TRANSPORT & ENVIRONMENT

Executive Summary

Clean and lean: Battery metals demand from electrifying passenger transport

T&E has developed three scenarios for the demand of battery raw materials, notably lithium, nickel, cobalt and manganese, between today and 2050. All the scenarios assume full electrification of passenger transport by 2050, but take different approaches to the size and number of private cars, as well as battery chemistry they use. The analysis reveals that:

- **The European cumulative battery demand by 2050 is 100- 200 times higher than in 2022, translating into up to 20 Mt of battery metals (compared to 170 Mtoe oil consumption in 2022)**
- **Even in the business as usual scenario the European demand is well within the global reserves, equivalent to 11% of the known global reserves for lithium and nickel, 10% for cobalt and 1% for manganese.**
- **Having smaller batteries, driving less private car km and going for innovative chemistries (such as sodium-ion) would reduce by over a third the amount of battery metals needed in the central (or "Accelerated") scenario compared to business as usual. In the most aggressive scenario this drops by half.**
- **Smaller batteries represent the single factor bringing the largest impact, or up to a quarter reduction in raw materials across the scenarios.**
- **In a supply constrained world, going for smaller batteries and cars is not only an environmental imperative, but also sound economic and industrial policy.**
- **Strong policy at European, national and local level is key, including an EU-wide strategy to shift to smaller, affordable and resource light electric vehicles.**

Europe, like many other regions, is accelerating efforts to electrify cars, buses and coaches in order to decarbonise passenger transport effectively and reach its climate goals. Electrification at speed and scale is essential, with all new cars, buses and coaches having to be zero emission by 2035 latest. But batteries - just like renewables and technologies relying on green hydrogen - will require metals like lithium and nickel to produce. What are the volumes of these metals that are required to electrify European passenger transport?

And how do choices - be it the size of cars, the technology used or the size of the car fleet - impact demand? This report answers those questions.

T&E has developed three scenarios for the demand of battery raw materials, notably lithium, nickel, cobalt and manganese, between today and 2050. All of the scenarios assume full electrification of passenger transport by 2050 and an accelerated uptake of battery electric vehicles up to then to maximise the CO2 savings from now on. The "Business as Usual" - *BaU* - scenario takes the currently expected industry trends on battery size and chemistry, as well as the status quo private car activity. The "Accelerated Innovation and Fewer Car Km" - or *Accelerated* - scenario assumes a substantial shift to smaller batteries, a faster uptake of battery chemistries with less critical metals (e.g. lithium batteries without cobalt or nickel (LFP), or sodium-ion batteries) and fewer km driven by private car. The final "Aggressive Innovation and Fewer Car Km" - or *Aggressive* - scenario takes these assumptions up another notch to more radical changes.

Demand for battery metals grows in all scenarios, but can be almost halved with innovative technology and car use policy

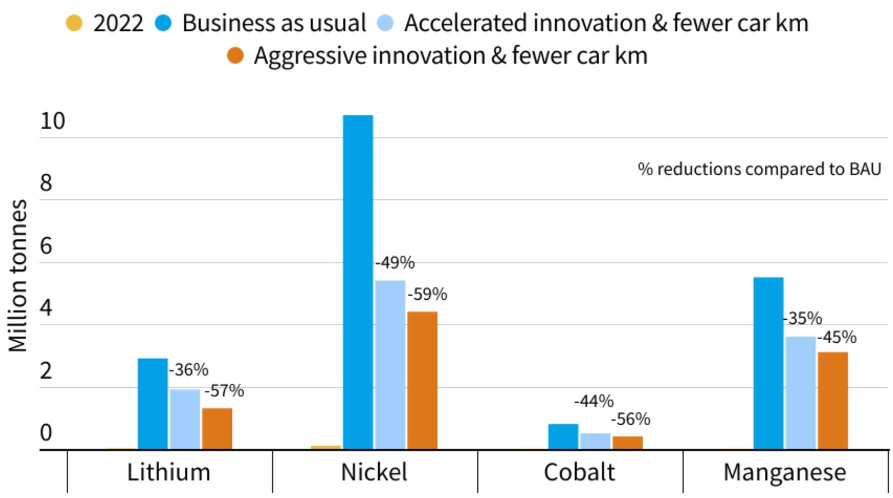
The demand for raw materials increases in all the three scenarios, with annual volumes in 2050 estimated to be 4 to 10 times higher than today, and cumulatively up to 200 times higher than the 2022 EV battery industry consumption. While this translates into 20 Mt of lithium, nickel, cobalt and manganese, it is well below the current annual oil consumption of around 170 Mtoe (expected to fall to around 20 Mtoe by 2050).

27 TWh of batteries will be needed cumulatively until 2050 in BAU, equivalent to 2.9 million tonnes (Mt) of lithium, 10.7 Mt of nickel, 0.8 Mt of cobalt and 5.5 Mt of manganese. This European demand represents up to 11% of the known global reserves for lithium and nickel, 10% for cobalt and 1% for manganese.

The Accelerated scenario would require a total of 19 TWh of batteries, or a third less. This means that compared to the BaU scenario, the raw material requirements are: 1.9 Mt of lithium, or over a third less, 5.4 Mt of nickel, or around half, 0.5 Mt of cobalt, or 44% less, and 3.6 Mt of manganese, or over a third less. The Aggressive scenario would require nearly half the amount of batteries cumulatively by 2050 compared to the BAU scenario, resulting in an even larger decrease in the demand of critical metals: 57% less lithium, 59% less nickel, 56% less cobalt and 45% less manganese.

This shows that the essential electrification of passenger transport will require a growing supply of critical metals in all scenarios. While globally there are enough reserves for the EU needs, the challenge is to extract and process those at speed, and above all in a social and environmentally responsible manner. In addition, a growing share (up to 15%) of the supply can be met by recycled metals by 2030 already. Ultimately, what the analysis shows is that the demand for metals can be seriously tempered depending on the transport demand scenario.

Battery demand for lithium, nickel, cobalt and manganese can be significantly lowered through effective policies



Source: T&E analysis

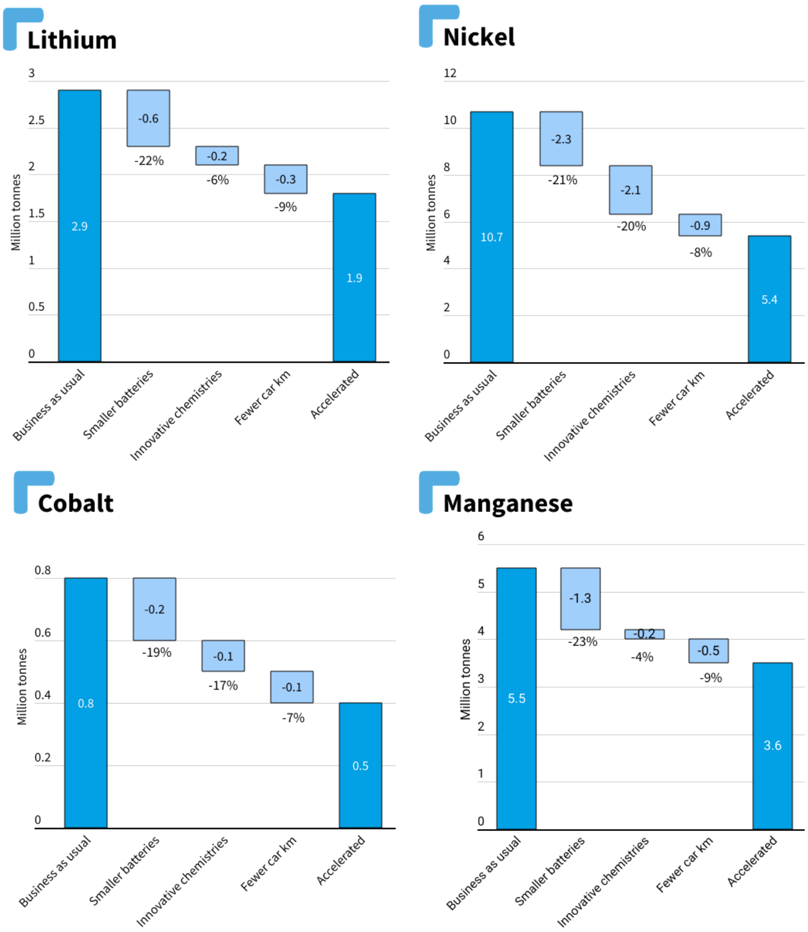
Smaller batteries are key to reduce demand for raw materials

T&E also analysed the relative contribution of the different factors - smaller batteries (either via smaller efficient cars, which also leads to less steel and aluminium demand, or simply shorter ranges), innovative chemistries and measures to reduce car travel - on the demand for battery raw materials.

The results show that both technological (battery size and chemistry) and car usage factors have an equally important impact on the demand. Smaller batteries represent the single factor bringing the largest impact, 19%-27% reduction in raw materials cumulatively across the Accelerated and Aggressive scenarios.

In the Accelerated scenario, shifting to smaller batteries results in a 19%-23% reduction in the raw materials demand. Switching to less resource intensive chemistries brings an additional 4-20% reduction. Reducing the km driven by private cars is responsible for 7%-9% of the reduction.

Demand can be reduced via smaller batteries, innovative batteries and less car travel



The single largest factor responsible for reducing battery metal demand is achieved by shifting to smaller batteries. This can be done by either downsizing electric vehicles themselves or by simply shifting to smaller batteries with less range while keeping the car size constant. Overall, including materials like steel and aluminium, downsizing vehicles is the best strategy not just for resource use, but also from the social (=affordability) and industrial (=large volumes globally) point of view. In a supply constrained world, this is also sound economic and industrial policy. But it requires a strategy to push European automakers to manufacture more entry-level smaller models given the dominance of large e-models on the European market today.

Smaller electric cars, being lighter, would be ideal for less resource intensive chemistries, notably sodium-ion, while guaranteeing sufficient range. But while first models with this chemistry are being sold in China from 2023 (e.g. the BYD Seagull), no commercial plans exist in Europe. It is critical European companies move into this space fast.

Key recommendations

1	Quickly ramp-up electric vehicle sales with focus on smaller affordable segments, charging and accelerate the electrification of corporate and urban fleets
2	Provide industrial support for the production of compact electric cars in Europe and remove subsidies for electric cars/batteries subsidised by the US Inflation Reduction Act or China
3	Provide R&D and industrial support to develop and commercialise production of new battery chemistries, such as sodium-ion, and reward critical raw material substitution
4	Add a weight or energy consumption component to the CO2 emissions based vehicle taxes (and electric car subsidies) across member states
5	Urban planning that disincentives car use, including congestion charging, parking pricing, expanding the Low- and Zero-Emission Zones, supporting public transport and car-sharing infrastructure

Further information: **Full report**

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