



Battery Energy Storage Systems Can Be Recycled

Battery Energy Storage Systems (BESS) provide a wide variety of valuable services to the electricity grid that will help California reach its aggressive low carbon grid goals. However, BESS products will eventually reach the end of their useful life and need to be removed from their initial service use. After this time, the battery may need to be recycled, reused, or reconditioned. Battery Energy Storage Systems can be safely and economically recycled.



University of California San Diego (UCSD) combines the fastest electric vehicle charging, second-life EV batteries, and solar at the campus microgrid.
Source: University of California San Diego

BATTERY RECYCLING ENSURES:

- **Resource conservation** - Recovery and reuse of viable and valuable materials including lead, iron, plastic, lithium, aluminum, cobalt and more
- **Waste management** - Protect the environment and health from universal waste stockpiling
- **Emissions reduction** - Fewer needs for extracting new raw materials translates to reduced GHG emissions
- **Safe battery management** - Safe deconstruction and disposal

CESA is a non-profit membership-based advocacy group committed to advancing the role of energy storage in the electric power sector through policy, education, outreach and research.



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Energy Storage Systems: A Life Cycle

Recycling, reusing, or reconditioning Battery Energy Storage Systems will greatly reduce environmental impacts, costs, and ensure environmentally responsible disposal. Battery Energy Storage Systems constructed using recycled materials in the manufacturing process requires 46-75% less energy than extracting and refining virgin metals¹. Safe battery recycling is a shared responsibility between manufacturers, battery retailers, installers, and end customers.



¹ European Commission Impact Assessment

A Typical Battery Recycling Process



LITHIUM-ION BATTERY RECYCLING

- 'Second-life' lithium-ion batteries from electric vehicles can be used to provide grid services after they are no longer suitable for EV applications.
- Recycling lithium-ion batteries allows for resource conservation by recovering viable materials including cobalt, lead, iron, plastic, lithium, aluminum, and more.
- Recycled materials from lithium-ion batteries can reduce production costs of new lithium-ion batteries by 10 to 30 percent¹.

¹ Argonne National Lab Press Release, Feb 15, 2019

OTHER BATTERY RECYCLING

- Lead-acid, sodium-sulfur, flow batteries, and other battery technology types contain valuable materials that can be recovered and recycled.
- Due to robust recycling policies and cost-effective recycling methods, lead-acid batteries are recycled at a rate of 99%².
- Vanadium flow battery electrolytes can be recycled and reused.
- Recovery of nickel allows nickel-metal hydride batteries to be economically recycled.

² epa.gov, Advancing Sustainable Materials Management: 2015 Fact Sheet

Energy storage systems encompass a broad asset class. Recyclability varies based on the type of energy storage with some batteries, such as lead-acid, achieving 99% recycle rates.