

Independent Speculator

Special Report



Lithium: An Independent Analysis

by Sudarshan Ramesh

Lithium prices soared to almost \$85,000 per tonne last December. That's higher than almost anyone imagined possible—ardent bulls included.

Unless you've just woken up from a coma, you likely know why: demand for electric vehicle (EV) batteries has blown the lid off the market.

Lithium is not rare, however, and high prices always cure high prices in such cases.

This takes time, of course. The current retreat back down to about \$48,600 per tonne is not due to new supply, but just a correction in a hot market.

What an independent speculator really wants to know is if lithium's still-stratospheric price is likely to rebound or continue falling over the years ahead.

Have high prices finally been the cure for high prices?

To answer, let's dive right in to the fundamentals.

Supply and Demand

This is a sellers' market. Battery and carmakers pay whatever they have to—and with the help of tax incentives, they've been able to pass the additional costs along to consumers.

EV sales in 2022 are estimated to be about 10.5 million vehicles, up 59% from 6.6 million in 2021. China accounted for about 60% of that volume.

This resulted in lithium demand of approximately 650,000 tonnes in 2022. Primary supply was around 645,000 tonnes. The difference doesn't seem enough to make prices soar—which is probably why they have corrected almost 18% already.

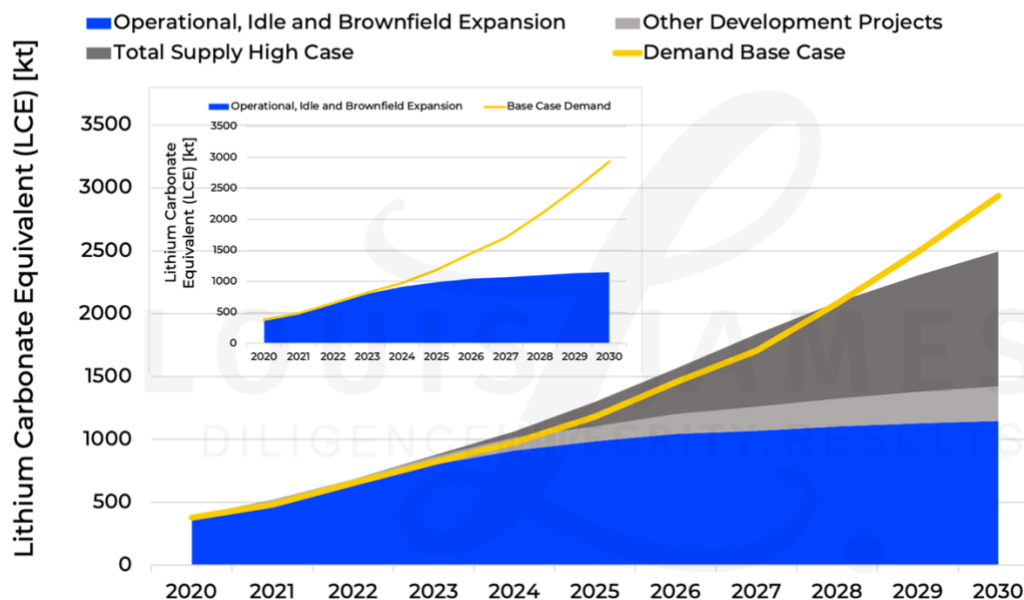
To estimate the balance of supply and demand—and hence the price trend going forward—we have to estimate EV sales going forward. Not knowing the future, we've considered four cases.

Case 1: No recession, and EV sales growing at 21% compounded until 2030.

Let's assume that all operating mines continue as planned and that idled and expansion projects deliver as planned. If we also assume that EV sales grow at 21% (adjustment of the EIA EV sales forecast with latest

available data), the balance of supply and demand is going to be very tight until 2025.

Lithium Supply and Demand - Current Rate of EV Adoption



As you can see in the chart above, existing, idled, and expansion projects (blue) in combination with advanced-stage development projects (grey) can meet demand until about 2024. This is optimistic, as on-time project development can't be assumed. If new projects can be brought online quickly, the balance would improve—but that's even less likely.

Remember that there was already a deficit of 5,000 tonnes in 2022. It's hard to see that improving materially this year.

The supply gap widens sharply from 2024 onward if we consider only the most likely sources of production, as you can see in the inset chart above. To meet demand after 2024, early-stage development projects must start delivering. Otherwise, we are looking at a huge deficit.

If we add earlier-stage projects successfully brought online for a high-supply case, there should be a slight surplus until 2028.

Note that beyond 2028, even in the high-supply case, there won't be enough lithium to meet demand.

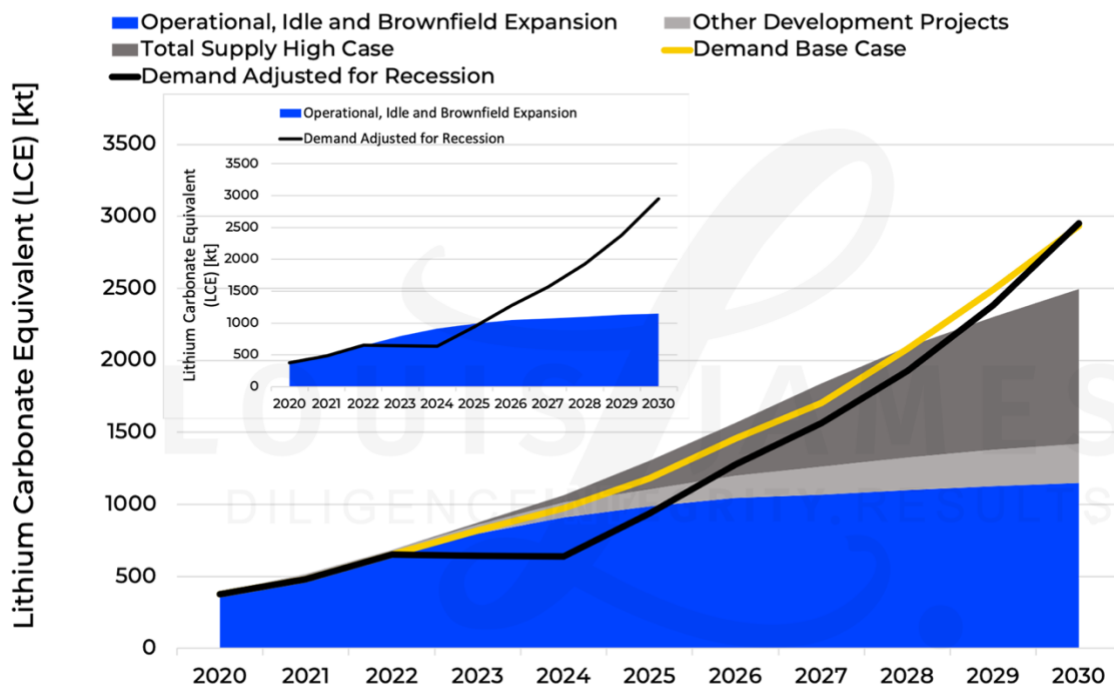
By 2030, we're looking at a deficit of 1.5 million tonnes of lithium-carbonate equivalent (LCE), when considering only the more likely supply

(blue and grey combined). In the high-supply case, there's still a deficit of 438,000 tonnes of LCE.

Case 2: EV sales affected by a 2008-type recession.

EVs are generally seen as luxury cars. During the great financial crisis of 2008, luxury car sales dropped by an average of 5% in 2008 and 10% in 2009. Sales then saw strong growth for two years. Applying these figures to our EV forecast, the lithium market would be oversupplied for 2023 and 2024, even considering only operational, idled, and expansions (blue).

Lithium Supply and Demand - 2008 Type Recession



As you can see in the chart above, in the more conservative case, the market would return to a balance in 2025 and go into deficit in 2026 (inset chart).

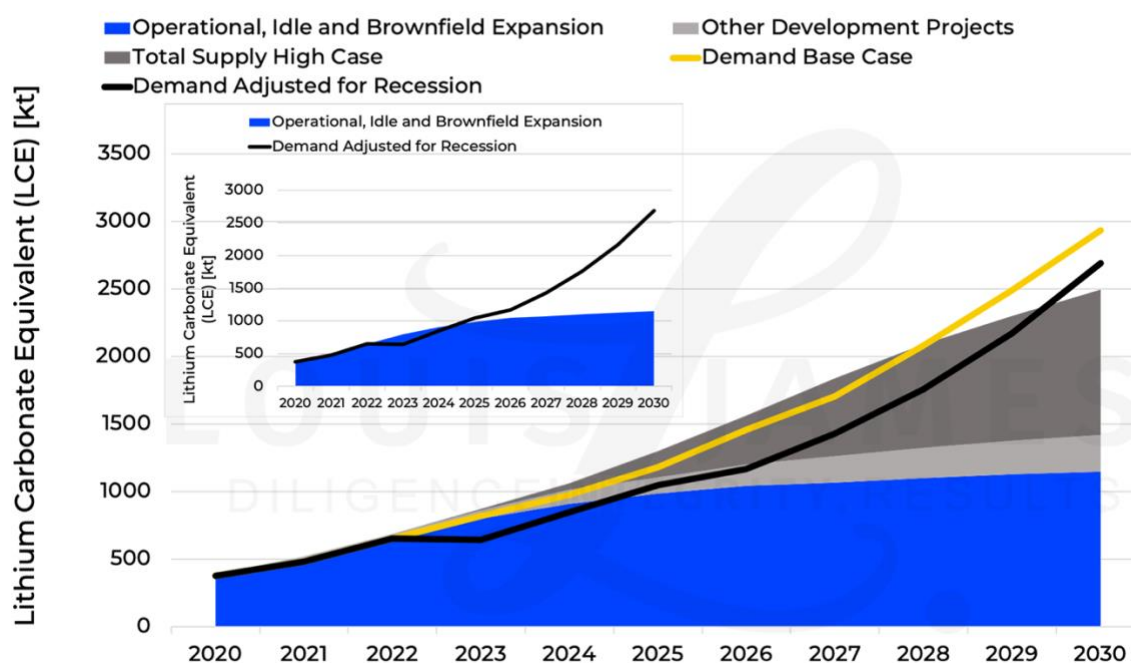
If we assume the success of earlier-stage projects, large deficits don't emerge until 2029.

If things play out this way, the deficit in 2030 would be around 450,000 tonnes of LCE in the high-supply case, and 1.8 million tonnes of LCE in the more likely case.

Case 3: EV sales affected by a mild recession.

The average drop in auto sales during the previous recessions has been around 5%. Right after a recession, demand tends to rebound sharply, with double-digit growth, and then return to trend. In such a scenario, the lithium market would be oversupplied in 2023 and 2024. When including the advanced developmental projects, the market would be oversupplied until 2026, although not by much. After 2026, early-stage projects would have to succeed in order to avoid a deficit, as you can see in the chart below.

Lithium Supply and Demand - Mild recession



In the high-supply case, we'd only see a deficit in 2030. But if we consider the more likely sources (blue and grey combined), the deficit would be around 1.5 million tonnes of LCE.

Case 4: EV adoption drops due to energy crises and higher battery prices.

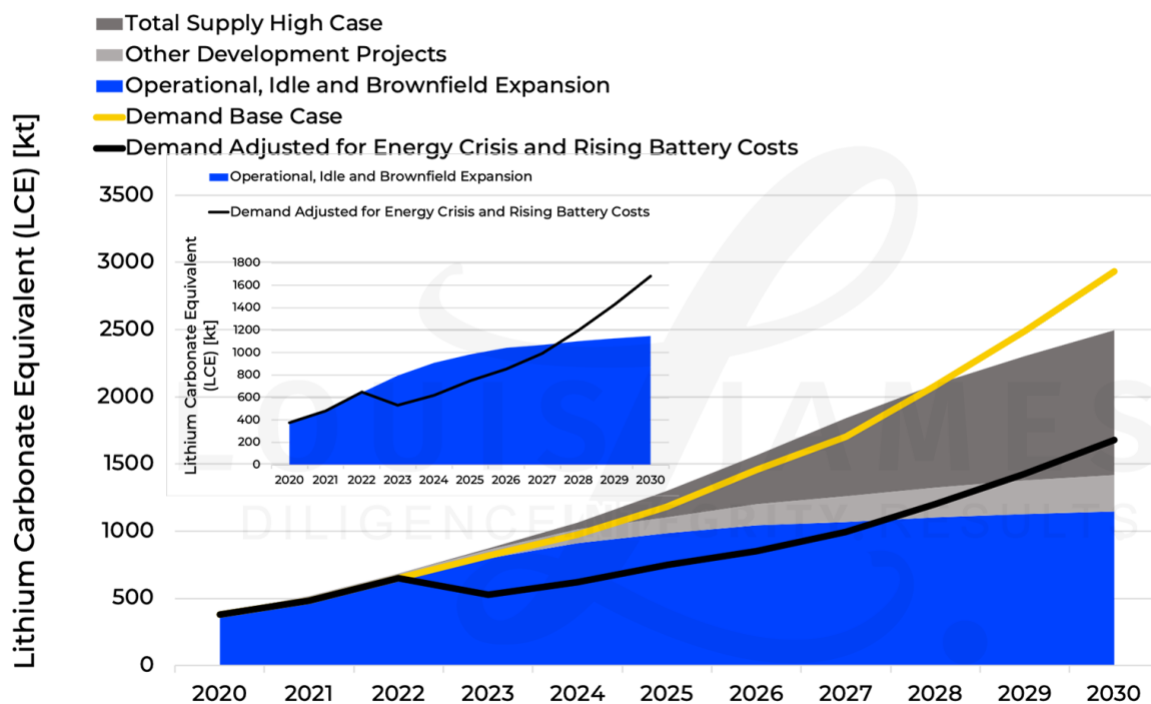
Continuing effects of the COVID-19 lockdowns and the invasion of Ukraine have driven energy prices much higher. In some places, electricity prices are so high, it's cheaper to run gas cars than EVs[1]. Prices for battery metals are also up significantly, making EVs more expensive. Just the lithium in a 60 kilowatt-hour (kWh) battery has shot

up from \$400 in 2021 to around \$2,500. As a result, prices for EV battery packs in \$/kWh had been falling until 2021, but are now rising[2].

Expert consensus is that battery costs need to be below \$100/kWh to be competitive with internal combustion engine (ICE) cars. That was starting to happen... until 2022.

This cost issue is likely to impact the EV adoption rate. If we assume a 50% decrease in the projected rate of EV sales through the decade, the more likely supply (blue areas) would keep the market oversupplied until 2027. If the earlier-stage projects come online as well, the market would be massively oversupplied, with a surplus of 820,000 tonnes of LCE in 2030. If no new early-stage projects come online this decade, the deficit by 2030 would be 534,000 tonnes of LCE, as you can see in the chart below.

Lithium Supply and Demand - Slower EV Adoption Due to Energy Crisis and Rising Costs



In short, all scenarios involving a recession or other hits to EV demand put off any possible supply deficit for two years or until the end of this decade (or longer, in the case of a permanently lower sales rate and high supply).

The only scenario in which supply remains tight is the no-recession case, and even this would not go into deficit until mid-2024 if the more likely development projects come online as expected.

But even with a recession of one kind or another, the market does go into deficit within a few years if the earlier-stage projects don't come online—and such projects are always iffy.

Bottom Line

The main variable for the balance of the lithium market in the near term—and hence its price—is what happens with the recession.

Those on Team Soft Landing should consider buying lithium plays while the metal is relatively on sale.

Everyone else should wait to see what the recession and/or higher costs do to EV sales.

The Rest of the Story

Those who wish to understand the lithium market better should dig in to its fundamentals...

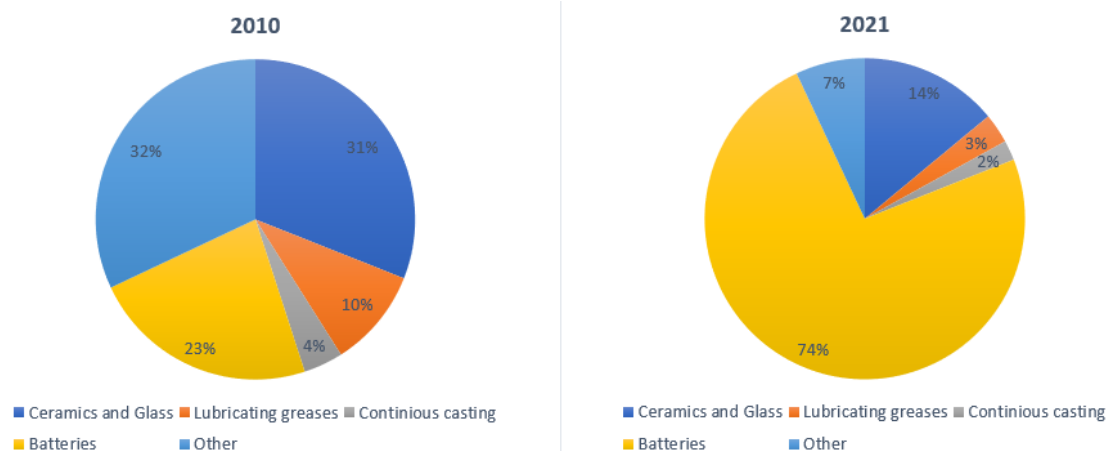
The Metal

Lithium is the lightest and the most-reactive alkali metal in the periodic table. It loses an electron easily, which makes it very reactive. This is why it's never found as a pure metal.

The ability to lose an electron easily, along with its very low weight, is also what makes lithium so great for batteries.

Lithium is also used for making ceramics, glass, and lubricating greases, to name a few other industrial uses.

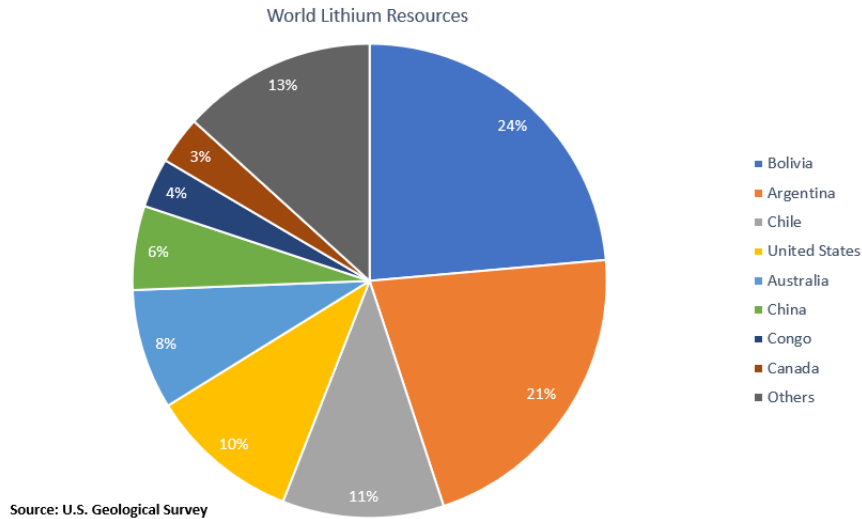
The chart below compares how the share of lithium use has changed between different industries from 2010 to 2021. Use in batteries has skyrocketed from 23% in 2010 to over 70%. Going forward, we expect this large piece of the pie to increase further.



U.S Geological Survey

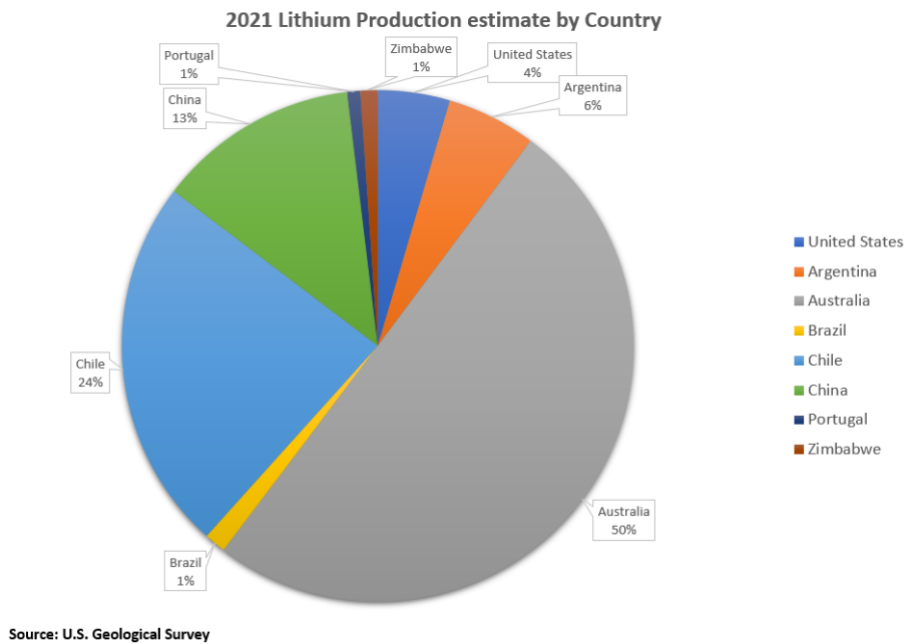
Lithium is not a rare metal. It is the 33rd-most abundant element on earth. However, its distribution is not even, and many sources are not economic.

Global lithium resources are approximately 89 million metric tonnes. Of this, more than 50% is in Argentina, Bolivia, and Chile. This region is known as the "Lithium Triangle." Worldwide lithium reserves by country as of 2021 are shown in the chart below.



Even though the Lithium Triangle countries have the world’s largest reserves, Australia is the world’s largest producer, followed by Chile. Together, these two countries account for almost 75% of the current global lithium supply. This concentration is a potential risk to supply, especially given that Chile is becoming less friendly to mining. Note also that there’s almost no production at scale from Bolivia, despite it having the largest lithium resource in the world.

The USGS reports total production for 2021 at approximately 550,000 tonnes of LCE.



Occurrence

There are three major lithium deposit types or sources.

- **Brines.** Lithium is often found in the salt flats of terminal lakes (lakes that do not drain out into any river or sea). The only way for water to leave the system is through evaporation. The most famous of these are the Lithium Triangle salt flats in South America.



Source: <https://e360.yale.edu/features/lithium-mining-water-andes-argentina>

Water extracted along with oil from some oilfields can also be rich in lithium. Water from geothermal hotspots can also have lithium. However, there's currently no commercial extraction from these potential sources of lithium.

- **Pegmatites.** This is a rock that often contains spodumene, a lithium mineral. In some regions of China, there are pegmatites containing lepidolite, another lithium mineral. Lithium in spodumene is generally higher grade than in lepidolite. The most famous spodumene mine is the Greenbushes mine in Australia.
- **Clays.** Lithium is also sometimes found in certain clays on the Earth's surface. The Thacker Pass project in Nevada is a well-known lithium clay example.

Processing

- **Evaporation.** Production from salt flat brines is usually through evaporation in large artificial ponds on the surface, where the sun can do most of the work for free. The ponds are very large—often several kilometers long—so it takes 18–24 months to produce lithium carbonate. It also takes about 500,000 gallons of water to produce a tonne of LCE. This can be a problem, as these regions are among the driest places on Earth. Local communities sometimes object to what they see as excessive draining of their aquifers.
- **Hard-rock mining.** This is mainly open-pit mining of pegmatites. The rock is crushed and processed to produce a spodumene or lepidolite concentrate. The concentrate undergoes further processing to produce lithium hydroxide or lithium carbonate. Lithium hydroxide is commonly produced from spodumene.
- **Direct lithium extraction (DLE).** This is a relatively new technology that is used to extract lithium from brines with lower lithium concentrations or higher impurities. It uses adsorbents, membranes, or solvents to separate the lithium from a brine solution. The specifics of DLE processing change from project to project. It has to be adapted based on the specific lithium concentration and impurities. Livent is producing lithium carbonate at its Fenix project in Argentina using a hybrid DLE and evaporation method for over two decades now, but other producers applying the technology are more experimental.

Major Producers

- **Albemarle.** This is a somewhat diversified chemical company with operations on multiple continents. The company is involved in both upstream and downstream operations for producing lithium, bromine, and catalyst compounds. In 2021, lithium accounted for 41% of Albemarle's total revenue. The company accounted for 19% of global lithium sales in 2021.
- **Sociedad Química y Minera de Chile S.A. (SQM).** SQM is a Chilean company that produces several chemicals, including lithium from salt brines in Chile. The company is involved in both upstream and downstream operations for producing lithium and iodine compounds, plant nutrients, potassium fertilizers, and industrial chemicals. In 2021, lithium accounted for 33% of SQM's revenue. The company accounted for 19% of global lithium sales in 2021.
- **Ganfeng Lithium.** This is a Chinese company focused on producing lithium and lithium compounds. It currently has operations in

Argentina, Australia, and China. The company is the third-largest lithium producer after Albemarle and SQM, producing about 17% of global lithium sales in 2021—and 28% of the total lithium hydroxide produced in 2021.

- **Tianqi Lithium.** This is a Chinese company focused on producing lithium specialty compounds. It holds a 21% stake in SQM and a 51% stake in Talison Lithium Australia, which is a joint venture between Tianqi and Albemarle. Talison operates the Greenbushes mine in Australia. Tianqi accounted for about 9% of global lithium sales in 2021.
- **Livent Corporation.** This US company was formed when FMC Corporation spun out its lithium business in 2018. It sources its lithium from the Salar del Hombre Muerto salt flat in Argentina. Livent accounted for about 7% of global lithium sales in 2021.

The top five producers account for over 70% of global lithium production; the top three account for over 55%. This concentration makes it easy for lithium bulls to pick their producers, but it makes the market vulnerable to disruption if anything goes seriously wrong with any of these companies.

Lithium Prices

The lithium market lacked price transparency and was quite opaque until 2021. Contracts were signed directly between producers and consumers with little information regarding prices immediately available.

Benchmark Minerals started reporting lithium contract prices in 2014 and S&P Global Platts followed in 2018.

But in 2021, the London Metal Exchange (LME) and Fastmarkets launched a cash-settled futures contract called “LME lithium hydroxide CIF.” CME and Fastmarkets also launched a futures contract called “Lithium Hydroxide CIF CJF (Fastmarkets).” This was the first spot-type public price quote, giving much-needed transparency.

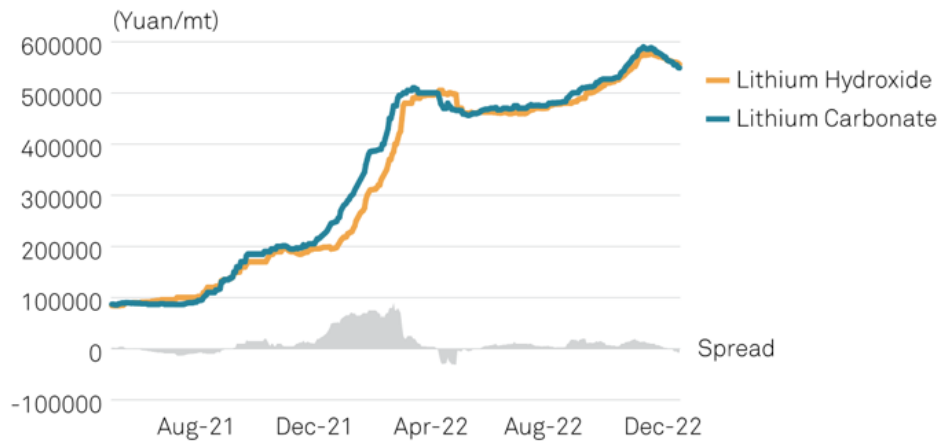
Even so, there isn’t really one spot lithium price used by all participants. Prices differ in different regions of the world, as well as between different forms of the commodity: lithium hydroxide and lithium carbonate.

For instance, lithium carbonate in China hit an all-time high price in November 2022—not the December peak previously mentioned. It has since dropped around 22% due to softening EV demand in China.

We generally expect the hydroxide to trade at a premium compared to the carbonate, as hydroxide needs less processing (carbonate is often converted to hydroxide). However, this can change depending on the

regional supply and demand for either product. Since August 2021, lithium carbonate has mostly traded at a premium to lithium hydroxide in China, as you can see in the Platts chart below.

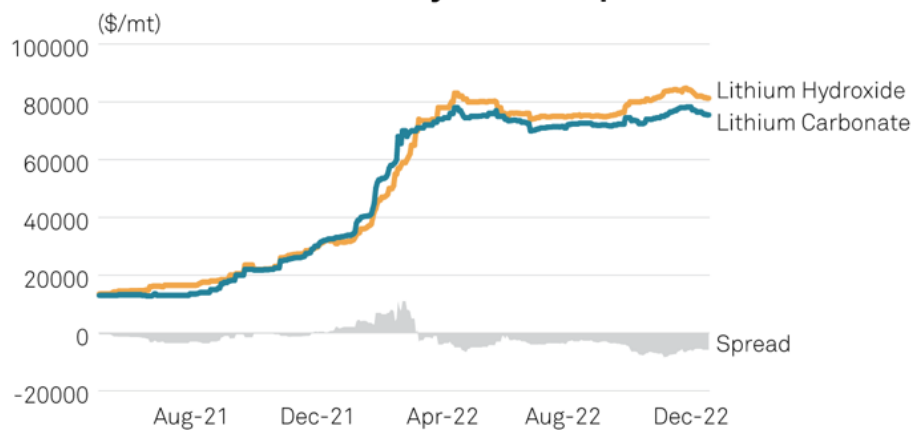
Platts' lithium carbonate-hydroxide spread DDP China



Source: S&P Global Commodity Insights

However, when looking at Platts' lithium carbonate-hydroxide spread CIF North Asia, the hydroxide has generally traded at a premium compared to the carbonate, as you can see in the chart below.

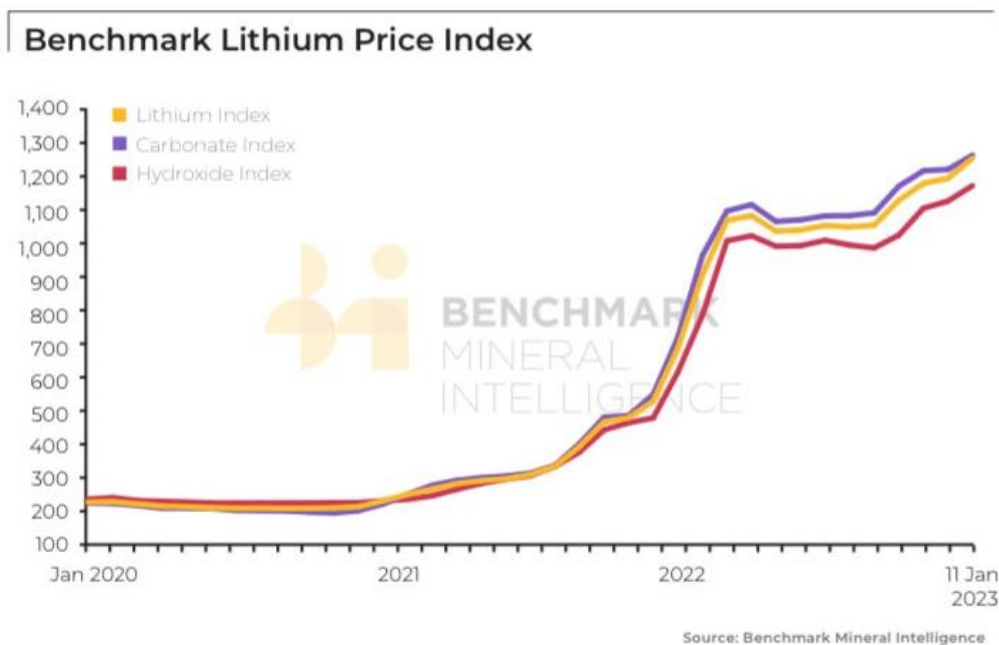
Platts' lithium carbonate-hydroxide spread CIF North Asia



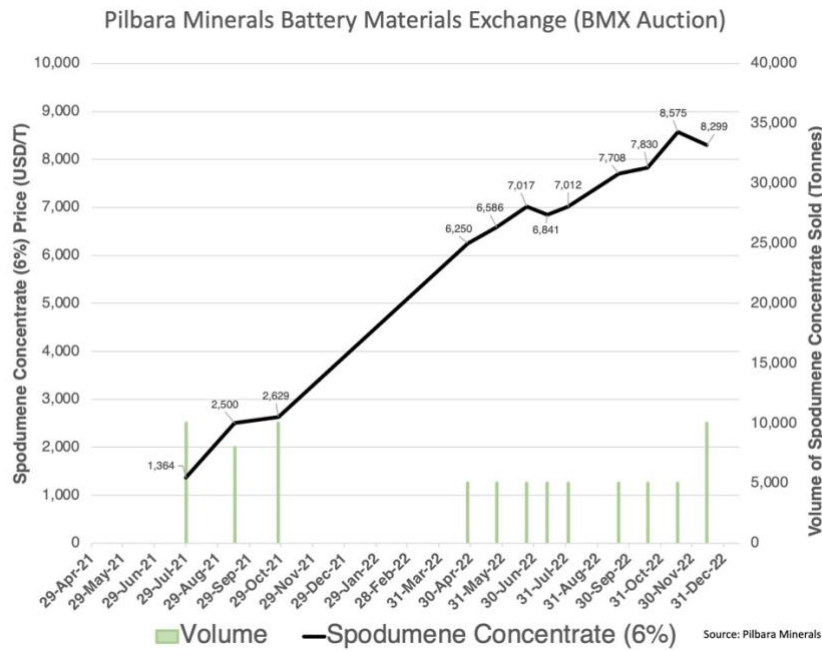
Source: S&P Global Commodity Insights

More striking is the different behavior in the prices. CIF North Asia has traded flatter for longer after the big rally in 2021. DDP China corrected faster and started rising sooner. Prices have softened for both, however, since November 2022.

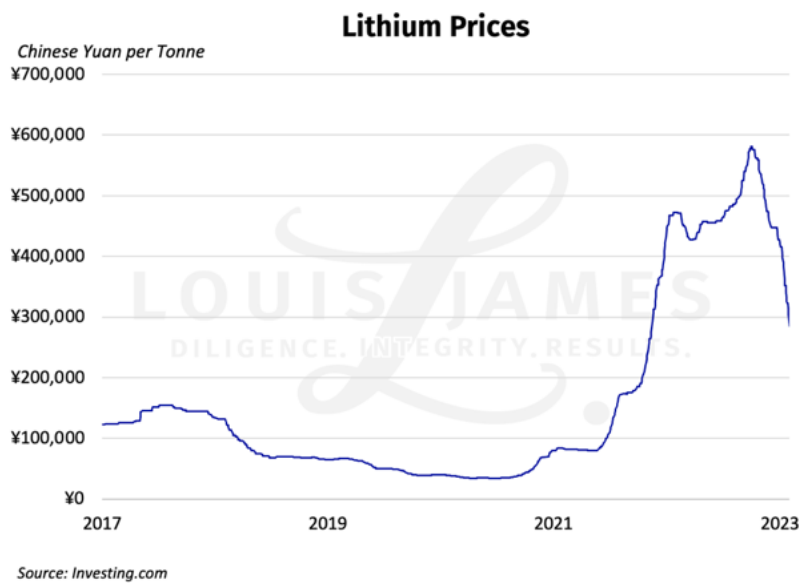
In contrast, the prices reported by Benchmark (carbonate, hydroxide, and their lithium index) continued rising since August of 2022. There was no drop in price, even in January of 2023.



Pilbara Minerals launched a Battery Metals Exchange auction in July 2021. This shows what consumers are willing to pay for spodumene lithium concentrates, which they will process to produce hydroxides or carbonates. The company sells its own spodumene concentrate via auctions on this exchange. The price for spodumene concentrate remains elevated, as shown in the chart below.



More recent data tracked by Trading Economics shows a sharp decline continuing this year:



In short, though there is a general similarity, there are significant differences in prices for different lithium products and in different places. If one invests in a lithium exploration, development, or mining company, one should be sure the prices quoted are those relevant to its product and location.

When someone asks or quotes a lithium price, we need to ask: “Which one?”

Given the big surprises this market has delivered in recent years, we're not going to make a price forecast.

We do expect demand to continue increasing, however—the question is at what rate. So, while a deepening global recession this year is likely to keep lithium in correction territory for the duration, we doubt prices will crash to pre-EV levels. And given how difficult we know it is to permit and build new lithium mines, we expect lithium prices to head higher again once the recession passes.

Price target?

Forget it. And don't believe any you see.

We'll be happy if we get the direction right.

How to Invest

If you are interested in speculating in the lithium space, you should be aware that it's quite a minefield. That said, even if prices don't rise much more until after the global recession, we do expect them to remain elevated going forward.

- For the more risk-averse speculator, the obvious place to start is with the top producers.
- Those looking for more leverage should consider developers that are able to bring production online in the next couple of years. They should enjoy good cash flow at elevated prices—and the transition from spending money building mines to making money from operating them should deliver handsome capital gains. The ones that can capture as much of the downstream process as possible (that can produce not just concentrates, but are able to produce near battery-ready compounds) should make the most profit.
- Those who want to swing for the bleachers on potential 10-baggers will have to take their chances on exploration plays. They should only do so understanding that they are swimming in the very high-risk end of the pool—and it's full of sharks.

Speaking of sharks, other risks to keep in mind include:

- Due to lithium prices skyrocketing in the last couple of years, the amount of money that poured into this sector has resulted in valuations as ridiculous as mainstream market-darling tech stocks. Watch out for explorers with large market caps and no measurable value in the ground.
- There are many juniors claiming to be able to produce within the next two years. Almost none will. History has shown that it takes about eight to ten years even for established producers to put a new lithium mine into production. For integrated operations (mine + conversion), the least time taken to produce a final product has been eight years.
- Europe and North America (USA and Canada) currently have very little lithium production. Permitting new mines and/or new technologies for lithium extraction is going to take years—if these projects can get through NIMBY thinking at all.
- Production projected in a feasibility study—or even total installed capacity—is rarely the same as actual production.
- Lithium extraction using complete DLE technology is not proven; its economics are yet to be determined. I would personally not be an investor in a new junior claiming that they are going to start producing lithium in a couple of years from a low-grade lithium brine using DLE.

Other non-company-specific issues to keep in mind include:

- **A recession will most likely hit EV sales—and hence lithium demand—hard.** We've shown what happens to the supply and demand balance under different scenarios above. Don't underestimate this.
- China is due to remove EV subsidies. It was supposed to remove its subsidies in 2020, but it extended them until the end of 2022 due to the COVID-19 lockdowns. Remember that China accounts for 60% of all EV sales, so this is a big deal. It remains to be seen how negative the impact will be on lithium demand.
- Western countries are offering new subsidies to push EV sales. The misnamed Inflation Reduction Act alone adds a \$7,500 subsidy, provided the vehicle meets certain conditions. This is bullish for lithium.

- Range anxiety is abating. With improving charging infrastructure and faster charging, the range anxiety that has kept many consumers away from EVs seems to be dropping. This will help manufacturers use smaller batteries (lower kWh) to make EVs cheaper. Smaller batteries could be negative for lithium demand if sales don't increase enough to make up for the smaller amounts used per EV.
- High electricity costs. The energy crisis sparked by the invasion of Ukraine is likely to keep the cost of charging an electric car elevated for years to come. This could be a strong headwind for EV sales and hence lithium demand.
- High metals prices. The prices of lithium, copper, nickel, cobalt, graphite, and other minerals have a direct impact on EV prices. This could slow the EV adoption rate, which would be negative for lithium demand.
- Sodium-ion batteries. This new battery technology is still in development. At the moment, there is no commercially viable alternative to lithium. But if there is any breakthrough resulting in faster adoption of lithium-free batteries, it would clearly be bad for lithium demand. Heads-up.
- Recycling. Lithium recycling is not expected to become a substantial supply until the next decade. Still, it's important to be aware of the risk of recycling creating large secondary supplies.

These are the issues we would keep in mind if we were convinced there will be no recession and were looking to buy lithium stocks now.

We do think the deepening recession argues for patience—but that just gives us more time to apply the above consideration to researching great lithium stocks before they take off again.

No arm-twisting, but if you'd like help with your due diligence picking stocks in the lithium space, *My Take* may be just the thing for you. Several of the *companies mentioned in this report—and more that are not—are covered*. We're constantly adding more—and we take requests from subscribers.

For the convenience of lithium bulls, we've pulled together our latest evaluations of lithium plays into one special edition, available to subscribers only. [**Please click here to subscribe and gain access to our latest takes on these lithium stocks—and about 600 other resource company evaluations.**](#)

Regardless of your decision on that, we suggest you download and save this report to keep as a reference as you consider your own speculations in the sector.

Caveat emptor!

Try My Take

Other Research Reports

1. [Why I'm Not a Nickel Bull](#)
2. [The Pre-Production Sweet Spot](#)
3. [The Upside Maximizer](#)

References

1. <https://www.wsj.com/articles/rising-power-prices-in-europe-are-making-ev-ownership-more-expensive-11671719724>
2. <https://www.greencarcongress.com/2021/10/20211030-benchmark.html>

TERMS OF USE (Extract)

(Please read the complete version of the Terms of Use by following [this link](#).)

Please read the following terms and conditions (“Terms of Use”) before using the Independent Speculator.com website (the “Site”) operated by Louis James LLC, a Puerto Rico limited liability company (the “Firm”), which includes (a) information and content (including newsletters) made available for free on or through the Site and (b) the Firm’s paid content (including content on the Site or in newsletters disseminated through the Site) and available on a subscription basis (the Site and any information described in (a) and (b) above is referred to individually and collectively as a “Publication” or the “Publication”).

THE FIRM IS A FINANCIAL PUBLISHER, NOT AN INVESTMENT ADVISER

Nothing in the Site or the Publication is an offer to buy or sell, or the solicitation of an offer to buy or sell, any security, financial product or instrument, or to participate in any particular trading strategy.

The Firm is strictly a financial publisher. It is not an investment adviser, broker-dealer or other financial adviser or planner and is not registered as an investment adviser or broker-dealer with the U.S. Securities and Exchange Commission or with any state or other securities regulatory authority.

The Firm publishes information regarding investment ideas, companies, issuers, stocks, options, futures, commodities, currencies or any other securities in which the Firm believes its subscribers may be interested and its reports reflect its sincere opinions. The Site and the Publication are for information only and do not and are not intended to provide any individualized investment advice.

The Firm will not and cannot offer personalized trading or investment advice and cannot request or consider your financial circumstances. Therefore, you agree not to provide the Firm with any information about your financial situation, investment portfolio or other individual information, and further agree not to request any individualized investment advice. The fact that the Firm has published information through the Site and the Publication is not a recommendation that you enter into a particular transaction or a representation that any investment described in the Publication is suitable or appropriate for you. Many of the investment ideas described in the Publication involve significant risks, any you should not enter into any transactions unless you fully understand all such risks and have independently determined that such transactions are appropriate for you. Any discussion of the risks contained herein with respect to any product should not be considered to be a disclosure of all risks or a complete discussion of the risks mentioned.

LIMITATION OF LIABILITY; DISCLAIMER OF DUTIES

Neither the Firm nor any of its officers, partners, employees or affiliates will be liable to any subscriber, guest or anyone else for, among other things:

Any interruption, inaccuracy, error or omission, regardless of cause, in any information appearing on or furnished by the Firm or for any damages whatsoever allegedly caused thereby;

Any unavailability of use of the Site or the Publication, nor undelivered e-mails due to Internet bandwidth problems, equipment failure, or acts beyond the Firm’s control, such as fires, floods, earthquakes, weather, war, terrorism, labor strikes or civil disturbance;

Any losses or damages whatsoever claimed to arise from investing or trading in securities, issuers or ideas appearing on the Site or in the Publication; or

Any damages alleged to arise from the use of any idea, trading or investment strategy described or contained on the Site or in the Publication. The

information, software and services published on this Site and in the Publication

may include inaccuracies or typographical errors. Due to various factors, including human and mechanical error, the Firm does not guarantee the accuracy, completeness, timeliness and correct sequencing of such information, software and services, including factual information, calculations, estimates, prices, product images, specifications, availability, and services. The Site and the Publication may be unavailable from time to time due to required maintenance, telecommunications interruptions or other reasons. The Firm and/or its suppliers make no representations about the suitability of the information, software, products and services on the Site or in the Publication for any purpose. All such information, software, products and services are provided “as is” without warranty of any kind. The Firm and/or its suppliers disclaim all warranties and conditions regarding this information, software, products and services, including all implied warranties and conditions of merchantability, fitness for a particular purpose, title, non-infringement and availability. Because some states and other jurisdictions do not allow the exclusion of implied warranties, the above exclusion may not apply to you.

Your use of the Site and the Publication is at your own risk.

You are solely responsible for any damage to your computer system, loss of data or any other damage or loss that results from downloading any content from the Site or the Publication. The Firm and/or its suppliers shall not be liable for any direct, indirect, punitive, incidental, special or consequential damages arising out of or in any way connected with or relating to the use of or access to the Site or the Publication or with the delay or inability to use the Site, the Publication or any information, software, products or services obtained through the Site or the Publication, whether based on contract, tort, strict liability or otherwise, even if the Firm or any of its suppliers has been advised of the possibility of damages. Because some jurisdictions do not allow the exclusion or limitation of liability for consequential or incidental damages, the above limitation may not apply to you. The Firm and any person creating or transmitting the information on the Site and the Publication shall not be liable for any infection by viruses or damage to any computer that results from your use of, access to or downloading of such information. If you are dissatisfied with the information, products or services offered on the Site or in the Publication or with these Terms of Use, your sole and exclusive remedy is to discontinue use of and access to the Site and the Publication.

INDEMNITY

You agree, at your own expense, to indemnify, defend and hold harmless the Firm, its parents, subsidiaries and affiliates, and their officers, directors, shareholders, partners, managers, members, employees, agents, distributors and licensees, from and against any judgments, losses, deficiencies, damages, liabilities, costs, claims, demands, suits, and expenses (including, without limitation, reasonable attorneys’ fees and expenses) incurred in, arising out of or in any way related to your breach of these Terms of Use or the Privacy Policy, your use of the Site or the Publication or any product or service related thereto, or any of your other acts or omissions, including but not limited to the actual or alleged infringement or use of the Firm’s or third-party proprietary or intellectual property right arising out of your copying, republishing, uploading, posting, transmitting, distributing, selling or using anything on the Site or in the Publication in any manner not authorized by the Firm.