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Argus White Paper:

Pricing mechanisms for an evolving cobalt market

The cobalt market is in a critical period of transition — not for the first time. Once favoured for pigments and colouring extracted from smaltite, a mineral form of cobalt, the use of its metal form to produce super-alloys rapidly became more prevalent as the 20th century ushered in the rise of the aerospace industry and medical advances. Now, in the 21st century, growing battery usage — first in smartphones and increasingly in electric vehicles (EVs) — is changing the market yet again and bringing with it a necessity for pricing mechanisms appropriate to its structure and direction. Scrutiny is mounting, both on the liquidity of the cobalt metal spot market and on the industry's gradual evolution away from traditional metal-based pricing structures, toward a pricing structure more focused on cobalt hydroxide and cobalt sulphate.

Forecasts from Argus Consulting indicate demand for cobalt from the EV battery sector will rise to about 80,000t in 2030, equivalent to 37.5pc of overall global cobalt demand. By 2025, EV batteries' share of cobalt demand is on track to hit 63pc, followed by 69pc by 2030.

This will facilitate a rise in the direct conversion of cobalt hydroxide – most of which comes from the Democratic Republic of Congo (DRC) – to cobalt sulphate and other chemicals, splintering the traditional pricing structure based on premiums to refined metal prices and making it all the more necessary to assess prices for cobalt chemicals such as hydroxide in their own right as opposed to a payables structure.

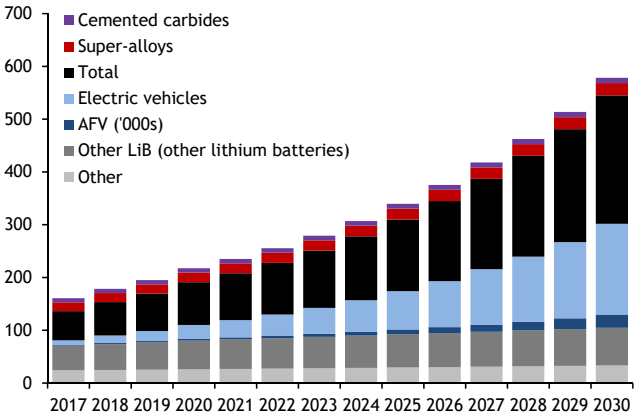
Also worth noting is that, while demand for refined cobalt metal will continue to rise, it will also become increasingly specialised, splitting spot liquidity and potentially rendering daily physical pricing more problematic.

China sets the tone

When it comes to batteries, as in so many other sectors, China remains the market leader. By 2025, China is expected to have at least 600GWh of battery capacity installed — about half of global battery capacity — according to estimates by P3 Automotive. China is also ahead of other countries when it comes to precursor chemicals, with almost all of the world's cobalt sulphate and other chemical production concentrated in China.

Chinese sulphate refineries increasingly convert hydroxide directly into sulphate because it is cheaper to do so than buying metal briquettes or broken cathode. As battery markets around the world try to catch up to China, they are likely to follow this trend and chemical-grade metal demand will become further disjointed from the fundamentals surrounding the metals themselves.

Cobalt demand by application 'oot



Metals
illuminating the markets

This shift is already happening. While prices for metal in Europe and the US have fallen in recent weeks, cobalt hydroxide prices have held fairly steady as demand from Chinese sulphate producers drives the market.

Direct hydroxide conversion goes global

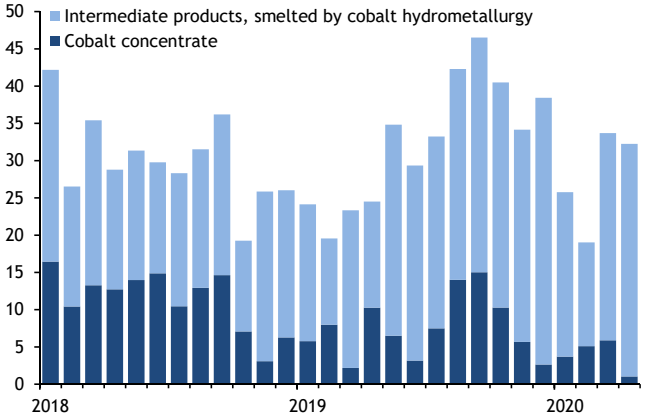
Concerns about the concentration of global supply in China have brewed for some time, with automotive producers wanting reliable and more diverse cobalt supply chains. The first stages of the Covid-19 pandemic highlighted the world's over-reliance on China and has acted as a further catalyst for changes that were already starting to unfold.

There are now several projects outside of China dedicated to producing battery precursors that are scheduled to open in the coming years, such as First Cobalt, which aims to become North America's first cobalt sulphate producer. The refinery just completed a feasibility study that demonstrated it could produce about 25,000 t/yr of cobalt sulphate. The company plans to convert directly from hydroxide.

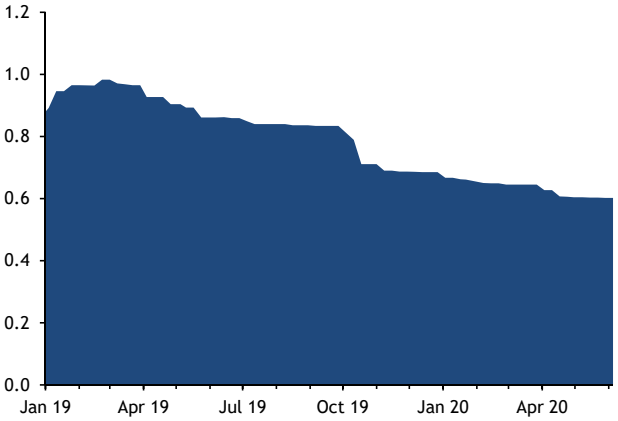
In Europe, there are several projects under way. Chemicals giant BASF plans to open a battery cathode factory in Schwarzheide, Germany, and another in Finland. The initial plan is to produce enough precursor for about 400,000 EVs each year, but more capacity could be added. Other projects are focused on recycling battery materials, which may lead to an evolution of the battery scrap markets.

As this global marketplace develops, hydroxide prices are likely to register a closer correlation to cobalt sulphate and achieve greater independence from refined metal prices. This independence is already evident, underscoring *Argus*' decision to assess cif China cobalt hydroxide prices in their own right rather than follow the traditional payables model linked to the refined metal.

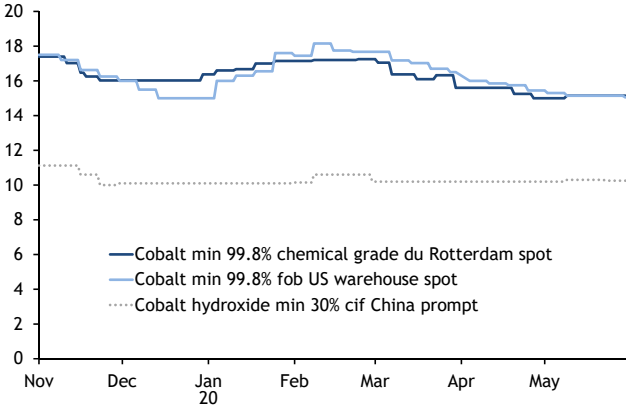
China cobalt hydroxide imports *'oot*



LME cobalt stocks fall albeit from relative high *'oot*



Global cobalt metal vs hydroxide prices *$/lb*



Chemical-grade cobalt in decline

As the shift towards an EV-focused market continues, demand for chemical-grade cobalt metal is declining. Some suppliers have already idled production because of falling prices in 2019. This shift has already been under way for many years but pricing mechanisms have lagged in reflecting it.

Production at the Chambishi refinery in Zambia, Eurasian Resources Group's broken-cathode producer, has been in decline since 2012. Output fell to about 1,900t in 2018, from 5,435t in 2012. The plant was idled in 2019. The other large broken-cathode producer, CTT, in Morocco, is not offering any material on the spot market with prices so low.

Production of chemical-grade briquettes at the Ambatovy nickel/cobalt project in Madagascar, a joint venture between Korea Resources group and Sumitomo, has also been declining. In 2019, it produced 2,900t of refined cobalt, down from a peak of 3,400t in 2015. The mine was temporarily closed recently because of Covid-19.

The result of consistently low prices over the past year and the shift towards direct hydroxide-sulphate conversion is a fall in spot liquidity across the chemical-grade cobalt metal market, further compounded by the impact of Covid-19 on the aerospace sector, which has pressured the alloy-grade market globally. The outcome is a physical spot market tailored to twice-weekly pricing at most, colliding with a paper market that favours daily.

Physical collides with paper

Cobalt is something of an anomaly within the London Metal Exchange's (LME's) suite of offered contracts in that the exchange lists both physically settled and financially settled contracts for the metal. No other minor metal is traded on the exchange in this fashion and, indeed, while molybdenum was traded similarly, the physically settled contract was discontinued on 8 March 2019.

The key problem is the lack of liquidity within global spot markets and the heterogeneity of cargoes. One trading firm recently said it is reluctant to engage with the physically settled contracts for fear of making only a thin margin on the paper and being "lumped" with some lower grade material at the port of Singapore. The industry widely views the LME's physically settled cobalt contract as being problematic to hedge with – unless you are the world's most dominant producer.

Nor is the financially settled contract without its issues. The lack of European spot liquidity has exposed a tendency for choppy price changes, particularly while liquidity remains at all-time lows due to Covid-19. Furthermore, an assessed payable mechanism to the metal price means the full price activity within cobalt hydroxide markets is only partially revealed through that imperfect proxy.

Overall, many market participants consider any moves toward daily Rotterdam cobalt pricing to be premature in such an illiquid market. And while it is likely that liquidity will pick up as Covid-19-related lockdowns ease, lumpy price movements and severe volatility are likely to leave the contracts thinly traded in the short term. Conditions being what they are, the evolution of cobalt's paper market might be better suited to a future stage, assuming underlying daily physical indexes could be bolstered by a healthy and consistent flow of spot trade.

Argus' global cobalt price offering includes:

- Cobalt (Electrolytic metal) min 99.8% ex-works China
- Cobalt chloride min 24% ex-works China
- Cobalt hydroxide min 30% cif China
- Cobalt oxide 72% ex-works China
- Cobalt powder min 99.8% ex-works China
- Cobalt sulphate min 20% ex-works China
- Cobalt tetroxide min 73% ex-works China
- Cobalt min 99.8% alloy grade du Rotterdam
- Cobalt min 99.8% chemical grade du Rotterdam
- Cobalt min 99.8% fob US warehouse

Full methodology available on request.

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