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Battery demand for lithium stood at around 140 kt in 2023, 85% of total lithium demand and up more than 30% compared to 2022; for cobalt, demand for batteries was up 15% at 150 kt, 70% of the total. To a lesser extent, battery demand growth contributes to increasing total demand for nickel, accounting for over 10% of total nickel demand.

Almost 60 percent of today"s lithium is mined for battery-related applications, a figure that could reach 95 percent by 2030 (Exhibit 5). Lithium reserves are well distributed and theoretically sufficient to cover battery demand, but high-grade deposits are mainly limited to Argentina, Australia, Chile, and China.

The increase in battery demand drives the demand for critical materials. In 2022, lithium demand exceeded supply (as in 2021) despite the 180% increase in production since 2017. In 2022, about 60% of lithium, 30% of cobalt and 10% of nickel demand was for EV batteries.

Further upward pressure on raw-material prices is likely to come from significant increases in demand. For instance, the battery industry"s demand for lithium is expected to grow at an annual compound growth rate of 25 percent from 2020 to 2030, while demand for nickel could multiply as battery demand shifts to nickel-rich products. 4 Marcelo ...

Of the two principal battery chemistries of today, nickel manganese cobalt oxide (NMC) and lithium iron phosphate (LFP), the former is particularly well suited for recycling because it contains greater quantities of valuable metals.

As the world shifts up a gear in its transition to electric vehicles, the demand for batteries has skyrocketed in major automotive markets in Europe and the United States. Automotive and battery manufacturers face a difficult period of uncertainty in the battery supply chain, and many are turning to building their own battery gigafactories or forming joint ventures to address squeezed supply.

This speed of scaling new technology leads to notable challenges: shortages of labor and materials, delays in the construction of gigafactories to produce batteries at scale, and competition for resources in the supply chain, among others. In fact, the battery supply chain risks facing a situation similar to the current semiconductor chip shortage, where demand growth has outstripped capital investment in new supply. Furthermore, environ-mental, social, and governance (ESG) factors will play a more significant role--raising another set of issues that companies need to address.

The situation is difficult and novel. Yet it presents significant opportunities for growth across the value chain for those who choose to address the issues at hand and accelerate their move into the EV battery market. These players are of three primary types: incumbent battery manufacturers expanding their operations, auto OEMs

entering the space to support their EV ambitions, and smaller new entrants using disruptive technologies.

This article focuses on three key measures for preventing or responding to EV battery shortages: industrialization and scale-up of gigafactories, strategies to find and retain talent, and establishment of a robust and efficient supply chain.

Once facilities come online, first-year yields are often only around 60 percent of nameplate capacity, with losses split evenly between higher-than-expected yield losses and machine downtime. Quality issues during battery manufacturing also present a challenge in terms of both reputation and finance; for example, recalling batteries for 100,000 vehicles could turn a 5 percent profit into a net loss of more than 150 percent, due to lost sales and reimbursement costs.

To build in flexibility, companies could consider factory designs that are as modularized as possible, including prefabricated complex factory components. Companies could also adjust standard factory design in line with local battery plant design standards and optimize for space (such as clean-room volume) and cost.

Factory layout based on simple process flow, combined with a serious reduction of material conveyance, could further reduce operating expenses and production time. Reconsidering the different production processes not as separate areas but as pieces that fit together seamlessly could also help drive design efficiency. Allowing enough room for additional capacity would avoid extensive factory redesign down the line.