Pathfinder Investment Outlook

For the week ending November 20, 2020

Commodities for Tomorrow

We will finish up our resource series with a high-level discussion on key battery metals that we believe will be at the forefront of the growing electric market. While battery metals encompass a number of different metals including nickel, lithium, copper, vanadium, cobalt, and graphite, our focus will be on Ni and Li (copper previously discussed), two metals that have come to the fore front as battery technology has improved. Batteries have evolved from the common lead-acid battery, to Ni-Cd (Nickel-Cadmium), and now to Li-ion (Lithium-ion). Lithium-ion batteries have taken center stage because of their lighter weight, high voltage, and excellent capacity. A key component of Li-ion batteries is nickel due to the advantage it offers in providing higher energy density and greater storage capacity at a lower cost, enabling longer range for EV's. The shift to increasing Ni in batteries has reduced the demand for cobalt which was once seen as a main commodity in EV market.

Where does the supply come from? Lithium is actually very abundant and can be produced from brines or hard rock sources. Much of the brine production comes from Argentina, Chile, and Bolivia whereas hard rock sources are mainly from Australia (China produces both brine and hard rock Li). Lithium in brine generally occurs in salars or basins where water has leached Li from the surrounding rock and then becomes trapped and concentrated through evaporation within these basins. This brine is then extracted and further refined through additional evaporation and processing to remove impurities to produce a lithium carbonate which contains about 19% Li. Further processing is required to produce higher grade lithium hydroxide. Hard rock Li is mined from granitic rocks called pegmatites (spodumene) by conventional processes of mining, blasting, and crushing. The crushed rock is then heated in a rotary kiln, roasted and then further crushed into a fine powder and mixed with sulfuric acid. This solution is then refined to increase the Li concentration and produce lithium hydroxide. Although lithium carbonate is more widely used, lithium hydroxide is becoming the preferred choice for the longer range EV batteries.

Figure 1: Global annual passenger vehicle sales by drivetrain

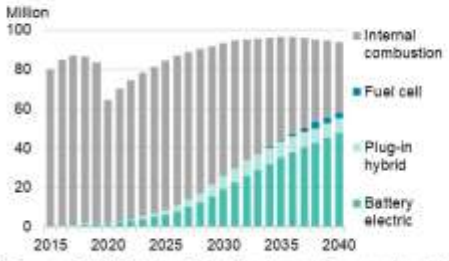
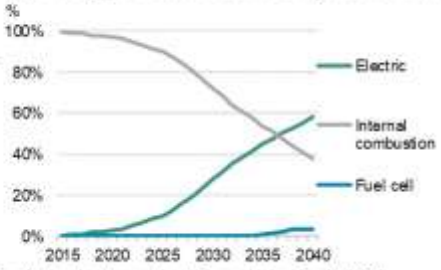


Figure 2: Global share of total annual passenger vehicle sales by drivetrain



Source: BNEF. Note: Electric share of annual sales includes battery electric and plug-in hybrid.

Nickel can also be mined from two different sources, sulphide-type ore deposits and laterite-type deposits. Sulphide Ni production is mainly from Canada and Russia whereas Indonesia and the Philippines mine nickel produced from laterites. Sulphide Ni is processed through conventional processes similar to copper where the crushed material is floated and separated from the waste material to produce a Ni-concentrate which then requires smelting to produce a Ni-cathode. Laterite ores are a bit more complicated and require a much greater energy input initially to remove the moisture content using rotary-kiln furnaces. The oxide is then converted into a Ni metal in an electric furnace to produce a ferronickel product which requires additional refining in order to be used in steel or batteries. Currently, about 2/3^{rds} of Ni production is used to produce stainless steel as an alloy to help prevent corrosion. However, as demand in EV's is expected to increase over the coming decades, the demand for battery grade Ni is expected to increase by almost 50% which is significant for under-valued miners.

"This means that" not all battery metals are made equal and not all types of deposits produce the quality of metal required for this booming electrification market. As the EV market is set to grow exponentially through increasing government policies shifting towards greener initiatives, we see a significant opportunity in battery metals. From our discussion, it's evident that select companies have the potential to produce battery grade commodities and will benefit compared to others. By having a finger on the pulse of these new trends and using our technical abilities to filter through the various investment opportunities, we believe we are well positioned to capitalize on these future trends.

Gary Sidhu, MBA | Analyst

Pathfinder Asset Management Ltd. | **Equally Invested**
1320-885 W. Georgia Street, Vancouver, BC V6C 3E8
E info@paml.ca | T 604 682 7312 | www.paml.ca
Sources: Bloomberg, Pathfinder Asset Management Limited

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*All returns are time weighted and net of investment management fees. Returns from the Pathfinder Partners' Fund and Partners' Real Return Plus Fund are presented based on the masters series of each fund. The Pathfinder Core: Equity Portfolio and The Pathfinder Core: High Income Portfolio are live accounts. These are actual accounts owned by the Pathfinder Chairman (Equity) and client (High Income) which contain no legacy positions, cash flows or other Pathfinder investment mandates or products. Monthly inception dates for each fund and portfolio are as follows: Pathfinder North American: Equity Portfolio (January 2011), Pathfinder North American: High Income Portfolio (October 2012) Pathfinder Partners' Fund (April 2011), Pathfinder Real Return Plus Fund (April, 2013), Pathfinder International Fund (November 2014) and Pathfinder Resource Fund (May 2018).

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