The EV revolution: The road ahead for critical raw materials demand

Ben Jones, Robert J R Elliott, and Viet Nguyen-Tien

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In this policy brief we consider the implications for the availability and affordability of the raw materials required to facilitate the energy transition, particularly the mass adoption of electric vehicles (EVs). The impacts on mineral demand are currently not well understood.

We develop a CoMIT (Cost, Macro, Infrastructure, Technology) model to analyse the impact of mass EV adoption on critical raw materials demand. Our unified framework simulates demand for eight raw materials essential for e-mobility in a way that is transparent, consistent, and inclusive of numerous drivers of e-mobility. See Figure 1.

We consider: increases in vehicles adoption that differ across regions; 'green' policies; changes in the price and associated operating costs; metal needed for charging and hydrogen stations; and anticipated technical progress in lithium-ion battery production - better range, reduced cost, less dependence on cobalt.

KEY POINTS

+ The mass adoption of electric vehicles (EVs) is expected in the years ahead.

+ The CoMIT framework models the impact of EV adoption of critical materials demand.

+ By 2030, relative to 2015, demand for lithium and cobalt will increase 18 and 37 times, respectively.

+ Significant demand increases are also predicted for copper, chrome, and aluminium.

+ China is expected to be an increasing important buyer of inputs to EV manufacturing.

By 2030, we forecast that demand for vehicles will increase by 27.4%, of which 13.3% will be EVs. The model also predicts large increases in demand for certain base metals, including a 37 and 18-fold increase in demand for cobalt and lithium (relative to 2015 levels), respectively. Without major changes in certain technologies, the cobalt and lithium supply chains could seriously constrain the widespread deployment of EVs. Significant demand increases are also predicted for copper, chrome, and aluminium. We also highlight the importance of China in driving demand for EVs and the critical materials needed to produce them.

BACKGROUND

Governments around the world are actively promoting EVs and global sales have now exceeded two million vehicles. Automakers and their suppliers have made plans for large scale investment in EV related production capacity. However, such a rapid transformation will require a step change in the demand for, and supply of, the raw materials that are used in the EV production process. This raises questions regarding the availability and cost of these raw materials.

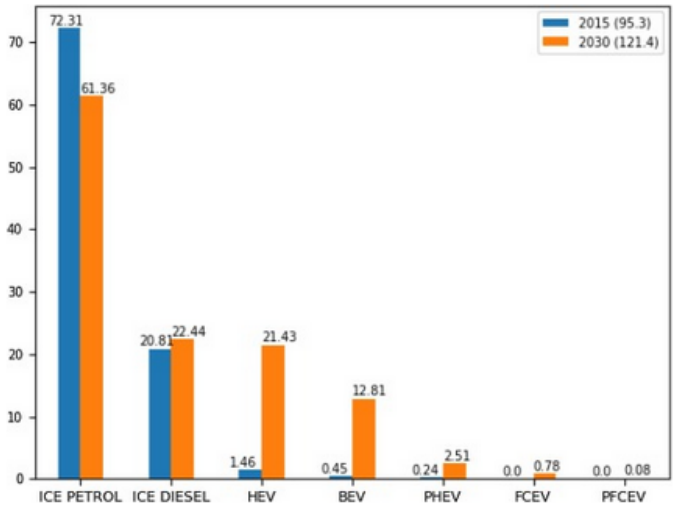

Fig. 5 Sales by powertrains (million). *Sources:* Authors calculated from LMCA data for 2015 and projected for 2030 by the CoMIT model.

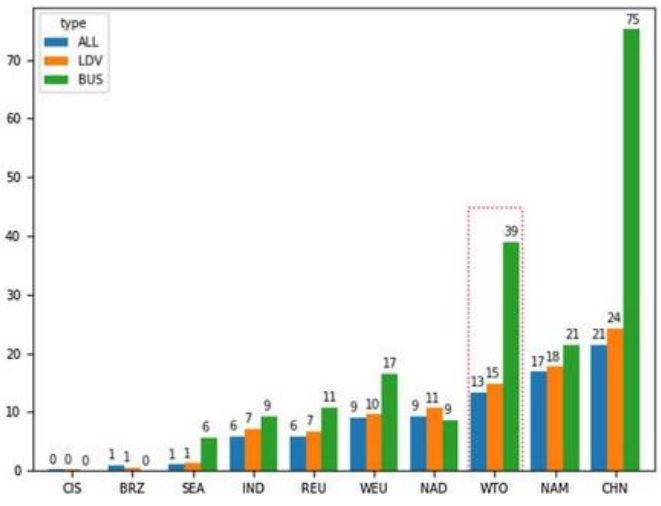

Fig. 6 EV share as % of 2030 sales. *Sources:* Authors calculated from LMCA data for 2015 and projected for 2030 by the CoMIT model.

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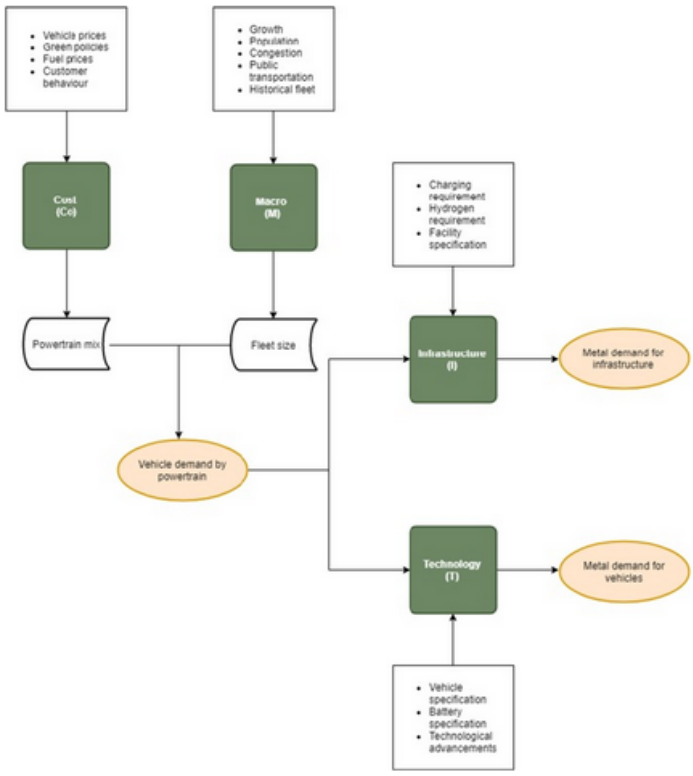

Fig. 1 CoMIT framework overview. *Note:* Our analytic framework is specific for 10 regions × 3 vehicle types × 7 powertrains × 8 mined commodities as detailed in Section 2.1 and summarised in Supplement Table 1. Section 4 only illustrates and discusses key findings from aggregated results while more disaggregated results are available upon appropriate request.

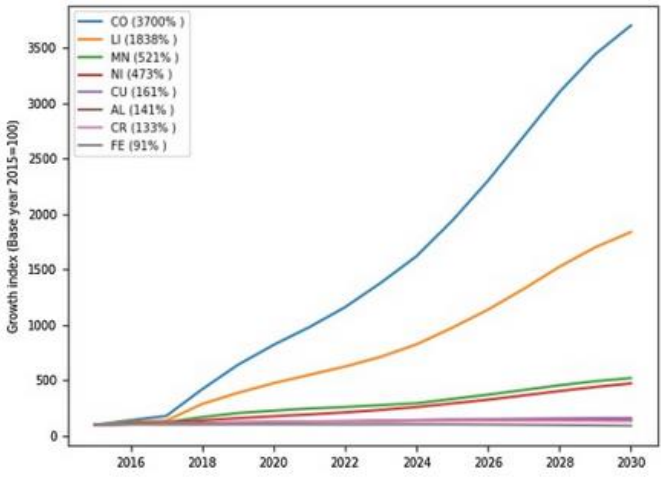

Fig. 7 The growth of metal demand for vehicles. *Sources:* Authors' calculation. Figures in brackets next to legend indicate projected growth indices of metal demands in 2030 in comparison with base year 2015 (set at 100).

RESULTS

Figure 5 presents the projected sales by powertrain comparing 2015 and 2030 while Figure 6 shows the share of vehicles that will be electric with buses leading the way in many countries. The dominance of China is shown. Figure 7 shows the massive percentage increases in critical materials led by cobalt and lithium demand. Significant demand increases are also predicted for copper, chrome, and aluminium.

SUMMARY

We highlight the interdependency between electrified mobility and the mining, metals, and materials industries. By evaluating the role of key economic, technological, policy and societal drivers underpinning the EV revolution, we examine key market dynamics.

Incremental demand due to mass EV penetration could critically shape the size and spatial distribution of raw materials demand. For example, China's share of global lithium and cobalt demand for transport (the dominant end use) is likely to rise to about 68% by 2030. China's leading role is likely to have a major bearing on raw material trade flows and concomitant supply chain risks.

These trends could exacerbate an emerging, and challenging to address, deficit across a range of critical metal markets. To fully assess these risks, it important to consider these impacts within the wider context of the market, technical, financial and policy conditions facing the resource industries.

Policy makers will need to be cognisant of these issues, raising a clear need to design energy policy in parallel with wider resource and materials sector policies. Rapid growth in mineral demand reinforces the need for effective policies to ensure adequate recycling as well as land and waste-water management; and will further sharpen the importance of effectively managing environmental and social risks associated with mining and metal processing.

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