Cobalt market product and demand shift

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Cobalt was initially used primarily in the metallurgy of super-alloys and other industrial applications. The advent of the rise in rechargeable batteries and their use in electric vehicle (EV) batteries led to an increase in the demand for cobalt. The content of cobalt in battery chemistries has decreased over the last two years, resulting in a drop in the price of cobalt. Cobalt is however not fully excluded from the EV battery chemistry. A shift in the market in 2024 led to a call for pricing of cobalt to be done according to the beneficiated product, rather than the metal price as is the current practice. This would benefit the primary cobalt producing countries and also make it viable for the establishment of domestic beneficiation plants in these countries.

INTRODUCTION

The Democratic Republic of Congo (DRC) is the world's largest producer of cobalt ore, and China the largest refiner. The cobalt market is experiencing a major shift in the type of product delivered to the market. This shift was triggered by the cobalt glut in 2023. The rapid expansion of the DRC and Indonesian markets outpaced the demand. The price of cobalt as a key battery element was a major contributor to the change of battery chemistries to reduce the overall content required. It is however expected that EV batteries will still account for 41% of future demand. Historically, cobalt pricing was based on the cobalt metal value. The market is shifting towards pricing of the material against the local Chinese cobalt sulphate price. It is expected that this pricing against the chemical will become the norm by 2030. Cobalt supply contracts are often fixed against spot prices, which are assessed by third-party agencies. The ore producers would sell the cobalt concentrate in either hydroxide or sulphate form at a percentage of the global metal price, as published by the UK company Fastmarkets. The Chinese refineries however now insist on referencing the cobalt sulphate price against the Shanghai Metals Market (SMM).

The main risk is that this shift will result in less control by the producing countries over the end-product market, increasing their exposure to huge market fluctuations. A mitigating measure is to implement variable cost/price formulae into new sales contracts, such as cobalt metal and payables, cobalt hydroxide quotes and cobalt sulphate salts. Because cobalt is produced as a by-product of either primary copper or nickel production, it is still possible for losses in cobalt to be offset, as long as these metals retain a highly profitable market value.

Cobalt producing countries, notably the DRC and Indonesia, have placed restrictions on the export of unprocessed ore and have embarked on programmes to attract investment in companies setting up domestic refineries and battery factories. This would support more job creation, upskilling of labour, enhance proximal development, prompt infrastructure improvement, and stimulate the economy. Domestic beneficiation also decreases Scope 3 emissions.

COBALT SOURCES

The DRC reigns supreme as the world's leading source of cobalt, contributing over 70% of global mined cobalt in 2019. This dominance stems from the rich mineral deposits found in the DRC's southern provinces, Lualaba and Haut-Katanga, collectively known as the Copperbelt. Here, cobalt is primarily extracted as a by-product of copper and nickel mining operations run by large-scale mining (LSM) companies.

The grade of cobalt ore, signifying its concentration, varies depending on the mining method. LSM operations typically produce higher-grade cobalt, allowing for more efficient processing. However, the DRC also has a significant artisanal and small-scale mining (ASM) sector, responsible for an estimated 15-20% of the country's cobalt output. ASM operations often involve rudimentary techniques and yield lower-grade cobalt ore.

While the DRC stands out, other countries contribute to the global cobalt supply. The Philippines and Cuba hold significant cobalt resources, though their current production volumes are lower compared to the DRC. Additionally, recycling of cobalt from spent batteries is gaining traction as a potential future source, but its contribution to the current supply chain remains modest.

The booming demand for cobalt is driven by major economies like China, the United States, and Europe. These regions house the leading manufacturers of lithium-ion batteries and other cobalt-intensive technologies, making them the primary offtakers of cobalt. The cobalt supply chain has its share of challenges. Ethical concerns regarding labour practices and environmental impact in the DRC's ASM sector have spurred initiatives for responsible sourcing. Additionally, geopolitical factors and supply chain disruptions can affect cobalt prices and availability.

The current cobalt glut (2023-2024) – a situation where supply significantly exceeds demand – is a result of a confluence of factors. The leading factor is the oversupply from increased mining via the rapid expansion of cobalt mining, particularly in the DRC. Driven by the initial surge in EV demand and high cobalt prices, miners significantly increased production capacity. However, EV battery technology advancements and slower-than-expected EV adoption dampened the growth in demand. Furthermore, the changing battery chemistries in the EV industry witnessed a trend towards lithium iron phosphate (LFP) batteries. While less energy-dense than cobalt-rich options, LFP batteries offer good stability, lower costs, and are less reliant on cobalt. This shift reduced demand for cobalt in the battery sector. It was also reported in 2024 that significant Chinese stockpiling is suspected, with some analysts believing that China stockpiled cobalt during the initial EV boom, further inflating the current oversupply.

DEMAND AS A BATTERY MINERAL

The consumption of cobalt is mainly driven by the EV battery market. Over the last couple of years the demand and price of cobalt increased steadily before suffering a dramatic collapse in 20023, with the low global prices for cobalt persisting into 2024. The demand for cobalt is presented in Table 1.

Table 1. Historic and future demand of cobalt (After: Benchmark Minerals, Cobalt Market Forecast, 2023)

Year	Global EV Battery Demand for Cobalt (Tonnes)	Growth Rate (%)
2020	35,000	-
2021	50,000	42.9%
2022	74,000	48.0%
2023 (estimated)	100,000	35.1%
2030 (projected)	320,000+	(CAGR of 16.5% from 2023)

Several factors contribute to the continued demand for cobalt in EV batteries. The main driver is the battery chemistry of lithium-ion batteries with higher cobalt content (NMC 622, NMC 811) that offer a superior range and performance, driving their use in high-end EVs. The stringent emission regulations and EV adoption incentives from governments are accelerating EV sales, with the goals of Agenda 2030 in mind. While research on cobalt-free batteries continues, cobalt-containing chemistries dominate and will be dominant in the near future.

Despite its advantages, cobalt dependence in the EV battery market presents challenges; the supply chain constraints remain a constant risk and as the DRC dominates cobalt production, concerns about geopolitical instability and ethical sourcing practices remain high. The last two years (2023-2024) also demonstrated the effect of price volatility, where the cobalt prices are susceptible to fluctuations due to supply-demand dynamics, impacting EV battery costs.

Environmental, social and governance (ESG) concerns, especially related to environmental impact and the concerns around irresponsible mining practices in the DRC have raised concerns.

Researchers are actively exploring alternatives to reduce cobalt dependence by changing the battery chemistry of EV batteries to contain less cobalt. This has led to the development of lithium iron phosphate (LFP) batteries that offer good stability and lower costs, but have lower energy density compared to cobalt-rich chemistries. In addition, high-nickel cathode materials (NMC 660, NMC 800) have reduced cobalt content but may require further advancements to address stability concerns. The drive for increased battery recycling of spent batteries can help recover cobalt and reduce reliance on virgin mining.

COBALT PRICING

Due to the global shift in demand from cobalt metal to cobalt salts, there has been a call to change the way in which the cobalt price is determined. The pricing of the various cobalt products are summarised in Table 2. Changes have been suggested to increase the benefit to cobalt ore producing countries and also stimulate the development of domestic beneficiation.

Table 2. Summary of cobalt product prices (After: Benchmark Minerals, 2023)

Product	**Historical Price (2019)**	**Current Price (July 2024)**	**Projected Future Price (2030)**
Cobalt Metal	$38,000	$27,440	$26,547 - $38,972 (range)
Cobalt Hydroxide	$42,000 (estimated)	Not publicly available (estimate based on metal price + processing premium)	Not publicly available
Cobalt Sulphate	$45,000 (estimated)	Not publicly available (estimate based on metal price + processing premium)	Not publicly available

Cobalt Metal
Major players like the London Metal Exchange (LME) offer cobalt futures contracts. These contracts allow producers, consumers, and speculators to hedge against future price fluctuations. While not directly setting the spot price, futures trading activity reflects market sentiment and influences spot prices.

Actual physical transactions of cobalt often occur through over-the-counter (OTC) deals between miners and refiners, or refiners and battery manufacturers. Negotiated prices in these deals are considered when determining the spot price.

Independent agencies like Fastmarkets and Benchmark Minerals track and report on the cobalt market.

These agencies gather data from various sources, including exchange activity, reported OTC deals, and expert analysis. They then publish assessments of the prevailing spot price for cobalt metal. These assessments are based on methodologies that ensure that they reflect real-world transactions and are not simply influenced by speculation.

Cobalt Hydoxides and -Sulphates
Like cobalt metal, the prices of cobalt hydroxide and cobalt sulfate are primarily determined by supply and demand dynamics. The demand comes from various industries, with the battery sector being a major consumer. Futures contracts for these cobalt compounds may exist on trading platforms like the LME. Negotiated prices in OTC deals between miners, refiners, and end-users also play a role. Independent agencies like Fastmarkets and Benchmark Minerals track and report on these markets, providing assessments based on methodologies similar to cobalt metal.

Differences in price determination are related to market depth, where the cobalt metal market is typically deeper, and more liquid compared to the markets for cobalt hydroxide and cobalt sulfate. This means that a higher volume of trading activity influences the price of cobalt metal.

Cobalt hydroxide and cobalt sulfate are intermediate products that require further processing to create refined cobalt metal. The price of these compounds reflects the cost of production (including mining, refining, and transportation) and the value addition associated with processing the raw material (cobalt concentrate). Contractual terms between buyers and sellers can play a significant role in determining the final price of cobalt hydroxide and cobalt sulfate compared to cobalt metal. This might include factors like delivery location, volume discounts, and contract length.

MARKET SHIFT: FASTMARKETS vs. SMM

Understanding the impact of the market shifts is essential for determining the viability of developing cobalt refining projects. China's decision to reference the Shanghai Metals Market (SMM) for cobalt sulphate pricing instead of the established Fastmarkets benchmark represents the most significant recent shift in the global cobalt market.

Shifting away from the widely used Fastmarkets benchmark could lead to a fragmented market with two distinct pricing points, one based on SMM and the other on Fastmarkets. This could create challenges for global price transparency and complicate transactions between Chinese and international players. Fastmarkets' price assessments are based on a global dataset, encompassing supply and demand dynamics across different regions. SMM's assessment might focus primarily on the Chinese domestic market, potentially leading to a price that doesn't fully reflect international market conditions. The bargaining power due to China's dominance in cobalt refining and its growing influence on the EV battery sector could give them leverage to influence the SMM cobalt sulphate price. This could potentially benefit Chinese battery manufacturers by lowering their cobalt procurement costs. The long-standing reputation and established methodologies of Fastmarkets might hold an advantage over SMM, especially if the latter's assessment process lacks sufficient transparency. Building trust in SMM's assessment as a reliable alternative will be crucial.

The reasons for the shift and specifically China's motives for this move remain unclear. It could be a strategic attempt to gain greater control over the cobalt market or a response to perceived shortcomings in the Fastmarkets assessment process. The international cobalt market's reaction will be critical. Continued acceptance of Fastmarkets as the benchmark could limit the impact of SMM pricing. Whether the two pricing points converge over time or diverge significantly will depend on various factors, including the level of transparency in SMM's assessments and the willingness of international players to adopt them.

The main risk is that this shift will result in less control by the producing countries – primarily the DRC – over the end-product market, increasing their exposure to market fluctuations. Domestic suppliers in

cooperation with the government and international agencies would need to implement mitigating measures, which would potentially include the introduction of various formula into new sales contracts, such as cobalt metal and payables, cobalt hydroxide quotes and cobalt sulphate salts. As cobalt is produced as a by-product of either primary copper or nickel production, it is still possible for losses in cobalt to be offset, as long as these metals retain a high profit market value.

EXPORT BANS

The potential for a cobalt ore export ban by the DRC has emerged as a recurring concern. A cobalt export ban would essentially prohibit exporting raw or unprocessed cobalt materials like cobalt concentrate or hydroxide. This would force companies to refine the cobalt within the DRC before exporting it as a finished product. A further cobalt market disruption resulting from a sudden ban could disrupt the global cobalt supply chain, leading to price spikes and shortages for battery manufacturers.

The viability of a fully-fledged export ban remains debatable. The potential upside of a partial ban on the export of raw ore is increased revenue for the DRC, as the government hopes to capture a larger share of the cobalt value chain by forcing processing within the country. This could generate additional revenue through taxes and royalties. Job creation for DRC nationals is also envisaged, where refineries would create employment opportunities within the DRC. This would prompt technological advancement with a focus on refining that could spur the development of a domestic processing industry in the DRC.

The viability of an export ban is at present limited by various factors, where a lack of infrastructure is the most prominent. The DRC currently lacks sufficient infrastructure to handle large-scale cobalt refining. Building this infrastructure would require significant investment and time. Early in 2024 it was announced that the construction of a domestic beneficiation plant and metal refinery would be set up by Buenassa SARL in the Lualaba province of the DRC (Bentham, 2024). As with most developing nations, power shortages are a constraining factor, where the DRC struggles to have a consistent electricity supply, making large-scale energy-intensive refining operations challenging. In addition, concerns exist regarding potential environmental damage from unregulated or poorly-managed domestic refining operations.

A complete export ban might be too drastic and disruptive. A more measured approach could involve a phased implementation, with a gradual increase in export taxes on unprocessed cobalt, eventually leading to the requirement for a certain percentage of cobalt to be refined domestically. There would also need to be an urgent and large-scale infrastructure investment, involving collaboration with international partners to develop the necessary infrastructure for large-scale domestic refining. In order to meet ESG requirements for export purposes, strict environmental regulations would need to be enforced to ensure responsible and sustainable refining practices.

DOMESTIC BENEFICIATION

According to the UNECA (2024) there are plans to develop a Special Economic Zone (SEZ) for EV battery production, as a joint venture between the DRC and Zambia. The envisioned BEV SEZ transcends the simple extracting and exporting of raw materials. It aims to create a comprehensive ecosystem encompassing several key aspects.

The primary aim is to establish a battery precursor and battery production for the two countries: the SEZ will house facilities for processing cobalt and copper into battery precursors – essential building blocks for lithium-ion batteries. In the next stage, battery manufacturing plants will be established, aiming to produce batteries for EVs within the zone. The SEZ could potentially attract car manufacturers to set up assembly lines, creating a complete production cycle from raw materials to finished EVs.

To ensure smooth operations, the SEZ will require robust infrastructure development, including reliable power sources, efficient transportation networks, and a skilled workforce.

The successful development of the BEV SEZ offers a multitude of potential benefits for both the DRC and Zambia, including economic diversification, where the project has the potential to move these nations beyond dependence on raw material exports, fostering economic diversification and job creation within the EV sector. The SEZ could act as a catalyst for technological advancements in battery technology and vehicle manufacturing within the region. Locally produced electric vehicles could contribute to cleaner transportation options, reducing reliance on fossil fuels and promoting environmental sustainability.

Despite the promising vision, the project faces several challenges that need to be addressed, with the main constraints still relating to infrastructure development, building the necessary infrastructure requires significant investment, and attracting investors hinges on a stable political and economic climate. This project would also require a highly skilled workforce; developing a skilled workforce in battery technology and EV manufacturing will be crucial for the SEZ's success.

The success of the DRC-Zambia BEV SEZ has the potential to resonate beyond these two nations. It could serve as a model for other resource-rich countries seeking to leverage their natural endowments for economic transformation and sustainable development. Moreover, a robust regional EV sector in Central Africa could contribute to a more geographically diverse and secure supply chain for the global EV market, meeting the demands of Western nations to secure supplies outside of China.

CONCLUSION

China's decision to potentially use the SMM for cobalt pricing based on cobalt hydroxide and cobalt sulfate, instead of the established Fastmarkets benchmark based on cobalt metal, has far-reaching consequences for the DRC, the world, and the EV battery market.

The potential impact on the DRC can be summarised as increased revenue, but only if the SMM's pricing for cobalt hydroxide/sulfate is consistently higher than Fastmarkets' metal pricing could the DRC potentially earn more from cobalt exports. It may also grant the DRC greater control where a China-centric pricing system might give the DRC more leverage in negotiating with international buyers.

A shift away from the widely-used Fastmarkets benchmark could create market fragmentation and uncertainty, potentially discouraging investments in the DRC's cobalt sector. Lingering transparency concerns of the SMM assessment process compared to Fastmarkets could erode trust among international buyers.

The global impact could potentially result in a focus on downstream processing, where a shift towards hydroxide/sulfate pricing might incentivise more downstream processing closer to mine sites, potentially creating jobs in other regions.
A less established pricing system like SMM might be more susceptible to manipulation or short-term fluctuations, leading to price volatility for consumers. It may also result in a disruption of the supply chain, where companies accustomed to Fastmarkets pricing might face challenges adjusting to a new system, potentially disrupting established supply chains.

The biggest impact on the EV battery market would be from higher battery costs: should the SMM pricing lead to a consistent increase in cobalt hydroxide/sulfate prices, battery manufacturers could face higher production costs, potentially impacting EV affordability. Additionally, this could lead to slower EV adoption as increased battery costs could slow down the overall adoption of EVs.

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