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YOU NEED TO KNOW  
ABOUT INVESTING  
IN LITHIUM**

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# Dangers and Opportunities in Lithium

## How to Find Explosive Gains in the Lithium Markets

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### **The First Step: Become a Key Supplier in the Booming Electric Car Industry**

Common reactions to a car called the Rimac Nevera are “insane,” “ridiculous,” and “incredible.”

And the hosts of the popular auto TV show Top Gear said, “If that is the future, I am SO READY”



The Nevera can go from zero to 60 miles per hour in 1.9 seconds. Its top speed is around 258 miles per hour.

It can put an astounding 1,914 horsepower to work on the road – an insane amount of power when you consider that “just” 600 horsepower is a high figure for production sports cars. This makes the Nevera basically a rocket on wheels.

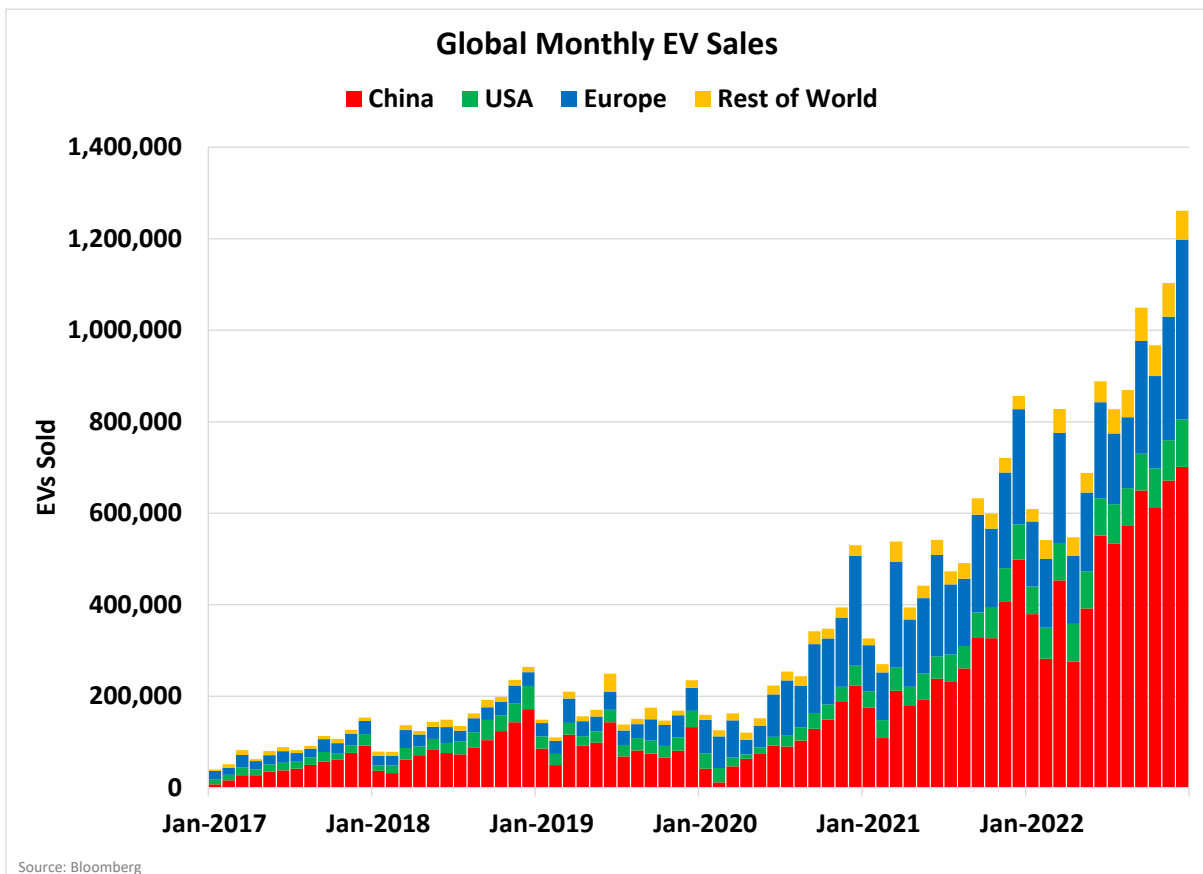
Unlike the big horsepower cars of the past, the Nevera doesn’t burn gasoline or any kind of special liquid fuel. Every Rimac car is an electric vehicle. Nevera is one of the world’s fastest, most powerful cars... and it runs on batteries.

Once confined to science experiments, electric vehicles (EVs) are now capable of incredible things... and they're rapidly becoming a common sight on roads across the world.

Every major car company is racing to build their own electric vehicle models. Just a few years ago, less than a million cars would have been sold of the course of a year.

In February 2023, EV sales topped 1.4 million and this year EV sales are expected to reach 8 million or more.

This science experiment is now the real deal, and it is changing the car owner mindset. Below is a chart that shows the enormous increase in EVs on the road since 2017.

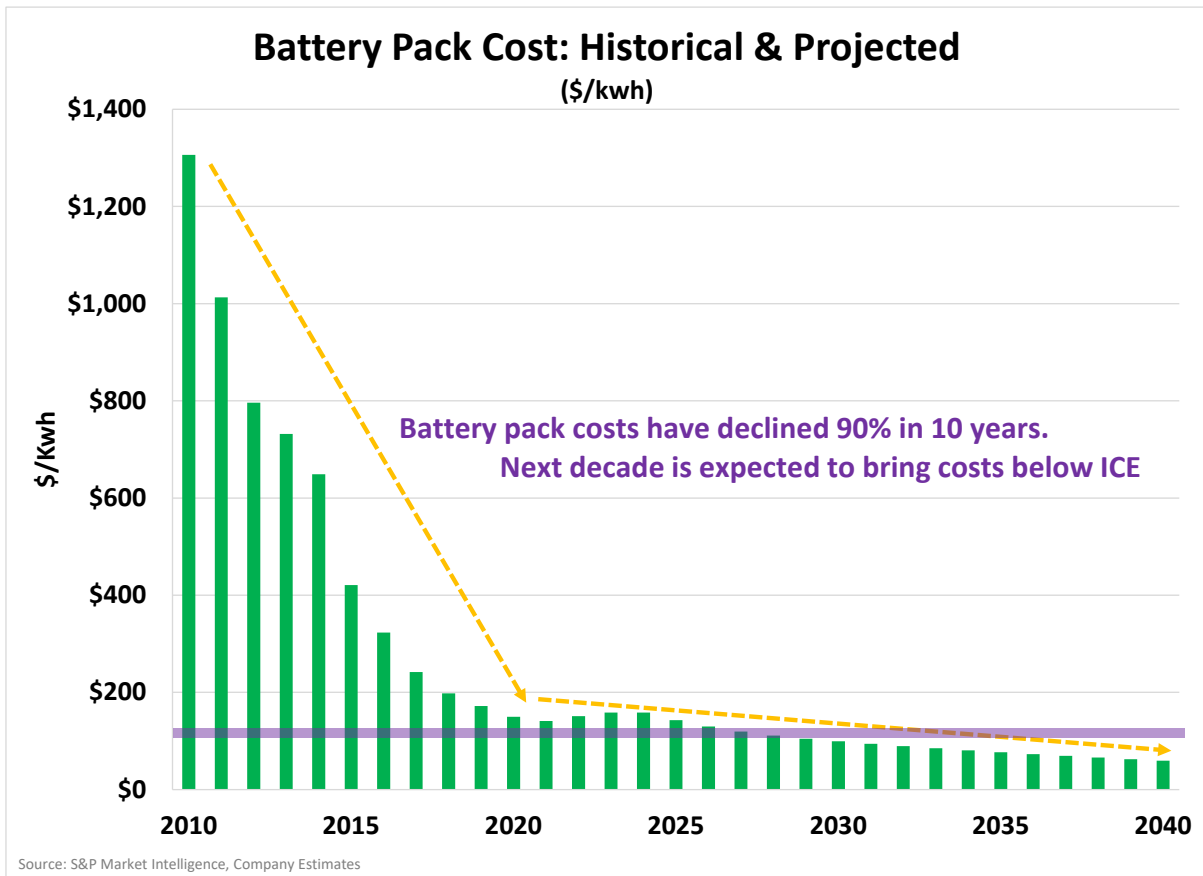


The three core regions for EVs are China, Europe and the United States. Each region have dedicated EV policies which have helped pave the way towards mass adoption and exponential growth.

Further fuelling the adoption process is the improvement in EV batteries.

Building affordable electric vehicles required a massive decrease in the cost of car batteries. I have always stated that humans innovate best through necessity.

Lowering the price point of an EV battery is a textbook example. Since 2010, the cost of an electric car battery has declined by approximately 90%. Below is a chart that shows this dramatic decline.

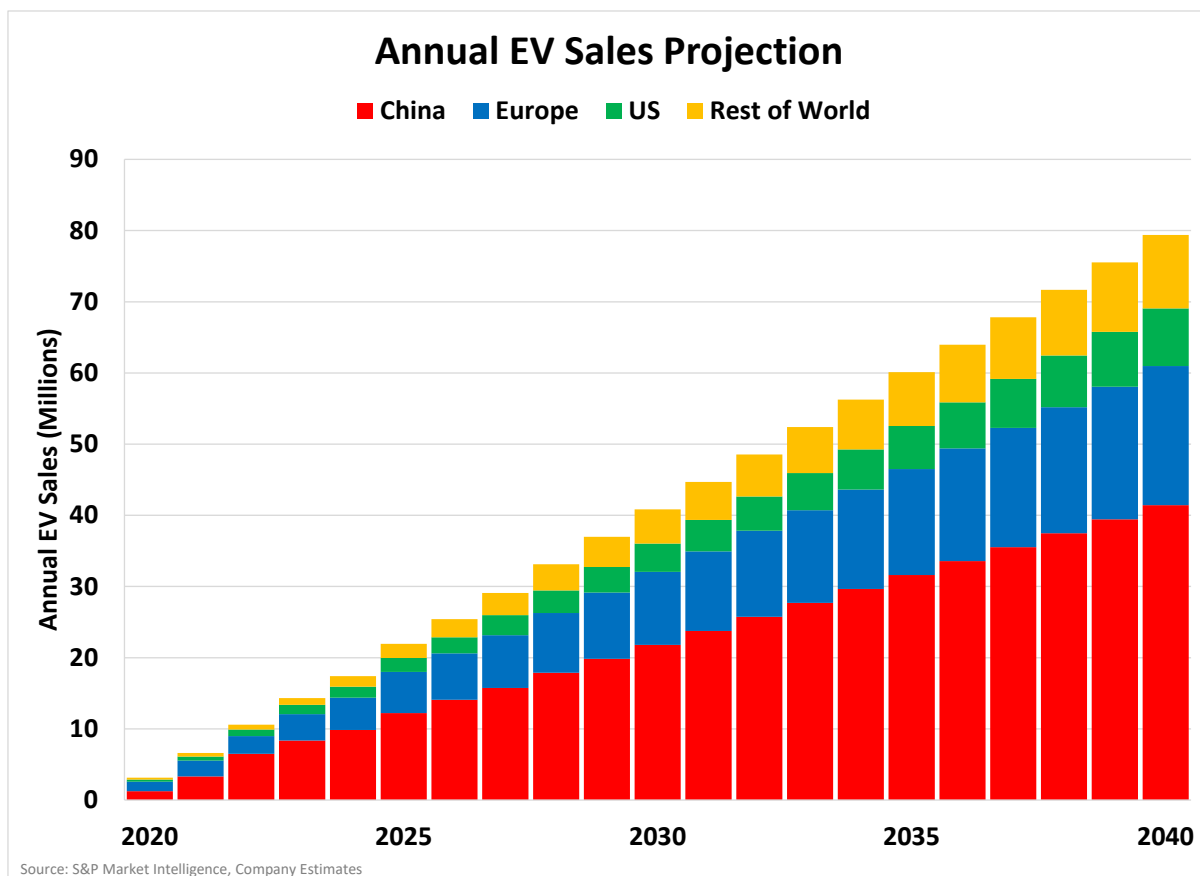


What the keen eye will also notice, is that the cost curve is still declining. While it looks squished, over the next decade we could see battery costs fall by another 25-50%. This is a critical step towards mass adoption because lower battery costs means EVs that are as cheaper to produce than the average gasoline powered car.

## EV Sales are about to go parabolic

- The International Energy Agency has set a target of 100 million EVs on the road by 2040.
- According to Bloomberg’s New Energy Finance group, by 2025, over 8 million electric vehicles will be sold each year.
- Goldman Sachs predicts 70+ million EVs sold annually by 2040

Below is a chart which shows a base forecast for EVs over the coming decades.



The seismic shift from gasoline-powered cars to electric vehicles is a generational change. The U.S. electric car company Tesla is now comparable by market capitalization to General Motors and Ford... while selling a fraction of the number of cars of GM or Ford.

Tesla is given this high valuation because it is leading the change in the mindset of consumers all over the world. Tesla is as much a tech company as much as it is a car company. And the valuation reflects that. Tesla's CEO and founder Elon Musk is a visionary who is bent on making the world a better, more technologically advanced place. And Musk is a visionary that is pushing forward his agenda of using cleaner forms of energy for everything – especially in the form of cars.

So instead of gasoline, he wants every electric vehicle to run on battery power (which is common sense nowadays). And the vast majority of electric vehicles are powered by a battery you may have heard of: the lithium-ion battery.

Due to the electric vehicle revolution and implied battery demand, lithium has been an incredibly hot sector. Albemarle, the ExxonMobil of the lithium world, is up over 150% since January 2016 (and was up as much as 200% at one time). SQM, another major producer, is up 180% since January 2016. I was an early investor in lithium junior that ended up being acquired for over \$700 million.

I have had more meetings than I can count with companies trying to get me to buy into their lithium projects.

## **What You Need To Know About EV Batteries**

In this report, we cover the demand boom in the vital elements used to make EV batteries. Conventional gas-powered vehicles have fuel tanks. EVs have batteries. Today's EV sales are only possible because of recent advancements in batteries. The same will be said about EV sales in the future.

The good news is that you don't have to try to pick a winner from among the current automotive technology leaders. You can simply sell every EV manufacturer the material they must all use in huge quantities for decades into the future.

This means that battery chemistry is incredibly important. Getting the right blend of metals to create efficient, long-lasting, and safe batteries is no easy task.

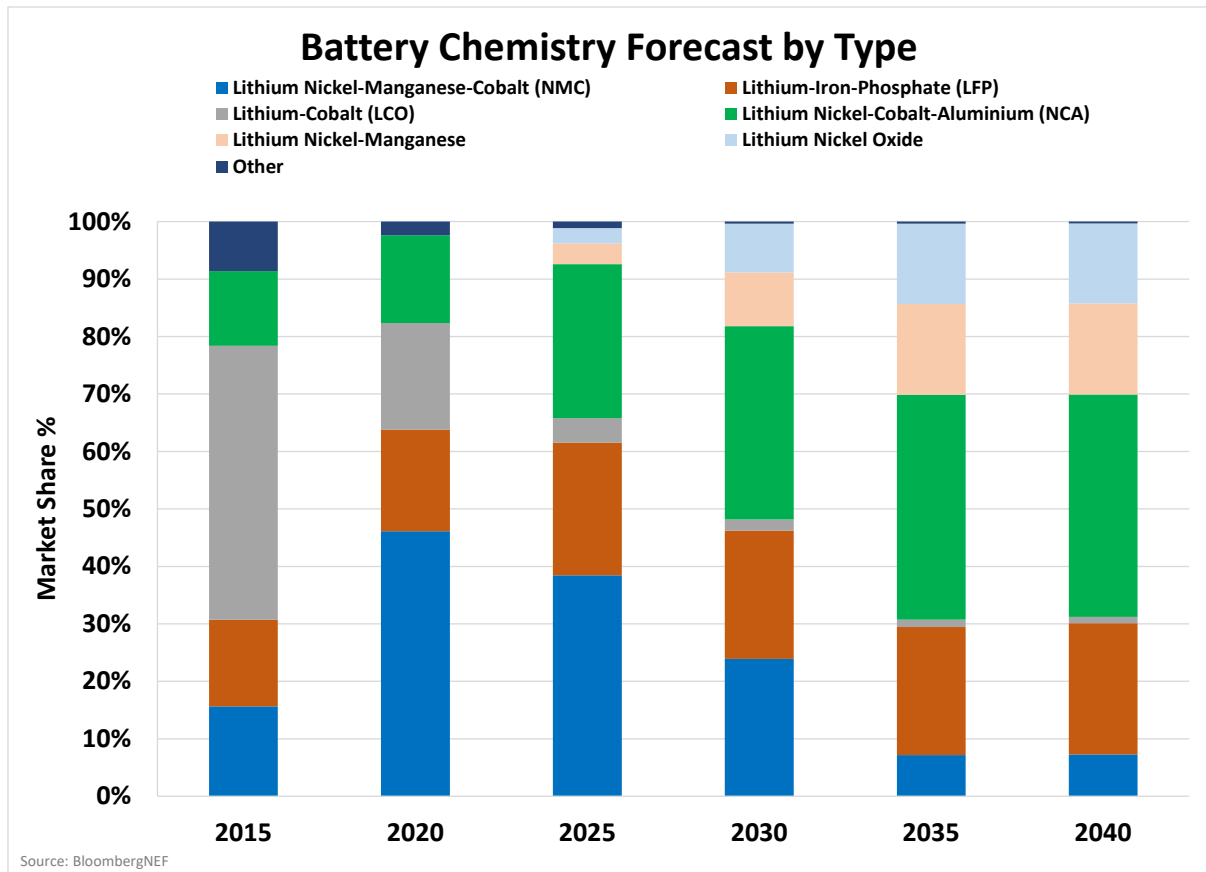
### **There are 3 main battery chemistry types**

1. Lithium Iron Phosphate (LFP)
2. Nickel Manganese Cobalt (NMC)
3. Nickel Cobalt Aluminium (NCA)

There are also a handful of other chemistries which make up a small portion of market share, these include Lithium Nickel oxide and Lithium Nickel Manganese oxide-based batteries.

Below is a chart which shows the transition in battery chemistries expected over the coming decades.





As you can see, battery pack manufacturers shifted their chemistries away from cobalt, pivoting the chemistry towards more plentiful and cheaper commodities. Tesla was the first major EV producer to move away from cobalt intensive batteries and others have and will continue to follow suit.

## In a gold rush, sell picks and shovels.

The most important takeaway from all of these battery types is this:

- **All major battery chemistries have 1 single shared metal: Lithium.**

Lithium is a key ingredient in nearly every single EV battery that is going to be produced.

## From Mine to Musk: Understanding lithium

Virtually every electric vehicle on the road today is powered by some sort of lithium-ion battery. Unsurprisingly, lithium is a main ingredient in the lithium-ion battery. However in its purest form, lithium is actually not that useful.



- **The special compound used in EV batteries is either lithium carbonate or lithium hydroxide.**

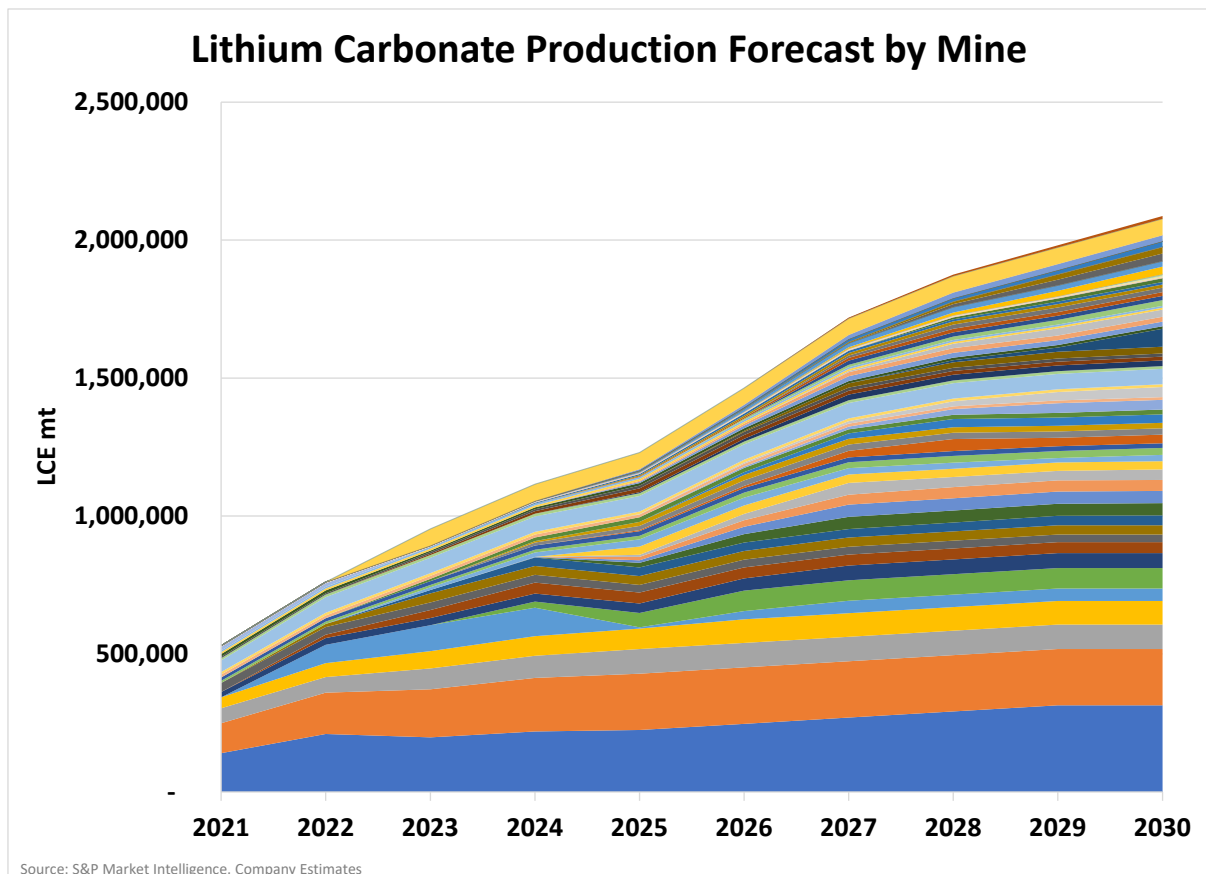
Lithium carbonate and lithium hydroxide are sourced from lithium. Lithium in its pure form does not exist, but it does exist in compounds composed of lithium and other elements. Lithium is produced either through evaporation of a lithium bearing liquid. Or through physical extract of lithium from a host rock, in a similar manner to copper or gold production. Either way lithium is separated from other elements and you are left with pure form lithium. Now you need to take this pure lithium and turn it into something useful, which is either lithium carbonate or lithium hydroxide.

Lithium carbonate is mainly prepared by sulfuric acid method. Lithium sulfate is obtained by the reaction of sulfuric acid and spodumene. Sodium carbonate is added to lithium sulfate solution and then precipitated and dried to prepare lithium carbonate.

Lithium hydroxide is mainly prepared by alkaline method, that is, it is prepared by the roasting of spodumene and calcium hydroxide, and some of them are prepared by the so-called sodium carbonate pressure method, that is, the solution containing lithium is prepared first, and then lime is added to the solution to prepare lithium hydroxide.

Before electric vehicles became mainstream, lithium carbonate demand was not particularly high. Roughly 110,000 tonnes (242 million pounds) are consumed each year by sources outside of the battery industry. The supply side was essentially built to handle a market of this size. So as the EV market has exploded in popularity over the past few years, miners have needed to bring additional production online to satisfy the demand.

Below is a chart that shows current lithium carbonate production, along with every mine that could realistically come online between now and 2030. Each colored bar represents a mine's annual lithium carbonate production (note that LCE = Lithium Carbonate Equivalent).



In an effort to meet the massive demand wave, we can see from the chart above that lithium carbonate production has the potential to increase four-fold by 2030.

That begs the question: What is lithium carbonate demand going to look like in 2023 and beyond?

To arrive at this answer, we will take our EV forecast and multiply the number of cars sold annually by the amount of lithium in each EV. Of course, each EV is going to be different. But the amount of lithium for each battery chemistry is not going to change drastically.

Conservatively, the math works out to roughly 90-100 pounds of lithium carbonate per electric vehicle.

## Lithium Demand: Back to the Basics

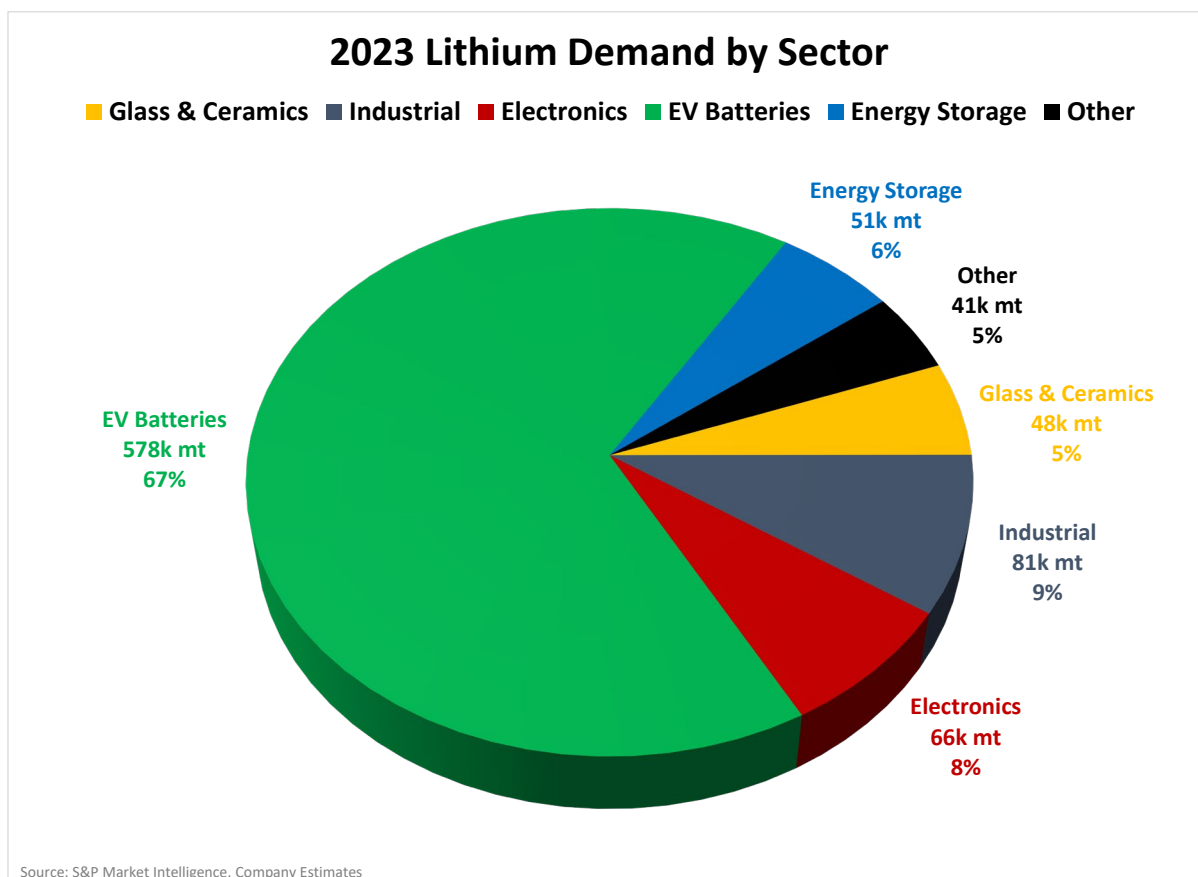
Lithium is the lightest metal on the planet.

Because of that property, lithium is used to make lightweight alloy metals for high-speed rail, planes, and armoured vehicles. Lithium is also used in lubricants, glass, ceramics – and famously, to treat depression.

Lithium is extremely abundant on earth. Only the elements hydrogen and helium are more abundant.

To put it in perspective, in 2016, 60% of all uses of lithium were for non-battery applications. In 2023, EV batteries make up 67% of lithium demand and energy storage makes up another 6%. So just in 7 years the script has totally flipped for lithium.

Below is a chart which shows the current demand for lithium by sector.

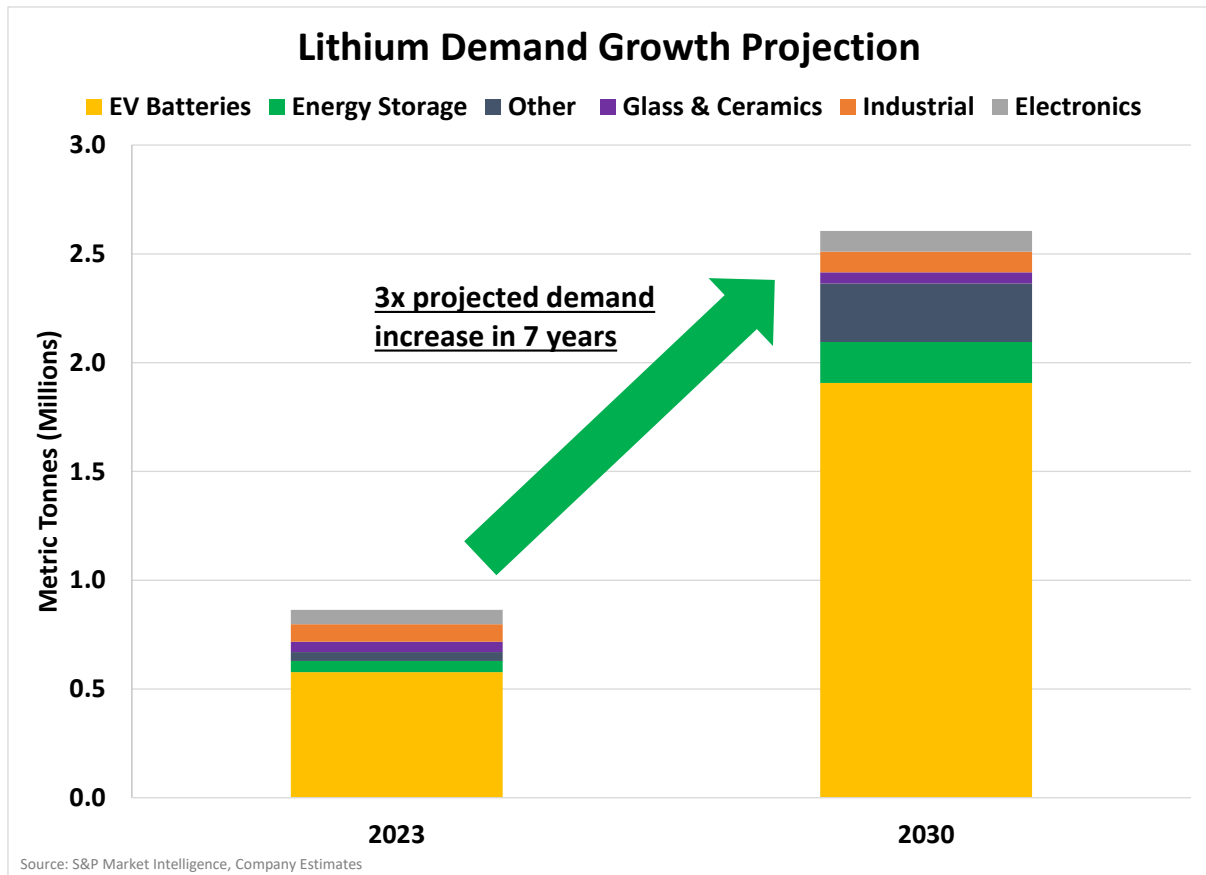


The trend here should continue. The most important growth for lithium in the future will be for battery applications... specifically for electric vehicles.

There is no denying lithium's importance will increase moving forward due to the expected increase in the number of electric vehicles. A lot of people do not realize the effects of the drastic drop in the cost of lithium-ion batteries. This is very bullish for the future applications of lithium-ion batteries in electric vehicles.

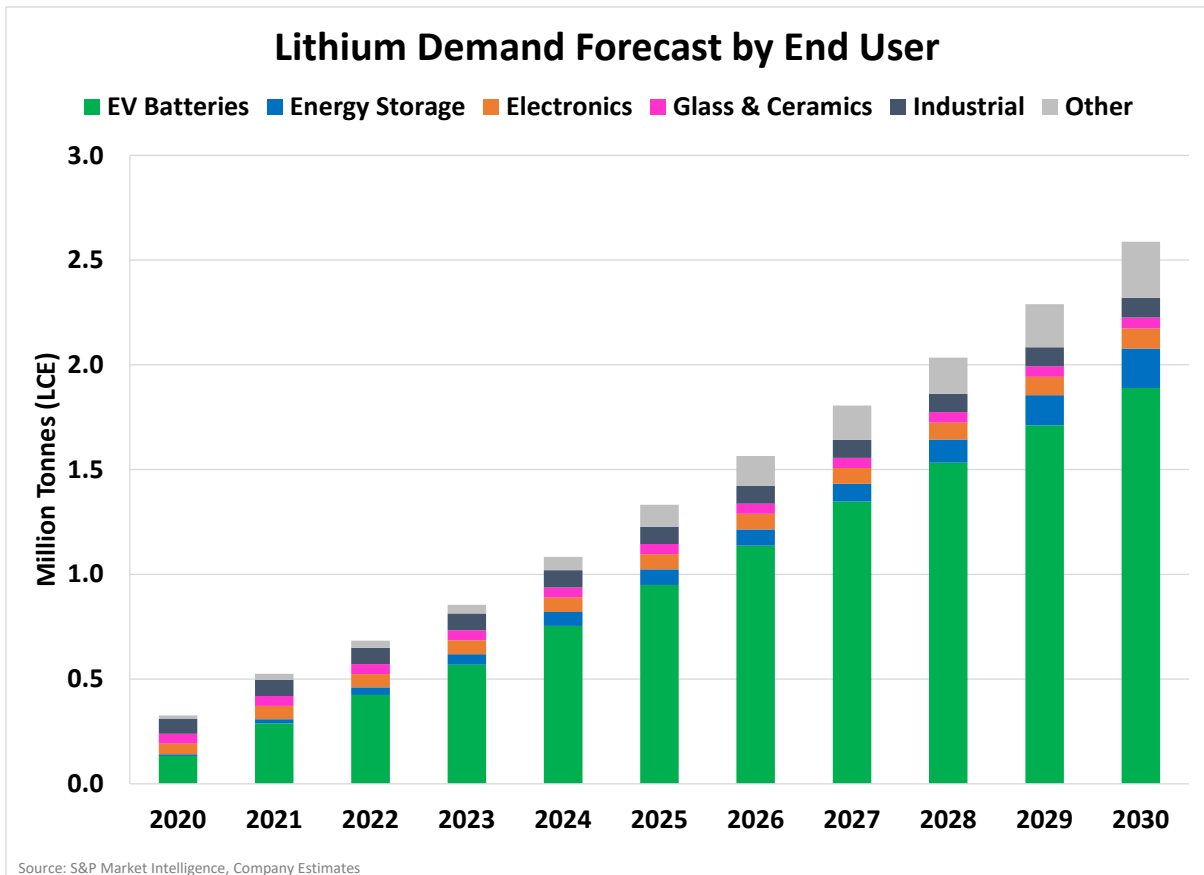
**If you do not believe in the electric vehicle revolution, save your time and stop reading now.**

The future of lithium is directly tied to the mass adoption of the electric vehicle. As you can see in the chart below, over the next 7 years, lithium demand is forecast to triple.



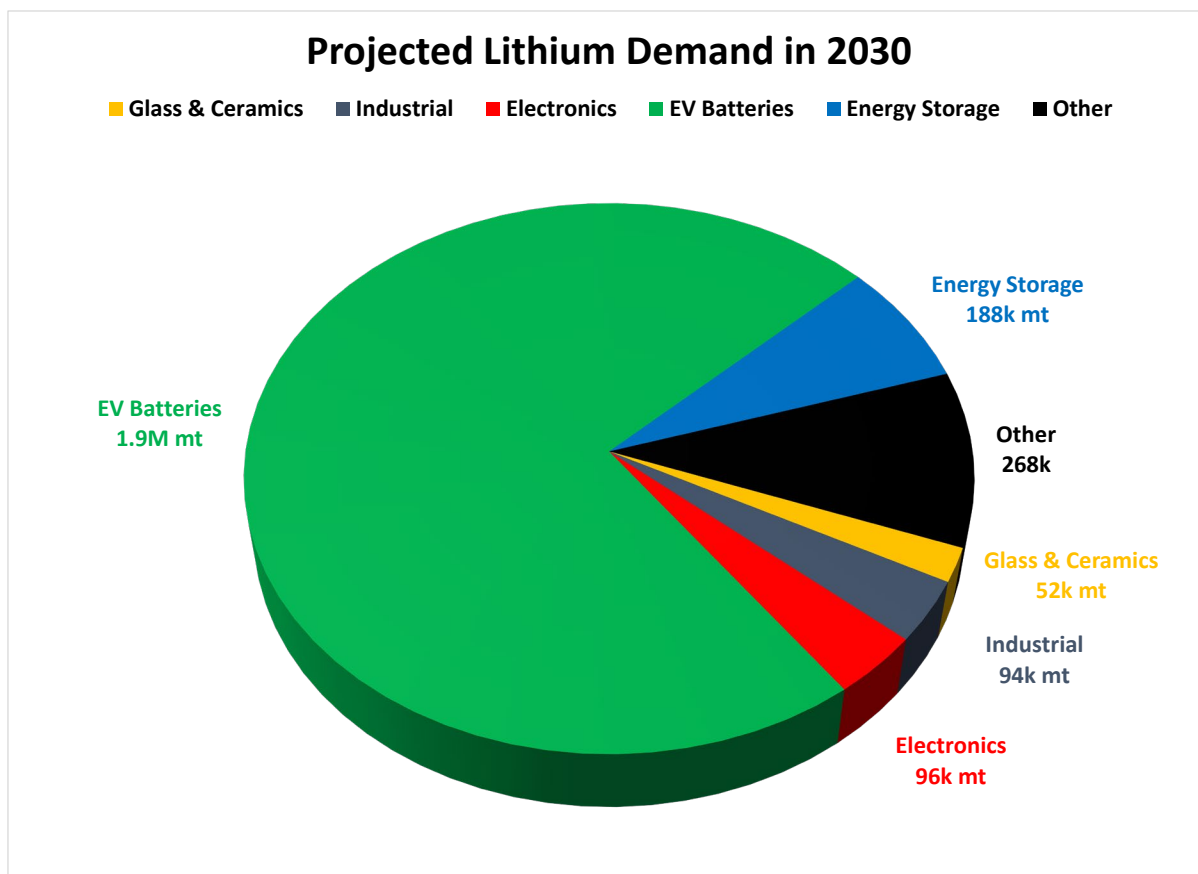
The demand for electric vehicles is real. I expect the demand will increase as more manufacturers design electric vehicles and the quality of electric cars increases.

Now, we'll get into estimates on the growth of the lithium demand for batteries in electric vehicles. As you can see in the chart below, the growth of lithium directly depends on the growth—both sales and adoption—of the electric vehicle (which can be seen in the green bar portion of the bar graph).



By 2025, electric vehicles will make up nearly 1 million tonnes of lithium demand, which is nearly 75% of the global lithium demand. There is no other metal in the world with such a clear and specific demand-growth outlook.

The pie chart below shows what the global demand for lithium per sector is expected to be in 2025. Non-battery application demand, which was 60% in 2015, makes up only 22% in 2025. The biggest expected growth is in the use for batteries in electric vehicles.



### Putting it all Together: Is a massive deficit on the horizon?

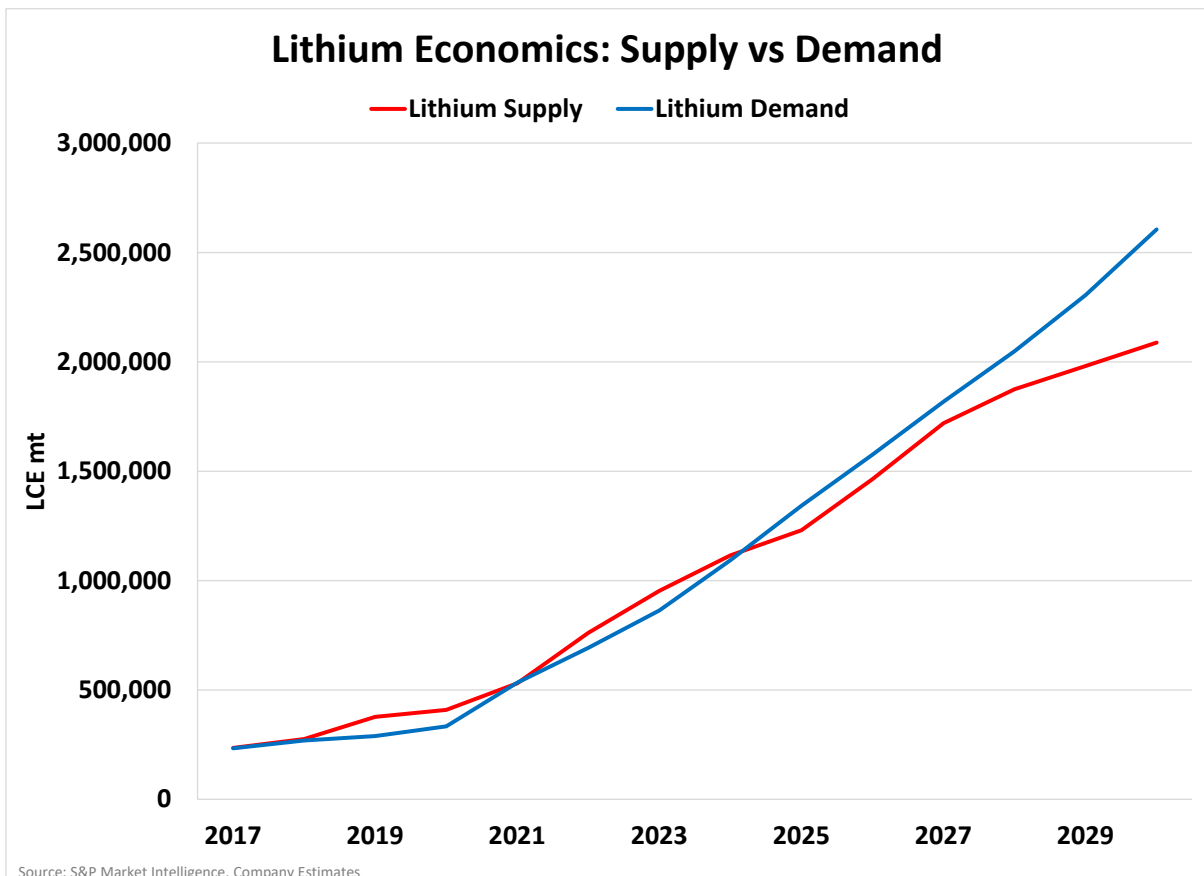
I do believe that long-term demand for lithium is legitimate. Yes, there will be bumps in the road when the economy struggles, but even over the past 6 months while the world has teetered on the brink of recession, EV sales have climbed worldwide. I do believe this trend will continue and that lithium demand is the real deal.

So if we believe in lithium demand, then the key question remaining is: How tight is the lithium market going to get?

- **By 2030, lithium required for electric vehicles will represent more than three times the current global supply.**

I painted a rosy outlook for lithium in the supply section. Let's not forget that places like Chile, Peru and Argentina, while home to fabulous lithium reserves are also places that face considerable social pressures from mining. We have seen increased social unrest in those countries and many rumours of increased taxes and royalties on commodity producers, lithium could be no different in this regard. Which will its negative for some producers, it is a positive catalyst for commodity prices due to the jurisdictional risk premium and to those companies with high quality assets outside those high-risk jurisdictions.

Below is a chart that shows the demand and supply forecast for lithium carbonate through 2030.



But that doesn't mean all lithium stocks are good speculations.

In fact, most are awful speculations.

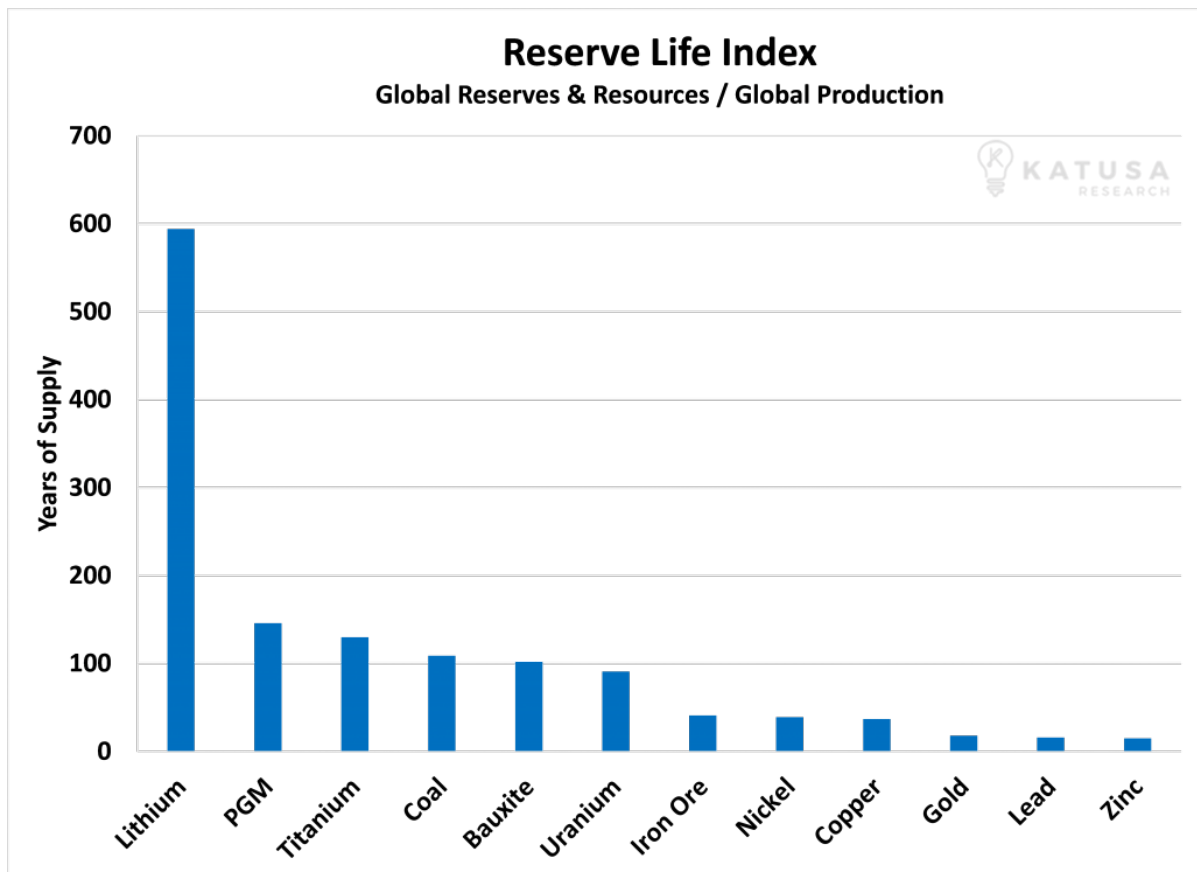
Most lithium companies do not have lithium deposits that will ever be put into production. Thus, they are essentially worthless. The point of this report is to explain what it takes for a company to have a successful lithium project.

Before we get into project specifics, I want to provide the current status of the lithium sector as a whole.

Lithium is in no shortage.

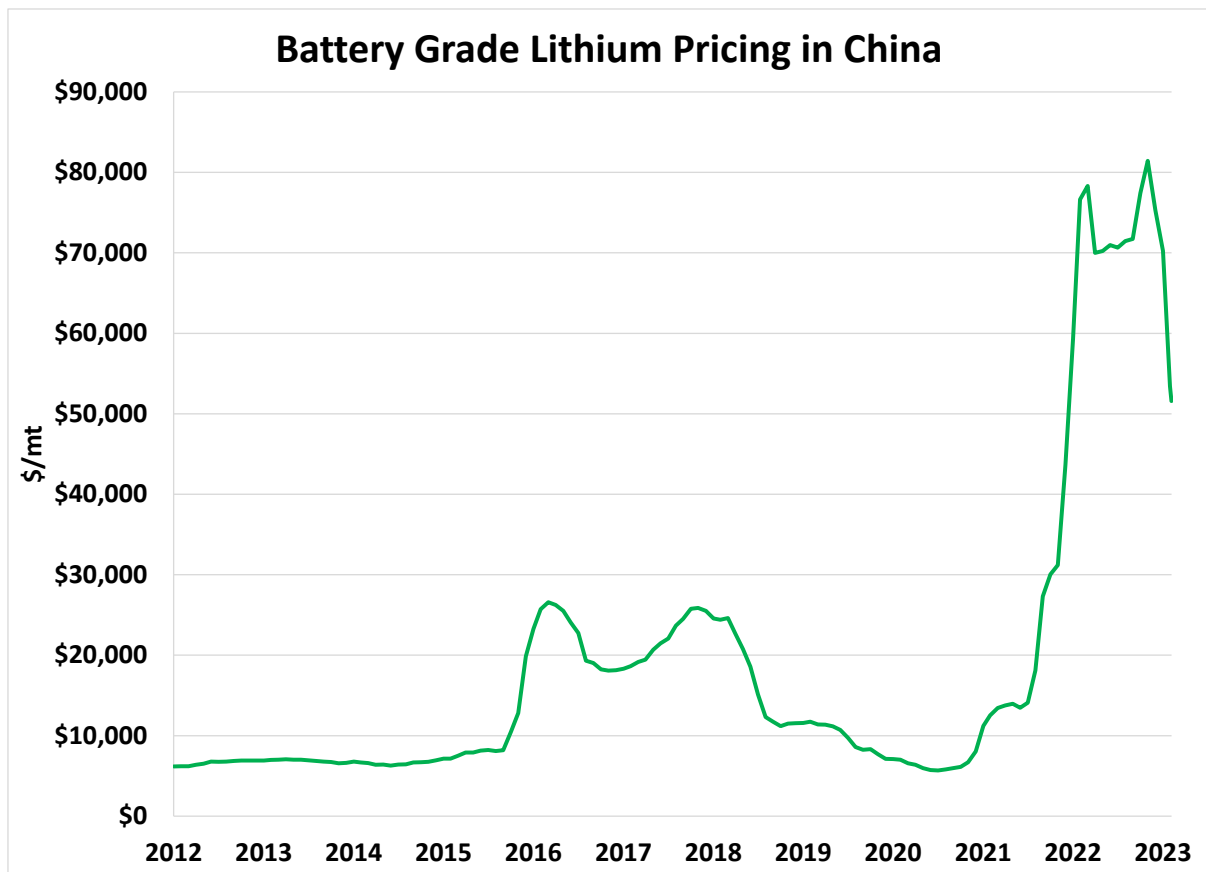
For example, there is so much lithium on earth that it dwarfs supplies of copper and gold. Currently, there is over 600 years of known lithium supply on the planet. The chart below shows various resources and the years of known supply we have of them. Lithium has the highest amount of reserve life of any metal on the planet in the ground (not above-ground stockpiles).





But the price of lithium has been on fire for the past 24 months. It has climbed in price because of a significant increase in battery-grade lithium demand, and refiners have been scrambling for above-ground supply.

The price performance of battery-grade lithium, which is 99.5% lithium carbonate, is below. It's one of the best performing metals in the world over the last 24 months. The price of battery-grade lithium sold in Asia has soared from less than \$10,000 per ton to more than \$50,000 per ton.



I do not believe the current high price for battery-grade lithium is here to stay. There is just too much supply in the ground available that is economic at current prices. It is reasonable to expect efficiencies and new expansion of existing projects and new top-tier projects to lower the current price for battery-grade lithium by at least 20%.

The only reason the price hasn't dropped yet is because it takes many years for a mine to put the metal into production. So there is a time lag to production.

Do I think prices are going back below \$10,000/tonne? No I don't. But I don't think the all-time high of \$80,000 a tonne is particularly realistic either.

Producer margins are very healthy in the \$35,000-\$50,000 per tonne range.

## Understanding The Lithium Monopoly

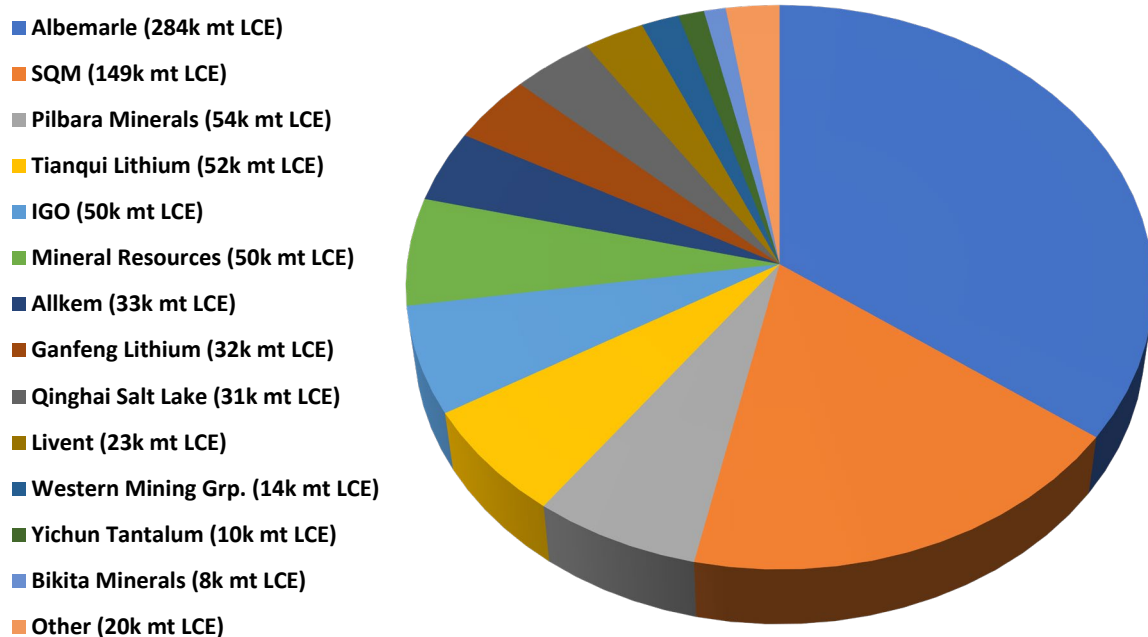
If you can believe it, there are 2 key players in the lithium sector.

1. Albemarle, a USA based publicly traded company.
2. Sociedad Quimica y Minera del Chile, or SQM for short which is the Chilean state owned producer.

Combined, those 2 companies produce over half the world's lithium. Then there are the "mid-tiers" which produce around 50,000 tonnes of lithium per year. Then come the "juniors" which produce below that 50K threshold.

Below is a pie chart which breaks down global lithium production.

## 2022 Global Lithium Carbonate Production by Company



Source: S&P Market Intelligence

With the recent spike to all time high lithium prices, many new projects can get financed and attempt to come into production, or previously uneconomic mines get put back into production.

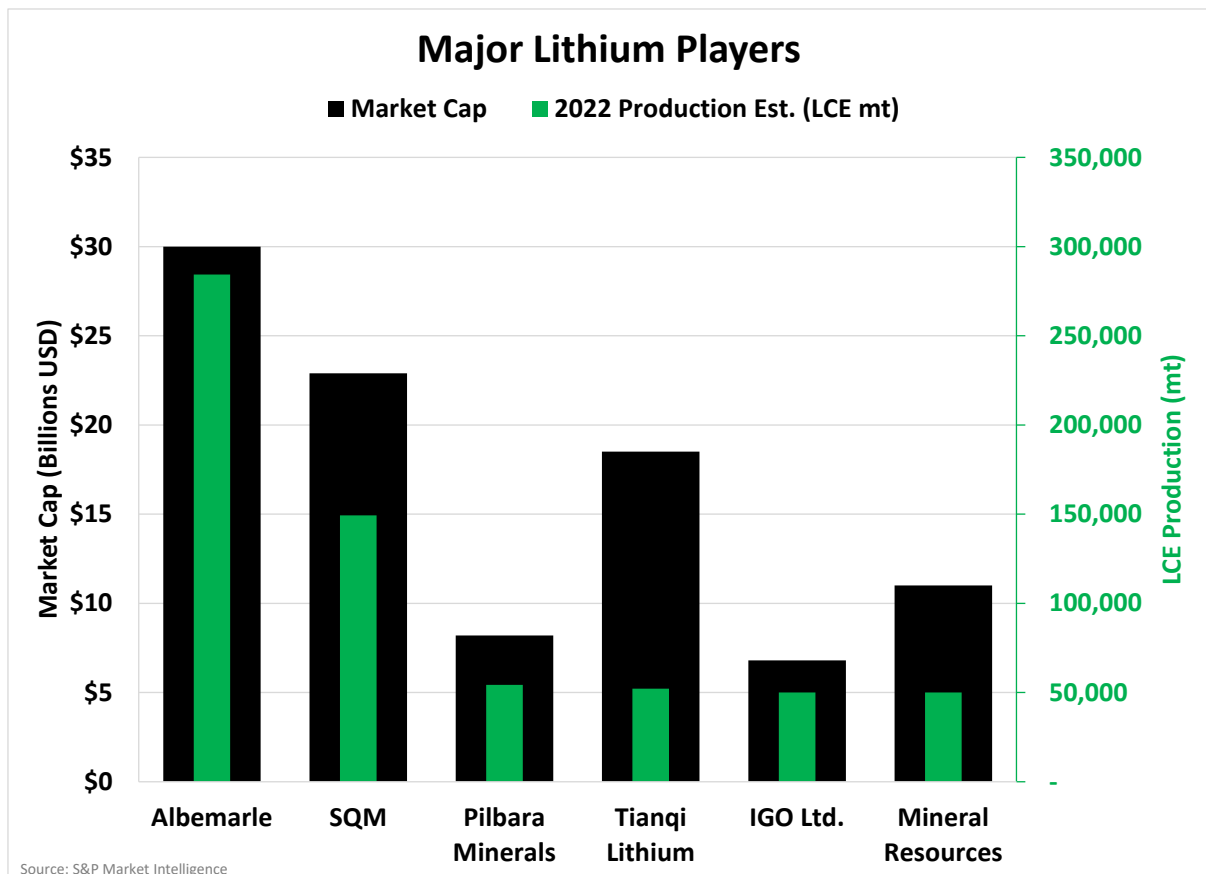
The largest lithium producers shown above will not simply let new entrants into the market. When only a few companies control 80+% of the global supply of a specific metal's production, one can safely call that an oligopoly. Oligopolies come with different market characteristics.

So, one of three things can happen:

1. The Big Two will buy out any of the juniors or mid-tiers that pose a real threat to their oligopoly.
2. If given enough time, the Big Two will produce more lithium and the price of lithium will drop significantly. This will make it uneconomic to bring any new production online.
3. All of the top mid-tier lithium companies with near-term lithium projects will merge to create a competitor.

I've been in the resource industry for almost two decades – and I just don't see option 3 ever happening. That leaves only two options.

The chart below shows the market share and valuation each of the six largest lithium producers. Each of these companies have big market caps, big balance sheets, and large, long-life lithium deposits.



In an monopolistic market, where just a few companies control such a large market share, two things usually happen. The largest companies will produce more lithium, and as a direct result, the price of battery-grade lithium will drop; **and** during that time lag of more lithium production coming online, the largest companies will buy out the juniors which have the best lithium deposits.

**This all leads to my point... If you speculate in lithium, you want high-grade, large, low-impurity and low-cost production.**

Here are the four most important factors you need to focus on for a lithium speculation.

1. Grade
2. Size
3. Impurity levels
4. Cost of production
5. Emissions output

Let me start with **cost of production**.

We have already established that there is no shortage of lithium. The companies that will win in the lithium space will be companies that are able to come to market quickly and with a low cost of production. You only want to be exposed to (own) stocks that will be the lowest cost lithium producers.

There are only three types of lithium deposits that have any real chance of going into production globally:

1. Salars,
2. Spodumene, and
3. Hard rock deposits.

First off, don't even bother with low-grade hard rock lithium deposits.

Hard rock lithium deposits (in almost all cases for undeveloped projects) will be a high-cost producer. The cost to blast, crush, and extract the lithium out of the host rock cannot compete with the lower half cost of current lithium production.

And the cold hard truth for many junior lithium explorers is that the lithium grade and size of the lithium resource required to make a spodumene deposit economic is very rare.

Not a single deposit owned by a junior will be in production for at least 3-5 years. It takes that long – in a best case scenario – to put a well-defined economic deposit into production. It usually takes longer.

The world's largest producing lithium mine is located in Australia, and is called Greenbushes. It is a spodumene deposit jointly owned by Albemarle and Tianqi. It produces over 200,000 tonnes of lithium carbonate every year. The operators have managed to get production costs down towards \$2500 per tonne. The average Australian spodumene mine has a production cost of \$3500 per tonne.

The third type of lithium deposit is a salar.

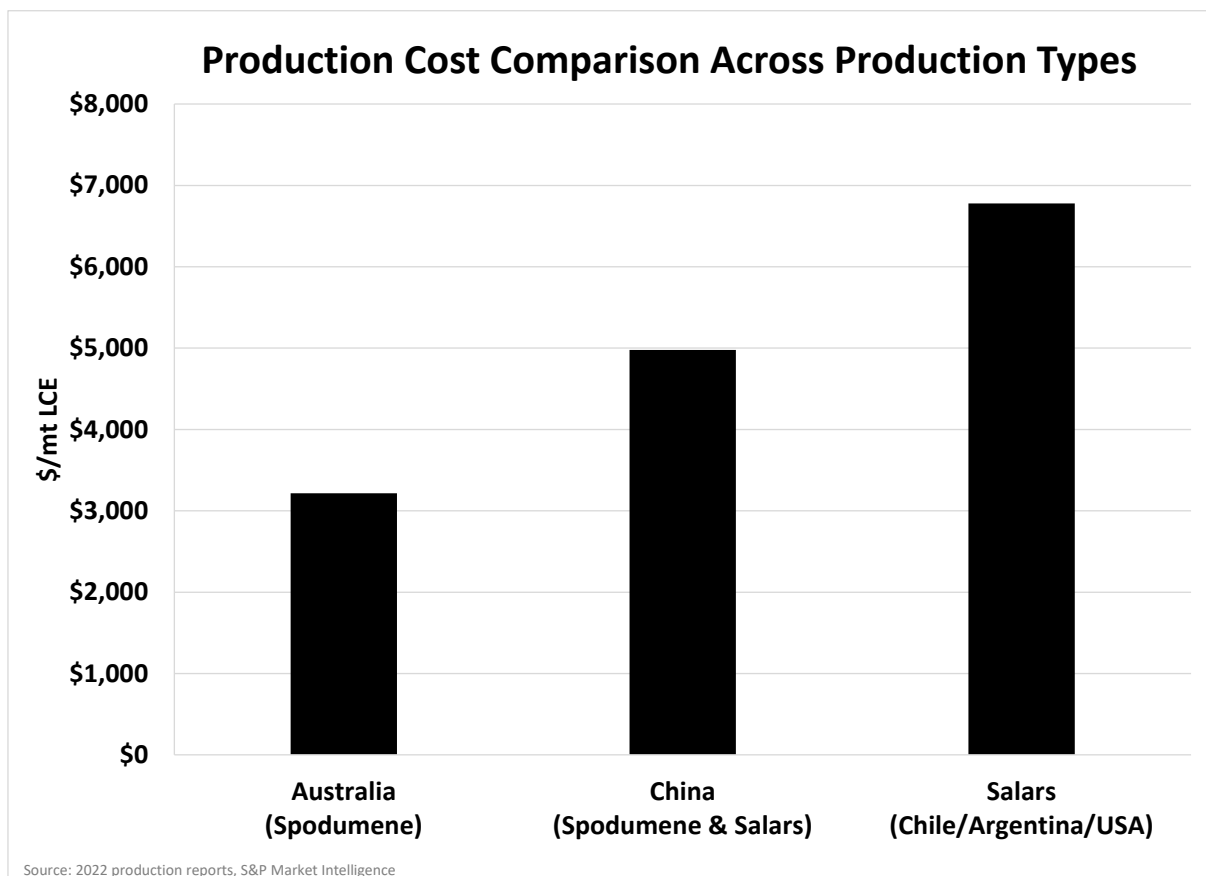
A lithium salar is a brine reservoir (think of a very salty lake) that is filled with hypersaline lithium bearing brine (salt water – not fresh water). There is no rock to blast, move, crush, or extract the lithium out of. The production process is about as simple as it can get. Basically, evaporation ponds are created from the salars, and the material left over is very high-concentrated lithium-bearing salts and other minerals. Unlike the spodumene deposits, salars have a "recharge rate" which means new lithium bearing liquids can flow directly into the formation.



*Pictured above is the Salar de Uyuni in Bolivia. It is the world's largest salt flat.*

In addition, there are no crushers, ball mills, large trucks, or shovels.

Below is a chart which shows the production costs across lithium deposits worldwide.



It may surprise you that open pit mining is lower cost than the salars.

There are a few reasons for that.

High altitude can impact evaporation even in very arid climates which in turn impacts recovery rates and raise costs. Known as reagents, these are the compounds that assist in separating lithium from the brine. These are expensive and typically have a cost close to \$2000 per tonne. Now recall, salars are typically found in jurisdictions such as Peru, Chile and Bolivia. These nations have material interest Tack on royalty rates which are typically another 3000-4000 per tonne and all of sudden margins are considerably tighter. Furthermore, most salars are found in regions with high energy costs, which in turn can add upwards of \$500 per tonne to the cost to produce lithium.

### **Emissions in Lithium Extraction**

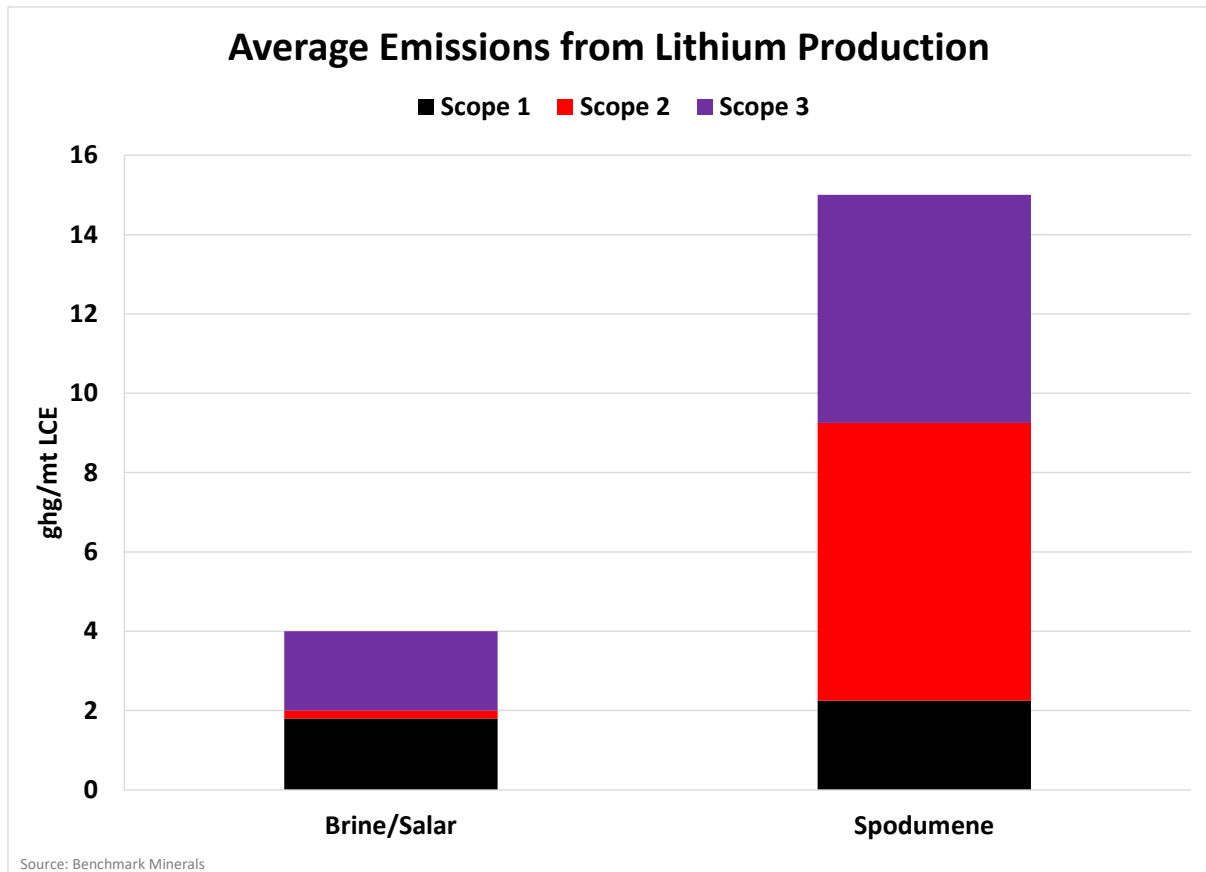
An issue that few investors realize is that the extraction process for spodumene and hard rock deposits can generate a large quantity of greenhouse gases. That makes the “green metal” pretty “un-green” quite quickly. In fact, on average spodumene mines generate up to 3x more greenhouse gases than salar operations. This is due to several key factors.

1. Non-renewable forms of electricity at the mine and processing facilities
2. Gasoline/diesel consumption at the mine sites
3. Shipping the lithium concentrates to China.

Outside the emissions scope, but still on the environmental angle is the fact that spodumene mines can require nearly double the amount of water to produce lithium, compared to salars.

A chart showing the average emissions per tonne of lithium carbonate produced is shown below.





As you can see in the chart above, spodumene mines really aren't that green and have much higher greenhouse gas emissions than salar operations.

At a spodumene operation, the largest drivers of emissions are going to be the power generation source at the mine site and the gasoline or diesel powered transportation required to move ore around the site. It is ironic that many of these mines are actually quite dirty, yet are deemed to be mission critical to the EV movement.

At a salar operation, the largest emissions component is soda ash, which is used in the evaporation process.

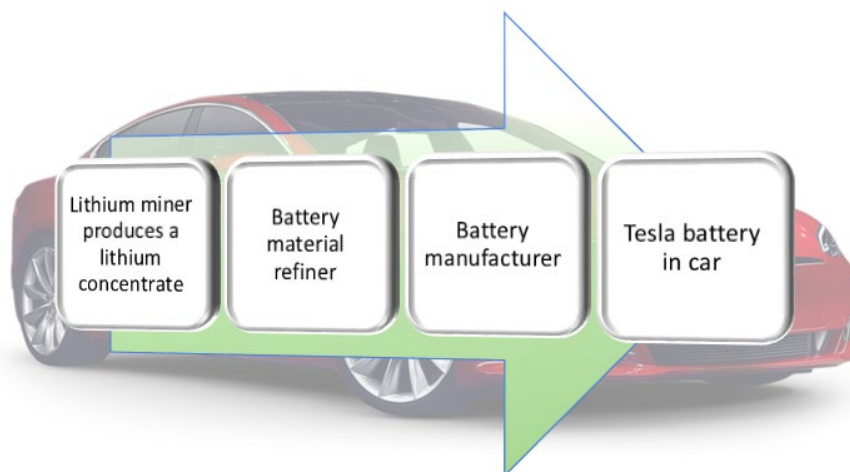
### **NOT ALL SALARS are created equal**

Here is the secret for salars: chemistry matters. Impurities, meaning non lithium compounds found within the salar will greatly impact the time it takes for evaporation and the end quantity of lithium produced.

Here's another crazy fact for you.

There are less than a dozen teams globally who have actually built and operated a lithium salar to produce a lithium concentrate that a battery manufacturer can turn into a Tesla battery.

Think of the production chain in these steps:



It's obvious that over the next few years, the winners in the lithium mining sector will be those who win the race to high-quality lithium concentrate.

And that takes us back to understanding the chemistry. This includes having a high-grade, low-impurity, low-cost operation, and most importantly, good people. You want the people who have the know-how to actually produce a quality brine that will be turned into the battery-grade lithium concentrate the manufacturers want.

Every brine has a unique chemistry (think of it as DNA). Each lithium salar has its own chemical compositional characteristics which will require its own unique process for lithium extraction. This is where the people become so critical; as stated earlier, there are less than a dozen teams globally that have the experience and know-how to tackle these processing issues.

**Over my 15-year career, I've invested in just three lithium juniors.**

**The first two were both very big wins, returning over 1,000% each, and the third was a 200% gain.**

I have a complete database of all the salars in Chile, Argentina, and Bolivia that I first compiled in late 2008 and have added to since.

The irony of the sector is that most of the companies are run by management teams who have no clue what chemistry will make a profitable lithium concentrate. Never mind them actually having the right salar. Actually, most management teams running a junior lithium explorer would not pass Chemistry 101.

Because of the very large price appreciation of battery-grade lithium, the lithium sector as a whole has attracted "*Johnny come lately's*."

I call these people *rounders*, because they are always "around" and creating crappy new companies in whatever sector is hot at the time. Rounders are fly-by-night entrepreneurs who raise early seed capital from their supporters, then hire a bunch of geologists and grab some very early stage projects that are located in "promising" areas, also known in the industry as an "area play". These assets are

almost always crappy, but they are touted as the answer to Tesla's future lithium needs. The rounders sell stock to the unsuspecting public after it has been promoted.

When uranium was hot in early 2006, these rounders made up the majority of the 1,000+ exploration companies in 2007.

When rare earth metals were hot in 2010, they were around en masse in 2011.

When graphite was hot in 2011, they were around.

And they are now doing the same for lithium. There are now literally hundreds of lithium exploration companies, both public and private.

Be aware of the rounders. Some may mean well, but the reality is they don't have the technical ability, know-how, or financial endurance to create a low-cost producer or a resource package that one of the Big Four will want to buy out.

The lithium sector is currently full of promotion, excitement, and expectations, and a lot of that has to do with Tesla and Elon Musk.

I've seen this before. Been there, done that.

I can confidently say that you do not want to own most of the companies currently in the lithium sector. That said, there will be a few winners in the sector. I do not view a "winner" as a stock promotion that doubles or triples. The next 3-5 years will prove that the real winners will be those who win the race to production with a high-quality, low-cost lithium concentrate.

## **So Marin, Where Are You Putting Your Money?**

All the research I've done tells me that if you are a lithium explorer without a resource, it's going to be tough to break into the market. My basic conclusion is to stay away from early-stage projects that will not threaten the existing dominant producers.

I believe the lithium market has already begun to mature. Many of the main projects will be coming online within the next decade. Investing in the sector is now more of a trend-following investment, rather than a new sector with explosive growth.

I believe lithium producers will do well, along with companies who have large lithium reserves in low-risk jurisdictions. There are ample opportunities for making the lithium extraction process at salars and open pit mines more efficient, which paves the way for higher margin operations.

Regards,

Marin Katusa

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