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## Sulfide Projects

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EV batteries require premium materials such as nickel sulfide, for which production levels remain low. The EV story is as much about nickel as it is lithium, and some would argue even more so.

**The electric vehicle (EV) story is as much about nickel as it is lithium, and some would argue even more so.**

Nickel sulfate powder—produced from nickel sulfide ore—is a critical ingredient in the cathode formulation for lithium-ion batteries, and analysts expect to see a boom in demand as global automakers transition away from internal combustion engines and into producing EVs. Saad Rahim,

chief economist at Trafigura, has **forecasted** a demand increase of 50 percent to 3 million tonnes of nickel sulfate by 2030.

However, more than half of global nickel production is ferronickel (nickel pig iron or NPI) for stainless steel fabrication. There is some conjecture that “the pricing of ferronickel and high-grade nickel sulfate will diverge in the coming years, improving the fortunes of miners that can produce battery-quality material,” **according** to the Globe and Mail. This divergence in the nickel market is also leading the London Metal Exchange to consider launching a separate contract for nickel sulfate, **reported** Reuters.

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**Tartisan Nickel Corp** (CSE:TN) is a Canadian mineral exploration and development company focused on gold, silver, and zinc projects in Peru and—more recently—a nickel-copper-cobalt project in Ontario, Canada.

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## Nickel's role in the lithium-ion battery

**Energy** in the lithium-ion battery is stored in the **cathode**, which consists of a **base metal** oxide skeleton with lithium ions embedded inside. The base metals used in the cathode chemistry determine the performance of the battery. The preferred chemistries for the rapidly growing EV market are lithium nickel **manganese cobalt** oxide (NMC) and lithium cobalt **aluminum** (NCA) batteries.

Nickel, in the form of nickel sulfate, is one of the most important cathode components not only chemically but for ensuring the widespread adoption of the electric vehicle. One of the main questions on-the-fence consumers have about EVs is range—how many miles can I cover before I need to recharge?

Increasing the range requires increasing the concentration of nickel within the battery cathode. “Nickel is really responsible for what’s termed energy density in lithium-ion batteries, so the higher the nickel content, the higher the energy density,” Jon Hykawy, president of Stormcrow Capital, told INN at the [6th International Nickel Conference](#). “What that translates to is essentially extended range in a battery electric vehicle — if you want the vehicle to be able to travel 500 kilometers instead of 400, you put more nickel into the battery.”

## The impact of growing EV demand on the nickel market

Today’s [global nickel market](#) is largely driven by the stainless steel sector, which accounted for nearly 70 percent of nickel consumption in 2017, according to a recent [Roskill](#) report. However, over the next decade stainless steel is expected to lose at least 10 percent of that market share to explosive growth in the EV battery sector.

By 2027, nearly 70 percent of passenger vehicles purchased globally “will have some degree of electrification” as the world moves away from fossil-fueled combustion engines, forecasts Roskill. Additionally, battery manufacturers are increasing the amount of nickel used in battery cathodes in order to increase vehicle range. Chevrolet and Nissan’s EVs use a battery cathode currently comprised of 60 percent nickel, 20 percent manganese and 20 percent cobalt. However, manufacturers of this battery type are working to increase the nickel

content to [80 percent](#) in an effort to increase range. Roskill’s analysts expect this development to be a “double-boost” for nickel in the battery industry.

## Not all nickel created equal

While the long-term demand outlook for nickel is clearly strong, questions concerning how to supply this demand are beginning to emerge. And that concern has more to do with supply levels of a specific type of nickel product—nickel sulfate—rather than the global supply of nickel overall. “The problem for the nickel industry is it’s not a macro issue; it’s not an issue where we’re going to run out of nickel, but the

specific nickel that's required," said Hykawy. "The specific chemistry and the specific purity that's required for batteries is likely going to put a strain on the supply chain."

Nickel sulfate, derived from high-grade nickel sulfide deposits, is the product favored by EV battery manufacturers. However, the majority of global nickel production is in the form preferred by the stainless steel industry, ferronickel. In fact, most of the forecasted 10 percent growth in nickel production in 2018 will be NPI.

This represents a potential supply side problem for the EV battery industry. Nickel in the form of NPI is not at all suitable for battery cathodes. And the process to convert NPI to battery-grade nickel is much too costly.

"Nickel sulfate can only be produced economically from class one nickel products, which are defined as products with a nickel content of 99 [percent] or more, with the cost of converting ferronickel and nickel pig iron to nickel sulfate not being economically viable," explained S&P Global writer Adam Webb. "This effectively rules out the supply of nickel for lithium-ion batteries from all ferronickel and nickel pig iron operations."

For now, the largest producers of high-grade nickel sulfide ores include major miners BHP Billiton (NYSE:[BHP](#), ASX:[BHP](#), LSE:[BLT](#)), Norilsk Nickel (MCX:[GMKN](#)), Vale (NYSE:[VALE](#)) and

Sumitomo (TSE:[8316](#)). BHP's recent decision to [increase production](#) is evidence that the market is beginning to recognize the need to address rising demand for battery-grade materials.

## Where will new nickel sulfide ore come from?

The supply side for battery-grade nickel products is even more complicated by the fact that there are very few high-grade nickel sulfide deposits under exploration and development given the depressed price environment between 2010 and 2015. According to S&P Global Platts, capital expenditures on [nickel projects](#) reported by one of the world's top nickel producers (NorNickel) fell from \$7 billion in 2012 to \$2 billion in 2017. "Current forecasts

should mean mining companies will be searching hard for feasible projects this year despite low prices and potentially not very promising net present value calculations," said Platts analysts.

New discoveries of high-grade nickel sulfide deposits are not an easy prospect, but Junior Stock Review's Brian Leni told INN at the [Mining Investment North America conference](#) in Toronto that he believes the underinvestment in nickel sulfides represents a significant opportunity to take advantage of a growing market. "So the issue becomes where do these nickel sulfide mines come from? They take five to 10 years to develop sometimes if you're lucky, and what we're seeing right now is a real divergence between what's there and producing, and what needs to be there to meet the projected demand," said Leni.

Some of the most promising nickel sulfide projects can be found in Canada's premiere mining jurisdiction of Quebec and Ontario.

RNC Minerals' (TSX:[RNX](#)) Dumont nickel-cobalt project located in the Abitibi region of Quebec is billed as the largest undeveloped nickel and cobalt reserve in the world. The project has the potential to produce some of the world's highest-grade nickel and cobalt sulfide concentrate, "ideal for producing nickel and cobalt material feed to be sold directly into the battery industry," according to RNC President and CEO Mark Selby. RNC is looking to 2019 to begin the construction phase of the Dumont project.

[Tartisan Nickel's](#) (CSE:[TN](#)) Kenbridge project and the past-producing Alexo-Kelex mine are nickel sulfide-copper-cobalt properties located in Ontario, a province known for its nickel sulfide deposits. The company believes it is the only battery nickel development junior which holds a nickel sulfide deposit with regulatory compliant resources of approximately 100 million pounds of nickel. "Nickel deposits are made, not found, and are subject to supply and demand-driven price cycles," Tartisan President and CEO Mark Appleby told INN. "Large scale underinvestment in nickel exploration and development has led to a rising spot price because of perceived scarcity notwithstanding new

production that has promised to come online for years now. Nickel futures out to one year are in contango, which bodes well for continued price strength.”

## The takeaway

The nickel market is on the verge of a dramatic change in its investment landscape as the ferronickel and nickel sulfate markets diverge in price. Growing demand for a premium product which is currently experiencing supply side concerns amidst a bull market run presents a potentially lucrative opportunity for investors.

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