CLOSING THE LOOP

American Battery Technology Company addresses the projected battery metals shortage in the U.S.

By Stacey Phillips

RYAN MELSERT
CEO/CTO of American Battery Technology Company (ABTC)

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With the growing demand for lithium-ion batteries to power electric vehicles (EVs), stationary grid storage systems, and consumer electronics, the domestic production of battery metals that supply these operations has not kept pace, according to Ryan Melsert, CEO/CTO of American Battery Technology Company (ABTC), headquartered in Reno, Nevada.

"Total demand for battery metals is forecast to jump by 50% this year to 4.8 million metric tons, and race to over 17.5 million tons by the end of the decade," according to BloombergNEF. "Demand for lithium is set to grow the fastest, surging more than sevenfold between 2021 and 2030."

Under Melsert's leadership, ABTC is addressing the projected battery metals shortage in the United States through its first-of-kind innovations.

"No other battery technology company is solving the challenge of meeting the soaring demand for battery metals like ABTC," said Melsert. "We are uniquely positioned to supply low-cost, low-environmental impact, and domestically sourced battery metals through our three core operations to support a sustainable, closed-loop battery metal economy." These include the first commercial-scale implementation of the company's integrated lithium-ion battery recycling technologies, primary metals resource development and primary metals extraction.

ABTC's CEO recently shared information with *Automotive Recycling* about the company's initiatives.

***Automotive Recycling*: What are some of the current challenges with battery metals supply?**

RYAN MELSERT: Globally, and especially in the U.S., there's a large capacity for producing EVs and battery cells but very little capacity to make the battery materials that go into them. The supply chain only has the throughput of the most limiting factor – in this case, battery-grade materials.

The U.S. federal government considers the primary battery metals – lithium, nickel, cobalt and manganese – 'essential to the economic or national security of the U.S.' However, less than 1% of the global manufacturing capacity of these materials is within the country.

At the same time, the cost of manufacturing and importing battery metals has grown rapidly over recent years as demand has increased far faster than new supply can enter the market. Another challenge is the environmental impact of the supply. Conventional methods of mining battery metals can result in the emission of large amounts of greenhouse gases, air pollutants, and contaminated water and soil.

***AR*: How did your prior experience lead to the creation of ABTC?**

MELSERT: I've worked in the battery materials space for nearly 15 years. Initially, I focused on research and development, creating a variety of selective sorbents for the extraction of lithium from unconventional resources, including geothermal and wastewater brines. In early 2015, I began working at Tesla as part of the initial team hired to design, construct, and commission the world's first battery Gigafactory located outside of Reno, Nevada.

In my third year at Tesla, I moved to the R&D division and formed a team called the Battery Material Processing Group. We developed new processes of how to liberate materials from unconventional ores and brines that were nickel, cobalt and lithium-bearing, and then how to purify the recovered metals. We also created new manufacturing methods to synthesize refined components like active cathode material, and test those against what we witnessed in the market. A group of us later left Tesla and joined ABTC in 2019.

ABTC is constructing a 100,000-square-foot first-of-its-kind Battery Recycling Pilot Plant in Fernley, Nevada.

***AR*: Can you tell us about ABTC's vision and the company's unique focus on mining and recycling?**

MELSERT: ABTC is an advanced technology lithium-ion battery recycling and primary battery metal extraction company.

For the last several years, we have been validating and optimizing first-of-kind battery recycling technologies from defective and end-of-life batteries. The company is also refining these battery materials to meet battery grade material specifications for reintroduction into the domestic supply chain to enable a closed-loop circular economy.

Our work in lithium-ion battery recycling technologies was validated early on when we were recognized in 2019 as the winner of a global competition to identify the most promising lithium-ion battery recycling technologies enabling a circular economy. "The Circularity Challenge" was hosted by BASF in partnership with Greentown Labs. BASF is one of the largest cathode active materials manufacturers in North America.

In the spirit of circularity, the primary goal of establishing a battery recycling system is to enable a closed-loop flow of battery materials. We were recognized because when end-of-life, full battery assemblies (including scrap materials) go through our recycling process, each element is extracted and purified to battery grade quality and can be introduced back into the supply chain to manufacture new batteries.

Since then, our team of 50 employees has continued to develop proprietary technologies to produce domestically-sourced battery-grade metals at substantially lower cost and lower environmental impact than current conventionally-sourced battery metals.

As part of our focus on lithium-ion battery recycling and primary metals manufacturing, ABTC is constructing a 100,000-square-foot first-of-its-kind Battery Recycling Pilot Plant in Fernley, Nevada, which will separate and recover critical materials from end-of-life batteries and purify the products to meet battery grade material specifications. Ramp-up of the plant is underway and commissioning is targeted to start within the next few months. The plant is expected to process 20,000 metric tons of feedstock annually and produce battery-grade materials to be redeployed into the North American battery supply chain.

In March, ABTC announced the purchase of an additional commercial-scale battery recycling facility in the Tahoe-Reno Industrial Center in Nevada to expand operations of our battery recycling technologies.

This will enable the company to rapidly implement its internally-developed lithium-ion battery recycling technologies at significantly higher capacity than previously planned. The approximately 137,000-square-foot facility was previously used for the recycling of lead-acid batteries.

In terms of ABTC's primary resource development, we are designing a process to manufacture battery cathode grade lithium hydroxide from Nevada-based sedimentary claystone resources as part of our Tonopah Flats Lithium Project near Tonopah, Nevada. In this historic mining town, lithium has been found in brine and claystone

resources. This novel method allows for significantly lower consumption of acid, lower levels of contaminants in generated leach liquor, and lower overall production costs.

Partnering with the Nevada Center for Applied Research (NCAR) at the University of Nevada, Reno, and Greentown Labs, ABTC scientists and engineers at our research development center support the design and development of extraction technologies for both recycling and primary metals extraction. Because we have these capabilities in-house, ABTC is uniquely positioned to increase the domestic U.S. production of battery metals while ensuring that these materials are returned to the manufacturing supply chain in a closed-loop fashion.

***AR*: In building one of the first non-thermal battery recycling plant in the U.S., what does the closed-loop process of recycling EV batteries look like for your company?**

MELSERT: The primary goal of establishing a battery recycling system is to enable a closed-loop flow of battery materials. An individual battery cell is a closed system. Over time, the compounds degrade but the elemental composition of the battery is the same at the end-of-life as the day it was manufactured.

Recycling is very important to close the loop and ensure that once an element is introduced into the battery market, it can stay there indefinitely. That would be enough if the occupied mass of batteries in the field was constant. However, the occupied mass is growing very quickly because of the dramatic growth in EVs and stationary grid storage systems.

In addition to closing the loop, you also must fill the loop the first time. That's why we became involved in developing this new method for the primary manufacturing of battery-grade lithium.

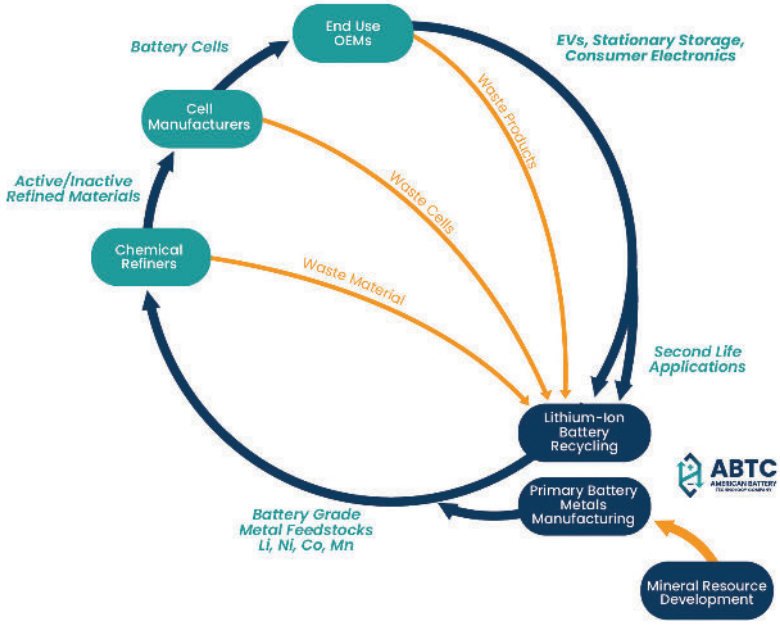
Traditionally, the battery metal supply chain has worked in a more linear fashion, starting with primary metals, like lithium, first harvested or extracted from ores and brines in the ground. These metals are refined by large companies and then manufactured into high-energy-density active cathode material. These synthesized cathode materials are sold to battery cell manufacturers to make batteries and the battery cell manufacturers sell their materials to original equipment manufacturers (OEMs).

Most end-of-life batteries are treated as waste rather than a valuable source of battery materials. Many recycling firms take a battery and burn about half of it or drop it into a shredder and mix everything. When you do that, it makes it very difficult and expensive to isolate one element. Because of that, they tend to get lower recovery efficiencies and only recover the high-value materials. It ends up being a low percentage of the whole battery by unit mass, usually less than 20%.

Our team didn't want to just recover the token elements. Instead, we're able to separate large amounts of the byproducts early to sell those materials and then retain the high-value metals that go into our chemical extraction loop.

Our closed-loop battery recycling process is based on a strategic de-manufacturing approach to extract metals and recover materials from spent batteries. It separates and recovers critical materials from end-of-life batteries and purifies these battery metals to the same, or higher, quality specifications than conventional materials sourced from mining operations. The two-part process is highly streamlined and efficient, with the potential to process materials within a very short residence time and has recovery rates of greater than 90%.

We have been able to realize greater net benefits than current conventional methods. These include reduction of waste, conservation of natural resources, such as water, decreased air pollution associated with smelting, increased operational efficiencies, higher material recovery rates, and capture of battery-grade materials with no quality degradation compared to conventional virgin-sourced materials.



***AR*: Can you tell us about the grants ABTC has received for its recycling and primary resources projects?**

MELSERT: In 2021, we received a $2 million battery recycling grant from the United States Advanced Battery Consortium LLC (USABC), which is comprised of the U.S. Department of Energy (DOE), Ford, General Motors and Stellantis. The focus of the 30-month project is to show that battery-grade metals can be manufactured from recycled materials at lower cost, with lower environmental impact, and with higher domestic U.S. sourced content than conventional virgin sourced metals.

By working with partners across the supply chain, including BASF and cell technology developer C4V, we are demonstrating the commercialization of our integrated lithium-ion battery recycling system and production of battery cathode grade metal products.

In November 2022, ABTC was selected for a competitive U.S. DOE grant for a $20 million project to develop and commercialize next-generation techniques for ABTC's lithium-ion battery recycling processes. As previously mentioned, we're completing construction on the Global Development Center in Fernley, Nevada, to validate and test our recycling technologies.

We also received grants for our Tonopah Flats Primary Resources project. A $4.5 million U.S. DOE grant was awarded to construct a field demonstration site to produce lithium hydroxide from sedimentary claystone resources in Central Nevada. We kicked off the project in October 2021.

Recycling is very important to close the loop and ensure that once an element is introduced into the battery market, it can stay there indefinitely.

With decades of experience in the field, our on-the-ground specialists bring a breadth of expertise in exploration, mining, geology, and the dynamics of the Nye-Esmeralda County area.

Because we met all the milestones to date with that project, we were able to apply for additional government funding. In 2022, we were awarded a $57 million U.S. DOE grant to construct a $115 million first-of-kind battery manufacturing facility in Nevada. The project was announced by President Biden and U.S. Energy Secretary Jennifer Granholm during a White House ceremony. It was an honor to receive that recognition and support going from laboratory to pilot to commercial-scale operations.

We're very excited to have received these grants with these partners; it helps us to solidify the path forward.

***AR*: Can you share information about the Tonopah Flats Lithium Project?**

MELSERT: Most of the lithium manufactured today comes from conventional resources. About half is from hard rock ores mostly in Western Australia. The other half is from lithium-bearing brines, mainly in South America. Both concentrates are primarily shipped to China for processing and refinement into battery-grade materials.

In the United States, we don't have especially large quantities of these conventional resources of high-concentration ores or brines, or the manufacturing capacity. Therefore, we began looking at unconventional resources, including what the legacy mining industry had overlooked for many decades. One of these resources is sedimentary claystone, which is very prominent in central Nevada. It was explored many times, but a commercial process hasn't been developed that could economically extract the lithium from that type of material and produce it into a battery.

ABTC's Tonopah Flats Lithium Exploration Project encompasses one of the largest known lithium claystone resource deposits in the U.S. The project, which is co-funded by two Department of Energy (DOE) grants, includes the exploration of 517 unpatented mining claims covering about 10,340 acres of land administered by the Bureau of Land Management. We're conducting geological mapping, sampling, drilling, geochemical analysis and proprietary extraction trials to characterize these resources and quantify the performance of the lithium extraction and manufacturing operations.

We're excited to move forward commercially. We interviewed some of the largest construction firms worldwide and selected Black and Veatch to work on the project, which will kick off in the next few months. The 30,000-ton-per-year facility is expected to be complete in 2025 and will be one of the largest lithium hydroxide plants in the world.

***AR*: What is the focus and value of building strategic relationships?**

MELSERT: We enjoy working with world-class partners in the private industry, public university, and government laboratory sectors. These include auto manufacturers, cell

manufacturers, and chemical refiners. We highly value these relationships because we recognize that's how this industry will grow.

All our strategic relationships involve our customers. They're either generators of end-of-life batteries to deliver products to us or customers of recycled battery metals that we sell our products to. When you move to a closed-loop economy, that blends together.

We've also had discussions with many trade associations, including the Automotive Recyclers Association. We're in the early stages of logistics and transportation with the battery supply chain; however, there are opportunities to get much higher collection efficiencies and reduce those collection and transportation costs. Working as an industry to establish that is important to ensure recycling can grow.

***AR*: What are your thoughts about EVs and electric batteries and some of the obstacles?**

MELSERT: It's difficult to create a balanced manufacturing supply chain in one region. Currently, there are about 15 under construction in the U.S., including Tesla's Gigafactory.

Each is a multi-billion-dollar investment and they must import close to 100% of their feed. That puts them at risk if there is a natural supply chain disruption like we saw during the pandemic or political supply chain disruption, which increases the cost when they must source metals from the other side of the world to pay import and export tariffs and transportation costs. It also leaves a larger environmental footprint to have those metals harvested in less regulated areas and then have them shipped worldwide.

One of the main obstacles is creating a balanced supply chain within the U.S. where you can source domestic factories with domestic materials. Closed-loop battery recycling can play a large role going forward but it depends on making a balanced closed loop. This is why encouraging critical battery material manufacturing in the U.S. is so important.

A few years ago, everyone wondered if EVs would take off and dominate. Now, it's how long it will take before they are the main choice for consumers.

Stacey Phillips is a freelance writer and owner of Radiant Writing & Communications, where she specializes in providing content and digital marketing for the collision repair industry. She also serves as the marketing director for CIECA since 2017.

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