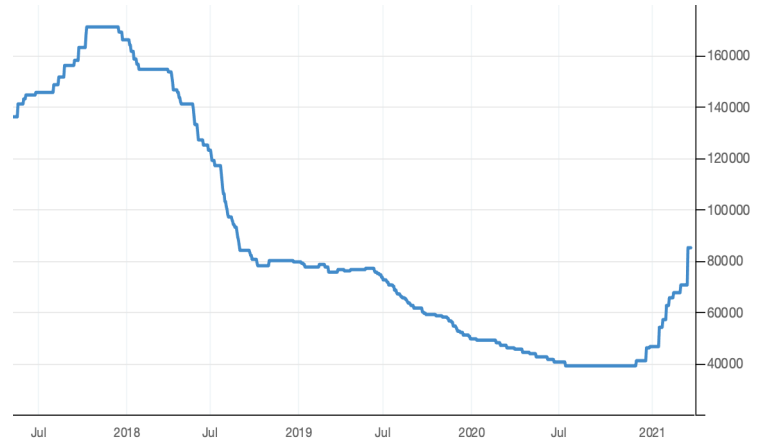


LITHIUM CARBONATE

Publish Date	22 MAR 21
Sector	Resources
Current Price	\$8,250
12 Month High	\$9,000
12 Month Low	\$3,950
All-Time High	\$17,100
All-Time Low	\$3,950

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Lithium Carbonate (USD/t)

Source: Trading Economics

MARKET OVERVIEW

Lithium is a popular metal used extensively as an electrode and electrolyte material in disposable and rechargeable batteries. The chemical element in lithium has many uses, but its most notable benefit is in batteries, glass & ceramics, rocket fuel, and lasers. Lithium-ion batteries are high-energy rechargeable batteries mostly used in portable devices like smartphones, laptops, cameras and other electronic devices.

Global Lithium Deposits



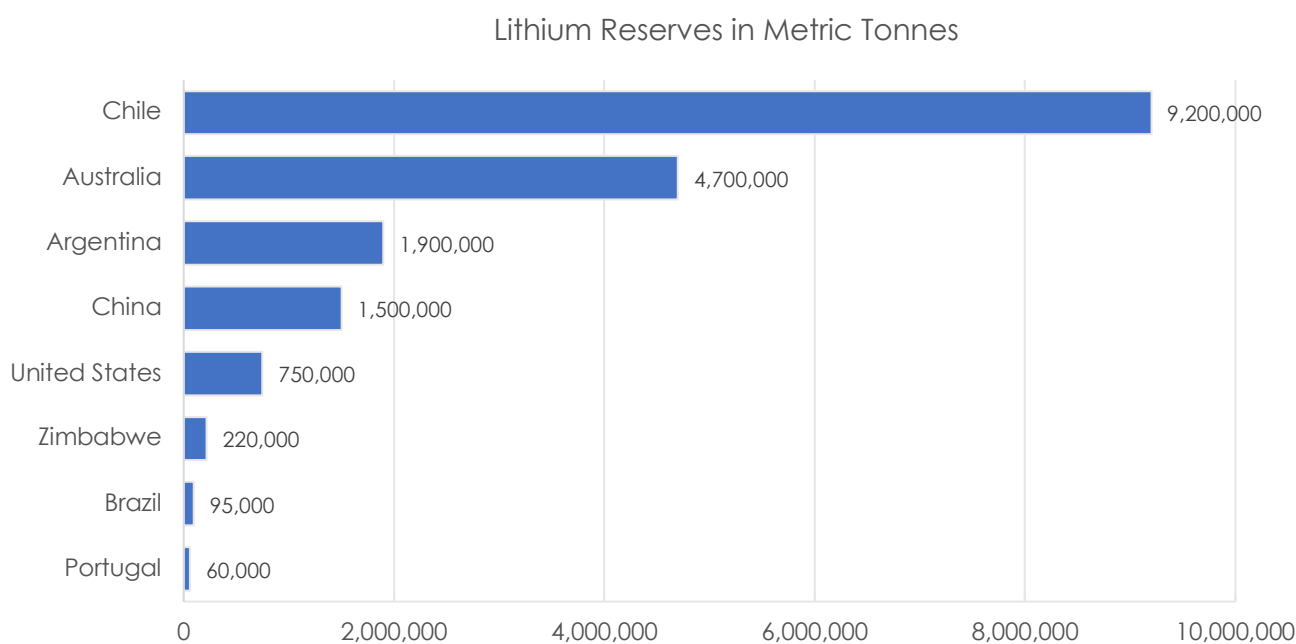
Source: Reuters

The primary sources of lithium are brine lake deposits, pegmatites, and salts in marine springs. Pegmatites are coarse-grained igneous rocks formed by magma's crystallisation at a depth of the Earth's crust. Other potential sources of lithium are clays and seawater. Lithium constitutes about 0.002% of the Earth's crust. Brines with high lithium concentration is available in the Salars in the Lithium Triangle of Chile, Bolivia, and Argentina. In contrast, Salars with lower lithium concentration can be found in the United States and the Tibetan Plateau. Lithium chloride is extracted from alkaline brine lakes before being converted into carbonate in the brine production process.

Until the 1990s, the lithium chemical and the metal market was dominated by American production from mineral deposits. By the turn of the 21st century, most of the production was derived from non-U.S. sources. Currently, Australia, Chile, and Zimbabwe are the world's largest suppliers.

LITHIUM SUPPLY

Chile has an estimated 9.2 million metric tons of lithium reserves. Australia comes in second with reserves estimated at 4.7 million metric tons.



Source: S&P Global

According to the Wilson Centre, 58% of the world's lithium reserves are in the Lithium Triangle. While lithium produced from brines should be cheaper when compared to hard rock (spodumene) producers, many of the brine reserves in the Lithium Triangle sit in remote areas with little or no access to the infrastructure required to put a mine into production. Miners in the Lithium Triangle that can bring a mine into production should see significantly lower production costs, as the raw product in this area seems to be of a much higher level of purity than other jurisdictions.



The Lithium Triangle holds 58% of the world's Lithium

Source: Latin America Post

While the cost of infrastructure may have deterred many explorers in these remote areas while the lithium price was at recent lows, should the price of lithium continue to rebound strongly, we should start to see more projects come online as the CAPEX associated with mining in remote locations becomes less of a factor. Despite typically being more expensive to produce lithium from hard rock compared to brines, existing infrastructure from the mining of other minerals in these areas lowers the CAPEX requirements required to bring these mines into operation.

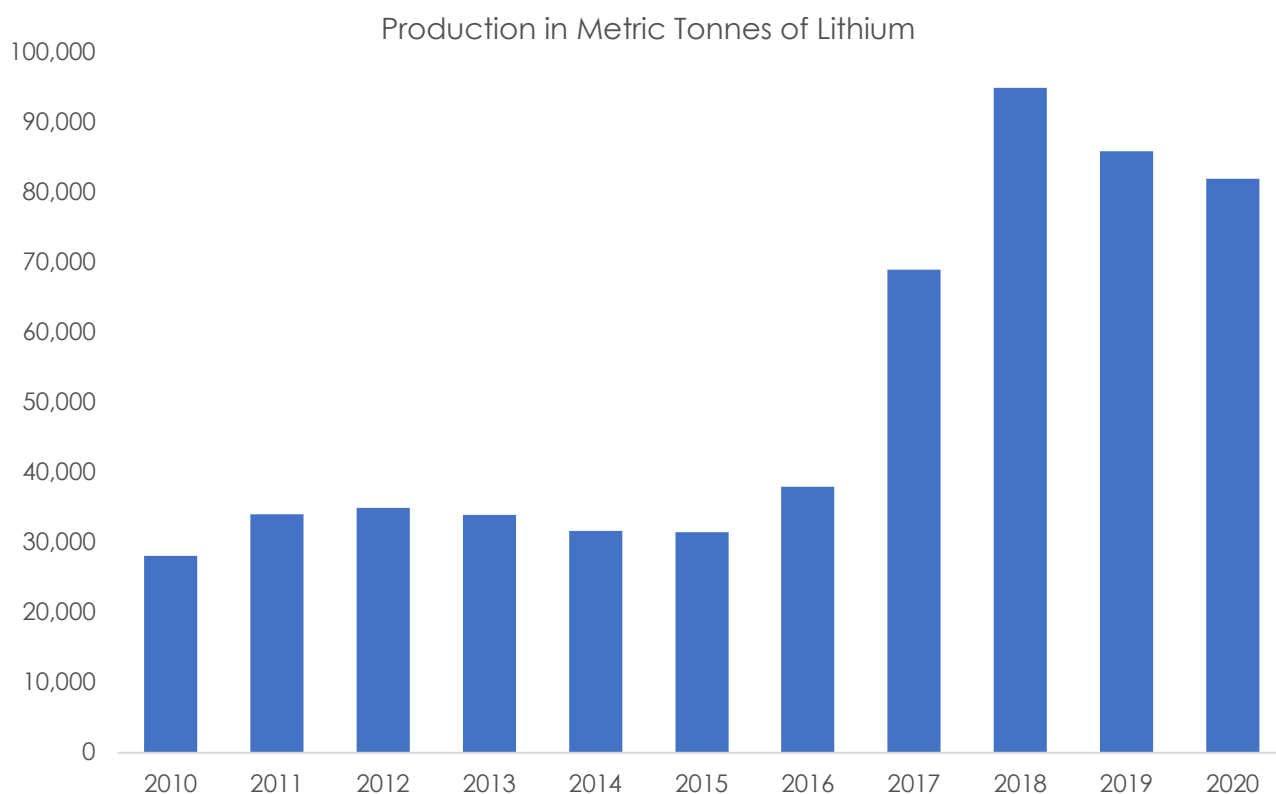
One of the benefits of producing lithium from hard rock can be the by-products such as petalite, which can be used in the production of glass ceramics. By-products such as petalite can be on-sold for a credit which can reduce the overall production costs of lithium. Zimbabwe's spodumene is rich in petalite, and lithium developers in the area have been securing off-take agreements for their petalite lowering their production costs before production has even begun. Lepidolite is another good example of a hard rock source of lithium with an array of high value by-products which have the potential to substantially reduce the cost of the final lithium product.

Southeast Asia also offers good prospects for lithium production, and its proximity to the advanced Asian industrial centres offers some key advantages. Thailand in particular is South East Asia's largest auto producer and the 4th largest in east Asia behind China, Japan and Korea. Thailand wants to retain its auto manufacturing leadership position and to do so has introduced very competitive incentives to entice auto manufacturers to produce EVs in Thailand. As a result, Toyota, Honda, Nissan, Mercedes, BMW are currently producing or planning to produce EVs in Thailand

“The South East Asia Tin and Tungsten Belt has granites with lithium rich pegmatites, lithium rich metasediments, and possibly associated geothermal lithium around the lithium rich granites, which in some cases sit in active geothermal fields.”

Paul Lock, Pan Asia Metals Limited

Lithium mines produced an estimated 82,000 metric tons in 2020, which was a significant increase from 28,100 metric tons in 2010. Australia was the top country in Lithium production in 2020, producing around 40,000 metric tons that year. According to Bloomberg, the global lithium battery market is projected to grow substantially in the coming years from USD 343,521.50 million in 2018 to USD 896,521.30 million by the end of 2025 at a compound annual growth rate (CAGR) of 14.68%.



Source: Bloomberg

“The raw material race is unfolding. USA and Europe are now playing catch up and competing with China to secure supply. All the lithium hydroxide production being developed needs raw material. Pressure to secure spodumene is expected to intensify, as existing production have forward sold their supply.”

Sam Hosack, Prospect Resources Limited

The lithium market's supply-side constraints have hindered expansion plans, with several projects temporarily suspended. The supply-side depends on incentivising prices to encourage existing players to expand capacity and assist new players in entering the market. Despite the gradual expansion by existing producers in new developments and increasing Lithium volumes from various secondary sources, the demand growth continues to rise faster than supply. Thus, large investments are the key to lithium production throughout the supply chain. According to GlobalData, 2010-2017, lithium supply witnessed an annual growth of 6.4%. The forecast estimates the global output will reach 154Kt between 2018-2022.

LITHIUM DEMAND

Lithium has witnessed a surge in demand in the recent past. According to a report by Roskill, the global demand could surge by 19% per annum up to 2030. The demand growth could create a tight market situation, support lithium prices, and lead to new lithium production commissioning. Benchmark Mineral Intelligence estimated that in 2021, lithium's total demand would grow over 400,000 tonnes of lithium carbonate equivalent (LCE) for all applications. In 2019, rechargeable batteries accounted for 54% of the total lithium demand, mostly from Li-ion battery technology. The growth drivers are Li-ion batteries in the automotive and energy storage systems, higher industrial uses of lithium products, and other applications.

“the growth of individually owned off-grid power sources requiring battery storage and support from local governments and energy providers in moving towards a green energy revolution.”

Bruce Richardson, Anson Resources Limited

In one of his first acts as US President, Joe Biden has flagged his administration's intent to invest in green energy which will require energy storage, mainly with lithium-ion batteries. The President's comments saw a flood of new investment into the sector.

INDUSTRIAL USE

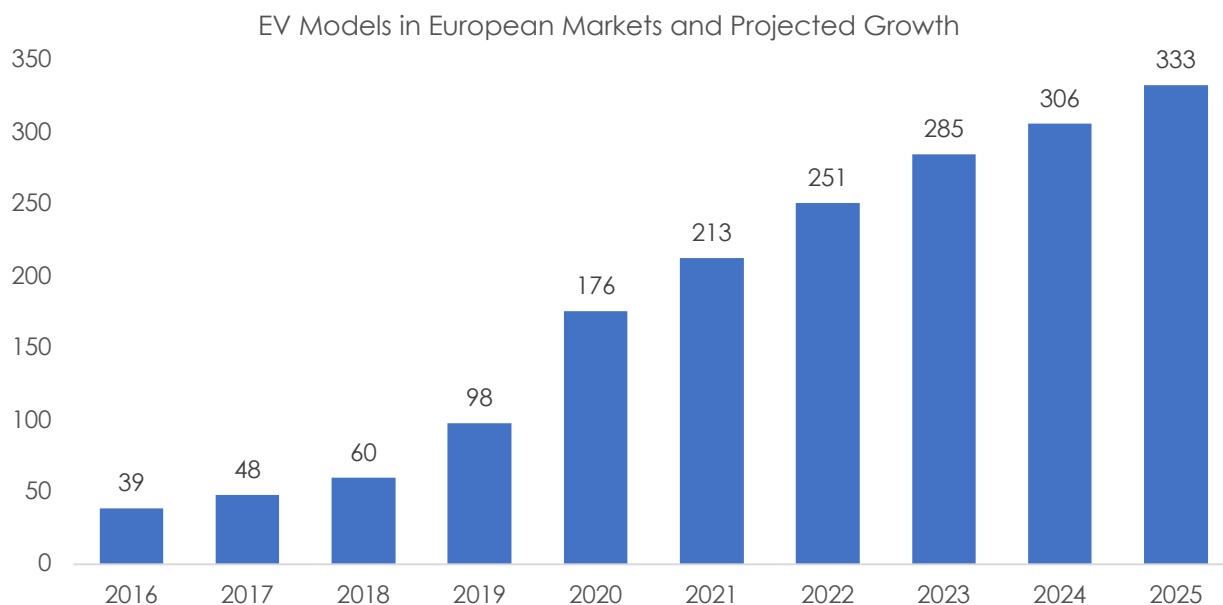
Lithium's primary application is in industries like batteries, glasses, ceramics, pharmaceuticals, aluminium, and magnesium alloys. The EV industry is the primary consumer of the Li-ion battery. The transition to 5G technologies is another sector creating opportunities for rapid growth in battery demand.

Lithium-ion (Li-ion) batteries are high-energy rechargeable batteries and mostly used in electric vehicles. The growing awareness to reduce carbon footprint, the long life and low maintenance of Lithium-ion batteries have enabled it to penetrate the automobile sector. Several countries around the world demand Energy storage systems (ESS) that aim to reduce carbon emissions and encourage clean energy technology, which will, in turn, accelerate product penetration. According to Bloomberg, there would be around 500 EV models globally by 2022 (might be delayed due to Covid). The Passenger EV sales jumped from 450,000 units in 2015 to 2.1 million in 2019. The sales could rise to 8.5 million by 2025, 26 million by 2030 and as high as 54 million by 2040.

“Electric vehicles are the future. Automotive OEM's not centring their strategy on EV's will be left behind”

Sam Hosack, Prospect Resources Limited

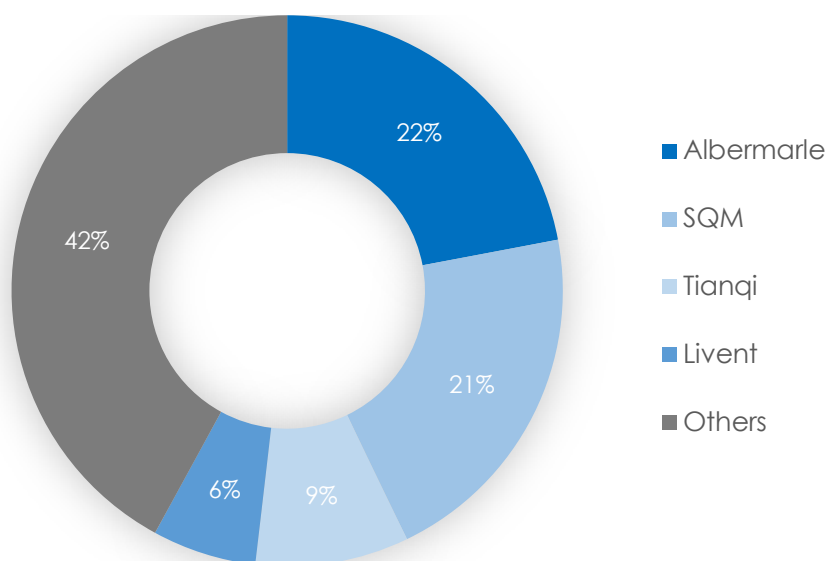
Compared to total vehicle sales, the EV's market share is still small (2.7% in 2020). According to Bloomberg, the market share could grow to 10% by 2025, but by the end of 2040, over half the passenger vehicles sold are likely to be electric. Up to 50% of an EV's cost is its battery pack; it is the largest factor in the price difference between EVs and regular vehicles. This differential could change as battery prices decline along with subsidies granted to EV manufacturing and distribution in many countries.



Source: Bloomberg

TOP LITHIUM PRODUCERS GLOBALLY

For many years lithium production has been dominated by North Carolina-based Albemarle, Chile's Sociedad Química y Minera (SQM), Philadelphia-based FMC, and China's Tianqi Lithium. In fact, these producers controlled more than 58% of the world's lithium supply in 2020.



Source: S&P Global

ALBEMARLE (USA)

The company is operating since 1997 with a pilot plant in Kings Mountain, NC. The products include a wide range of new chemicals, including amides, hydrides, and alkoxides. The lithium bromide brine has uses in industrial absorption refrigerators, lithium bromide anhydrous for dehydrobromination reactions of organic compounds, and conductive salt in lithium battery electrolytes.

Albermarle is one of lithium's leading manufacturers with an 800-acre site for the lithium battery industry, including lithium ingot and lithium metal foils. In 2012, the company completed a new 5,000 metric ton battery-grade lithium hydroxide plant and a new 57,000 square feet Global Technical Centre that will contribute to Kings Mountain, making it one of the most sophisticated lithium material sites globally.

SQM (CHILE)

SQM is a global company focusing on a wide range of sectors, including health, food, clean energy, and technology. The company's business lines include Specialty Plant Nutrition (NVE), Iodine and derivatives, Lithium and derivatives, Potassium and Industrial Chemicals.

SQM has offices in 20 countries and a presence in over 115 countries. The company offers lithium carbonate and lithium hydroxide, which have applications in electronics, ceramics, glass, and lubricating greases.

LIVENT CORPORATION (USA)

Livent Corporation was spun out of FMC Corporation, an American chemical manufacturing company headquartered in Philadelphia, USA, in an IPO on the NYSE in 2019. FMC retained approximately 85% of the issued capital in Livent after the IPO.

Livent has an international supply chain and produces and supplies battery grade lithium. Livent recently announced that it has signed a four-year deal to supply BMW Group with lithium for its EV division.

TIANQI LITHIUM (CHINA)

Tianqi Lithium is an energy material company with a primary focus on lithium. The major businesses include lithium resource investment, lithium concentrate extraction and the production of advanced lithium speciality compounds.

Tianqi has a presence in Australia, China, and Chile. The Greenbushes mine in Western Australia and the Cuola mine in Sichuan provide a stable supply of lithium raw materials. The application industry includes 3C products, electric vehicles, electric bicycles, power tools, energy storage systems, etc. It is also the primary raw material for the nuclear industry and speciality glass products.

EXPECTED CAPACITY & PRICE FORECAST

The lithium producing countries have seen massive growth in recent years due to the increasing demand for EVs and consumer electronics. According to United States Geological Survey (USGS), global lithium production was 77,000 tonnes in 2019, which is a year-on-year decline of 19%. According to NS Energy, the top producing countries include:

Australia: The country produced 42,000 tonnes in 2019. Australia has the fifth largest reserve of lithium, estimated at 4.7 million tonnes.

Chile: Despite being the second-largest lithium producer, it has the third-largest reserves in the world, estimated at around 9 million tonnes.

Argentina: The country stands fourth in lithium production and has the second-largest reserves, accounting for 17 million tonnes.

Zimbabwe: The country is the sixth-largest producer in the world. According to the USGS data, the country has 220,000 tonnes in lithium mining reserves.

According to many analysts, the decline in the lithium price is as a result of a forecasted oversupply into the 2020's. But as discussed earlier, severe supply-side constraints have led to several large projects being suspended until a sufficient supply of lithium can be secured. As more and more lithium developers close in on becoming producers, we expect many of these projects that had been suspended brought back online.

Add to these factors a global push towards ESG (Environmental, Social & Governance) style investments from Government and industry, we may see the lithium price may test its all-time high in the near future.

“The increase in the price of lithium is due to several factors, including sustained demand in China for EV's due to government policies, consumer demand in Europe and the USA for EV's.”

Bruce Richardson, Anson Resources Limited

When all of the facts are considered, it's becoming more and more apparent that the lithium supply shortage is being brought forward, as many near developers and producers have pre-sold their lithium supply in off-take agreements. This is creating a squeeze and should force the lithium price higher while the EV and battery makers of the world search for new supplies of lithium. We've even seen established prestige auto manufacturers, including Ferrari and Porsche, launch hybrid or pure electric vehicles within the last 12 months, following in the footsteps of other established European automotive manufacturers, Mercedes Benz, BMW and Audi.

ASX LISTED LITHIUM COMPANIES

There are a number of ASX listed lithium companies, with a choice of explorers, developers and producers, with a significant price differential between each stage. For many lithium explorers and developers, the key is deliverability at scale; it's one thing to find lithium, it's another thing to extract the raw product from the ground and produce battery grade lithium, especially for those miners in remote areas with little or no infrastructure.

There are approximately 70 ASX listed companies that offer exposure to lithium. We see the investment opportunity in those near-term producers (1 – 5 years) that demonstrate good economics and a cost of production that sits in the bottom half of the cost curve.

MAJORS

Galaxy Resources Limited (ASX.GXY)

Galaxy Resources is a lithium producer with assets in Australia, Canada and Argentina. Its flagship project is Sal de Vida based in Argentina.

Mineral Resources Limited (ASX.MIN)

Mineral Resources provides mining services and owns interests in the Mount Marion and Wodgina Lithium projects in Western Australia.

Pilbara Minerals Limited (ASX.PLS)

Pilbara owns 100% one of the largest hard-rock deposits in the world, the Pilgangoora Lithium-Tantalum project in Western Australia.

Orocobre Limited (ASX.ORE)

Orocobre, built the first brine production facility 20 years ago. Its flagship project is the Olaroz Facility located in Argentina.

Piedmont Lithium Ltd (ASX.PLL)

Piedmont explores and develops resource projects in USA. It owns 100% of the Piedmont Lithium project in North Carolina, USA.

WATCHLIST

Lake Resources Limited (ASX.LKE)

Lake Resources explores and develops lithium brine projects. Its flagship project is the Kachi lithium project in Catamarca, Argentina.

Galan Lithium Ltd (ASX.GLN)

Galan Lithium holds interests a number of projects in Catamarca, Argentina. Its flagship project is the Hombre Muerto West project.

Prospect Resources Limited (ASX.PSC)

Prospect is a hard rock lithium and petalite developer. Its flagship project is the Arcadia lithium project based in Harare, Zimbabwe.

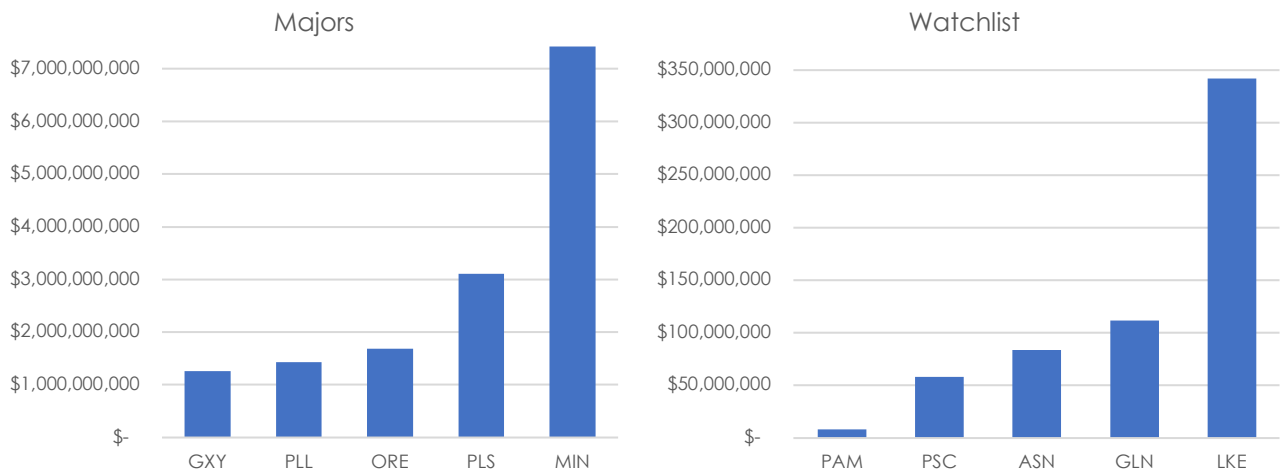
Anson Resources Limited (ASN.ASX)

Anson is a developer with lithium assets in USA and Western Australia. Its flagship project is the Paradox brine project in Utah, USA

Pan Asia Metals Limited (ASX.PAM)

Pan Asia is a specialty metals explorer in South East Asia. Its two hard rock lithium projects are located in Southern Thailand

ASX MARKET CAPITALISATION COMPARISON (\$AUD)



Source: Bloomberg

CONCLUSION

It appears that the long-term demand and growth for lithium products led by battery applications will require an increase in current production capacities. The supply of Lithium should remain tight with a sustained supply deficit through the mid-2020s.

Although the scheduled pipeline capacity may appear sufficient to meet the demand, there could be setbacks in the development and financing process in mining and refining lithium. There are also technical and financial hurdles associated with scaling capacities to sizable volumes, and hence, even the prominent lithium producers may fail to meet their production targets. One of the biggest challenges many brine projects will face is deliverability, with many of these projects sitting in remote areas without access to existing infrastructure.

While many 'experts' have stated that there is an oversupply of Lithium, which forced prices down over the last few years, our research suggests otherwise; Many of the battery and vehicle manufactures have either deferred projects or scrapped them all together because they cannot access sufficient quantities of Lithium to complete their research and development, and as a result, there has been a significant underinvestment in new supply and expansion of existing operations. Therein lies the reason for the resurgence in the lithium price recently – Investors are looking for near-term producers to invest in, and for those that can firm up a resource should see a significant re-rating of their market capitalisation.

The above market capitalisation comparison of 5 ASX listed lithium majors to 5 developers and explorers demonstrates the increase in value possible for developers and explorers that are able to overcome the obstacles of becoming a producer.

We firmly believe that the demand for Lithium and other battery minerals will only increase as the world continues its search for more sustainable fuel sources. And in the case of lithium, it would seem that if you can produce it, you will sell it.

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