



Lithium-Ion Battery Manufacturers and Recycling

By Dan Wilkins and John Kuna | October 2023

30 Second Snapshot:

- EV battery manufacturers across the nation are establishing battery recycling facilities and partnering in public-education efforts to promote recycling to reach circularity.
- Despite a sixfold increase in lithium-ion battery demand expected by 2023, the U.S. remains reliant on battery imports, emphasizing the importance of effective recycling and reuse strategies.
- The Environmental Protection Agency is working with the battery industry to establish best practices for labeling and recycling, aligning with the Department of Energy's goal of a [90 percent](#) recycling rate for all consumer, EV, and grid-storage batteries by 2030.

Introduction

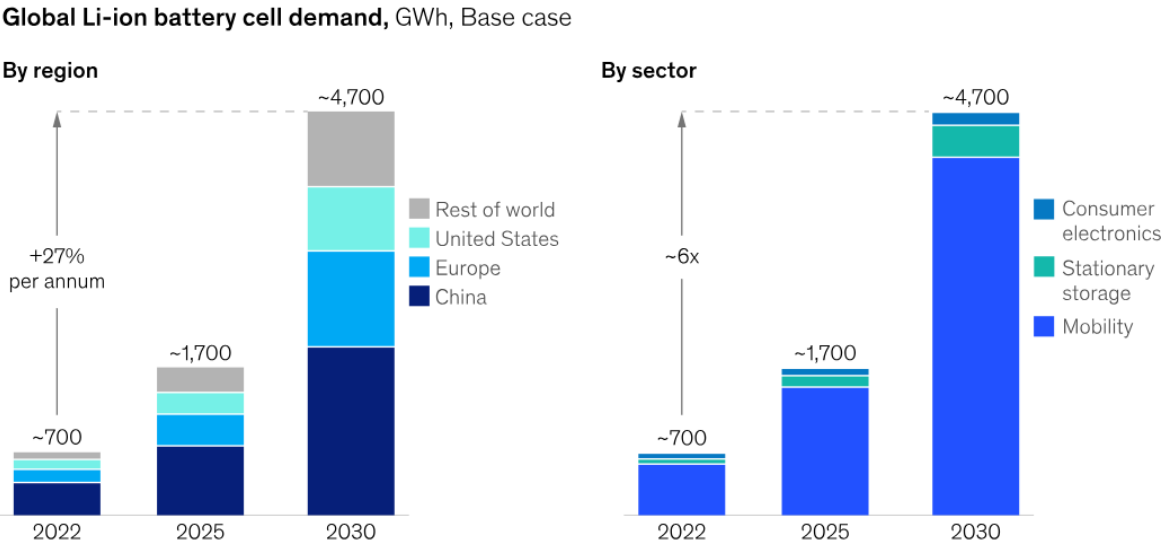
Increasingly, the world runs on lithium batteries. Whether it's smartphones, power tools, electric scooters, or electric vehicles, many new devices rely on lithium-ion batteries to power them. As automakers aggressively transition from gas-powered internal combustion engines to battery electric vehicles, the U.S. Department of Energy (DOE) [estimates](#) that global demand for lithium-ion batteries will grow by a factor of five to 10 over the next 10 years. This heightened demand underscores a crucial moment for EV battery original equipment manufacturers (OEMs) and traditional consumer lithium-ion battery producers. Rather than merely expanding production, increased focus is now being given to recovering, reusing, and recycling battery materials back into the supply chain. This fact sheet outlines the initiatives of battery makers and industry stakeholders in investing in this sustainable approach and their engagement with the recycling sector.

Battery Makers Exploring Greater Engagement in Recycling

The lithium-ion battery market is in the midst of a historic period of growth. McKinsey [estimated](#) lithium-ion battery demand to leap from 700 gigawatt-hours (GWh) in 2022 to approximately 4,700 GWh by 2030. The DOE notes that this is the equivalent power of [42.72 million](#) Nissan Leaf EVs. Notably, mobility solutions will account for a staggering 90 percent of this demand. To better understand this sense of scale, see Figure 1.

This anticipated growth has prompted battery producers to explore various ways to meet demand, including [exploring new chemistries](#) with less critical minerals, recycling batteries at their end-of-life, and integrating supply chains.

Figure 1: Lithium-ion battery demand to increase by more than 550% by 2030



This figure notes the substantial rise in demand for lithium-ion batteries globally between 2022 and 2030. Mobility includes passenger cars, commercial vehicles, two-to-three wheelers, off-highway vehicles, and aviation.

Source: [McKinsey & Company](#)

Major EV battery manufacturers currently operating in the U.S. are increasingly recognizing the importance of embracing circularity:

- Panasonic:** From 2025 onwards, Panasonic’s DeSoto, Kansas plant will source recycled battery cathode materials from Redwood Materials in a [multi-billion dollar deal](#). This aligns with Panasonic’s greater promotion of recycling in both production of batteries and end-of-life circularity, as noted in their [2030 net zero goals](#).

- **LG:** LG Chem and LG Energy Solutions [are investing](#) \$50 million in Canadian battery recycler Li-Cycle. Starting in 2023, LG will receive 20,000 tons of recycled nickel from Li-Cycle’s Rochester, New York hub over the course of a decade. LG Energy Solutions is aiming to establish a closed loop system to all battery manufacturing plants [by 2025](#).
- **SK On:** Partnering with Ascend Elements, SK’s ecoplant [will invest](#) \$65 million to establish an EV battery recycling facility in Kentucky, slated to open in 2025. The facility will process approximately 24,000 tons of used EV batteries annually. The company’s commitments to overall battery circularity and sustainability are not known.

These three entities—Panasonic, LG, and SK On—held roughly [26.4 percent](#) of the global EV battery market share through August of 2023. The top two leading manufacturers, CATL and BYD commanded 36.9 and 15.9 percent of the market share, respectively, but do not have active operations within the United States at this time. In September 2023, Ford [paused construction](#) of a U.S. battery plant to be built in partnership with CATL due to the company’s concerns over the plant being competitive and amid scrutiny from the U.S. Congress about CATL activity in China, including forced labor. Prior to the pause, Ford had [announced](#) a collaboration with Redwood Materials to “build out battery recycling and a domestic battery supply chain.” It is unclear if Ford’s partnership with Redwood Materials would feed the CATL-partnered battery plant if and when it is completed.

Consumer Education & Sourcing Materials from Consumer Batteries

The rise of EVs necessitates efforts from battery manufacturers within their own supply chains and a coordinated response from the consumer battery market, regulatory bodies, and recycling organizations. Individual consumer action also plays a crucial role in the battery recycling ecosystem. Success in the battery recycling sector is not just essential for the DOE’s goal of achieving a [90 percent](#) recycling rate for all consumer, EV, and grid-storage batteries by 2030. It is also essential to address the looming market supply gaps. Argonne National Laboratory notes that demand for lithium batteries in the United States is poised to surge by a [factor of six by 2030](#). Despite this significant growth in demand, the United States is projected to remain reliant on battery imports (currently at [over 50 percent](#)), emphasizing the need for effective recycling and reuse strategies.

Individual companies and coalitions are pushing new initiatives to increase battery recycling. Call2Recycle, supported by over [200](#) industry companies, [educates consumers](#) about battery recycling and claims to have collected millions of pounds of lithium-ion batteries in [2022](#). In addition, Panasonic’s ‘[Take Back for Tomorrow](#)’ program launched in 2023 focuses on the recycling of electronic personal care devices. Recognizing the

inconvenience barrier, Panasonic offers a mail-in system where consumers can sign up online, receive a pre-paid shipping label, and send their end-of-life products to Redwood Materials, who will then recycle and remanufacture metals into components for Panasonic’s EV batteries.

Google is also ramping up efforts to promote consumer buy-in to e-waste recycling. According to the company, only about 20 percent of post-consumer e-waste ever reaches the recycling stream. To tackle this issue, Google, in collaboration with major tech brands like Amazon and Apple, initiated a doorstep collection program in Denver in [2022](#). By focusing on reducing barriers identified in their [research](#)—such as low awareness of recycling options, emotional attachments to devices, and data security concerns —Google aims to boost recycling rates and reintegrate valuable minerals into the circular economy. Collectively, these programs highlight the need for extensive industry collaboration, innovative strategies, and consumer awareness campaigns to bolster circularity for battery recycling.

Embracing National Mandates & Engaging in a Constructive Dialogue

Battery makers amplify their collective voice through participation in industry groups like the NAATBatt International, the Consumer Technology Association (CTA), the Portable Rechargeable Battery Association (PRBA) and the National Electrical Manufacturers Association (NEMA). With over 300 member companies, NAATBatt promotes development and commercialization of advanced battery manufacturing in North America through partnerships with [research institutions](#) like the National Renewable Energy Laboratory. CTA releases sustainability reports that highlight the achievements of their 2,200 member companies such as [waste diversion, repair and reuse, and electronic recycling](#). PRBA’s members represent over 65 percent of the global lithium-ion battery industry, while NEMA encompasses nearly 325 member companies providing a range of products within the electrical equipment sector. These organizations, representing a substantial portion of the global battery market, have been pivotal in shaping the discourse around best practices for battery recycling.

Through the Bipartisan Infrastructure Law (BIL) of 2021, EPA is [developing best practices](#) to design effective labeling and recycling strategies through active engagement with the battery industry and other key stakeholders. Their approach encompasses a wide array of batteries, from consumer to EV batteries. Numerous stakeholders including [Tesla](#), as well as [NEMA](#) and [PRBA](#), submitted recommendations to EPA for their request for information in 2022 on battery recycling best practices and labeling guidelines.

Below are standout suggestions for future best practices and guidelines:

- **Unified Battery Labeling via QR Codes:** Both PRBA and NEMA stressed the importance of aligning with global standards, pointing to the European Union’s [Batteries Regulation](#) for creating a “[battery passport](#)” via QR codes. QR codes, suggested by both PRBA and NEMA, among others, was recognized as a potent tool to effectively share critical information with both consumers and industry partners within the recycling space.
- **Environmental Handling Fees (EHFs):** PRBA and NEMA advocated for EHFs at the point of sale and believe they can raise recycling awareness among consumers. PRBA’s comments also noted that there are several successful examples of EHFs in the United States—paint, tires, and used pharmaceuticals—and a battery EHF would be an equitable way to ensure batteries are collected safely. PRBA and NAEM did not advocate for a “producer responsibility” model as they believe requiring companies to collect batteries of their foreign competitors in the domestic market places an uneven burden on U.S.-based companies.

As the battery recycling market in the United States expands, the industry must weave together new business partnerships, launch consumer education initiatives, and pioneer new recycling methods. While the overarching objective is a sustainable lifecycle for batteries, the pairing of consumer awareness with policy and labeling initiatives can amplify the impact.