

The Global Advanced Rechargeable Battery Recycling Market 2026-2046

<https://marketpublishers.com/r/G5B80B7C1841EN.html>

Date: March 2026

Pages: 251

Price: US\$ 1,500.00 (Single User License)

ID: G5B80B7C1841EN

Abstracts

The global advanced rechargeable battery recycling industry stands at a pivotal inflection point. What has historically been a lithium-ion (Li-ion) dominated sector — shaped primarily by the explosive growth of electric vehicles (EVs) and consumer electronics — is now transitioning into a broad, multi-chemistry ecosystem. Sodium-ion, solid-state, vanadium redox flow, zinc-based, lithium-sulfur, lithium-metal, and aluminium-ion batteries are each advancing through commercialisation at varying speeds, and each will generate distinct end-of-life recycling demands, material recovery economics, and technological requirements that fundamentally diverge from the Li-ion recycling infrastructure developed over the past decade.

This comprehensive 240+ page report, published by Future Markets, Inc., provides the most detailed and authoritative analysis of the global advanced rechargeable battery recycling market available, covering the full period from 2026 to 2046. Drawing on primary interviews with industry participants, proprietary market modelling, and exhaustive secondary research, the report quantifies market size and growth across all relevant battery chemistries, regions, and applications — and provides the strategic and technological context required for investors, recyclers, OEMs, battery manufacturers, regulators, and material suppliers to navigate this rapidly evolving landscape.

The report examines the structural factors reshaping the competitive and regulatory landscape, including the highly instructive collapse of Li-Cycle Holdings and Lithion Technologies in 2025 — two well-capitalised North American recyclers whose failures underscored the gap between technological promise and commercial viability at scale. The contrasting success of Redwood Materials — which by end-2025 had raised \$2.22 billion in private equity, achieved approximately \$200 million in annual revenue, and diversified its revenue model into cathode precursor manufacturing, anode copper foil

production, and second-life grid storage through its Redwood Energy division — provides the benchmark for the integrated, vertically diversified business model that defines best practice in the sector.

Key regulatory frameworks shaping market development are analysed in depth, including the EU Battery Regulation 2023/1542 (which establishes mandatory minimum recovered content targets for lithium, cobalt, nickel, and lead, and requires digital battery passports from February 2027), the US Inflation Reduction Act's critical minerals provisions, China's extended producer responsibility framework, and equivalent policies across India, South Korea, Japan, and Australia. The report addresses how these converging regulatory regimes — together with the strategic imperative of critical mineral supply security — are driving domestic recycling capacity investment globally.

Technologically, the report provides a rigorous comparative analysis of hydrometallurgical, pyrometallurgical, and direct recycling processes, including SWOT analyses for each approach, detailed treatment of hybrid hydrometallurgical-direct recycling as an emerging commercial paradigm, and coverage of advanced methods including mechanochemical pretreatment, electrochemical recycling, ionic liquid extraction, and graphite-specific recovery technologies. The rapidly growing PFAS and PVDF binder regulatory challenge — and the transition to fluorine-free electrode binder alternatives — is examined in dedicated sections with direct implications for recycling process design.

Extensive quantitative forecasting covers global Li-ion recycling volumes (ktonnes) and revenues by cathode chemistry (NMC, LFP, NCA, LCO, LMFP), end-use application (EV, grid storage, consumer electronics), and region (China, Europe, North America, Rest of Asia-Pacific) from 2018 through 2046. The dominant structural trend — the inexorable shift of recycling feedstock toward LFP chemistry, projected to represent over 81% of Li-ion recycling input volumes by 2046 — and its profound implications for recycling economics are analysed in depth.

The report also provides the first integrated treatment of beyond-Li-ion recycling markets, with dedicated chapters on sodium-ion, sodium-sulfur, vanadium redox flow, zinc-based, lithium-sulfur, lithium-metal, all-solid-state, and aluminium-ion battery recycling. Market forecasts, technology readiness assessments, and process descriptions are provided for each chemistry, alongside analysis of the regulatory framing and economic drivers specific to each stream.

The report concludes with 118 detailed company profiles covering the full spectrum of

the global recycling industry — from established industrial operators and materials conglomerates to technology-stage startups — across China, the United States, Europe, Japan, South Korea, Australia, and emerging markets.

Report Contents include:

Global market size, revenues, and CAGR forecasts to 2046 across all battery chemistries

Li-ion battery recycling market status in 2025: capacity, utilisation, and geographic distribution

Market revenues segmented by cathode chemistry: NMC, LFP, NCA, LCO, LMFP, and beyond-Li-ion

Total recycling input volumes (ktonnes) by chemistry and application, 2018–2046

Regional market analysis: China, Europe, North America, and Rest of Asia-Pacific

Market drivers: critical mineral supply security, EV fleet growth, grid storage deployment, and regulatory mandates

Market challenges: feedstock heterogeneity, LFP economics, capital costs, and collection infrastructure

Financial rationalisation: Li-Cycle Holdings bankruptcy and Lithion Technologies CCAA creditor protection

Redwood Materials as the benchmark for vertically integrated, privately funded recycling models

Battery technology landscape: Li-ion, sodium-ion, solid-state, vanadium redox flow, lithium-sulfur, lithium-metal, zinc-based, and aluminium-ion

Li-ion cell chemistry, degradation mechanisms, cycle life, end-of-life pathways, and circular lifecycle

EV battery longevity: real-world data from 22,700+ vehicles and implications for recycling feedstock timelines

Closed-loop EV battery value chain and the emerging replacement battery pack market

Recycling methods comparison: hydrometallurgy, pyrometallurgy, and direct recycling — SWOT analyses for each

Black mass composition, variability, and downstream processing

Pre-treatment processes: discharging, mechanical shredding, sieving, eddy current separation, and froth flotation

Hydrometallurgical process detail: leaching, solvent extraction, selective precipitation, bioleaching

Pyrometallurgical process detail: smelting, slag management, and refining

Direct recycling: electrolyte separation, cathode/anode separation, binder removal, relithiation, and cathode rejuvenation

Hybrid hydrometallurgical-direct recycling: commercial implementations and cost advantages

Graphite anode recycling: lab-stage developments, microwave methods, purity benchmarks, and commercial players

PVDF binder: regulatory pressures, recycling complications, and PFAS-free alternatives (CMC/SBR, PAA, LiPAA, alginate)

Beyond-Li-ion recycling: sodium-ion (PBA cathodes, hard carbon anodes), sodium-sulfur, VRFB electrolyte recovery, zinc-based, lithium-sulfur, lithium-metal, all-solid-state, and aluminium-ion

Vanadium redox flow battery electrolyte management: degradation, recovery, Nafion membranes, and carbon felt recycling

Global recycling capacity (current and planned, updated to Q1 2026), including

post-Li-Cycle and post-Northvolt revisions

LIB recycler partnerships and supply agreements: OEM-to-recycler and downstream offtake structures

Economics by chemistry: cobalt, nickel, lithium, and LFP-specific recycling economics

Second-life versus recycling economics: decision framework and Redwood Energy case study

Competitive landscape: market fragmentation, consolidation trends, and OEM in-house recycling

Supply chain analysis: feedstock streams, scrap versus end-of-life battery economics

Global regulations: EU Battery Regulation 2023/1542, US IRA, China EPR, India, South Korea, Japan, Australia

Digital battery passport requirements, carbon footprint declarations, and recovered content mandates

Transportation regulations for lithium-ion batteries (ADR, IMDG, ICAO, IATA)

Sustainability and environmental benefits of battery recycling

Research methodology, terms and definitions, and comprehensive reference list

118 detailed company profiles across the global recycling value chain

Companies Profiled include 24M, 4R Energy Corporation, American Battery Technology Company (ABTC), ACE Green Recycling, Accurec Recycling GmbH, Advanced Battery Recycle (ABR) Co., AE Elemental, Altilium, Allye Energy, Anhua Taisen, Akkuser Oy, Aqua Metals, Achelous Pure Metal Company Limited, Ascend Elements, Attero Recycling, Back to Battery, BASF, Battery Pollution Technologies, Batrec Industrie AG, Battri, Batx Energies Private Limited, BMW, Boree Cycling, CATL, CELLCIRCLE GmbH, Cellcycle, Cirba Solutions, Circunomics, Circu Li-ion, Cylib, Dowa Eco-System

Co., Duesenfeld, Econili Battery, EcoBat, EcoPro, Electra Battery Materials Corporation, Emulsion Flow Technologies, Energy Source, Enim, Eramet, ExPost Technology, Faradion Limited, Farasis Energy, Fortum Battery Recycling, Ganfeng Lithium, Ganzhou Cyclewell Technology Co., GEM Co., GLC Recycle Pte., Glencore and more...

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