Decommissioning and Battery End-of-Life Management

FINANCIAL CONSIDERATIONS

WHITE PAPER

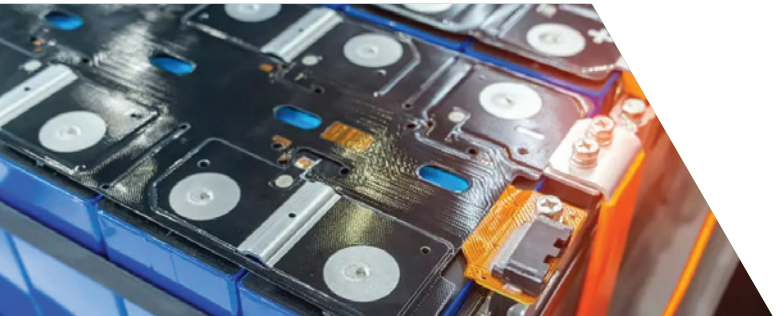
RENEWANCE
STEWARDSHIP OPERATIONALIZED

INTRODUCTION

Decommissioning a **Battery Energy Storage System (BESS)** is a complex, multi-phase process that requires careful planning and precise execution. At its core, it involves critical decisions about whether batteries, inverters, and balance of plant equipment should be repurposed for secondary use or recycled. The cost considerations alone are large factors to consider when approaching a decommissioning process. Each stage of the process carries direct and indirect costs that can significantly impact project economics if not anticipated early in the system's lifecycle. These decisions are also affected by a wide range of regulatory frameworks that vary by jurisdiction, making compliance an essential component of proper battery stewardship.

Decommissioning a **BESS** isn't just about removing batteries; it's a **multi-phase process** involving permitting, safe removal, recycling, site restoration, and compliance documentation.

This paper provides the main steps in decommissioning and end-of-life management of a large-scale BESS and the costs involved. Read on to discover how Renewance can help you forcast potential decommissioning costs, provide you a plan for end-of-life management, and unburden you with full turnkey decommissioning and recycling solutions.



The removal and transportation of battery packs represent some of the most labor and cost-intensive phases of an **Energy Storage System (ESS)** decommissioning project.

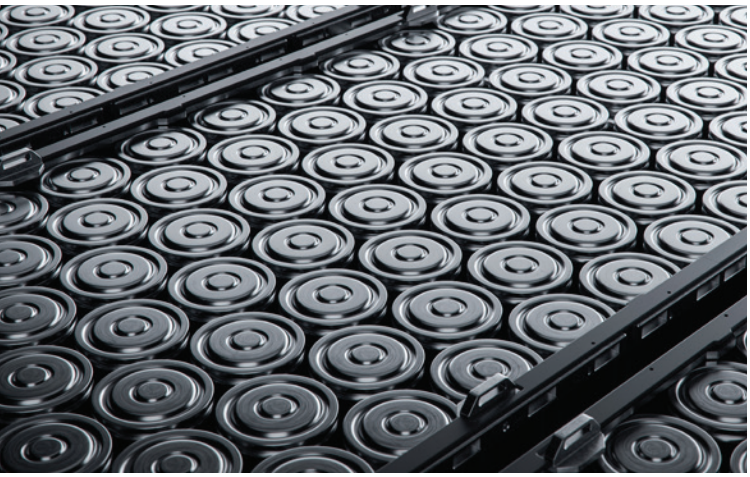
Pre-Decommissioning Planning: What Does This Process Entail?

Devising a detailed and thorough plan before decommissioning a BESS is critical to ensuring a safe, compliant, and efficient decommissioning process. The first step involves identifying qualified suppliers and contractors with the expertise to manage specialized equipment and materials. A good practice is to document the allocation of roles and obligations among all stakeholders involved in the decommissioning in a Division of Responsibility table, including the asset owner, EPC, decommissioning contractor, recycler, and the transport company you plan to use. This step helps in enforcing owners to follow industry best practices, ensuring accountability, regulatory compliance, and safe handling of material.

From a cost perspective, site restoration requirements involve returning the location to its pre-construction condition or as directed by contract or the authority having jurisdiction (AHJ), which can represent a significant expense. For a 200 MWh LFP system, for example, labor alone can exceed 5,000 man-hours, with hourly rates typically ranging between $80 and $130 depending on location and prevailing wage requirements. In addition, travel and living (T&L) expenses may range from $50,000 to $150,000 depending on project site conditions and crew mobilization needs.

Battery Removal, Packaging, and Reverse Logistics + Costs Involved

The removal and transportation of battery packs represent some of the most labor and cost-intensive phases of an Energy Storage System (ESS) decommissioning project. Proper execution at this stage is essential not only for worker safety but also for compliance with federal regulations, OEM guidelines, as well as ensuring minimal environmental impact.



Packaging Requirements

All modules must be packaged to prevent short circuits to prevent damage caused by movement within the package, and to prevent accidental activation of the equipment. This includes the use of strong outer packaging along with proper labeling to reflect the battery's chemistry and condition. Heavy batteries (≥12 kg), with strong, impact-resistant cases may be packed on pallets directly. Batteries should be palletized and packaged in accordance with the requirements of 49 CFR 173.24 and 173.24a.

The packages containing the batteries should be marked and labelled in accordance with 49 CFR 172, Subparts D and E.

Packaging costs vary significantly by module size and form factor, often ranging from as little as $5 per battery to more than $100 per battery, depending on the jurisdiction. To provide a comprehensive cost picture, packaging should be considered together with all required project supplies and rental equipment (e.g., site supplies, protective materials, and handling equipment).

Transportation and Costs

The transportation of hazardous materials is governed by the US DOT Hazardous Materials Regulations (HMR) contained in 49 CFR Parts 100-180, and regulations specific to the packaging of lithium-ion batteries are contained in 49 CFR 173.185. The US EPA imposes several additional requirements through the full transportation lifecycle.

These obligations include:

- Training personnel in proper waste management and emergency procedures.
- Complying with accumulation time limits for hazardous/universal waste.
- Maintaining records of waste handling and off-site shipments for at least three years.

Whether shipping a single battery or a palletized load of batteries, the safety of the package and those who handle it in transport depends on compliance with the HMR. Failure to comply with the applicable regulations could result in fines or even criminal prosecution.

Transportation is also a major cost driver due to the sheer weight of ESS batteries. For example, a 200 MWh LFP system (lithium iron phosphate, which contains no cobalt but is heavier per kWh) can exceed 3 million pounds. Transportation costs are directly influenced by the battery form factor and weight, with current estimates ranging from $0.15/lb to $0.30/lb or more. This may vary by jurisdiction.

End-of-life planning for battery systems is a complex, resource-intensive process that many organizations are not equipped to manage on their own. Let Renewance help!

Recycling Costs

Recycling fees are similarly weight-dependent, with estimated costs ranging from $0.50/lb to $1.50/lb for LFP batteries. Costs will vary based on the battery chemistry, jurisdiction, and size.

Integration of Advanced Logistics Platforms

To ensure each stage in a decommissioning process is completed with care, many companies will integrate an advanced logistics platform, a digital technology platform used to coordinate, track, and optimize the entire end-of-life process.

At Renewance, our mission is to help our clients repurpose or recycle in an environmentally appropriate and cost-effective manner. To reduce costs and warrant compliance, companies can benefit from Renewance's DOE Recycling Prize–winning stewardship platform, which integrates:

- Aggregation of volume, optimized reverse logistics routing, and competitive bidding by qualified logistics service providers to reduce transportation costs.
- Aggregation of volume and competitive bidding by qualified recyclers.
- Compliance guidance and record keeping.

By addressing packaging, transportation, and recycling holistically, incorporating advanced logistics and compliance tools, and leveraging its in-house technicians, Renewance can deliver safe, cost-effective, and environmentally responsible BESS decommissioning.

Commercial Liability Cost Considerations

Managing end-of-life industrial batteries involves financial asset retirement responsibilities comprising labor, transportation, recycling, and recordkeeping.

Here's a breakdown of the typical average costs for a 200 MWh BESS based on LFP batteries:

CATEGORY	DETAILS
Labor & Packaging (General BESS)	100 man-hours, $25/rack; >$78,000 total
Transportation (General BESS)	$0.40/lb; ~$117,000 for 146 tons
Recycling (General BESS)	~$0.70/lb or higher; cost varies
Labor (200 MWh LFP)	$450,000-$700,000+
Materials & Equipment (200 MWh LFP)	$500,000-$750,000+
Transportation (200 MWh LFP batteries)	$470,000-$950,000+
Recycling (200 MWh LFP batteries)	$1.6M-$4.7M+
Total Estimated Cost (200 MWh LFP BESS)	**$3.02M-$7.1M** (before restoration & permitting)

Non-compliance with federal, state, or local regulations carries additional risk, including fines, penalties, cleanup liabilities, reputational damage, and even insurance claim rejections. Finally, large quantity handlers of Universal Waste must maintain detailed shipment records, including destinations, quantities, and dates, for at least three years, underscoring both regulatory and financial responsibilities.

How Renewance Can Help

Renewance is leading the transition to a sustainable, decarbonized economy by delivering comprehensive lifecycle management solutions for industrial batteries. End-of-life planning for battery systems is a complex, resource-intensive process that many organizations are not equipped to manage on their own. It requires deep knowledge of evolving local, state, and federal regulations, as well as the ability to ensure full compliance at every stage. Without specialized expertise, the risks of oversight, non-compliance, and added liability increase significantly.

For Peace of Mind, Outsource Battery Lifecycle Management to **Renewance**, a Qualified Leader in Battery Stewardship.

Partnering with a turnkey provider like **Renewance** reduces those risks and provides confidence throughout the process. From installation and commissioning to maintenance and end-of-life management, **Renewance** delivers complete lifecycle services that optimize performance and ensure safe, responsible handling from start to finish.

Adding to its credibility, **Renewance** brings unmatched expertise in commercial battery recycling as a winner of Phase III of the U.S. Department of Energy's Lithium-Ion Battery Recycling Prize, which recognized its disruptive solutions to accelerate and improve the battery reverse supply chain.

Partner with Renewance for battery decommissioning.

For more information about our services, visit **www.batterystewardship.com** or contact a representative of **Renewance** in the U.S. at **1-800-233-5038** or **sales@renewance.net**.

RENEWANCE
STEWARDSHIP OPERATIONALIZED