

INDUSTRY REPORT

//Lithium and Battery Materials



STORMCROW

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LITHIUM 2019 – Commodity Update

- **2018 Turned Out to be a Tough Year:** Lithium chemical prices that went very high inside and outside China with a shortage of spodumene mineral concentrate generally went nowhere but down from November of 2017 to the end of calendar 2018.
- **2019 May Not Be Much Better:** With a surplus of spodumene continuing, it is possible that we will see an unimpressive price reaction in 2019, as well.
- **Get Used to It:** For all of the hot air about “paradigm changes” and all the rest around the use of lithium batteries in the automotive industry, what we have continued to repeat is still true: Lithium is not rare. The price will go up only to the point where someone else becomes willing to build another available source of supply and bring the price down.
- **Prices Not Going to Zero:** Or even close to zero. For all the alternative noise made by a few about lithium being too common, and thus prices being driven down to levels not seen since about 2011, the evidence says otherwise. Historical data suggest that lithium prices will remain higher than in previous cycles where there was also abundant supply, simply because the buying environment is becoming more robust.
- **Our Price Projections Will be Wrong:** This isn’t a steady-state and predictable market, not yet. Changes in laws or technology could yet play a major role in changing demand, and technology could upend the supply picture, as well. Our projections will likely be wrong, but hopefully our directionality will be correct, at minimum.

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Lithium Update 2019

It has become a touchstone in the lithium industry that supply is always late and insufficient, and demand is always rising much faster than predicted. Let's just dispense with this and call it what it is, namely nonsense. In 2018, the supply of spodumene concentrate from Australia sharply increased, and this led to oversupply in the market causing prices to sharply decrease. There are still some bottlenecks in the conversion of lithium carbonate to the lithium hydroxide that is the preferred feedstock for making high-nickel cathode active materials, but these bottlenecks may be removed through either additions to the conversion capacity within China, or the introduction of new technology in both the hard-rock and brine lithium arenas that can produce high-purity lithium hydroxide without first making lithium carbonate, or both.

On the demand side, and the willingness of the consumer to purchase battery electric vehicles (BEVs), we believe that the correct conclusion is that the jury is still out regarding market acceptance. As subsidies are decreased in both the United States and China, we will truly begin to see how well the BEV can compete against the products of what is truly the Golden Age of the Internal Combustion Vehicle (ICV). The automotive industry has never before sold such a broad collection of high-powered, comfortable and reliable ICVs, and we know these ICVs can be refueled in minutes at any readily available gasoline or diesel filling station. BEVs can't claim anything like the same ease of recharging, and demand for BEVs has not grown at anything like the pace predicted even five years ago.

Over the last 18 months, the price of lithium reached historical highs, demonstrating that, yes, in fact, the supply of lithium is essential to many different industries and that buyers would have to pay up if supplies were scarce. But those who suggest that this shows us that lithium prices can continue to rise, or at least remain steady, ignore the fact that if a material is not rare then new suppliers will enter the market to earn what margin they can and prices will fall. Given that a decent brine project can likely make battery-grade lithium chemical for a cost of perhaps \$4,500 a tonne, and a reasonable hard-rock lithium project can do the same (using existing technology) for less than \$7,000 a tonne, there is little reason for a material that is as common as lithium to sell at prices of more than \$15,000 for any significant length of time.

We are not challenging the future of the new energy vehicle, far from it. What we question is whether the BEV will remain supreme, whether the BEV is simply the creation of legislation that arose in California and is something of a technological dead-end. There are versions of new energy vehicles that could not only cost less



than a pure ICV, but also be operated far less expensively and substantially eliminate issues such as range anxiety. The one drawback is that these will not be zero emission vehicles, but they can and will be very substantially less polluting than today's ICVs.

We also do not subscribe to the notion that the natural abundance of lithium will drive market prices back down to the levels seen in 2010, or even down to the US\$7,000 per tonne level for technical-grade chemicals. The historical data show us that the larger the market, all else equal, the higher prices are driven, even in the face of excess supply. We fully expect higher-than-historical-average prices to be maintained, just not in excess of US\$20,000 per tonne.

We have completed our forecast for lithium prices in future, using available historical data through to the end of calendar 2018. Our pricing data is taken from Asian Metal, representative of the spot market in China. Some have pointed out that the spot market is most active in China, with contract buying the dominant method for purchase outside China, and we agree. However, China is the largest market for lithium chemicals in the world, so its spot market is not insignificant. And as with essentially all commodity markets, if the direction of pricing in the spot market is down, then it is highly likely that ALL prices will be moving down, with the reverse being true, as well. In addition, the quality of Chinese lithium chemical products is improving, so that what was once a very substantial price gap between Chinese and Western supplies is narrowing.

We have removed the effect of VAT on the historical spot prices for lithium in China, so we can evaluate likely impact on the global price. Our analysis found that overall market demand and the gap between supply and demand are the dominant factors in predicting price. We have maintained our forecast for lithium moving forward, with a proprietary forecast for the mix between various lithium cathode chemistries that is predicated on the incumbent lithium battery technology maintaining its dominance (if/when solid state batteries become a player in the mix, then we reserve the right to heavily revise our predictions). We continue to believe that those suggesting the need for millions of tonnes of lithium, in LCE terms, by 2025 or 2030 are being, let us say, irrationally exuberant. However, we do note that there is substantial potential for major annual discrepancies between any forecast and actual pricing, because a project delayed for a year or an unforeseen increase in supply from existing mines can push prices meaningfully up or down.

All that said, our projections for lithium demand in select years are:

**Exhibit 1 – Projections for Lithium Demand (t LCE)**

| | 2019 | 2024 | 2028 | 2030 |
|----------------------------|----------------|----------------|----------------|----------------|
| Rechargeable Batteries | 116,098 | 181,453 | 275,530 | 343,981 |
| Ceramics | 34,703 | 48,445 | 63,265 | 72,297 |
| Glass-Ceramics | 29,745 | 41,525 | 54,227 | 61,969 |
| Greases | 15,882 | 18,411 | 20,722 | 21,984 |
| Glass | 22,309 | 31,143 | 40,670 | 46,476 |
| Metallurgical Powders | 14,873 | 20,762 | 27,114 | 30,984 |
| Polymer | 10,219 | 12,137 | 13,997 | 14,994 |
| Air Treatment | 10,219 | 12,137 | 13,997 | 14,994 |
| Non-rechargeable Batteries | 3,856 | 4,363 | 4,792 | 5,034 |
| Aluminum | 435 | 143 | 47 | 30 |
| Other | 17,867 | 20,713 | 23,312 | 24,732 |
| Total | 276,206 | 391,232 | 537,673 | 637,475 |

Source: Stormcrow (2019)

Our forecasted supply levels are shown, below. Note that there is potential for existing suppliers to delay market entry based on oversupply, or to simply produce below available capacity levels, but this is less likely for new market entrants or converters in China, who have more immediate cash flow concerns than maintaining overall market prices:



Exhibit 2 – Projected Lithium Supply Levels (t LCE)

| Producer | 2019 | 2024 | 2029 | 2030 |
|--------------------------------|----------------|----------------|----------------|----------------|
| SQM Chile | 47,900 | 95,000 | 95,000 | 95,000 |
| Greenbushes | 105,000 | 150,000 | 180,000 | 200,000 |
| Domestic China | 25,000 | 45,000 | 55,000 | 75,000 |
| Bikita | 5,500 | 5,500 | 5,500 | 5,500 |
| Orocobre | 17,000 | 17,500 | 30,000 | 35,000 |
| FMC Lithium | 22,000 | 22,000 | 22,000 | 22,000 |
| Rockwood Brine | 75,000 | 105,000 | 105,000 | 105,000 |
| Lithium Americas/Ganfeng | | 20,000 | 40,000 | 40,000 |
| Nemaska | 5,000 | 36,000 | 36,000 | 36,000 |
| Galaxy Resources (Arg) | | 10,000 | 20,000 | 20,000 |
| Galaxy Resources (Aus) | 30,000 | 30,000 | 30,000 | 30,000 |
| Neometal/MIN/Ganfeng (Aus) | 25,000 | 25,000 | 25,000 | 25,000 |
| Additional Australian Hardrock | | 20,000 | 50,000 | 60,000 |
| POSCO | | 55,000 | 75,000 | 75,000 |
| Frontier Lithium | | 5,000 | 7,500 | 7,500 |
| Total (t LCE) | 357,400 | 641,000 | 776,000 | 831,000 |

Source: Stormcrow (2019)

And our forecasts for lithium pricing are thus:

Exhibit 3 – Projected Future Lithium Chemical Pricing (USD per kg)

| Year | 2018a | 2019e | 2020f | 2021f | 2022f | 2023f | 2024f | 2025f | 2026f | 2027f | 2028f | 2029f | 2030f |
|----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Tech Grade CO ₂ | \$ 13.58 | \$ 11.66 | \$ 10.69 | \$ 10.61 | \$ 10.19 | \$ 9.92 | \$ 9.51 | \$ 10.17 | \$ 9.71 | \$ 10.35 | \$ 12.26 | \$ 14.84 | \$ 17.94 |
| Batt Grade CO ₂ | \$ 15.13 | \$ 13.19 | \$ 12.10 | \$ 12.00 | \$ 11.53 | \$ 11.22 | \$ 10.76 | \$ 11.51 | \$ 10.99 | \$ 11.71 | \$ 13.87 | \$ 16.80 | \$ 20.30 |
| Tech Grade OH | \$ 16.15 | \$ 13.25 | \$ 12.15 | \$ 12.05 | \$ 11.58 | \$ 11.27 | \$ 10.81 | \$ 11.56 | \$ 11.04 | \$ 11.76 | \$ 13.92 | \$ 16.87 | \$ 20.39 |
| Batt Grade OH | \$ 17.75 | \$ 17.95 | \$ 16.47 | \$ 16.33 | \$ 15.69 | \$ 15.27 | \$ 14.64 | \$ 15.66 | \$ 14.96 | \$ 15.94 | \$ 18.87 | \$ 22.86 | \$ 27.63 |

Source: Stormcrow (2019)

We believe that the most interesting changes in pricing will occur between 2024 and 2029. While the supply situation is likely under control through to 2024, the next cycle of significant public markets interest in lithium will probably play out then as new projects are again required to increase supply and constrain price increases. Our price projections for 2029 and 2030, as shown above, do not assume new projects entering the market. We reiterate, with the natural abundance of lithium, and better processing technology being introduced on a variety of fronts, there is no need for prices to spike in 2029 and 2030. We fully anticipate the arrival of new projects, or



the scaling up of existing projects, to constrain the prices of 2029 and 2030 compared to what we have shown, we just don't know which projects yet.

Conclusions

We believe that the 2016-2017 shortage in lithium and the attendant price spikes we saw are firmly in the rear-view mirror, with the only risk to our analysis being a very significant and very rapid increase in demand. Given the past experience with jurisdictions where subsidies have been curtailed, and with both the United States and China on a path to significantly reduce or eliminate subsidies for new energy vehicles over the next few years, this seems to us to represent a modest upside risk.

We are by no means negative on the future of new energy vehicles. The right types of new energy vehicles are very likely to be able to be sold at prices below those of conventional ICVs, will have operating costs dramatically below those of ICVs, and will have very few of the operating drawbacks of the current crop of BEVs. But they will also utilize smaller battery packs than the Tesla sedans of today, constraining growth in lithium battery demand.

Nevertheless, if a company such as Nemaska Lithium is likely able to produce battery-grade lithium hydroxide for less than USD\$3,000 per tonne but sell it for more than USD\$10,000 per tonne, there is absolutely nothing wrong with their business model. Nor will we need to take up a collection for a company like POSCO, when their PosLX technology enables them to produce cheap, battery-grade hydroxide from brine.

Lithium is not a flash-in-the-pan, and companies will continue to generate substantial incomes from it. Lithium will very likely remain the core of an ongoing technological shift in the automotive industry. Investors with vision would do well to take the recent price declines as an opportunity to buy into the best/lowest-cost producers in the market, with a plan to hold that investment until at least the next leg up in the lithium cycle. We are confident that knowledgeable market participants such as the battery manufacturers and automotive companies themselves will be doing exactly this over the next few years. Financial investors would do well to follow their lead.

Keywords

| | | |
|--------------------------------|--|---|
| Industry | Lithium, Batteries, Critical Materials, Mining, Industrial Minerals, Borosilicate | |
| Relevant Companies | Lithium Americas – TSX:LAC Orocobre Limited – TSX:ORL, ASX:ORE Tesla Motors – NSDQ:TSLA Sichuan Tianqi Lithium – SHE:002466 Western Lithium – TSX:WLC Jiangxi Gangfeng Lithium: SHE:00 2460 Nemaska Lithium Inc. – TSXV:NMX Critical Elements Corp. -- TSXV:CRE Neometals Ltd. – ASX:NMT | Bacanora Minerals – TSXV:BCN Galaxy Resources – ASX:GXY Sociedad Quimica y Minera de Chile (SQM) – NYSE:SQM Albemarle Corporation --- NYSE:ALB FMC Corp – NYSE:FMC Houston Lake Mining – TSXV:HLM Altura Mining – TSXV:AJM Cobre Montana – ASX:CXB |
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