



POWIN'S COMMITMENT TO SUSTAINABLE BATTERY RECYCLING



SUSTAINABLE **BATTERY RECYCLING**

At Powin, we're not just leading the charge in innovative energy storage solutions – we're pioneering the path to a sustainable future through our comprehensive battery recycling program. Our commitment extends far beyond providing state-of-the-art battery systems. We're also dedicated to responsible end-of-life management and recycling of our batteries, contributing to a circular economy and accelerating global decarbonization efforts.





OUR COMPREHENSIVE **RECYCLING APPROACH**

Powin offers customers optional battery recycling for full or partial systems at end-of-life (EOL). This multi-faceted program exemplifies our commitment to environmental stewardship and sustainable practices. Our approach includes:



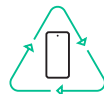
Partnerships with Expert Recyclers:

We collaborate with established third-party recycling companies with the infrastructure, capital, and expertise to recycle our LFP batteries at scale. Our collaboration with them ensures that the processes used to recycle our batteries are at the cutting edge of technology and efficiency.



Closed-Loop Systems:

The recycling efforts Powin utilizes generate significant environmental benefits, including landfill diversion and CO₂, NO_x, SO_x, and water usage offsets from the reduction of mining and refining operations. The recycled materials from Powin batteries end up back in the market for battery manufacturing purposes, thus contributing to a closed-loop system and circular economy.



Comprehensive Recycling:

Our commitment to recycling goes beyond batteries. We also recycle electronics and other metals utilizing local vendors, ensuring that every component of our energy storage systems is handled responsibly at end-of-life.



Trained and Certified Personnel:

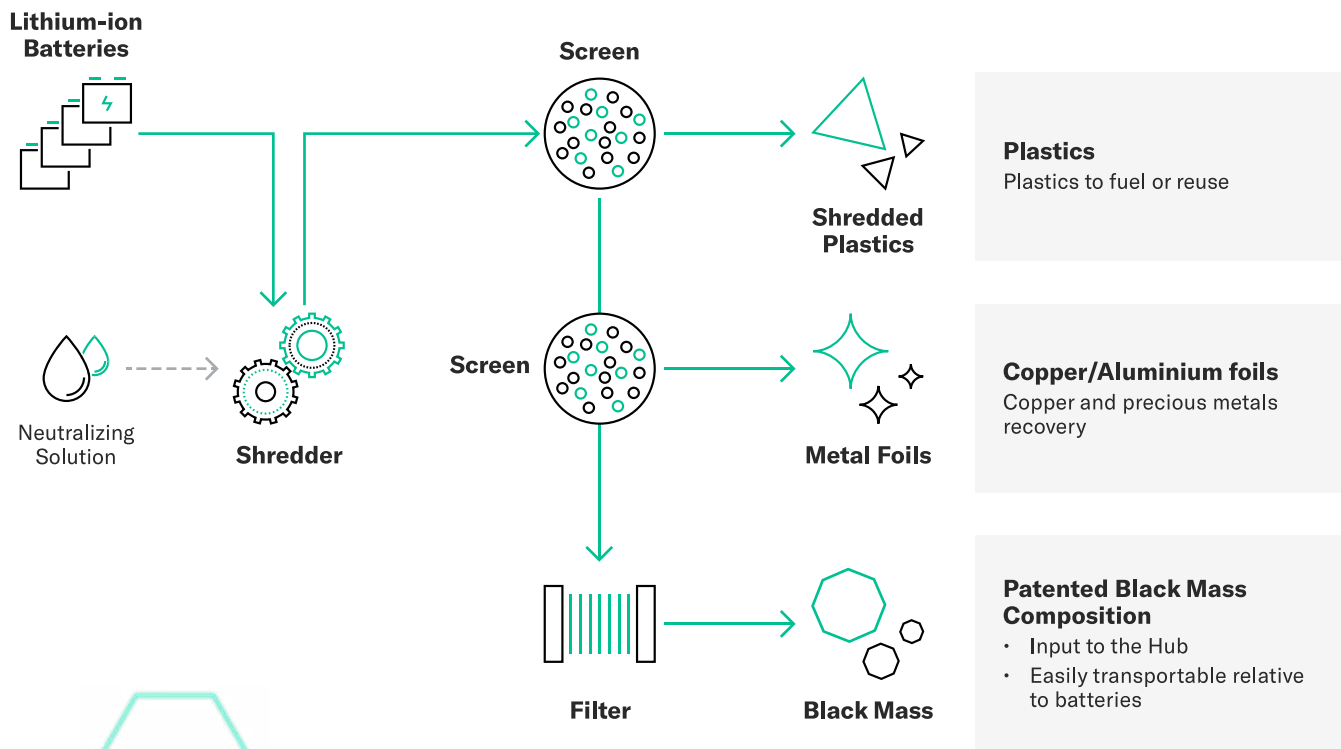
Powin's Field Services team members and many other Powin employees are specially trained and certified in 49 CFR Hazardous Materials Regulations and Hazardous Communications (HazCom). These specialized programs ensure our team is proficient in the proper handling, storage, transportation, and emergency response procedures related to lithium batteries. This expertise guarantees the safe packaging and shipping of end-of-life battery cells and modules directly from customer locations, maintaining the highest safety and compliance standards throughout the recycling process.

The Recycling Process:

A CLOSER LOOK

Our third-party recycling companies employ a state-of-the-art recycling process with up to 95% efficiency in recovering battery-grade chemicals. Here's a detailed breakdown of the process:

- 1 Shredding:** Batteries are mechanically broken down into smaller pieces using industrial shredders, enabling the safe handling of hazardous materials and preparing the components for further processing.
- 2 Materials Recovery:** The shredded components are separated into three main categories: plastics, critical metals, and "black mass." Plastics are removed and recycled separately. Next, critical metals are extracted. This leaves black mass, a shiny metallic powder containing high levels of lithium, manganese, and other metals. The black mass is valuable as it contains essential materials for making battery anodes and cathodes, which are the most expensive parts of a battery.
- 3 Chemical Processing and Recovery:** Advanced chemical treatments dissolve valuable metals from the black mass into a liquid solution. Specialized processes then separate and purify individual metals like lithium.
- 4 Reclaimed Materials Used to Make New Batteries:** The purified metals reclaimed are of battery-grade quality, allowing them to be sold back to battery manufacturers for use in a variety of new battery types.



Environmental Impact:

MAKING A DIFFERENCE

Our recycling efforts have yielded significant environmental benefits, showcasing the real-world impact of our commitment to sustainability.

In 2022 alone, we reduced over 100,000 pounds (50 tons) of modules from entering landfills. To put this into perspective, that's equivalent to 25 cars, ten adult elephants, a fully loaded semi-truck, or 200 grand pianos.

Powin's utilization of battery resource recovery companies for recycling end-of-life batteries provides significant environmental benefits. These include NO_x, SO_x and CO₂ emissions offset factors as well as water usage offset factors, providing a strategic advantage compared to mining and refining the production of new batteries.



Recycling of Powin batteries results in impressive emission and resource-use reductions



74% CO₂
emission
offset factor



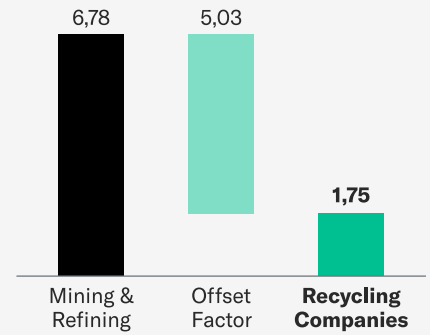
92% NO_x and SO_x
emission offset
factors



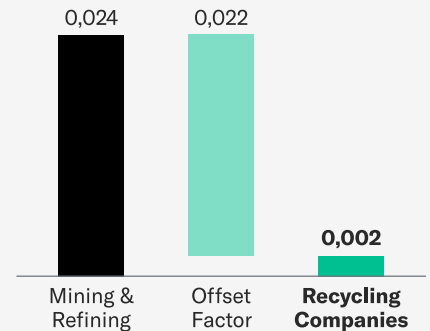
97% water
usage
offset factor

These offset factors represent the percentage reduction in emissions and resource use compared to mining and refining new materials for battery production. For example, a 74% CO₂ emission offset factor means that recycling our batteries produces 74% less carbon dioxide than extracting and processing new materials for the same amount of battery components. These impressive figures underscore the significant environmental benefits of our recycling program over conventional production methods.

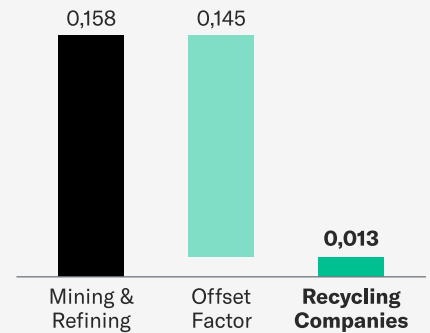
74% CO₂ Emission Offset Factor
Tonnes CO₂



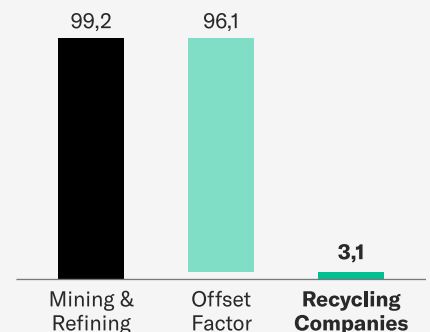
92% NO_x Emission Offset Factor
Tonnes NO_x



92% SO_x Emission Offset Factor
Tonnes SO_x



97% Water Usage Offset Factor
Tonnes Water



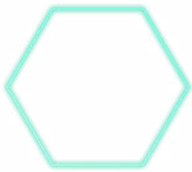
Our Battery Technology:

LFP LEADING THE WAY

Powin was an early adopter of Lithium Iron Phosphate (LFP) batteries, known for their superior safety profile and environmentally friendly characteristics:

- **Enhanced thermal stability**, reducing the risk of thermal runaway
- **A significantly lower risk of overheating or fire** compared to other lithium-ion chemistries
- **Free from cobalt and nickel**, addressing ethical and environmental concerns associated with these materials
- **Made from more abundant and less toxic materials**, making them easier to recycle and less harmful to the environment
- **An expected lifespan of 20 years**, aligning with the lifespans of most commercial/industrial solar and wind systems

To ensure this extended lifespan, we conduct ongoing accelerated life testing and real-time life testing, constantly refining and improving our technology. We also monitor over five million LFP battery cells in the field every day.



Powin's Commitment to Sustainability Beyond Recycling

Our dedication to sustainability extends beyond our recycling program and includes:



Continuous Innovation: We're constantly innovating our hardware and software design to maximize product value and sustainability. This includes improving energy density, extending battery life, and enhancing system efficiency.



Lifecycle Analysis: We're completing a comprehensive product lifecycle analysis. The findings will be incorporated into our circular economy program, further refining our sustainable practices.



Industry Leadership: We're committed to staying at the forefront of battery recycling technology. This involves ongoing research and participation in industry forums to drive advancements in LFP battery recycling technologies.



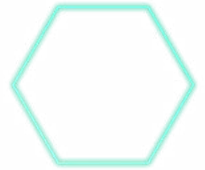
Education and Awareness: We believe in the power of knowledge. We're dedicated to educating our customers, partners, and the public about the importance of battery recycling and sustainable energy practices.

Looking to the Future:

POWERING A SUSTAINABLE TOMORROW

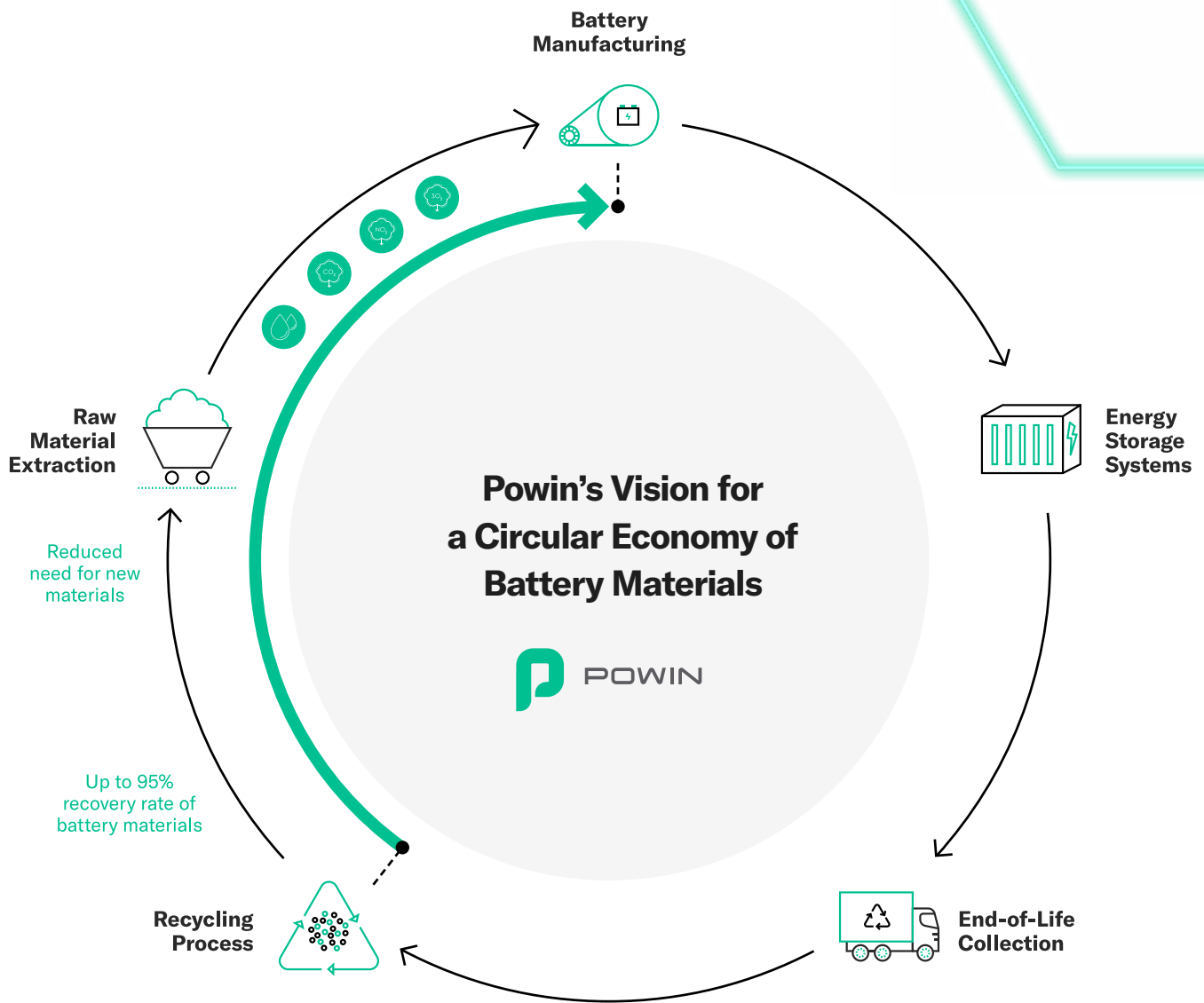
As the global demand for energy storage continues to grow, so does the critical importance of responsible recycling. Powin is committed to leading the industry in sustainable practices, ensuring that our energy storage solutions contribute to a cleaner, more sustainable future.

We envision a world where every battery is part of a closed-loop system, where materials are continuously recycled and reused, minimizing environmental impact and conserving precious resources. We're working tirelessly to make this vision a reality through our innovative technology, strategic partnerships, and unwavering commitment to sustainability.



BUILDING A MORE SUSTAINABLE FUTURE ONE BATTERY AT A TIME

By choosing Powin, you're not just selecting a leader in energy storage technology – you're partnering with a company that's deeply committed to environmental stewardship and sustainable practices. Together, we can create a more sustainable energy future, one battery at a time.



Join Us in Creating a Sustainable Future!

Visit our website or contact our team today to explore sustainable energy solutions: www.powin.com