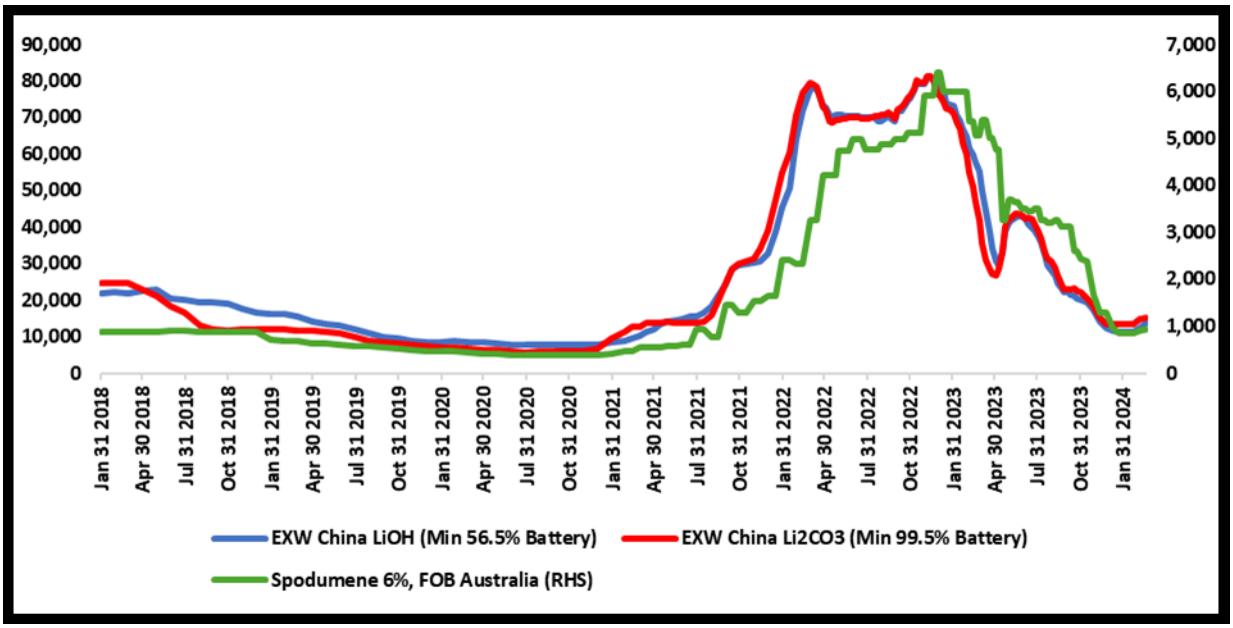
Lithium Price Volatility and the Road to Market Maturity

Ahmed Mehdi
Managing Director, Renaissance Energy, U.K.

Introduction

Previously a niche speciality chemical, lithium's importance to the energy transition is undisputed. Li demand since 2015 has shown a compound annual growth rate of 23%, invariably a function of the growth in electric vehicles (EVs) and battery energy storage systems (BESS). While there has been no shortage of analyses examining the challenges of scaling Li supply to meet long-term net zero targets, less discussed has been the role of lithium's pricing mechanisms. After all, it is price signals which determine the efficient allocation of capital in any market, particularly in an immature one where China has an outsized role. Li's pricing ecosystem has also come into play over the past year as spot chemical and feedstock prices have plunged from historic highs (see Figure 1).

Figure 1
Lithium Chemical Spot Prices (LHS) and Spodumene Concentrate (RHS), US$/t



Notes: EXW = Ex Works[1], LiOH = Battery-grade Lithium Hydroxide, and Li2CO3 = Battery-grade Lithium Carbonate.

Source: Benchmark Minerals.

But how does Li pricing work? This article sheds some light on the evolution of Li pricing and the future trends to watch as Li's road to market maturity gathers pace.

Lithium Price Cycles

The Li market has been through various cycles over the past several years, key among them being:

- **Spot price collapse of 2019-20**: This was a function of excess spodumene supply from Western Australia that saw spodumene concentrate (SC6) prices fall below US$400/t.

- **COVID recovery and government stimulus cycle**: While headlines in recent months have fixated on lithium's spot collapse, the question should not be why prices fell by 80% but why prices increased to high levels in 2022 (particularly the end-2022 peak of US$80,000/t, multiples above the cost of the marginal tonne). Clearly, the COVID-led stimulus packages of governments, pent-up demand stretching order books (shown by delays) and an element of irrational exuberance in buying patterns had a role.

- **Jan 2023-present**: The price collapse witnessed in 2023 cannot be pinned on a single factor but a range of drivers, the most important being:

  - **Chinese overcapacity**: Even accounting for higher exports in 2023 on a year-over-year basis, cell inventory builds were a key feature of Chinese balances last year. The same also held for cathode inventory, which limited pressure to purchase additional material on the spot market. In many ways, early indications were apparent at the start of 2023 when CATL – the world's largest cell producer in China – began offering lower prices for its cells in exchange for fixed orders from original equipment manufacturers (OEM) customers. CATL's cell discounts, based on a discounted Li carbonate price equivalent to cash costs of its integrated supply, reinforced the company's willingness to use its scale to secure market share, which was particularly acute given the withdrawal of EV subsidies by Chinese authorities at the end of 2022. The episode highlighted a key trend which came to define China's market in 2023 (and even more so this year): dog-eat-dog competition in the Chinese value chain, where margin compression was acute and overseas expansion a priority for tier-1 players.

The Evolution of Li Pricing

Unlike other markets where the road to pricing maturity took many years (*e.g.*, the development of iron ore futures), Li's pricing journey has only just begun. Several important features distinguish the Li pricing landscape, key among them being:

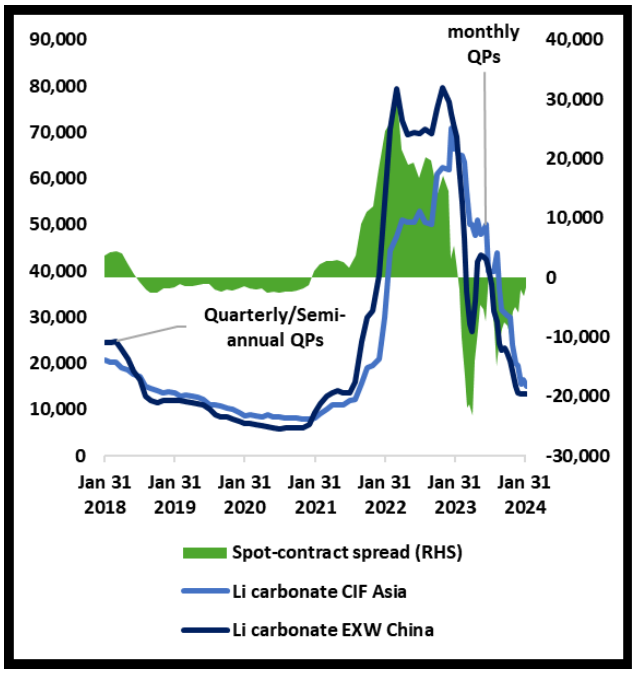
- **The role of product quality**: Li's value chain is deep and includes a range of products (*i.e.*, battery-grade carbonate and hydroxide as well as technical-grade products used in the lubricants/steel/glass industry). Lithium hydroxide - typically used by cathode manufacturers to produce high-nickel cathode active material for high-performance EVs - has typically commanded a premium over carbonate due to the cost of converting carbonate-hydroxide. Product quality also has an impact on tradability and suitability for a successful terminal market mechanism. Despite discussions around storage mechanisms or strategic stockpiling,[2] hydroxide has a limited shelf-life and unlike oil or LNG, battery-

grade products are highly specialized, making physical delivery upon contract expiry a challenge. For instance, participants may not receive material that meets their cathode specification or qualification requirements (*e.g.*, the CME Li contracts are cash-settled).

- **Contract vs. spot pricing***:* Historically, volumes in the Li market were dominated by long-term contracts with fixed-price components (*i.e.*, bilateral deals set to define the pricing level), largely insulating players from spot volatility. This reflected the immaturity of the industry. Fixed price deals guaranteed stable cash flows and was a means to securing financing, particularly for junior miners. Adjustments to the contract price (otherwise known as Quotation Periods, QPs) typically took place on a quarterly or semi-annual basis. In some cases, QPs could be even longer. In this sense, the average selling price (ASP) of some players during this period (2015-21) could be quite sticky and lag developments in the spot market. Typically, the contract price reference has been based on deals reported in the South Korean and Japanese markets – buyers of seaborne lithium (otherwise known as the Li carbonate CIF[3] Asia price) – upon which EU and North American CIF swap prices largely track. The spot price meanwhile has typically been determined by transactions in China, largely a function of its outsized role in the value chain. China represents around ~80% of global cathode capacity, where contracts are much shorter, allowing for greater spot liquidity and procurement channels. Given this liquidity concentration, Chinese buying of Li (above and beyond contracted volumes) has been seen as the industry bellwether for spot pricing.

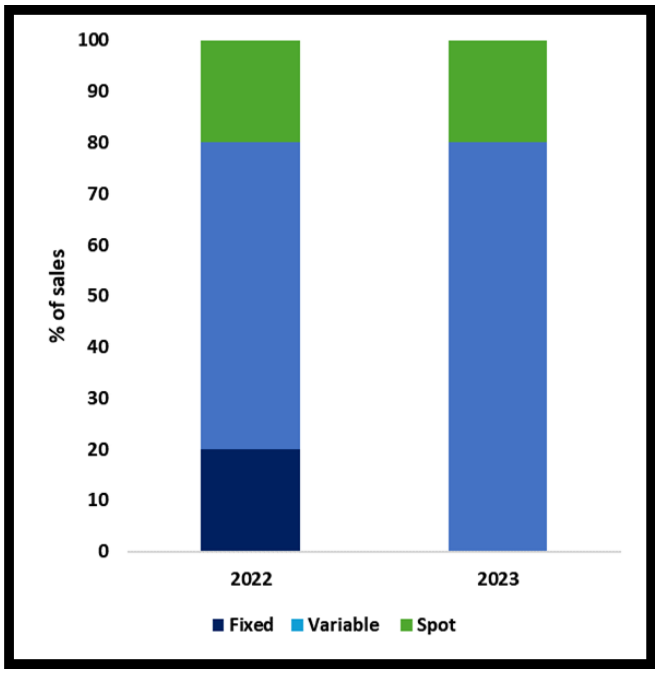
- **The emergence of dynamic pricing***:* The surge in the Li spot price in 2022 however led to a shift in mechanisms. Spreads between the Asia CIF-China EXW price blew out (see Figure 2 on the next page) and attention focused on how ASPs could capture Li's status as a seller's market, with prices being more market-led. For established players with a competitive position in the cost curve, dynamic pricing also made sense as it allowed for greater upside improving valuations and dividend streams and an ability to withstand downside pressures. As a result, QPs were shortened from quarterly to monthly and the contract price moved from a fixed to variable basis with a greater share of contracts moving to indexed-linked pricing, assessed by Price Reporting Agencies (PRAs). The development of more frequent reporting of spot prices from fortnightly to weekly to reflect greater spot volumes also helped with this trend.

Figure 2
Li Carbonate Contract vs. Spot and Spreads (RHS), US$/t



Source: Benchmark Minerals.

Figure 3
Albermarle Sales by Contract Type (2022 vs. 2023)



Source: Albermarle.

- **Role of floor and ceiling prices**: While Li pricing since 2022 has become more dynamic in the chemicals market, several factors prevent a full exposure to spot volatility, namely:

  - **price floors**: These come to the rescue of players during spot meltdowns. Price floors vary across the industry but are typically based on an understanding of long-run marginal costs/incentive prices. While some players may have floors in the range of US$12-16/kt, new project developers – particularly those in North America – would need floors in the low-mid 20s to be feasible given higher capital costs.

  - **price ceilings**: These are governed by bilateral negotiations between buyer and seller which also include discounts and other factors to dampen volatility risks.

In many ways, the lithium market's move to dynamic pricing continues to evolve and is the first chapter in the industry's road to market maturity. However, it has also exposed the value chain to greater spot volatility creating a dynamic tension with efforts to build out the value chain outside China, impacting Net Present Value (NPV) sensitivity for greenfield projects and the hurdle rate for new entrants.

Spodumene Concentrate Pricing: The Search for the Optimal Continues …

Li's pricing journey does not end with shifts in chemical pricing. As a primary feedstock for Li refiners, spodumene concentrate (SC6) pricing has a direct impact on Li refiner profitability and margins. This is

further reinforced by the industry structure of the Li value chain – split between integrated and non-integrated refiners. The latter typically sit at the top end of the Li cost curve, given their lack of integrated feedstock and sensitivity to raw material price volatility. This is similar in many ways to the oil refining cost curve, except without the ability to hedge cracks or pricing differentials.

While the Li chemicals market has coalesced on a clear path to variable pricing; the SC6 pricing landscape remains more fragmented. Currently, several pricing mechanisms exist in the SC6 market, namely:

- **Formula-based pricing**: SC6 has been priced as a formula linked to the price of chemicals tied to indexes for Li carbonate/hydroxide where there is greater liquidity, in some ways similar to the payables method used in cobalt hydroxide pricing.[4] While formulas vary in the market, a typical model would look like the following:

  SC6 formula price = (prevailing chemical price – conversion cost/processing fee + margin) ÷ recovery rate (i.e., number of tonnes of SC6 required) – freight (Aus-China)

The chemical price quotation is typically taken from a basket of PRAs, with a range of quotation periods used in the market.

Other formulas also exist in the market, including formulas which use a floor price for the miner and share of the converter's margin:

*SC6 Price = Cash cost of production + (Prevailing chemical ref. price ÷ Conversion factor - Floor SC6 Price) * SC Producer Margin Share*

- **Fixed price bilateral negotiations**

- **Link to independent SC6 price indices**

- **Spot sales and auctions**: A model was pioneered by Pilbara Minerals' platform auctions and used throughout 2022. Auctions for SC6 material can create competition for the marginal tonne and prove a useful tool for price discovery. However, the mechanism is largely limited by the volume of spot material and frequency.

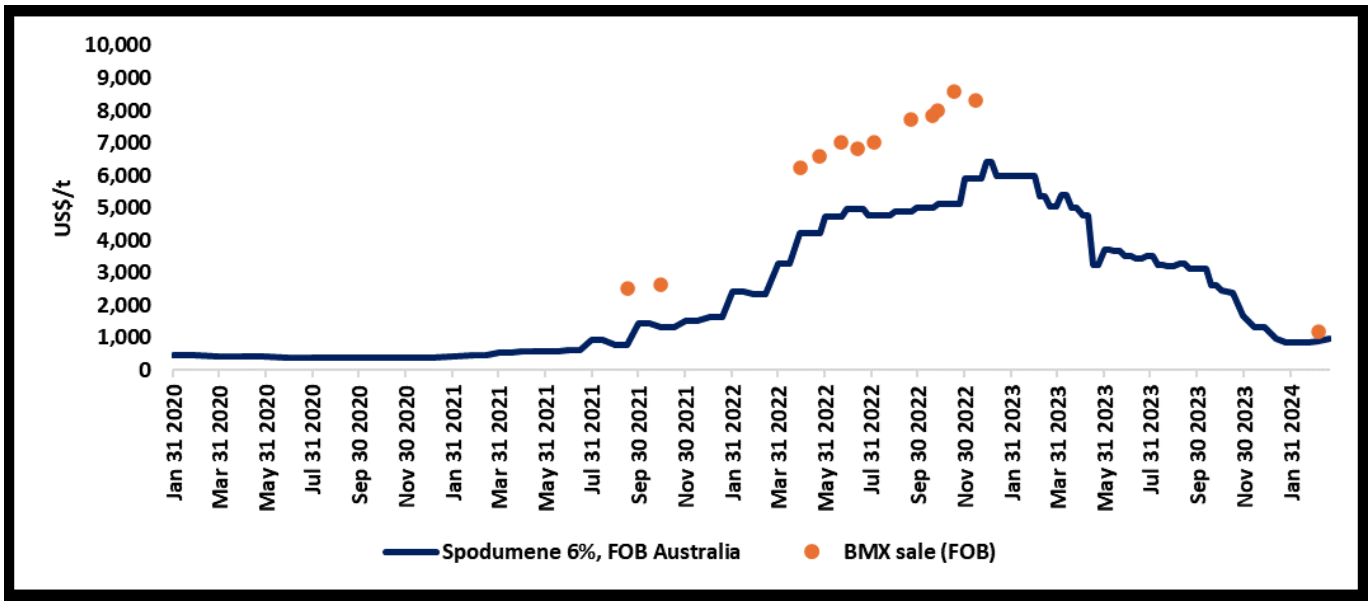
While all the above have been active components in the SC6 pricing ecosystem, 2024 has seen some key shifts take place. These include:

- **QPs used for chemical prices**: While a large percentage of formula-based pricing continues to reference an average of the chemical price from the previous month (M-1 basis), change has been afoot in the market. The volatility witnessed in 2023 has led Chinese converters to push for changes in the QP basis, moving from M-1 to M+1/M+2 basis – meaning that a converter would have greater ability to manage cash flow exposure during downcycles as the chemical price aligns more closely with

SC6 price upon delivery. The shift in QPs can be said to represent a migration in pricing power from Australian feedstock (SC6) suppliers to Chinese refiners.

- **Greater use of auctions by Li majors**: March 2024 saw the re-emergence of auctions as a tool of price discovery. Pilbara – the original pioneer of the auction system – was joined by other major Li producers in selling spot volumes via auction. These included Albermarle (the world's largest producer), Sigma and Mineral Resources. It remains to be seen if this represents a watershed moment for SC6 pricing and a potential stepping stone to something else (*e.g.*, SC6 derivatives pricing). It cannot be disputed that Australia – as the world's leading spodumene producer – has lost significant pricing power in the market, with China now able to leverage new sources of cost competitive supply (*e.g.*, African spodumene) and elastic sources (*e.g.*, Chinese lepidolite).

Figure 4
Pilbara Auction Sales vs. Spodumene Spot Price (US$/t)



Note: BMX refers to Pilbara's Battery Metals Exchange system.

Sources: Company reports and Benchmark Minerals.

How SC6 pricing evolves is not purely theoretical. Given the top-end of refining cost curve being determined by non-integrated producers, SC6 feedstock pricing can make or break converter margins – which has consequences for all players in the lithium value chain.

The Long Journey to Market Maturity

Regardless of whether the current slump in spot prices is setting the market for another round of volatility, several tools exist to manage price risk in the market, with further room for growth expected over the next decade. As noted on the next page, these include:

1) **OEM backward vertical integration:** A trend which has accelerated since 2022's price spike, OEMs are directly investing in raw material offtakes to mitigate price risk and ensure security of supply. Recent examples include GM's US$650 million investment in Li Americas, Ford's lithium offtakes (Albermarle etc.) and Tesla's plan to build a LiOH refinery in Texas.

2) **Floor prices:** OEMs may be encouraged to set a floor price with a Li producer, particularly if that player will act as a baseload source for future EV model launches. The floor price can be set at the cost of production, with prices above that floor set at a floating variable to the spot price. The OEM is encouraged to provide an adequate floor price to ensure security of supply.

3) **Growth of financial instruments to hedge price risk:** A relatively new trend has been the establishment of exchange-based venues to facilitate risk management. The CME Group, for example, has cash-settled contracts for lithium chemicals. Despite the increase of trading volume and open interest (OI) on these venues, liquidity remains relatively low and OI still a small percentage of overall ex-China OEM hedging demand. This should not overshadow the fact that OEM hedging demand is expected to increase substantially, creating significant room for trading volumes to grow and other exchanges to also establish exchange-based products (Till, 2024).

In many ways, the Li market has shown signs of moving to greater market maturity over the past several years – a greater range of players (*e.g.*, the entry of capitalized oil majors), a greater variety of feedstocks and technology routes (*e.g.*, Direct Lithium Extraction), and financing mechanisms (*e.g.*, prepayment deals). The end of fixed-term pricing also heralded a move to greater market maturity.

But that journey has only started. With no established global benchmark, a relatively small spot market and ongoing issues with the transfer of pricing risk, it remains to be seen where Li's pricing journey will move next.

Nevertheless, it is clear that new mechanisms are being sought after to ensure price discovery is not simply a function of China's control of the value chain where liquidity currently remains concentrated. While Western supply chains will never extract themselves fully from China, this does not mean that new pricing mechanisms won't develop. The biggest one to watch next could well be in the spodumene space, as more auctions are held this year. In the chemicals market, exchange-based pricing shows no signs of slowing, with liquidity and open interest gradually building. Until then, China is unlikely to want to give up its current pricing power – reinforcing the point that pricing has become a key battleground in the geopolitics of the lithium value chain.

Endnotes

1 EXW is a recognized incoterm whereby the seller must make a product available at the select location. After that, the buyer is responsible for all costs (*e.g.*, transportation). With EXW the seller is responsible for goods (and costs) until loaded "on board"; once done, liability falls to buyer.

2 It remains unclear what IEA (2022), for example, means by "strategic stockpiling" and at which point in the value chain.

3 “Cost, insurance, and freight (CIF) is an international shipping agreement, which represents the charges paid by a seller to cover the costs, insurance, and freight of a buyer's order while the cargo is in transit,” as phrased at https://www.investopedia.com/terms/c/cif.asp, which was accessed on April 29, 2024.

4 Change also appears to be afoot in the cobalt markets with growing focus on moving away from linking cobalt battery chemical pricing from metal pricing.

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Author Biography

AHMED MEHDI
Managing Director, Renaissance Energy Advisors

Ahmed Mehdi is Managing Director of Renaissance Energy Advisors, an energy advisory firm. He also serves as a Director at Benchmark Minerals Intelligence, a battery metals pricing agency. He previously served as an advisor at BHP Petroleum and currently serves as a Fellow at the Oxford Institute for Energy Studies and non-Resident Fellow at Columbia University’s Center on Global Energy Policy (CGEP) in New York.