



Strengthening the US EV Battery Recycling Industry to Onshore Critical Material Supply

By **Lewis (Zhaoyu) Wu** and **Dr. Tom Moerenhout**

The Biden administration has stressed that building domestic electric vehicle (EV) battery recycling capacity is necessary to achieve critical material supply chain resilience¹ and to meet the US energy transition goal of net-zero carbon emissions by 2050.² Developing new mines for such materials can be a lengthy process—it takes on average 29 years for a mine to go from discovery to production in the US³—and recycling materials lowers demand in the raw material mining sector.⁴ Greater domestic battery recycling would also provide a hedge against a potential short supply of materials as US automakers increase EV production in the long run.

Policy support at federal and state levels is in place to bolster the nascent battery recycling industry. Nevertheless, the industry faces many challenges, including securing a consistent supply of recyclable materials, managing the risk of losing feedstock to exports of end-of-life EVs, competing with international players, and countering China's overcapacity of battery material supply.

This commentary first discusses challenges facing the US battery recycling industry before outlining various policies currently supporting it, including recycling technology research, tax incentives, labor training, and battery recycling regulations. Additional policies could be applied to secure domestic feedstock, such as setting critical material recycling targets and establishing international recycling standards. Extended producer responsibility (EPR) for US-based EV makers to recycle retiring batteries could also propel the industry. Long-term success, however, will require mobilizing private capital to balance market forces with the need for securing critical materials.

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Challenges in the US Battery Recycling Industry

US recyclers face a range of challenges beyond the typical financial and operational issues common to many start-ups. They must secure a reliable supply of recyclable materials, some of which are lost through EV exports, while competing with established international players. These risks are intensified by a significant tension between the anticipated medium- to long-term demand growth for critical materials and the current unfavorable market due to global overcapacity in the battery and mineral sector and underperforming EV demand.⁵ Policy support can help address these challenges and, in turn, strengthen the supply chain for critical materials.

US EV battery recycling plants plan to have the capacity to recycle 1.3 million EV-equivalent batteries annually, but only 341,000 will be available by 2030.⁶ Given the expected shortage of waste EV batteries, recyclers likely will not have sufficient batteries and scrap from battery production processes⁷ for recycling to run their facilities at a high enough capacity to cover costs. As explained, however, maintaining a strong recycling industry is considered essential by the Biden administration for securing mineral supply. Some recyclers have established contracts with battery cell manufacturers for production scrap and agreements with automotive original equipment manufacturers (OEMs) for future supplies of end-of-life battery packs,⁸ but capacity still looks to overshoot feedstock.

A complication arises when used EVs are exported and their batteries wind up in foreign markets. The absence of a mechanism to retain recyclable materials from exported second-hand or end-of-life vehicles reduces the material feedstock available in the US market, undermining the economic viability of American recyclers and hindering their expansion efforts. International OEM recyclers, located at battery cell manufacturing facilities and automotive OEMs outside of the US, facilitate on-site recycling of scrap and end-of-life batteries, enabling a closed-loop system.⁹ The US could adopt similar practices, requiring manufacturers to retain ownership of battery materials to be made available as feedstock for US recyclers.

The Biden administration is concerned about China's industrial overcapacity and its potential threat to the US supply chain.¹⁰ China has three times the existing and planned battery recycling capacity of the US.¹¹ Treasury Under Secretary Jay Shambaugh has stated that the Chinese government's large-scale support to specific industrial sectors causes overcapacity that can compromise supply chain resilience, given the resulting overconcentration of some manufacturing sectors within one country's control.¹² The US government has made an effort to level the playing field of support through the Bipartisan Infrastructure Law, the Inflation Reduction Act, and trade enforcement measures like Section 301 tariffs,¹³ which impose sanctions on foreign countries that violate US trade agreements or engage in acts that are deemed "unjustifiable" or "unreasonable" and that burden US commerce.¹⁴



Current Policy Support for Recyclers

During the Biden administration (2021–24), numerous policies have been introduced to bolster the EV battery recycling industry. These efforts encompassed support for research and development (R&D), financial incentives, programs to develop specialized labor, and regulations to formalize recycling standards and practices.

To promote R&D, the government has launched several initiatives, including:

- **Critical Minerals Collaborative (CMC):** Aims to accelerate the research, development, and demonstration (RD&D) of domestic critical mineral supply chains, including material recycling.¹⁵
- **Battery Recycling RD&D Grants Program:** Funds projects focused on innovative approaches to increasing battery reuse and recycling.¹⁶
- **Critical Minerals Mining and Recycling Research Program:** Supports RD&D to advance critical mineral mining, recycling, and reclamation technologies, improving the use of domestic resources and reducing reliance on foreign minerals.¹⁷
- **Electric Drive Vehicle Battery Recycling and Second Life Applications Program:** Provides grants for the research and demonstration of EV battery recycling and second-life applications.¹⁸

For financial support, a range of incentives have been introduced, including:

- **Qualifying Advanced Energy Project Tax Credit (48C):** Provides tax credits for critical material recycling projects.¹⁹
- **Inflation Reduction Act of 2022 Clean Vehicle Credit:** Ensures that eligible vehicles meet critical mineral sourcing requirements for extraction, processing, recycling, and battery component manufacturing.²⁰
- **Battery and EV Manufacturing Tax Credit:** Supports projects that reequip, expand, or establish EV battery recycling facilities.²¹
- **Battery Manufacturing and Recycling Grants Program:** Provides funding for large-scale battery production and recycling facilities.²²
- **Advanced Energy Manufacturing and Recycling Grants:** Offers grants to small and mid-sized manufacturers for fuel cell recycling facilities.²³
- **Battery Collection Recycling Grant Program:** Encourages the creation of systems for battery collection, reuse, recycling, and proper disposal.²⁴

- **Battery Materials Processing and Recycling Grant Program:** Funds commercial-scale battery component production and recycling facilities.²⁵
- **Innovative Energy Loans:** Provide loan guarantees for eligible recycling projects through the Innovative Energy Loan Guarantee Program.²⁶ The loan program office also offers a conditional commitment to recycling companies. A notable example would be Redwood Materials, a top recycler, which received a \$2 billion conditional loan commitment for the construction and expansion of a battery materials campus in Nevada.²⁷

To address the growing need for specialized labor, the Battery Workforce Challenge was launched, offering funding to support engineers, technicians, and workers for the domestic EV and battery workforce.²⁸

In terms of regulation, the government has taken steps to standardize and formalize recycling practices, including:

- **Critical Emerging Technology Standards Development:** Accelerates private sector efforts to establish standards for battery recycling and reuse.²⁹
- **Battery Collection Best Practices:** Developed a report and toolkit outlining best practices for the collection and recycling of batteries.³⁰

There are not many significant state-level policies that provide financial incentives to the recycling industry, specifically, but some state governments offer tax incentives and foster a business-friendly environment, making their areas especially appealing for large-scale recycling operations. Notable examples include low or no state property, inventory, corporate income tax, and sales taxes (e.g., Nevada³¹ and South Carolina³²), and access to industrial land (e.g., Georgia's Ready for Accelerated Development Program³³).

Potential Policies to Address Specific Industry Needs

While the list of policies in the previous section is extensive, certain additional measures could address ongoing recycling industry issues, such as the need for more feedstock. For example, regulations could control exports of end-of-life EVs that contain domestically sourced materials to keep retiring batteries in the US. This could be coupled with implementation of extended producer responsibility (EPR) policies for US-based EV makers that hold them responsible for the full life cycle of batteries, essentially requiring manufacturers to take back and recycle retiring EV batteries. If choosing to take this route, the US would not be the first major EV producer and consumer to implement such policies. The Chinese government qualified black mass—or a shredded battery metallic mixture—as hazardous waste in 2018, which obstructed exports of



end-of-life batteries.³⁴ Similarly, a collection of industry and environmental organizations in the European Union has pushed the EU to qualify black mass as a hazardous waste to retain more of it in the region.³⁵

The US government may also consider setting strict critical material recycling targets for EV and battery manufacturers to promote domestic recycling, with legal consequences if these targets are not met. This is similar to the new EU batteries regulation that came into effect in 2023, which mandates that 25% of critical mineral demand in the EU comes from recycling by 2030.³⁶ It has been reported that these measures have pushed the industry toward a battery recycling capacity pipeline increase of 28% since the announcement of the target.³⁷ The government may promote a gradually increasing recycled-material content requirement for EV batteries, and such requirements can eventually spread to free-trade nations through various incentives and mutual trade agreements.

The US government could also work with international bodies to develop harmonized EV battery end-of-life treatment standards. Harmonized recycling standards could facilitate the global trade of recyclable materials and establish cross-border recycling agreements with countries that lack necessary facilities and infrastructures, thereby securing material feedstock for domestic recyclers. An important first step is to form a consensus among governments and international organizations that have authority in matters related to critical material recycling and are responsible for planning and implementing recycling standards on the definition of new vehicles/batteries, used vehicles/batteries, end-of-life vehicles/batteries, and the materials produced from preprocessing end-of-life vehicles/batteries. Enforcing the battery recycling standards would only be plausible with an agreement on these definitions.

Government incentives alone are not a sustainable solution to the problem in the long run, however, since much more capacity will be needed to be ready for a ramp-up in available end-of-life batteries in the next 10 years.³⁸ Certain policies could be deployed now to encourage private investor involvement, such as establishing a price floor for key recyclable materials for a certain duration to stabilize current price volatility.

Ultimately, the ability to expand the US EV battery recycling industry lies in balancing market forces to make it globally competitive. The US government's goal to better secure critical materials through domestic recycling requires a comprehensive policy approach that emphasizes incentives, international cooperation, and engagement of private capital.

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