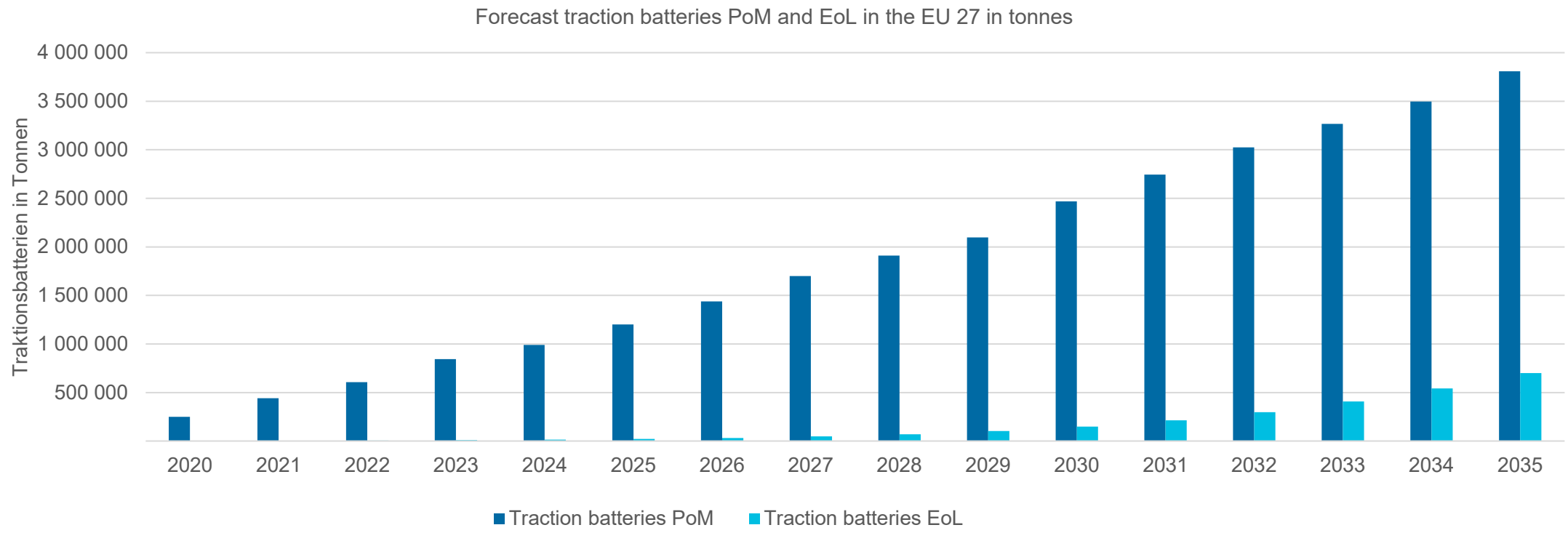





https://commons.wikimedia.org/wiki/File:Allocation_of_Space_for_Transport_Infrastructure_-_Example_of_Berlin.png, 19.06.2022
https://cdn.pixabay.com/photo/2014/04/02/11/13/recycling-305569__340.png 19.06.2022

# 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

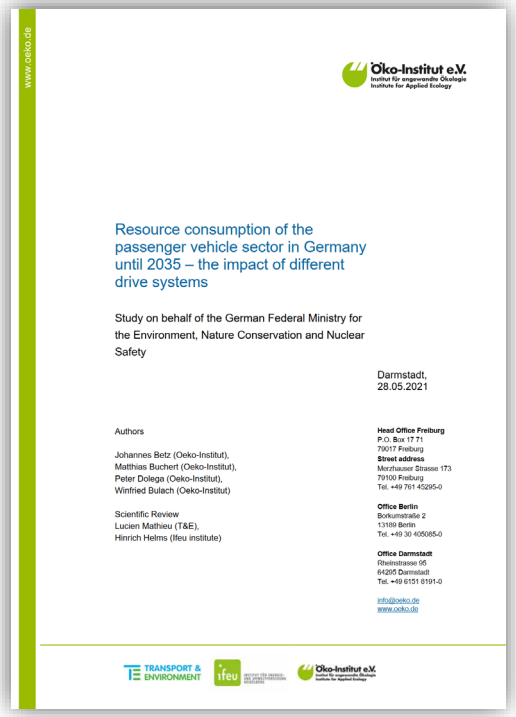





Stahl et al. (2021) Assessment of Options to Improve Particular Aspects of the EU Regulatory Framework on Batteries for the European Commission

# 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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Resource consumption of the passenger vehicle sector in Germany until 2035 – the impact of different drive systems

Study on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Darmstadt, 28.05.2021

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Betz, J.; Buchert, M.; Dolega, P.; Bulach, W.; Resource consumption of the passenger vehicle sector in Germany until 2035 – the impact of different drive systems, Study on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, scientific review by Mathieu, L (T&E) and Helms, H. (ifeu institute), 2021

# Thank you very much!

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