Measures to reduce the demand for raw materials for lithium-ion batteries: A scenario analysis

Johannes Morfeldt[1], Daniel Johansson[1], Simon Davidsson Kurland[2]

[1] Physical Resource Theory, Chalmers University
[2] Department of Earth Sciences, Uppsala University

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Motivation

Phase-out policies → Fast electrification ← Manufacturers shifting to EVs

Fast electrification ↓ Increasing battery demand

Sustainability concerns ← Increasing battery demand → Costs

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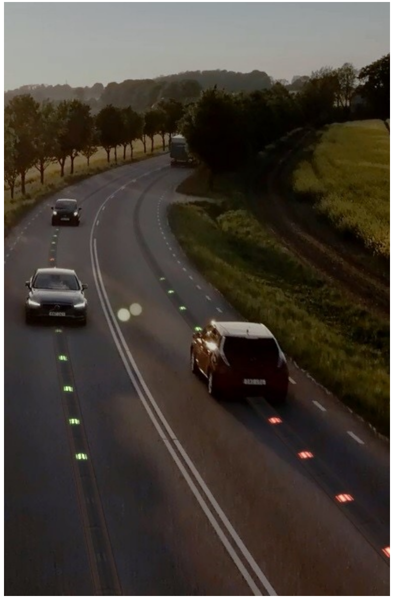
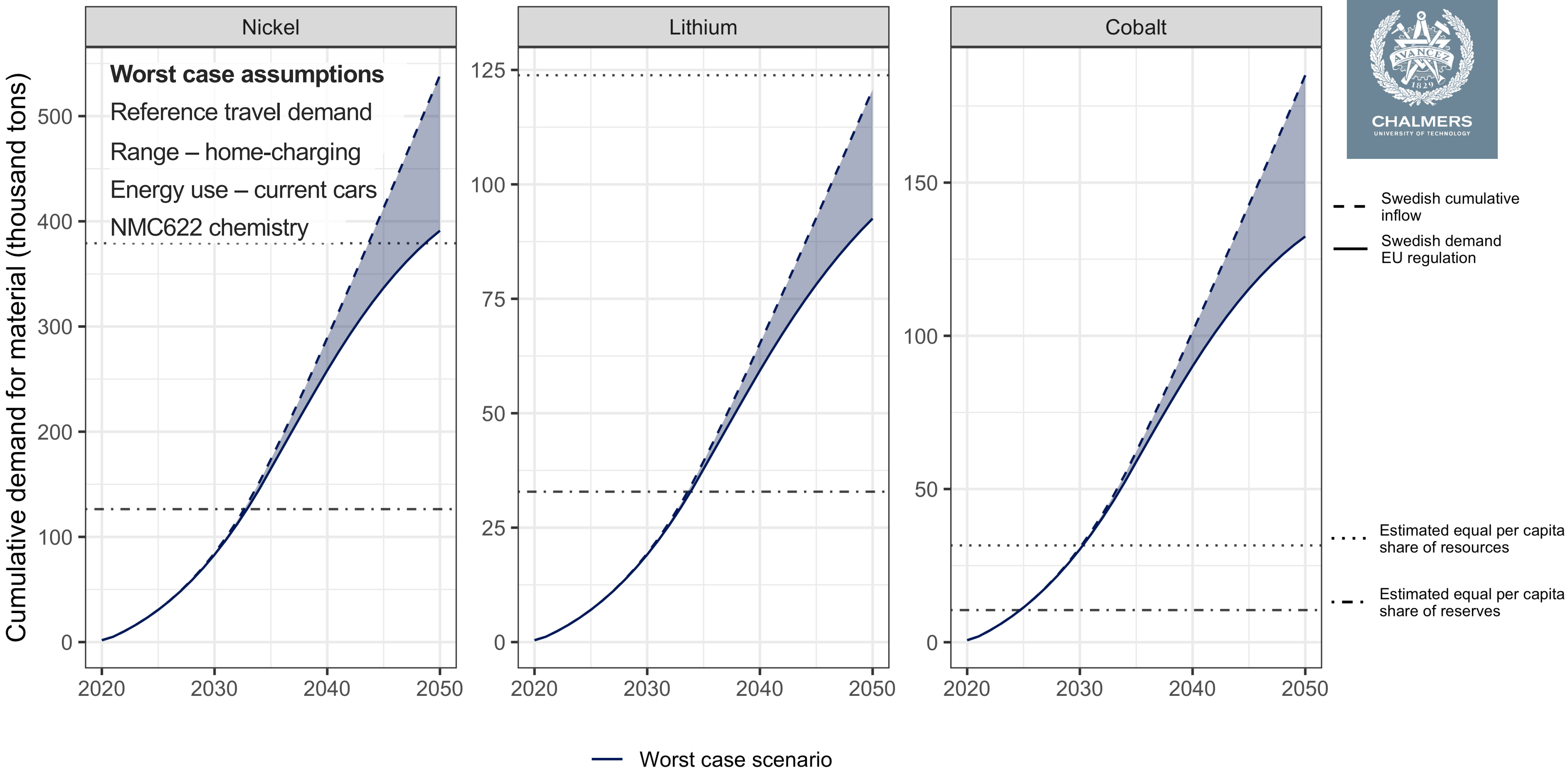


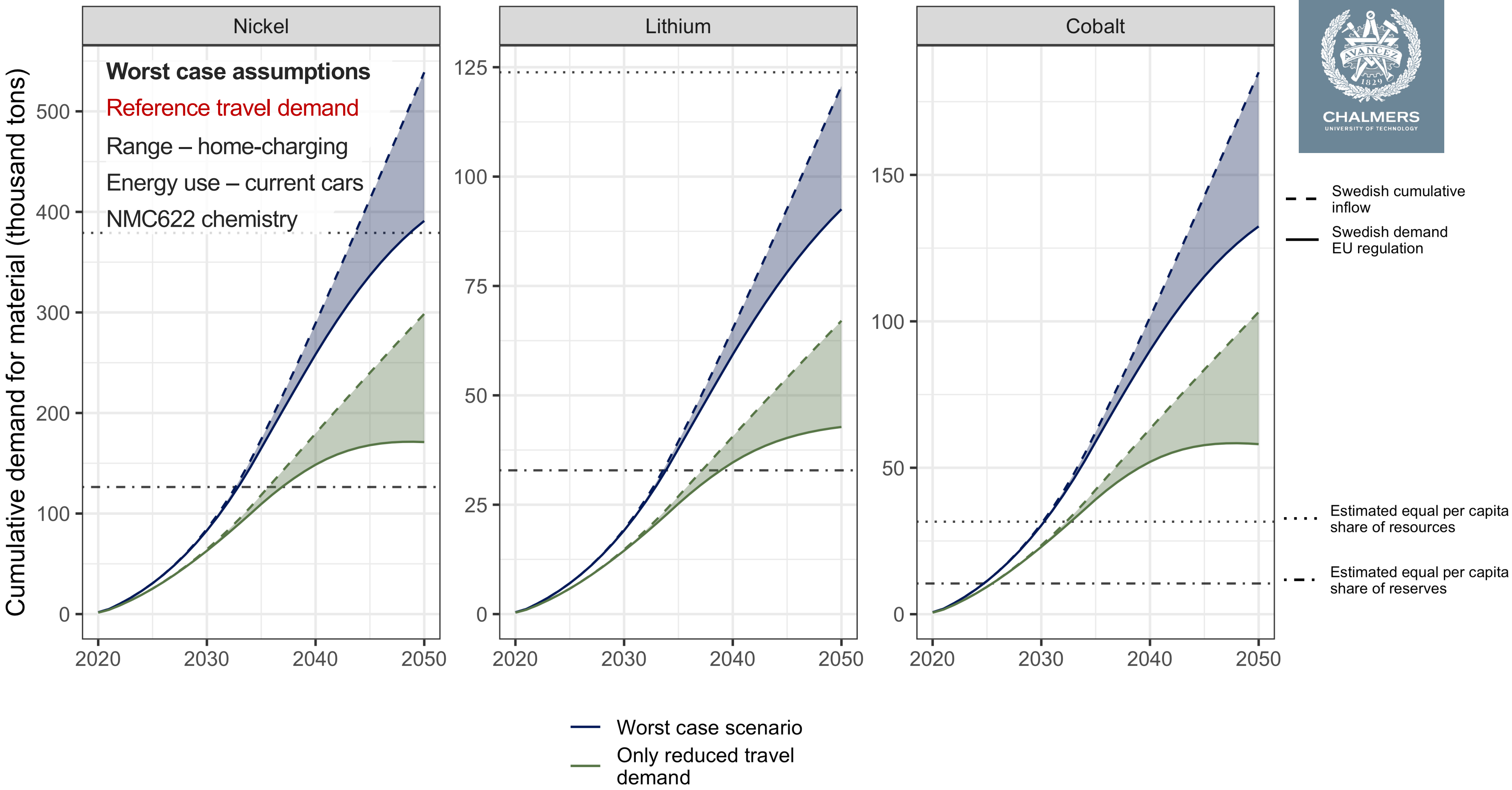
Measures to reduced material demand

- Vehicle technology options
  - New battery chemistries
  - Increased energy efficiency through technical improvements and downsizing
- Transport system options
  - Charging infrastructure – wireless charging / fast charging
  - Self-driving cars and/or sharing
  - Reduced travel demand and mode shifting

Method

- Vehicle Turnover model Assessing Future Mobility services (V-TAFM)
  - Total sales of BEVs depending on regulations and travel demand
- Battery requirements per vehicle
  - Range + Access to wireless/fast charging
- Energy efficiency in vehicles
  - Depending on future battery size and range assumptions
- Material demand for different battery chemistries
  - From current chemistries to (i) NMC622 or (ii) LFP


Nickel
Lithium
Cobalt
Worst case assumptions
Reference travel demand
Range – home-charging
Energy use – current cars
NMC622 chemistry
Cumulative demand for material (thousand tons)
0
100
200
300
400
500
25
50
75
100
125
150
2020
2030
2040
2050
Swedish cumulative inflow
Swedish demand EU regulation
Estimated equal per capita share of resources
Estimated equal per capita share of reserves
Worst case scenario



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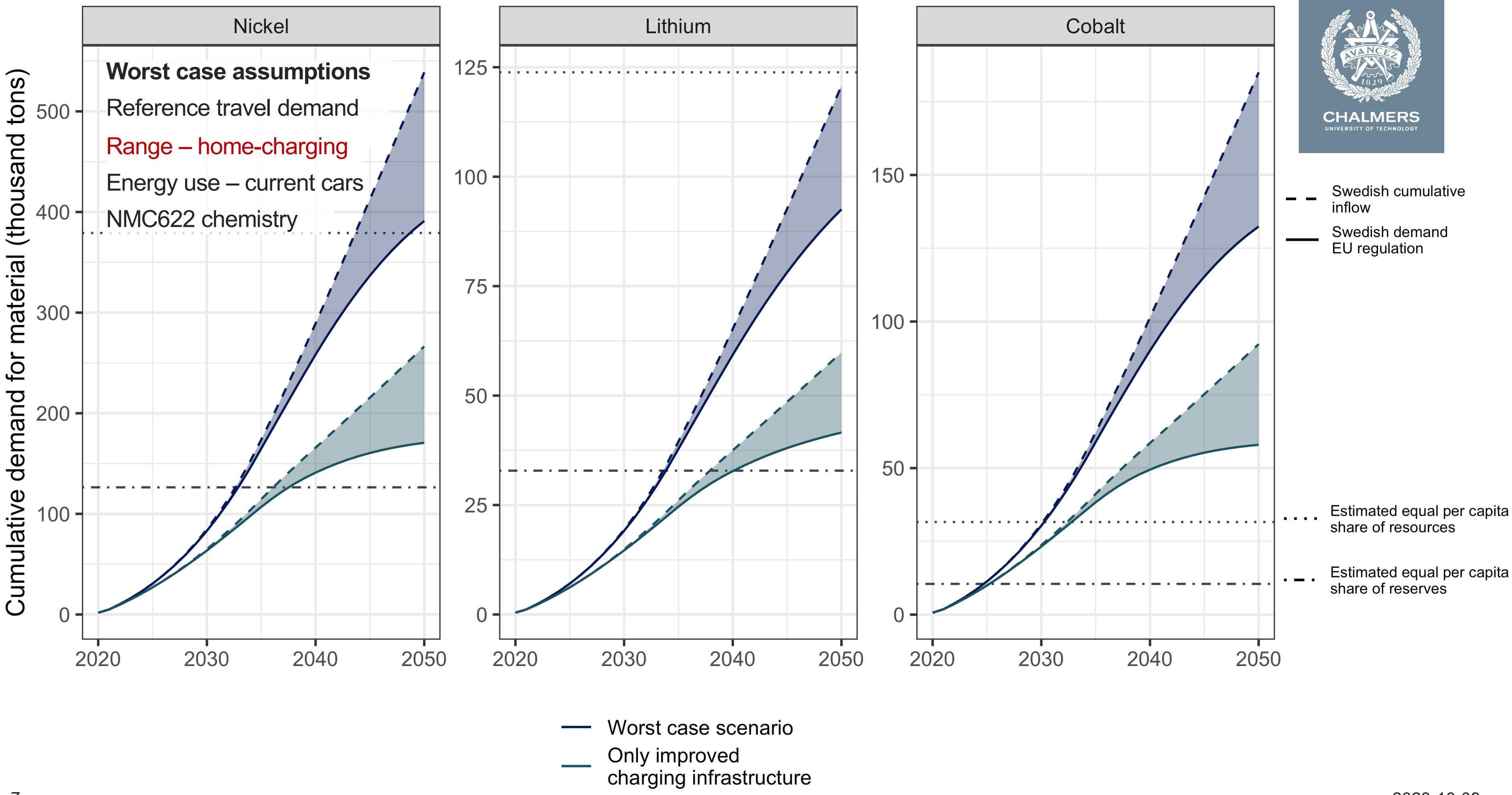
Worst case scenario
Only reduced travel demand



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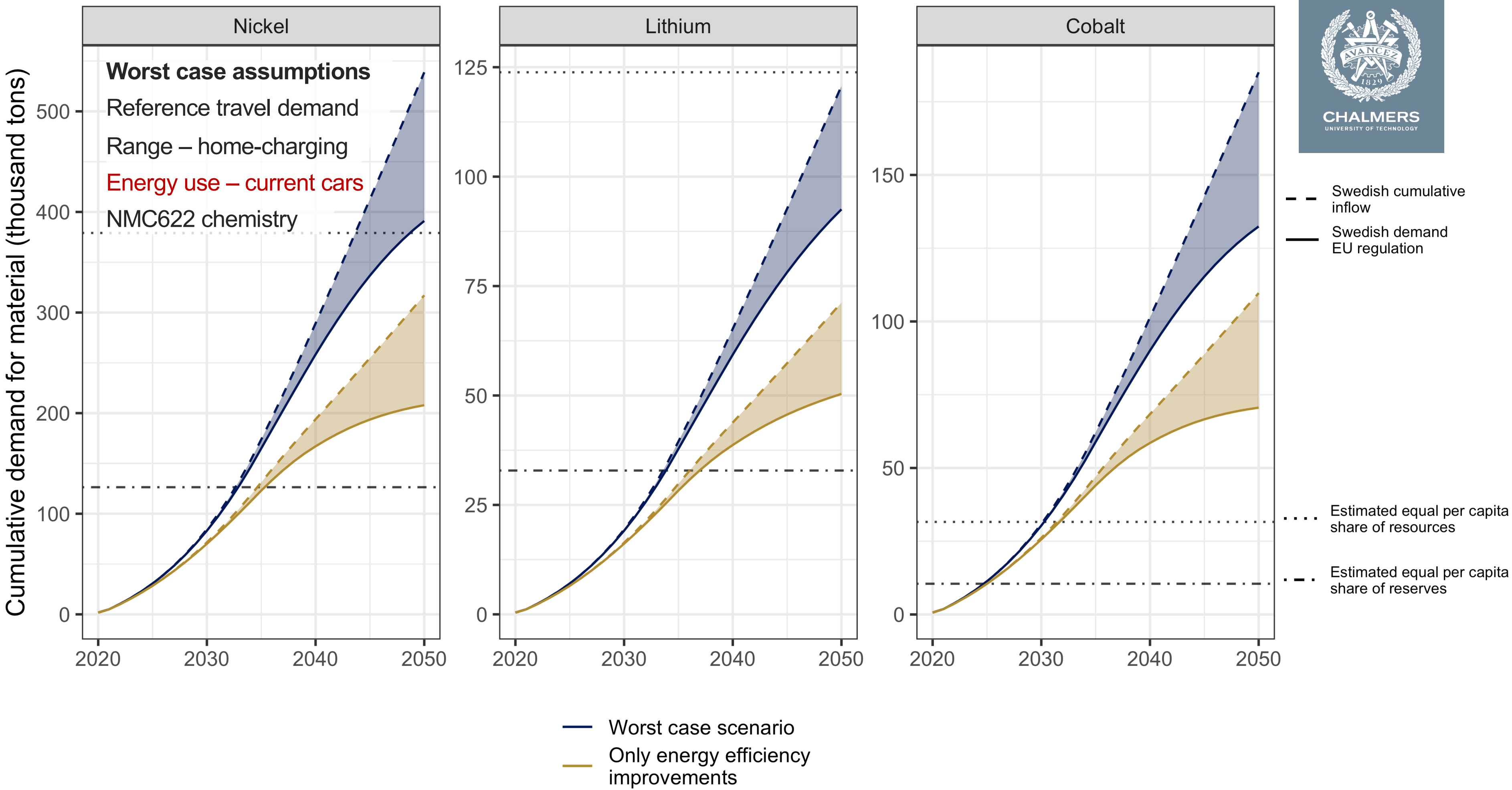
Worst case scenario
Only improved charging infrastructure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NMC622 chemistry
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Swedish cumulative inflow
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Worst case scenario
Only energy efficiency improvements
2020
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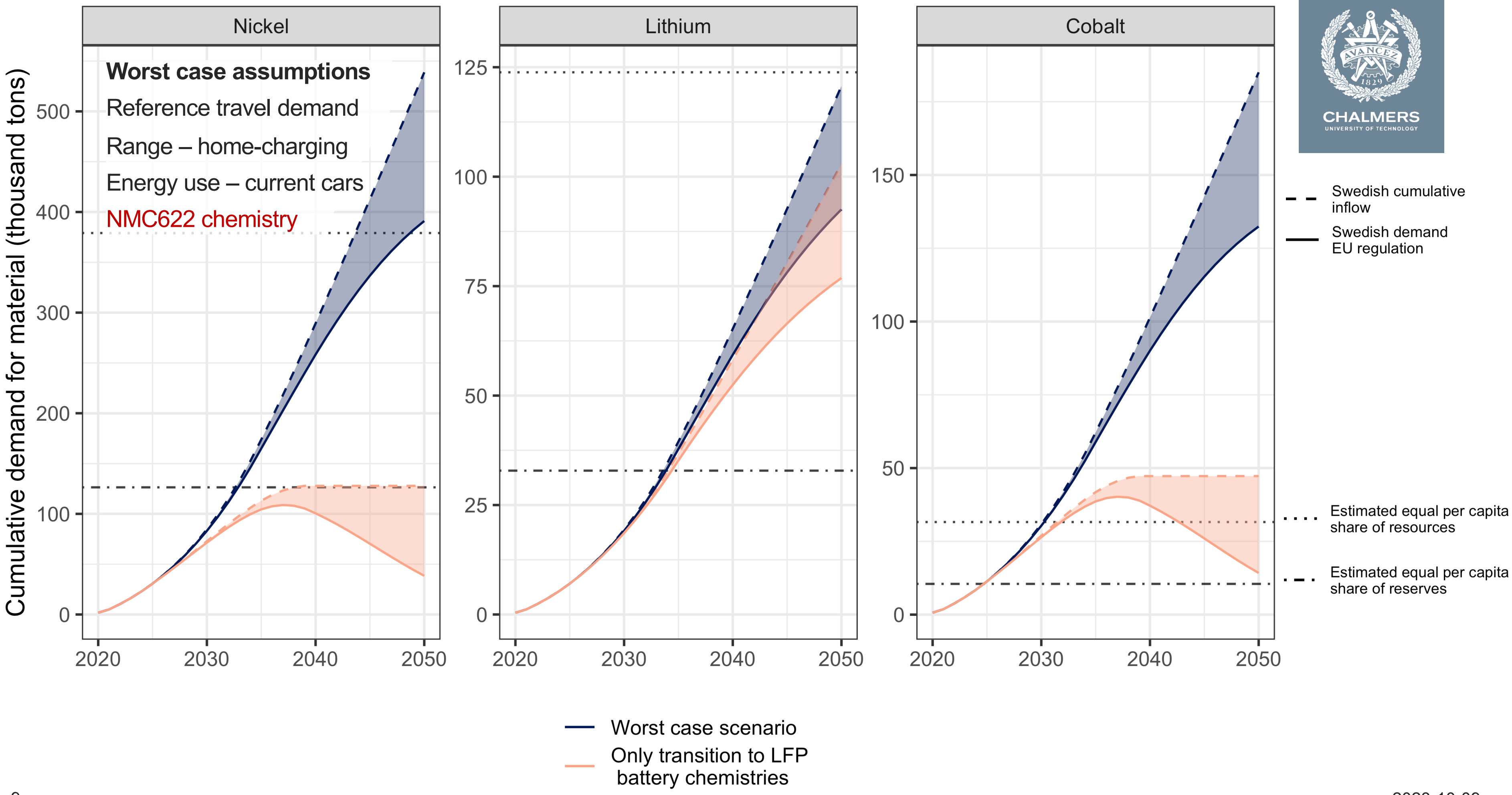
2050



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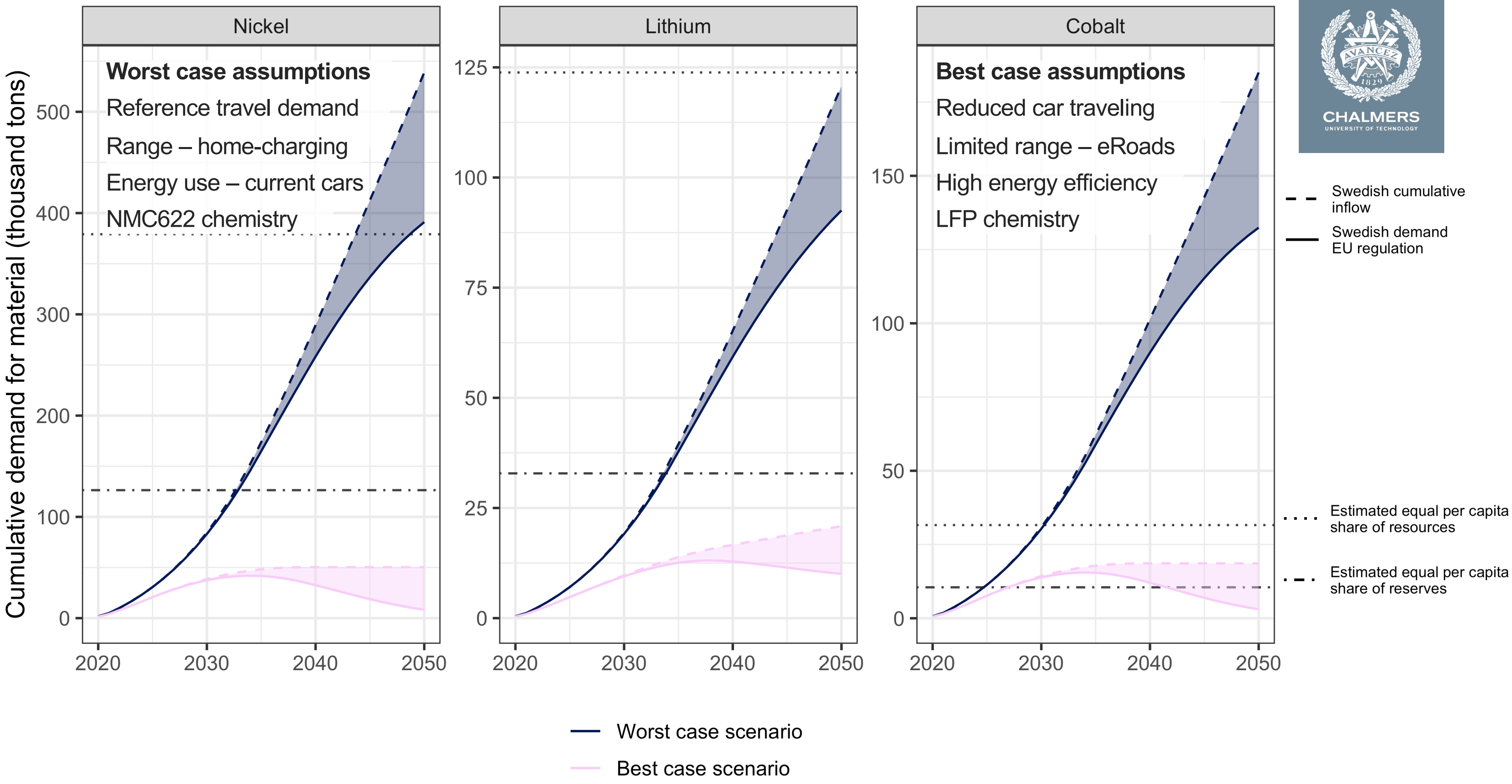
Estimated equal per capita share of reserves
Worst case scenario
Only transition to LFP battery chemistries


Nickel
Lithium
Cobalt
Worst case assumptions
Reference travel demand
Range – home-charging
Energy use – current cars
NMC622 chemistry
Best case assumptions
Reduced car traveling
Limited range – eRoads
High energy efficiency
LFP chemistry
Cumulative demand for material (thousand tons)
Swedish cumulative inflow
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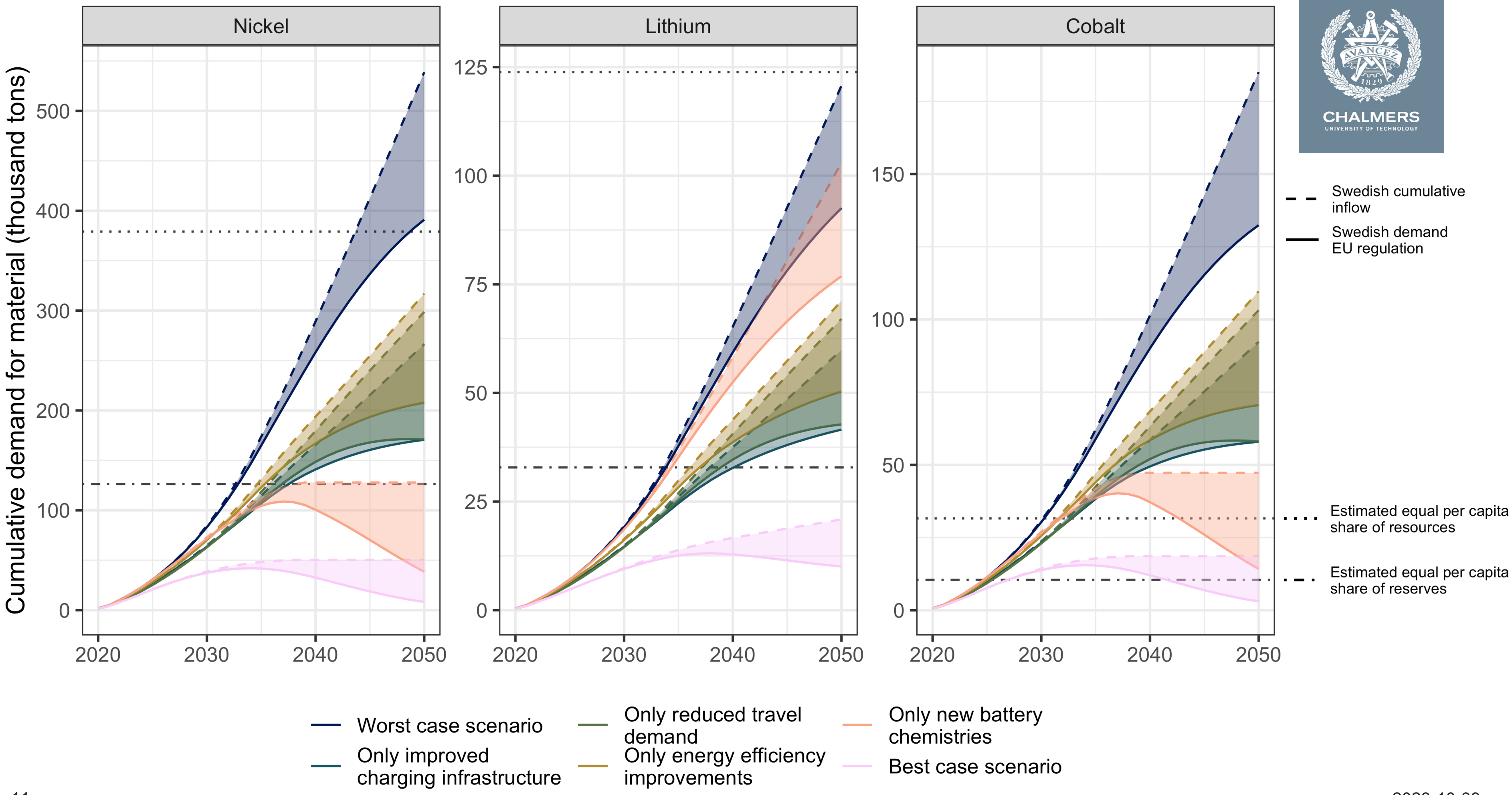
Estimated equal per capita share of resources
Estimated equal per capita share of reserves
Worst case scenario
Best case scenario



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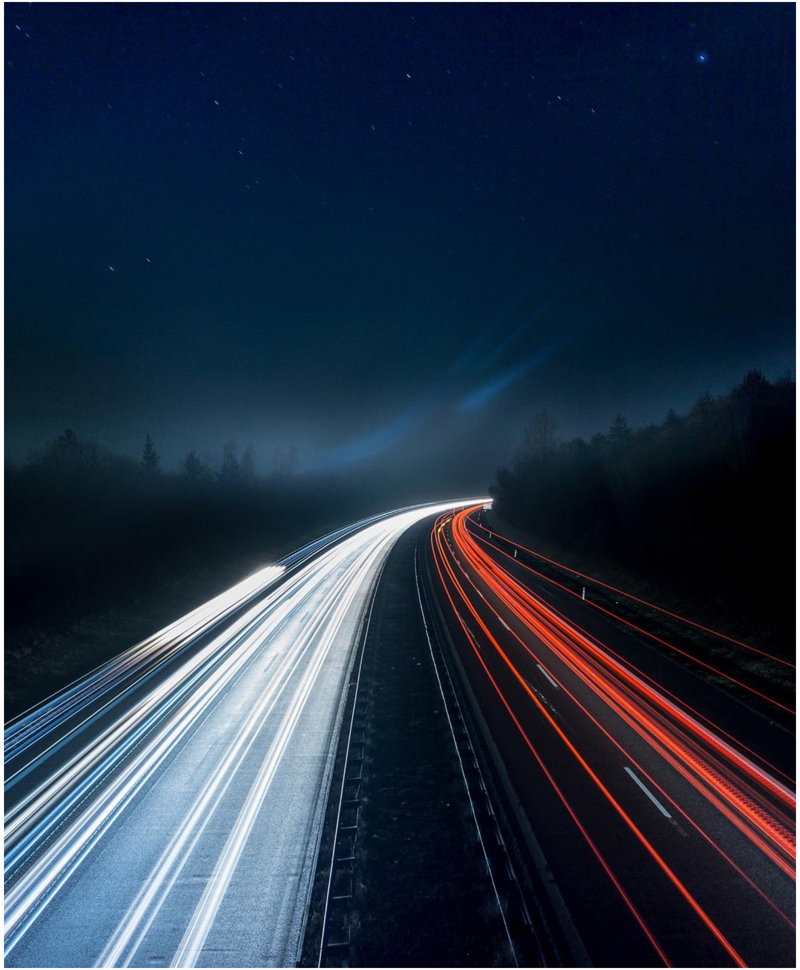
Worst case scenario
Only improved charging infrastructure
Only reduced travel demand
Only energy efficiency improvements
Only new battery chemistries
Best case scenario



Conclusions

- Increased **energy efficiency** in cars, new **battery chemistries**, reduced **travel demand** and improved **charging infrastructure** that allow for shorter range can together achieve material demands below equal per capita share of the global reserve for nickel and lithium.
- Individual measures, except new battery chemistries, achieve **similar results in isolation** with moderate impact on material demand.
- New battery chemistries may have a high impact on reducing nickel and cobalt demand, but **lithium demand could remain high** unless the industry moves towards non-Li batteries.

AVANCEZ

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