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Leiden
The Netherlands

Lithium-ion batteries and the transition to electric vehicles: environmental challenges and opportunities from a life cycle perspective

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Citation

Xu, C. (2022, December 21). *Lithium-ion batteries and the transition to electric vehicles: environmental challenges and opportunities from a life cycle perspective*. Retrieved from <https://hdl.handle.net/1887/3503659>

Version: Publisher's Version

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Propositions for the dissertation “Lithium-ion batteries and the transition to electric vehicles — environmental challenges and opportunities from a life cycle perspective”

1. Future material demand for electric vehicle batteries depends on electric vehicle fleet and battery chemistry developments (Chapter 2).
2. Future life cycle greenhouse gas emissions per lithium-ion battery cell production can reduce largely due to the decarbonization of the energy system (Chapter 3).
3. Global greenhouse gas emissions of global electric vehicle battery cell production are likely increase despite a relative decrease of emissions per kWh of battery capacity (Chapter 4).
4. Electric vehicle batteries alone could satisfy the short-term grid storage demand by as early as 2030 (Chapter 5).
5. Ensuring the transition to electric vehicles will require increased efforts to diversify battery manufacturing and critical mineral supplies to reduce supply risks and price spikes (IEA, 2022).
6. The environmental impacts of a battery may change significantly depending on where the battery is manufactured and the source of the material (Dai *et al.*, 2019).
7. Sustainable sourcing, including the use of low-emission materials and energy, as well as further efforts to increase material efficiencies, *e.g.*, via more circular systems, will help to decrease the environmental impacts of battery production (IPCC, 2022).
8. Vehicle-grid integration can provide benefits by leveraging the interaction between electric vehicles and the grid, which may include lowering the cost of using intermittent renewable electricity (Wolinetz *et al.*, 2018)
9. Electricity infrastructure has a long lifespan, and technology decisions regarding the electricity supply in the power sector over the next decade will affect the potential for electric vehicles to reduce greenhouse gas emissions over the next several decades (Samaras & Meisterling, 2008).