True Costs of ESG: Cobalt/EV Supply Chain Case Study

PZENA Investment Management

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INTRODUCTION

Decarbonizing the economy means shifting the global energy mix away from fossil fuels toward alternative zero or low emissions technologies. This is no small task, and the cost of doing so could amount to $275T by 2050[1]. For some sectors, the technology needed to fully decarbonize is not yet commercially viable. For others, such as the auto industry, regulation has already spurred significant technological advancements. Reaching Net Zero by 2050 for the auto industry will still be costly, requiring an estimated $3.5 trillion per year[2] for the continued replacement of vehicles that run on fossil fuels with electric vehicles (EVs).

The clear environmental imperative of electrifying transportation has largely overshadowed the unregulated social trade-offs embedded in the EV supply chain. For example, the mining of cobalt, a critical component of EV batteries, comes with its own set of increasingly visible social costs, which can lead to financial costs for companies, as detailed in this article. These complex – and at times conflicting – ESG value drivers lead us to integrate such considerations bottom-up into our fundamental research, rather than relying on aggregated ESG scores.

COBALT: BACKGROUND

WHY DO WE NEED COBALT?

Cobalt is one of the important metals needed for the electrification transition of the auto sector. Specifically, cobalt is used in lithium-ion battery chemistries, such as lithium nickel manganese cobalt oxide (NMC), lithium nickel cobalt aluminum oxide (NCA) and lithium cobalt oxide (LCO), which all contain cobalt in varying proportions.

Cobalt is used because of its high energy density (stores a significant amount of energy in a small space), stability (improves battery cycling performance and battery life, and reduces risk of overheating) and safety (reduces risk of overcharging and overheating). While some cobalt-free battery chemistries are in production today and are becoming increasingly competitive, they still tend to require some trade-offs on range, efficiency, and safety concerns.

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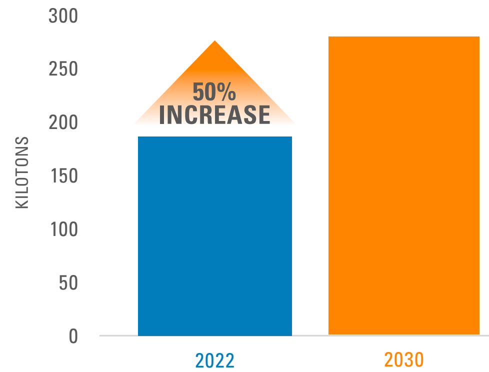
[1] McKinsey
[2] McKinsey

Demand for cobalt therefore remains strong for the foreseeable future. According to the Cobalt Institute, total global cobalt demand was 187kt in 2022. McKinsey projects global demand in 2030 of roughly 280kt which reflects approximately a 50% increase in cobalt demand between now and 2030 (see chart 1).

CHART 1: GLOBAL COBALT DEMAND



Source: McKinsey

WHERE DOES COBALT COME FROM?

Cobalt is mined and approximately 75% of global supply is from the Democratic Republic of the Congo (DRC); by 2030, that is expected to rise to 78%[3]. While mining conducted by large institutional mining companies comprises the bulk of existing operations, it is also estimated that between 20-30% of DRC cobalt comes from small artisanal mines (ASMs). ASMs are typically operated by local community members in areas where cobalt has been identified at levels that don't warrant full-scale institutional mining operations. ASM operations can be as primitive as digging out below residential dwellings. In some cases, ASMs operate within the active operations of institutional miners, either illegally or with informal consent from the institutional miners.

COBALT: SOCIAL COSTS

The mining industry is well known to be controversial from an ESG perspective. ASMs are particularly controversial because they do not operate under formal labor standards, and the consequences for workers can be severe. Examples include:

- Child labor: While the exact number of children working in cobalt mines in the DRC is unknown, the US Department of Labor estimates anywhere from 5,000 to 35,000.
- Health issues: Hours working in poorly ventilated, dust-filled mines without protective equipment means workers commonly experience respiratory issues.
- Safety risks: Falling rocks and/or landslides are common, causing frequent injuries and even death. There are estimated to be 10,000 to 15,000 tunnels dug by hand by artisanal miners, none of which have supports or ventilation shafts. These tunnels collapse frequently, burying alive anyone working in them.

With ASMs, there is clearly a cost to society associated with the loss of human life. It is difficult to accurately assess associated fatalities in DRC ASMs, given the informal nature of the work. One academic study[4] refers to a low estimate of 65 fatalities per year published by the World Bank in 2020, based on cases reported in the media. Given limited access and media

[3] *McKinsey*
[4] *https://link.springer.com/article/10.1007/s11367-022-02084-3*

coverage of ASMs in the DRC, this number is presumed to be a significant underestimation. The same study also considers a higher estimate of 2,000 fatalities per year based on a questionnaire administered by other academics in cobalt-producing provinces in the DRC. Given total workforce estimations of around 200,000, this higher fatality rate means that almost 1% of the ASM workforce could die every year.

COBALT: TRUE COSTS

Electrification of the auto industry is already capital-intensive. These costs will rise further if the industry also faces pressure to account for the embedded social costs and to decarbonize in a more humane way. Under increased public scrutiny, mining companies may experience pressure to either eradicate ASM-sourced cobalt entirely or raise the operating standards of ASMs to international sourcing standards.

Under the first scenario, a sudden removal of ASM-sourced cobalt from the global supply chain would decrease the total supply of cobalt in the market by approximately 20%. This supply gap would need to be filled by other, more expensive, sources of cobalt. This means, all else being equal, the price of cobalt would rise to account for the under-supply in the market; we estimate a roughly 50% overall increase in the marginal cost of cobalt as a result[5]. In the second scenario, a direct increase in operating costs from raising ASM operating standards, all else being equal, would increase the miners' cost of delivery. An increase in the cost of delivery would drive what we estimate to be a roughly 2.4x increase in the cost of artisanal cobalt, which also equates to an approximately 50% increase in the end price of cobalt[6]. Under both scenarios, the end price of cobalt increases approximately 50%, albeit for different reasons. This is potentially a conservative assumption, considering operating standards may need to be raised within some existing institutional operations as well.

The impact these theoretical price increases could have on OEM margins depends on several factors. For example, the cobalt content value in an EV, based on current market prices, can range from $0 to over $2,000, depending on the battery chemistry and capacity. Assuming an average size of the most common battery chemistry that uses cobalt (NMC811), a 50% increase in the price of cobalt translates to a roughly 5% hit to OEM EBIT margin[7], if these costs cannot be passed on directly to the consumer. This would put further pressure on already tight OEM margins. As such, OEMs are incentivized to find alternative viable battery chemistries that are better optimized for price and ethical sourcing considerations.

Several factors could mitigate an increase in the price of cobalt, including further exploration and development of alternative cobalt-free battery chemistries. Even if cobalt battery chemistries persist in the market, new and/or cheaper sources of cobalt may find their way into the supply chain. For example, polymetallic nodules found in the deep sea are rich in various metals required for the energy transition, including cobalt. While the environmental impacts of

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[5] Assuming 2026 total cobalt demand of 254,500 metric tons. Sources for analysis include CapIQ, Morgan Stanley and Pzena Analysis.

[6] Assuming artisanal cobalt is 33% of the cost of institutional cobalt and ore is 80% of the cost of refined cobalt. Sources for analysis include CapIQ, Morgan Stanley and Pzena Analysis.

[7] At current cobalt prices of $33.42/kg, a 75-kWh NMC811 battery has 6.45kg of cobalt, at a total cost of $216 (approximately 3% of the cost of the battery). A 50% increase in the price of cobalt would increase the cost of the NMC811 battery cell by 1.5%. This is assuming the NMC811 battery cell cost today is $100/kWh and cobalt is $2.89/kWh of that total. Since a battery cell makes up 1/3rd of the cost of the car, the total cost of a car increases by 0.5%. Assuming normal operating margin for OEMs is 10%, under this scenario operating margin would drop to 9.5%, which is equivalent to a 5% hit to EBIT margin.

deep-sea mining are debatable, if the International Seabed Authority gives the go-ahead, deep-sea mining of these minerals will undoubtedly contribute to the supply of cobalt in the market. Finally, improvements to the process of refining cobalt may also lower the total end cost.

Furthermore, eradicating ASMs would not be without challenges. The widespread nature and implicit acceptance of ASM operations has historically rendered regulation largely ineffective. ASM cobalt is currently making its way to the market through third parties willing to look the other way and not verifying the source of the cobalt. In addition, OEMs have limited leverage to source only from institutional mining operations, given high demand and relative concentration of mining and refining operations. Full supply chain transparency would require unprecedented cooperation between traders, refiners, battery manufacturers, OEMs, and large-scale institutional miners (where ASM-sourced cobalt can be sold into the institutional miners' supply). There are currently several multi-stakeholder initiatives aimed at enhancing collaboration, such as the Responsible Cobalt Initiative and the Fair Cobalt Alliance, but more would need to be done on the ground in the DRC to fully eliminate ASM operations.

BEYOND COBALT

While this case study focuses on cobalt, it is by no means the only component of EV batteries associated with ESG controversy. Nickel, another key metal for EV batteries, is largely mined in Indonesia, amid reports of poor working conditions, safety records, deforestation, and acid leaching into groundwater reserves. According to metals research firm CRU, Indonesia will account for 85% of nickel production growth between now and 2027. The cost of raising these mining standards would put further pressure on auto OEM margins.

CONCLUSION

This analysis is not intended to discredit the need for the electrification transition, but rather to more accurately project potential costs when accounting for the embedded social and environmental externalities. This type of scenario analysis is additive to our fundamental research insights, potentially expanding our conversations with company management teams in the mining and/or auto industries. These scenarios remain theoretical and are therefore not yet part of how we directly financialize material ESG considerations for either industry. The scenarios do, however, have the potential to widen the range of outcomes for a given investment.

It is misleading to imply that an investor can always minimize risks and maximize opportunities across all of a company's ESG issues at the same time. Solving for one ESG issue may create another in its place. The singular 'ESG' acronym and proliferation of aggregated ESG scores ignores the fact that environmental, social, and governance issues are separate and distinct sets of risks and opportunities that may conflict with one another. We believe it makes sense to think less in terms of company ESG exposure and more in terms of the individual issues that may contribute to or detract from value creation for a particular company over time.

FURTHER INFORMATION

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