

It Might Not Become a Utopia, But It Will Probably Be Enough!

In this issue we discuss:

- **Strange Days, Indeed** The volumes may be small these days, but the money is still good for battery-grade chemicals outside of China. Problem is, the prices for spodumene mean that most production of mineral concentrate is either shuttered or shutting down. Longer term, that means prices for the chemicals should improve, globally. Unfortunately, we are living through this market, now.
- **New Energy Vehicle Sales About Where They Should Be** Yes, new energy vehicle sales in China are slowly recovering, but it is now pretty apparent that barring a significant boost to incentives there won't be a dramatic resurgence. In fact, sales are about where they should be under what is basically the same rebate program as existed in 2019. The result is that sales will probably reach about the same levels, for the balance of 2020, as they did in 2019. And that means that this will likely be the second year in a row of flat to declining sales.
- **Politics and Lithium** One thing a new and emerging market doesn't need is politics getting in the way. But that's precisely what the bun-fight between Australia and China is giving us.
- **The UN Has the Most Realistic View on New Energy Vehicle Sales?** Maybe. We've read some of the latest and greatest predictions from a bunch of different sources. Those from the UNCTAD (by way of the IEA) look the most realistic to us. But even "realistic" expectations for new energy vehicle sales mean that we will run out of some critical materials unless we make dramatic changes in how we build electric vehicles.

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As a Matter of Introduction...

This is our tenth (semi)monthly newsletter! Time flies when you are having fun, or simply forgetting what day it is because every day is starting to feel the same. While we never produced a newsletter filled with cautions about the “best cure for high prices being high prices “ during the recent lithium heyday that extended through the middle of 2017, those who sat in on Stormcrow talks at conferences know that we were out there saying it. However, we feel even more strongly that the old maxim about the “best cure for low prices being low prices” is every bit as true, and given some pessimism around the battery materials market now, we believe that some realism (along with a little hope) is required.

First, for those who don’t know, Stormcrow deals with the markets for critical materials. Generally speaking, what amounts to a critical material is in the eye of the beholder, but we think of them as materials that are essential to making a product with the properties intended by its designers, even if those materials are not anything like the highest-cost item on a bill of materials. As an example, think about lithium in the battery of your cell phone. That lithium costs pennies as a raw material, but if your cell phone manufacturer was forced to do without it then the resulting cell phone would bring with it a very, very different operating experience than it currently does.

Over the coming months, we are going to deal with our views of the market prospects for some critical materials, and interesting facts about others. We will talk a little about technology and the impact, both good and bad, that it can have on demand for critical materials. We hope you find this interesting and worthwhile! Note that when not writing newsletters like this one, Stormcrow Capital functions as a corporate adviser (capital markets / financing / M&A) in the critical materials sector. We are registered as an Exempt Market Dealer in Canada (*additional disclosures included at the end of this note, for those who need help getting to sleep*).



Strange Days

Through June 2020 the markets for battery chemicals in China moved pretty much uniformly down. That's leading us into some interesting territory, which we will discuss further below:

Battery-grade LiOH • H₂O down 1.9%

Battery-grade Li₂CO₃ down 4.6%

Battery-grade CoSO₄ • 7 H₂O UP 1.4%

Battery-grade NiSO₄ • 6 H₂O down 0.4%

The markets for cobalt and nickel, both metals and chemicals, appears to have settled itself. The problem is that the market for lithium chemicals has not. There still appears to be a surplus of chemicals entering the system, and that likely only gets solved by some suppliers exiting the space or running out of feedstock.

The amount of inventory of spodumene concentrate in China is an uncertain thing (we have a guess, based on looking at importations and rough work on battery production for usage and the like). One thing that is much more certain is the price for spodumene concentrate versus the cost of production. As of around 09 July, the market price for chemical-grade concentrate was about USD\$405 a tonne. If we look back to a recent financial report from Galaxy Resources, March 2020 cost of production was about USD\$399 per tonne. So one can pretty quickly note that you aren't much further ahead selling product than if you keep it in the ground. Now, in general terms keeping mineral in the ground isn't going to help you pay interest on whatever debt you have, but neither will selling at cost.

Our assumption, then, is that the spodumene inventory in China is going to draw down, and spodumene prices will have to rise to get mines back into production. That, in turn, will push up chemical prices. But with demand for batteries and thus lithium chemicals slightly crushed right now, we don't have a better prediction regarding when this might happen than "soon".



New Energy Vehicle Sales Up, But Not Massively Up

In May, the sales of new energy vehicles in China was at almost 73,000 units, with the impact of COVID-19 starting to wane. To put this in perspective, sales of plug-in hybrid and battery electric vehicles in all of 2019 was 1.14 million units. Annualizing that 73,000 units for May doesn't get you to even the level of full-year sales from 2019, and that's with sales for the first five months of 2020 sitting at only 218,000 units (the impact of COVID-19 in sharp focus).

The problem is, we believe, a simple one. A BEV in China that has a decent-sized battery, something like the GAC Aion S, but is much cheaper than the equivalent would be in North America. That Aion S, depending on options, can sell for as little as about USD\$21,000 after subsidies, with a roughly 59 kWh NMC 811 battery made by CATL. Fantastic deal, especially comparing that price to prices here in Toronto. But in China, the median wage is still lower than American median wages (assuming we are looking at a more long-term, pre-COVID world). If the serious complaint about BEVs generally is that I have to pay more to get something that takes a lot longer to "refuel" than a conventional internal combustion-powered car, adding more relative cost to the purchase in an environment with lower levels of disposable income is going to be even more damaging.

And there are problems even beyond this one, which we will discuss a little more, below. Along with one possible solution.

Politics and Lithium

There are likely readers who have noticed the ongoing tension between China and the United States but who, because of their location, have not noticed the rising tension between Australia and China. That political tension is impacting the critical material industry and is likely to impact the lithium sector in a major way.

Allow me one second to editorialize and say that the impulse to start laughing over this situation is hard to resist. Australia had been, up until the COVID-19 outbreak, experiencing an economic boom of unprecedented size and duration. As one result, Australia has not seen a recession since 1991. And the reason for all this is simple and has a one-word answer: China. China has been buying agricultural output, mined commodities and making investment on a large scale in Australia for many years.

Which makes what has been happening lately all the stranger. In the last while, an Australian rare earth company named Northern Minerals had arranged for AUD\$20 million investment from China's Baogang Group, a company with deep expertise in the



mining and refining of rare earth elements. That investment would have given Baogang 11.1% ownership of Northern but would have given Northern access to the knowledge that Baogang has about the market and processing of rare earths, something that does not exist in large amounts outside of China. The investment was rejected by the Australian Foreign Investment Review Board as not being in the national best interest, although it was very much likely in Northern's best interest! Share price of Northern Minerals has declined by more than 20% since that decision was announced and the company has not rushed out with news that western investors have poured money into the company since then.

In perhaps a slightly more chilling moment, another Australian company called AVZ Minerals had a Chinese investor, Yibin Tianyi, withdraw an offer of a AUD\$14.1 million investment for 12% of the company after being informed that the Australian FIRB was going to prohibit this investment, too. AVZ's main project is a lithium/cesium/tantalum pegmatite in DRC but this did not dissuade the Australian FIRB from deciding that Chinese investment was undesirable in an African mining story.

OK, so little pre-revenue junior mining stories are being influenced by political action, so what? The point is that Tianqi Lithium, a roughly 24% owner of SQM in Chile and the majority partner in the JV that runs the Greenbushes lithium mine in Western Australia is in financial difficulty and is looking to sell some or all of its stake in Greenbushes, perhaps along with its developing lithium hydroxide plant in Kwinana, south of Perth, Australia. We hypothesize that since the Greenbushes Mine supplies a large chunk of the mineral concentrates converted to lithium chemicals for the largest battery-making nation in the world, Chinese authorities would be interested in seeing Greenbushes remain under Chinese corporate control.

But the FIRB will have a say in any sale, and it seems that they would be likely to say no to the sale of this asset to another Chinese buyer. If this decision results, as it already has for Northern Minerals and AVZ Minerals, in a solid bid being rejected with no comparable replacement, this would be a very negative outcome for Tianqi. It might prove to be an early Christmas present for a western company, though.

We will continue to observe what is happening with this situation, but it all has to be resolved before the end of this year. It's likely to prove to be a very interesting few months.



The UN Knows Electric Vehicles(?)

While taking a swim through various reports over the last few weeks and months, I was surprised to find a new report from the United Nations Conference on Trade and Development (UNCTAD; rolls off the tongue, don't it?). The report said nothing that has not been discussed literally for years at conferences regarding battery materials, which is that we need to worry about where our lithium, cobalt, manganese, nickel and what-all are coming from. But to quantify the level of concern, you have to provide a model for demand, and the UNCTAD report relies on an analysis done in 2019 by the IEA, and this is one of the more realistic governmental or quasi-governmental analyses that I have seen.

The IEA's *Global EV Outlook 2019* suggests that a fleet of about 145 million light-duty passenger BEVs will be on the road in 2030. This is far below some projections like the European 30@30 initiative that is trying to find a way to see 30% EV adoption by then and would result in a global rolling fleet of more than 250 million EVs in 2030. But let's simply take even the IEA's "conservative" number and do a quick and dirty analysis.

Let's assume a global fleet of 145 million passenger BEVs is on the road, and nothing more; no plug-in hybrids, no buses, no nothing else that uses batteries. Let's further assume that those vehicles each contain the average battery size used in China right now, which is about 40 kWh. Yes, that is way below what a Tesla uses, and it includes the impact of small-battery BEVs and some hybrids but bear with me.

So, between 2020 and 2030, we need to have built and shipped 5,800 GWh of battery. To try to minimize the need for rare stuff like cobalt, and to further minimize the technological risk in waiting for some kind of scientific Hail Mary-pass that sees a new battery that does not require cobalt to keep from bursting into flame, we suggest that all of these batteries be NMC 811 cells. In that case, the global rolling passenger light duty BEV fleet in 2030 will have used a total of something like 7.7 million tonnes of lithium carbonate equivalent, 9.8 million tonnes of nickel metal and 1.2 million tonnes of cobalt just to build the batteries in that rolling fleet. Never mind what has already been scrapped, what is being built that year for addition into the fleet the next year and all the batteries in other devices.

So, great news for junior mining, then! Except that for something to be good news, it has to be feasible, and this probably isn't. We have, basically, ten years to try and do this. So we need an average production of about 770,000 tpa LCE over those ten year, plus whatever we are selling today that goes into uses other than automotive, so something like at least 900,000 tpa LCE. The USGS would suggest that global production of lithium in 2019 in LCE terms was less than 400,000 tonnes. We need to double the global output of lithium starting now, and figure out some way of subsidizing producers to store it until



we need it, or forget this idea that there can be rolling BEV fleet of 145 million vehicles in 2030.

Note that, for lithium, this is more a case of average output being too large to enable this to happen by 2030 than anything else. There is ample lithium out there, and there are even new technologies being developed that can produce battery-grade lithium at far lower cost than the incumbent methods. But all of this will need time to develop and, arguably, this is time that the global environment does not necessarily have.

But wait, it gets worse. The cobalt requirement would be average production over a decade of 120,000 tpa. The USGS similarly says that global mine production in 2019 was 140,000 tonnes. But cobalt is actually rare and we know that additional production will require the cost to rise, perhaps very substantially. Right now, cobalt prices are low because overall demand is low thanks to the economic slowdown that resulted from the COVID-19 pandemic. A doubling of demand will significantly impact price, assuming it can be done at all. I would argue that it certainly can't be done within a 2030 timeframe.

Some readers might be tempted to say, "So what? These are ELECTRIC CARS we are talking about, here! Money is no object!! Get moving!!" That would be astonishing news to car manufacturers, who bend over backwards to carve a fraction of percent of cost out of each unit. The manufacturing of modern vehicles is a very complex dance taking place between safety and emissions requirements, buyer whim and cost. Cars are not military fighter jets, auto manufacturing is simply not a "money is no object" arena.

Astonishingly, the automobile industry (outside of Tesla, perhaps) is suggesting a solution, a simple one that doesn't mandate government subsidy or anything else, and that's a variant of hybrid vehicles. Let's hypothesize that we can sell a car which contains only a small battery, maybe only 15 kWh per vehicle (that will carry us about 100 km on a single charge). The good news is that a small battery is pretty cheap. That's great if we want to get to work and back, lousy if we want to drive 200 km to visit grandma.

So, only if needed, we add a range extender. The range extender is a gasoline or diesel engine attached to an alternator, a generator installed in the car. That gasoline engine is relatively small, because we don't need 300 hp (really, the accompanying torque) for acceleration, we have our battery and high-torque electric motor. Maybe someday that gas engine and alternator will be replaced by a fuel cell, who knows. But for now, it's a hopped-up lawnmower engine attached to an alternator to make electricity that tops up the batteries when required. And a small gasoline engine, compared to the turbo-super-charged, computer-controlled monster engines of today, is also cheap.

What the consumer gets is a cheaper vehicle than the internal combustion-powered car of today, with no compromise. Want to drive to work? Great, charge it up overnight and



drive for a fraction of the cost of using gasoline, after buying this thing for less than you would have paid for a gasoline-only vehicle. Need to drive 300 km to visit someone? Great, make sure there is gasoline in the tank and get moving. Once the generator kicks in, it won't be as cheap as driving on electricity alone but you also don't need to worry about stopping to recharge for an hour (two if there's a line for the charging station).

What the environment might get is a much larger fleet that, for most trips on most days, acts just like a BEV and "produces" emissions that are the average of the electricity generating infrastructure. Instead of 2-3% of vehicles being BEVs all the time, we could realistically have 30-40% of vehicles acting like a BEV for 70% of the distance they cover. By my math, that's 2-3% versus more than 20%, a ten-fold win for the environment.

And what does the automobile industry get? They get a vehicle that they can sell for less money, without any need to beg for government subsidies (or for the taxpayer to pay those subsidies). They also get to plan for and actually build them, because there is a hidden bonus in all this. If we are only putting a 15 kWh battery in each vehicle, then we don't need some energy dense chemistry like NMC 811, we can use something safe and cheap like LFP, the battery of choice for power tools.

145 million vehicles on the road in 2030 with a 15 kWh LFP battery would need a total of 1.9 million tonnes lithium carbonate equivalent. On average, we don't even need to double current lithium production. And for this purpose (there will be other uses where they are needed), we don't need any nickel or cobalt, the battery chemical lithium iron phosphate needs iron and phosphate, things the world is already swimming in.

So if you want to do something positive for the environment, forget lobbying for bigger subsidies so that your neighbor can buy a new electric Porsche for less money. Instead tell your politicians to get out of the way and let the car companies hit emissions targets by whatever means they want. Let the market figure out the cost-effective way to reach those goals, as opposed to government stuffing BEVs down our throats. And just maybe we can have these new energy vehicles achieve better than single-digit sales levels.

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