Sierra Nevada Ally
Lithium miner, processor sees opportunity under Biden's green imperatives
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ioneer's Ryholite Ridge pilot plant successfully converts lithium carbonate into battery-grade lithium hydroxide, awaits mine approval

Last week, ioneer Ltd. announced its successful development of converting lithium carbonate into battery-grade lithium hydroxide at its Rhyolite Ridge pilot plant in Esmeralda County, Nevada. This development positions ioneer, the state of Nevada, and the United States as a whole to potentially meet the burgeoning supply demands of the electric vehicle [EV] industry, which relies on lithium ion batteries.

Two types of lithium products are primarily used to create batteries for electric vehicles: lithium carbonate and lithium hydroxide. Both end products are initially developed from natural lithium carbonate, the likes of which are extracted from the Rhyolite Ridge lithium boron deposit, one of only two lithium boron deposits known globally.

"You can either sell technical-grade lithium carbonate, in which they take lithium carbonate and further purify it to make battery-grade lithium carbonate or they convert it into lithium hydroxide," Bernard Rowe, managing director of ioneer, said. "Our particular lithium carbonate is most suited toward making lithium hydroxide so in terms of going into batteries, we're producing a better suited product because we can make either [battery-grade lithium carbonate or lithium hydroxide]."

The advantage to producing both battery-grade lithium carbonate and lithium hydroxide largely falls in line with the types of vehicles they're suited for, respectively. Lithium carbonate batteries, according to Rowe, have a lower energy density that essentially shortens the range of an electric vehicle's travel distance.

"The lithium carbonate batteries tend to be the lower energy density batteries, so what that means is the travel distance is generally shorter unless you add more batteries, which means added weight that you don't want in a passenger car," Rowe said. "But in a bus or truck [weight] is not such an issue. So these lithium carbonate batteries, in general, are more applicable to vehicles that travel a very set distance every day, like a truck doing a delivery or a bus."

Lithium hydroxide-based batteries, on the other hand, are more suited for passenger vehicles that require the ability to travel both short and long distances. For this reason, Rowe says, companies like Tesla are moving toward primarily using lithium hydroxide-based batteries for their electric vehicles.

"Lithium hydroxide-based batteries have higher energy densities so [the EV industry] is looking to extend the range [of their electric vehicles]," Rowe said. "I think over time we will transition more and more to lithium hydroxide and less and less of the technical-grade lithium carbonate and there's a value add there. So if you're thinking about supplying the US, where you've got the second largest car market in the world, you certainly want to be thinking about producing lithium hydroxide, hence our announcement."

The project at Ryholite Ridge is at an advanced stage, having recently completed a definitive feasibility study. The presence of rare Tiehm's buckwheat on what would be the mine site could complicate permitting, as the plant is currently under consideration for protection under the Endangered Species Act. If the US Fish and Wildlife Service lists the buckwheat, mitigating mining impacts to the plant that only grows in that small part of the world would complicate the mine's approval. Despite this potential obstacle, Rowe said his company will find a workaround and expects their production operations to begin sometime in late 2023.

Solid State Lithium Energy Storage Units

Lithium carbonate and lithium hydroxide are the only chemicals used in EV batteries today, but ioneer is also exploring the possibility of supplying solid state lithium batteries as well. The difference, ultimately, comes down to understanding lithium's tendencies as an element.

Lithium metal is unstable on its own, which is why it always exists within a compound like carbonate or hydroxide. But since lithium ion batteries require a chemical reaction within the compound to produce the energy needed to operate the vehicle, they also inevitably produce a lot of heat. Consequently, cooling systems are needed in the battery packs to prevent overheating and fire risk in an electric vehicle.

“But solid state lithium batteries do not rely on a chemical process so there is none of this heat generation,” Rowe said. “Solid state batteries use lithium metal, so it’s not a chemical reaction. It’s just a transfer of ions and it means that you can pack a lot more energy into a battery, but also you can eliminate the risk of the overheating because you’re moving away from chemistry and into solid state. That opens up the use of those batteries in things like ships, submarines and aircraft, which as of today have largely stayed away from the lithium ion batteries because of the risk of overheating and fire.”

The use of solid state lithium batteries, however, still seems to be years away, with most projections commonly suggesting production toward the end of this decade. So in the meantime, should it be permitted, Ryholite Ridge will focus on its opportunity to supply both companies that produce lithium carbonate and lithium hydroxide batteries.

Yet today, the supply chain of lithium from in-ground deposits to EV batteries is still largely done outside of the US.

“At the moment, the world’s sources of lithium are dominated by two regions, one is Australia that produces a mineral called spodumene that is feeding Chinese production of the lithium chemicals of carbonate and hydroxide,” Rowe said. “The other part of the world is Chile and Argentina, so about 80-90% of the world’s lithium comes from those two regions. So if the US is going to need 300 to 400,000 tons within the next three to five years, then there’s not too many alternatives. So developing a domestic supply is obviously an increasingly important part of that equation because the idea of having these very long supply chains is critical to a lithium battery and electric car.”

The projections of a 400,000 ton demand within five years coincides with the new Biden administration’s ambitious goals for green energy. Rowe said that ioneer is planning to meet a significant amount of that demand.

“Most market watchers predict that we’re probably going to need something like 100 to 150,000 tons by 2024,” Rowe said. “Now whether there’s more aggressive targets that have been talked about by the Biden administration, you’re really talking about 300 and 400,000 tons of lithium chemicals a year that will be needed to electrify the significant portions of the US motor vehicle fleet. If we’re going to go totally electric by 2030, which incidentally Biden is talking about, then that would need about a million tons of lithium a year using current battery technologies. So if [US lithium production remains at] it’s 4,000 tons of current production, that would be meaningless.”

Additionally, today’s batteries and their cathodes, which is the part of the battery that contains the lithium, are primarily manufactured in places like Japan and Korea. But ioneer is optimistic that a greater domestic supply of lithium, in conjunction with a shorter supply chain brought about by partnerships like the recent signing of ioneer’s Memorandum of Understanding agreement with Dragonfly Energy, will strengthen the battery materials supply chain in Nevada and the US.

Bernard Rowe speaks to Fish Lake Valley community members in Jan. of 2020 – photo: ioneer
All things considered, however, an even greater supply of lithium within the US will still be needed. The two most advanced lithium projects in Nevada is Rhyolite Ridge, a sedimentary deposit and Thacker Pass, a clay deposit. Although Rowe and ioneer have no affiliation with the project at Thacker Pass, they recognize that if a domestic supply of lithium doesn’t meet the growing US market demands, the importation of lithium for EV battery demands will continue.

“Rhyolite Ridge has a production capacity of about 20,000 tons of lithium and you can double that production to get up to about 50,000 tons of lithium a year,” Rowe said. “But remember, we’re talking about 150,000 tons by 2024 and maybe 300,000 tons within a year or two after that. So you need not one or two of these [lithium mines], you need ten of them and when the US is not going to be 100%

self-sufficient in lithium, we will import lithium from Australia and South America and other parts of the world. So just to make a difference, you need a number of these projects to be developed and the other [lithium projects in Nevada] are at a much earlier stage and they're clay deposits so they're lower-grade and the economics is not quite so attractive. But a high lithium price for a prolonged period also makes them potentially economic."

Consequently, ioneer is hoping its development of lithium hydroxide production at its Rhyolite Ridge pilot plant, in conjunction with Tesla's factories located nearby, will position the state of Nevada and the US as a stronger player in the EV and lithium battery industry moving forward.

"In the longer term, we are hoping that it will be manufactured into lithium ion batteries in the United States, but we haven't got any sales agreements on our lithium yet," Rowe said. "So we see a very positive outlook for domestic lithium demand within the United States and Rhyolite Ridge is ideally positioned to supply to that market. It's the most advanced lithium project in the country and is the only lithium project that's completed a bankable feasibility to date and also run a full simulation pilot plan. We're still doing permitting, and financing around it, but it's very well-positioned to be a supplier to that rapidly growing US demand."