POLARIS MARKET RESEARCH

GLOBAL LEAD ACID BATTERY RECYCLING MARKET

- **By Battery Type** *(SLI Batteries, Industrial & Stationary Batteries)*
- **By Recycling Process** *(Pyrometallurgical, Hydrometallurgical)*
- **By End User** *(Automotive, Industrial, Telecom, UPS & Backup Power)*

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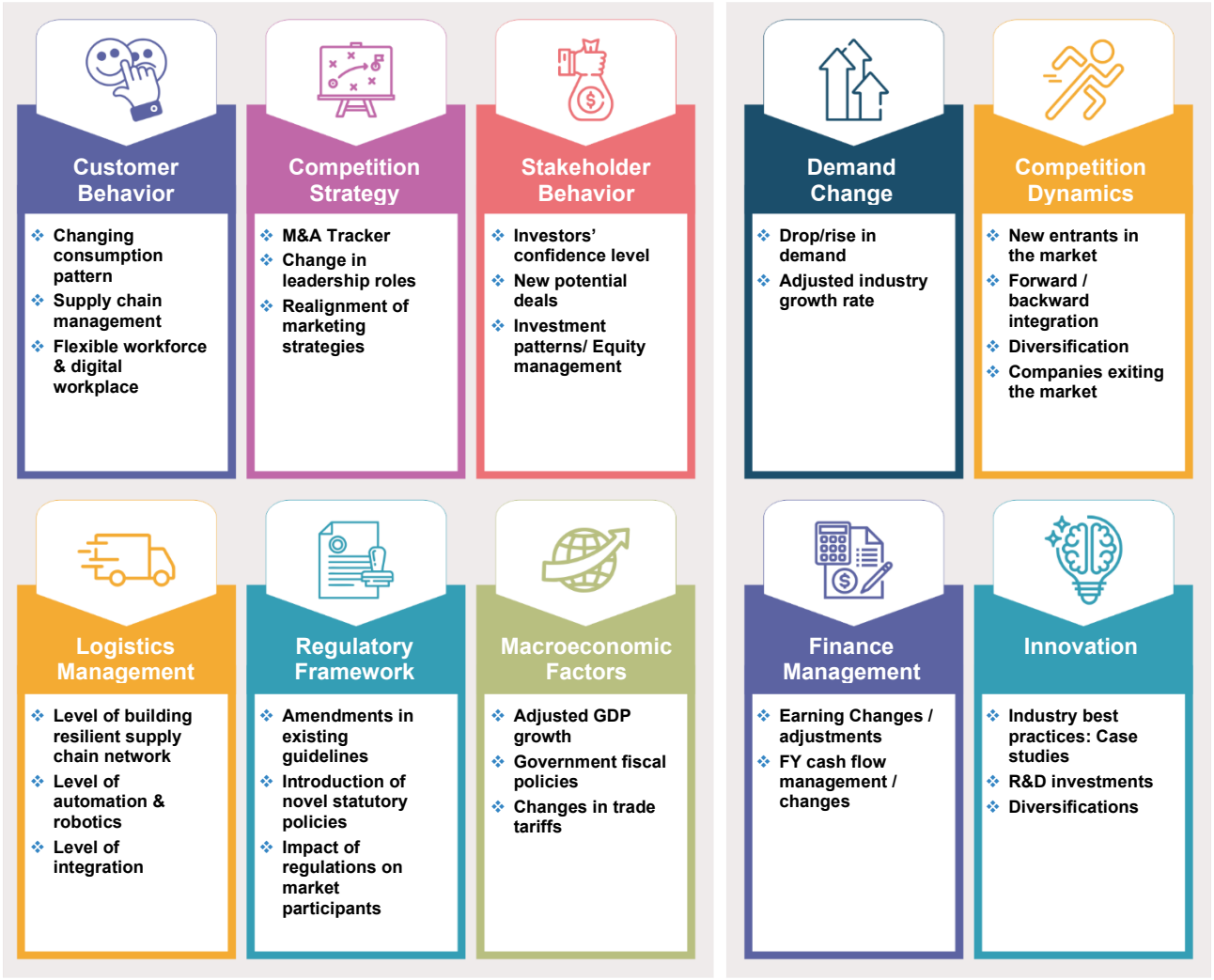

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What does it include?

This section includes sample market data points, ranging from trend analyses to Market estimates & forecasts

What does it include?

This section includes sample market data points, ranging from trend analyses to Market estimates & forecasts

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CHAPTER 1. EXECUTIVE SUMMARY

The global lead acid battery recycling market was valued at USD 16.02 billion in 2025 and is expected to grow at a CAGR of 5.94% during the forecast period.

Lead acid battery recycling refers to the structured collection and reprocessing of used lead acid batteries to recover lead, plastic, and electrolyte for reuse. In this system, batteries are broken in controlled units where lead grids and paste are separated and refined. Plastic casings are cleaned and converted into pellets for new battery manufacturing. This closed-loop system establishes the lead acid battery recycling process, which has a high rate of recovery above 95 percent. This recycling process helps in the recycling of batteries in the circular economy.

The lead acid battery recycling process is governed by tough environmental and hazardous waste laws due to its risk associated with lead poisoning. For instance, in August 2024, the Government of UK announced that waste lead-acid batteries containing POPs are to be classified as hazardous waste and can only be sent to authorized treatment facilities for destruction. In addition, the governments in the U.S., Europe, and some Asian countries enforce collection rates and recycling facilities. The standards of compliance include the control of emissions, occupational health and safety, and the safe neutralization of acid. ESG analysis is now a key consideration in the global lead acid battery recycling industry, as formal recycling minimizes the reliance on primary lead mining.

In addition, the lead acid battery recycling industry is still a structured market owing to its consistent generation of scrap materials from the replacement of lead acid batteries in the automotive and industrial sectors. The lead acid battery recycling industry is also supported by the predictable availability of feedstock and the established smelting capacity. The secondary lead supply also helps to stabilize the price of raw materials for battery producers. Unlike other battery types, the lead-acid battery recycling industry is already a mature market.

Key Insights

- Asia Pacific dominated in 2025 with a 41.8% share, supported by strong vehicle production, industrial expansion, telecom growth, and established secondary lead smelting capacity ensuring regional supply stability.
- North America held around 27.3% share in 2025, supported by high vehicle ownership, structured collection systems, deposit return mechanisms, and stringent environmental regulations strengthening recycling infrastructure.
- By Battery Type, SLI batteries accounted for nearly 64.5% share in 2025, driven by frequent starter battery replacements across passenger and commercial vehicles, ensuring continuous scrap generation and stable recycling volumes globally.
- By Recycling Process, pyrometallurgical processes held around 71.2% share in 2025, supported by established smelting infrastructure, high-volume processing capability, and cost-efficient bulk scrap handling across major recycling hubs.
- By End User, automotive remained the leading end user with 68.7% share in 2025, supported by structured collection networks, regular battery replacement cycles, and strong aftermarket demand ensuring consistent feedstock supply.

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1.1. Market Snapshot - Key Takeaways

Executive Summary – Lead Acid Battery Recycling Market

Market

- The global lead acid battery recycling market was valued at USD 16.02 billion in 2025 and is expected to grow at a CAGR of 5.94% during the forecast period.

Drivers & Challenges

Drivers:

- Rising automotive battery replacement
- Regulatory push for hazardous waste management

Challenges:

- Environmental compliance costs

Key Segment

- By Battery Type (SLI Batteries, Industrial & Stationary Batteries)
- By Recycling Process (Pyrometallurgical, Hydrometallurgical)
- By End User (Automotive, Industrial, Telecom, UPS & Backup Power)

Key Players

1. Ecobat
2. Cirba Solutions
3. Clarios
4. East Penn Manufacturing Company
5. The Doe Run Company
6. Exide Technologies
7. Gravita India Ltd.
8. Camel Group
9. Tianneng Group
10. GS Yuasa

Market Trends

- Stricter government battery waste regulations
- Growth in hydrometallurgical recycling technology
- Circular economy push for resource recovery
- Rising secondary lead demand

Strategic Recommendations

- Invest in hydrometallurgical recycling tech
- Partner with battery makers for feedstock
- Expand in APAC and MEA regions
- Automate sorting for higher recovery

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1.2. Lead Acid Battery Recycling Regional Market Place: 2025 & 2034

Table 2 Lead Acid Battery Recycling Regional Market Place: 2025 & 2034

North America

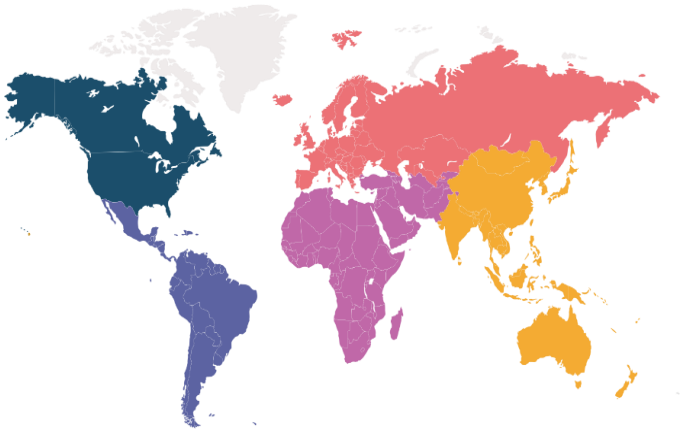
Revenue in 2025: $ xx Bn
Revenue in 2034: $ xx Bn
CAGR: xx %
Notable markets: US

Latin America

Revenue in 2025: $ xx Bn
Revenue in 2034: $ xx Bn
CAGR: xx %
Notable markets: Brazil

MEA

Revenue in 2025: $ xx Bn
Revenue in 2034: $ xx Bn
CAGR: xx %



Europe

Revenue in 2025: $ xx Bn
Revenue in 2034: $ xx Bn
CAGR: xx %
Notable markets: UK, Germany

Asia Pacific

Revenue in 2025: $ xx Bn
Revenue in 2035: $ xx Bn
CAGR: xx %
Notable markets: India, China, Japan

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North America, led by the U.S., remains a highly regulated and mature market. The region benefits from an established formal recycling infrastructure and some of the world's highest collection rates for used lead-acid batteries. Strict environmental standards enforced by the EPA, combined with steady replacement demand from the automotive sector, continue to sustain market activity.

Europe, with notable markets in the UK and Germany, operates under the stringent EU Battery Directive, which mandates high collection and recycling efficiency targets. The region is at the forefront of adopting advanced hydrometallurgical processes, driven by circular economy principles and a strong emphasis on reducing emissions from recycling operations.

Asia Pacific stands as the largest and fastest-growing regional market, led by India, China, and Japan. Rapid industrialization, urbanization, and expanding automotive production fuel demand for new lead-acid batteries, while rising environmental awareness and government crackdowns on informal recycling are accelerating investments in organized recycling facilities. The region's growing telecom and data center sectors also add to battery replacement volumes.

Latin America, with Brazil as the key market, is witnessing moderate growth. Improving economic conditions, infrastructure development, and gradually tightening regulations on hazardous waste disposal are shifting recycling activity from the informal to the formal sector.

The Middle East & Africa (MEA) region represents an emerging market. Growth is driven by increasing deployment of telecom towers and uninterruptible power supply (UPS) systems across the Gulf nations and South Africa, creating a steady stream of spent batteries requiring responsible recycling.

Overall, while North America and Europe lead in regulatory rigor and technology adoption, Asia Pacific offers the highest expansion potential, with Latin America and MEA following as developing opportunities.

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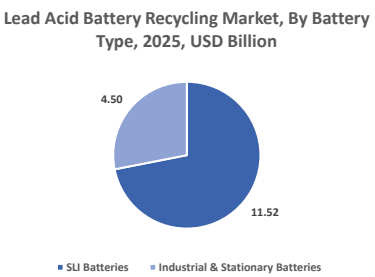
1.3. Lead Acid Battery Recycling Market, By Battery Type, 2025



SLI batteries maintained a dominant position in the lead acid battery recycling market due to their pervasive use in the global automotive sector. Every conventional internal combustion engine vehicle, as well as hybrid electric vehicles, relies on an SLI battery for engine startup and onboard electrical systems. The sheer size of the global vehicle parc, including billions of cars, trucks, and motorcycles, generates a continuous and massive stream of spent SLI batteries reaching end of life each year. Furthermore, the average service life of an SLI battery is relatively short, typically ranging from three to five years, which accelerates replacement cycles and sustains a steady inflow of scrap into recycling facilities. Unlike other battery types that may be discarded informally, SLI batteries benefit from decades of established collection infrastructure, particularly in mature markets such as North America and Europe, where deposit systems and recycling mandates achieve very high return rates. This

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combination of high volume, rapid turnover, and efficient collection logistics ensured that SLI batteries remained the largest source of secondary lead feedstock throughout 2025.

The growth of **industrial and stationary batteries** is primarily driven by expanding demand for backup power and energy storage applications. As telecommunication networks roll out new infrastructure including 5G towers, operators require reliable backup power solutions to maintain service continuity during grid fluctuations. Similarly, the proliferation of data centers, hospitals, and critical manufacturing facilities has intensified the need for uninterruptible power supply systems, all of which rely on large format lead acid batteries. Unlike automotive batteries that experience shallow discharge cycles, industrial batteries are often deployed in demanding deep cycle applications such as forklifts, floor cleaning machines, and material handling equipment. These harsh operating conditions lead to more frequent battery replacements. Additionally, the global shift toward renewable energy integration has created new demand for stationary battery banks that stabilize power output from solar and wind installations. While lithium ion technology is gaining ground in some segments, lead acid batteries remain preferred for cost sensitive industrial applications requiring high surge currents and proven safety records.

- ***Similar data will be provided for all the segment covered in table of content***
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1.4. Lead Acid Battery Recycling Market: Drivers & Opportunity

1.4.1. Key Market Driver: Rising automotive battery replacement

The global automotive secrot continues to expand steadily, with hundreds of millions of vehicles in operation worldwide. Each of these vehicles relies on a starting, lighting, and ignition battery to function. These batteries have a finite operational life, typically requiring replacement every three to five years under normal usage conditions. As vehicle ownership rises across emerging economies, the number of batteries reaching end of life each year grows proportionally. Even as electric vehicle adoption increases, the existing fleet of internal combustion engine vehicles remains massive and will require replacement batteries for many years. Harsh driving conditions, extreme temperatures, and frequent short trips accelerate battery degradation and shorten replacement cycles further. The automotive aftermarket for batteries is well established, with dedicated collection points at retail stores, garages, and service centers. This efficient reverse logistics network ensures that spent automotive batteries flow directly into recycling facilities without significant leakage. Consequently, rising automotive battery replacement generates a predictable, high volume feedstock stream that sustains recycling plant utilization rates. This consistent supply of scrap batteries forms the foundation upon which the entire lead acid battery recycling industry is built.

1.4.2. Key Market Opportunity: Growing Backup Power Demand from Telecom and Data Centers

Telecommunications networks require uninterrupted power to maintain call connectivity and data transmission during grid outages. Each telecom tower is typically equipped with a bank of stationary lead acid batteries that provide several hours of backup power. As mobile network operators expand coverage into rural and remote

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areas, thousands of new towers are being constructed annually. Simultaneously, the transition to fifth generation network infrastructure requires more densely located small cells, each with its own backup power requirements. Data centers represent another significant source of backup battery demand, as even milliseconds of power interruption can disrupt cloud services and enterprise operations. These facilities deploy large strings of valve regulated lead acid batteries in uninterruptible power supply configurations. Stationary batteries used in backup applications experience regular discharge testing and are replaced on scheduled maintenance cycles, typically every three to six years. The scale of battery banks at a single data center can involve hundreds or thousands of individual units. When these batteries reach end of life, they must be removed and replaced, generating substantial volumes of spent industrial batteries requiring recycling. Unlike consumer batteries that may be discarded improperly, telecom and data center operators have formal waste management contracts that direct spent units to licensed recyclers. This creates a reliable, high value feedstock stream for recyclers equipped to process industrial battery types. As digital infrastructure continues to expand globally, backup power related battery waste represents one of the fastest growing segments of the recycling market.

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Table 3 Global Lead Acid Battery Recycling Market, 2021-2034 (USD Billion)

Market Size	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
Total	xx	xx	xx	xx	16.02	xx	xx	xx	xx	xx	xx	xx	xx	26.93	5.94%

Table 4 Global Lead Acid Battery Recycling Market, by Battery Type, 2021-2034 (USD Billion)

Battery Type	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
SLI batteries	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Industrial & stationary batteries	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Total	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%

Table 5 Global Lead Acid Battery Recycling Market, by Recycling Process, 2021-2034 (USD Billion)

Recycling Process	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
Pyrometallurgical	xx	xx	10.88	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Hydrometallurgical	xx	xx	xx	4.08	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Total	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%

Hydrometallurgical processes are experiencing a gradual adoption rate in the recycling of lead acid batteries by process because of the lower emission intensity. Chemical extraction processes enable a controlled lead extraction process under controlled environments. Environmental compliance requirements support technology evaluation. Process optimization improves operational feasibility over time.

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Table 6 Global Lead Acid Battery Recycling Market, by End User, 2021-2034 (USD Billion)

End Use	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
Automotive	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Industrial	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Telecom	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
UPS & backup power	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Total	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%

Table 7 Global Lead Acid Battery Recycling Market, By Region, 2021-2034 (USD Billion)

Region	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
North America	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Europe	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Asia Pacific	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Middle East & Africa	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Latin America	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Total	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%

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CHAPTER 2. LEAD ACID BATTERY RECYCLING MARKET INSIGHTS

2.1. Lead Acid Battery Recycling - Market Segmentation & Scope

Table 8 Lead Acid Battery Recycling - Market Segmentation & Scope

By Battery Type	By Recycling Process	By End User
❖ SLI batteries	❖ Pyrometallurgical	❖ Automotive
❖ Industrial & stationary batteries	❖ Hydrometallurgical	❖ Industrial
		❖ Telecom
		❖ UPS & backup power

Attribute	Details
Base year used for market estimation	**2025**
Historic analysis	**Actual data for 2021, 2022, 2023, and 2024**
Forecast	**2026 to 2034**

2.2. Market definitions

The section will provide definition for each of the segments included in the shared table of contents.

The market segment comprises the following:

In the second level, the market has been split by region

- The North America regional segmentation includes the markets of the U.S., Canada, and Mexico.
- The European regional segmentation includes the markets of the Germany, Netherlands, UK, France, Italy, Austria, Spain, Rest of Europe
- Asia Pacific regional segmentation includes the markets of China, India, Japan, Vietnam, Malaysia, South Korea, Indonesia, Rest of Asia Pacific
- Latin America regional segmentation includes the markets of Brazil, Argentina
- Middle East and Africa regional segmentation includes the markets of Middle East countries such as UAE, Saudi Arabia, Israel, South Africa, Rest of MEA.

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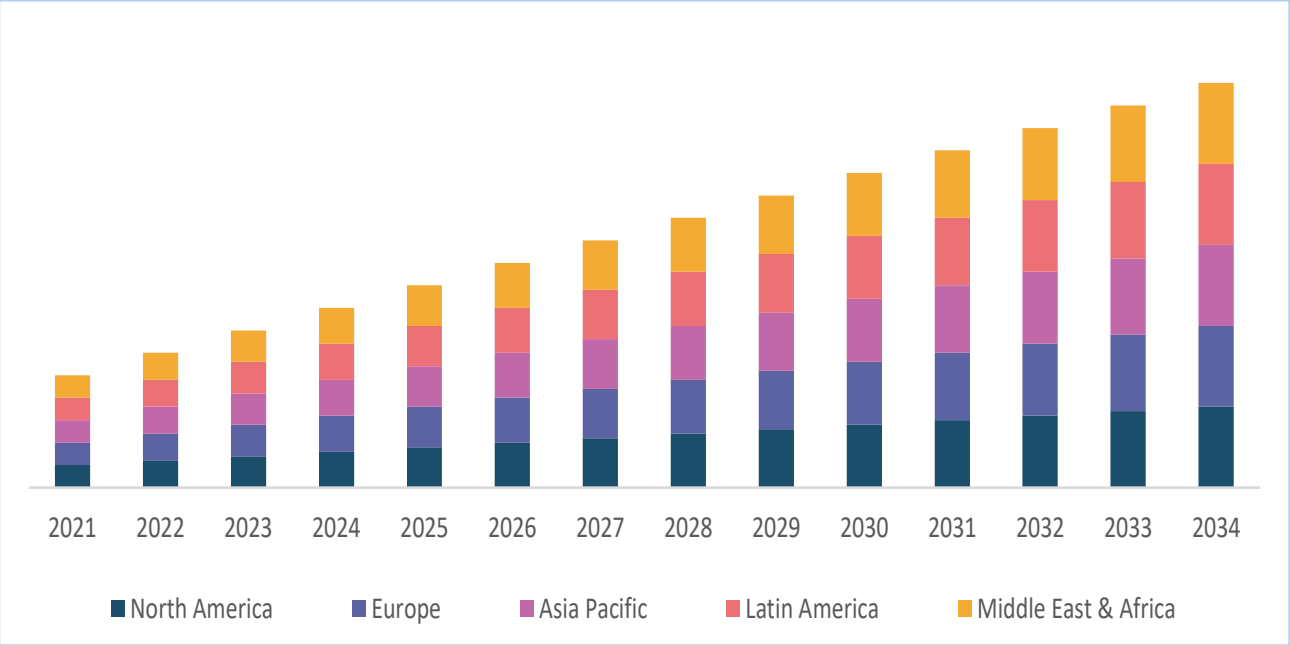
2.3. Lead Acid Battery Recycling - Market Size and Growth Prospects

Table 9 Lead Acid Battery Recycling - Market Size and Growth Prospects (Revenue - USD Billion)



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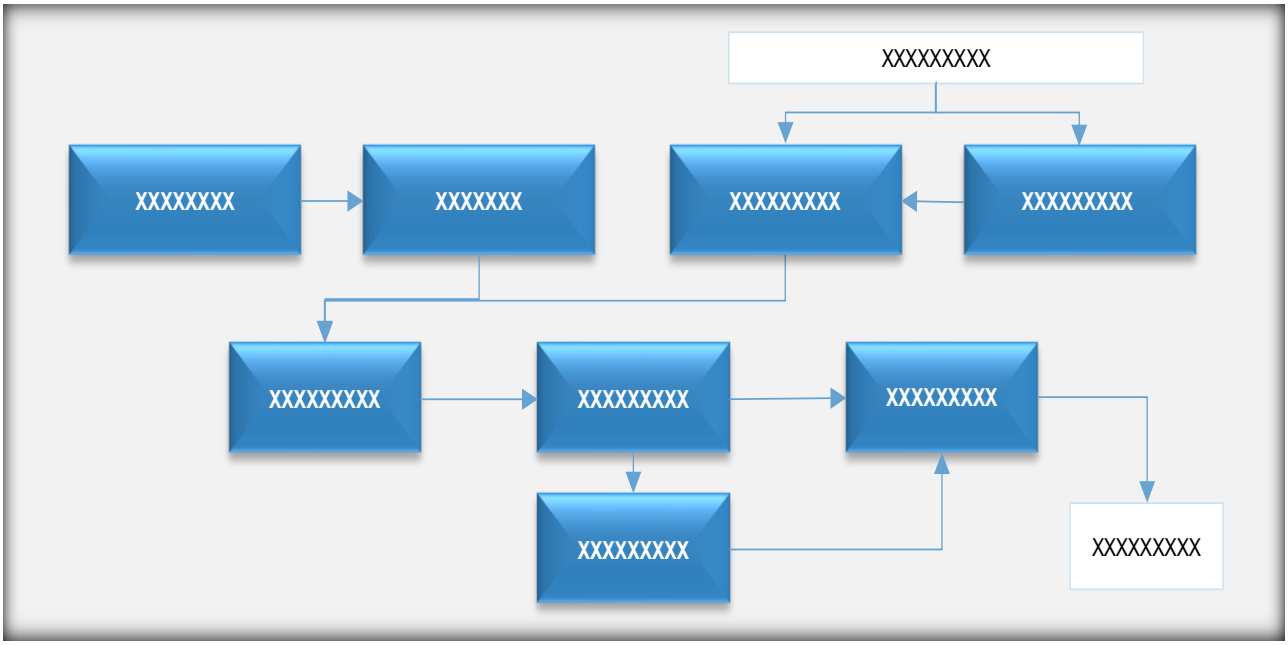
2.4. Lead Acid Battery Recycling - Value Chain Analysis

Table 10 Lead Acid Battery Recycling - Value Chain Analysis (The diagram is for representation purpose only)



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2.5. Lead Acid Battery Recycling - Market Dynamics

Table 11 Lead Acid Battery Recycling – Market Dynamics

Raw Material Supplier	Regulatory Trends	Supplier / Vendor Trends	Buyer / Application Trends
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2.5.1. Market Driver Analysis

Governments across the world classify spent lead acid batteries as hazardous waste due to their toxic lead content and corrosive sulfuric acid electrolyte. Improper disposal of these batteries can contaminate soil, groundwater, and surface water, posing serious risks to human health and ecosystems. In response, regulatory authorities have enacted stringent laws that mandate the collection, transportation, and recycling of used batteries through licensed facilities. Many jurisdictions have banned the landfilling of lead acid batteries entirely, effectively forcing all spent units into the recycling channel. Some regulations require battery manufacturers to take back used products, creating producer responsibility frameworks that finance recycling operations. Environmental agencies conduct regular inspections and impose heavy penalties on informal recyclers who operate without proper pollution controls. These enforcement actions drive scrap volume away from unregulated backyard operations and toward compliant, organized recycling facilities. The cost of non compliance including fines and legal liability makes formal recycling the only viable option for battery handlers. As environmental standards continue to tighten globally, the regulatory push becomes an increasingly powerful driver of formal market growth. This policy driven demand ensures steady throughput for legitimate recycling enterprises.

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Market Drivers	2021-2025	2026-2030	2031-2034
	Impact		
Rising automotive battery replacement			
Regulatory push for hazardous waste management			
Very High	High	Moderate	Low

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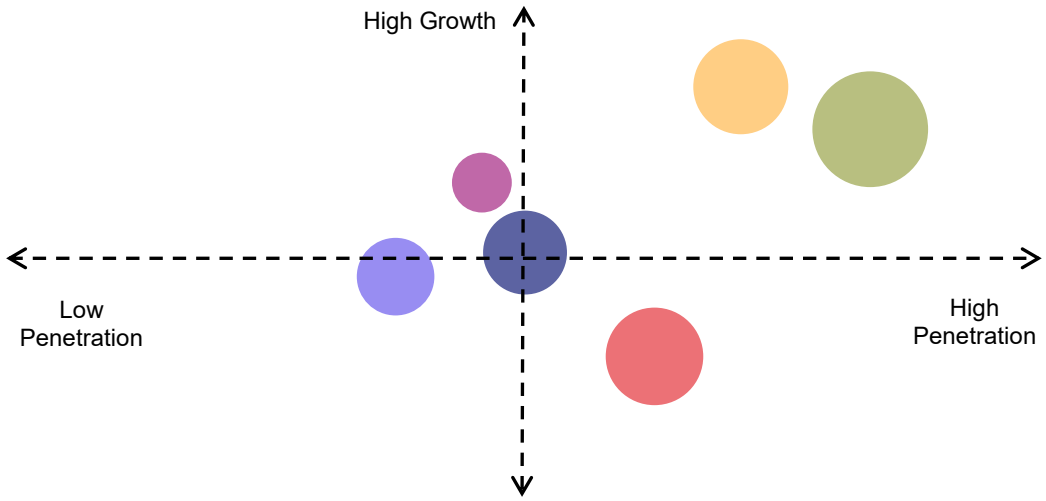
2.5.2. Lead Acid Battery Recycling - Penetration & Growth Prospect Mapping



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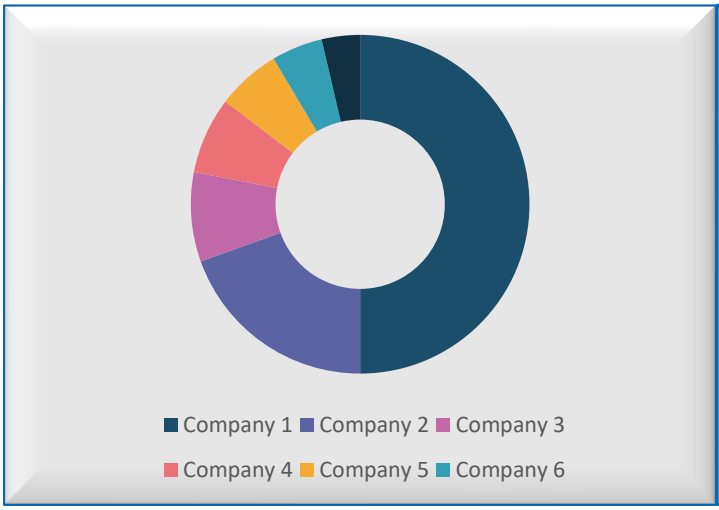
2.6. Industry analysis - Porter's

Table 12 Industry analysis - Porter's

2.7. Lead Acid Battery Recycling - Company Market Share Analysis, 2025

Table 13 Lead Acid Battery Recycling – Company Market Share Analysis, 2025 (The data is for representation purpose only)



Market Share Analysis 2025

The lead acid battery recycling market is considered / fragmented in nature with the top six players

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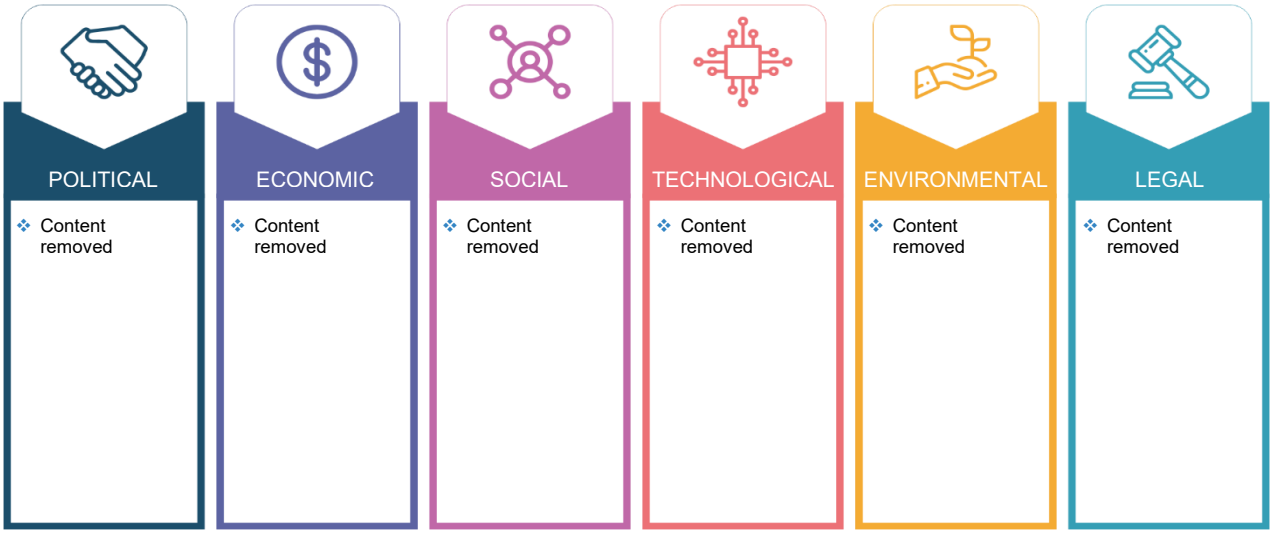
2.8. Lead Acid Battery Recycling - PESTEL Analysis

Table 14 Lead Acid Battery Recycling - PESTEL Analysis



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2.9. Lead Acid Battery Recycling - Emerging Advancements

Table 15 Lead Acid Battery Recycling – Emerging Advancements

Provider	Emerging Advancements
GME Recycling	Gravity-based braking system separates 5 ULAB elements with 50% less energy; electrochemical dissolution avoids high-temperature smelting for energy savings and high-purity lead; zero oxidation refining; automation/robotics for disassembly and sorting.
Ace Green Recycling	GREENLEAD hydrometallurgical process: 100% electrified, zero Scope 1 carbon emissions, modular plants producing battery-grade lead compliant with EU/USA regulations; high recoveries of lead and other materials.
Battery Council International (BCI)	Sustained 99% recycling rate via advanced hammer mill breaking, controlled vat separation of lead/plastics/electrolyte, rigorous EHS monitoring; drives innovation in lifecycle management.
xx	xx
xx	xx
xx	xx

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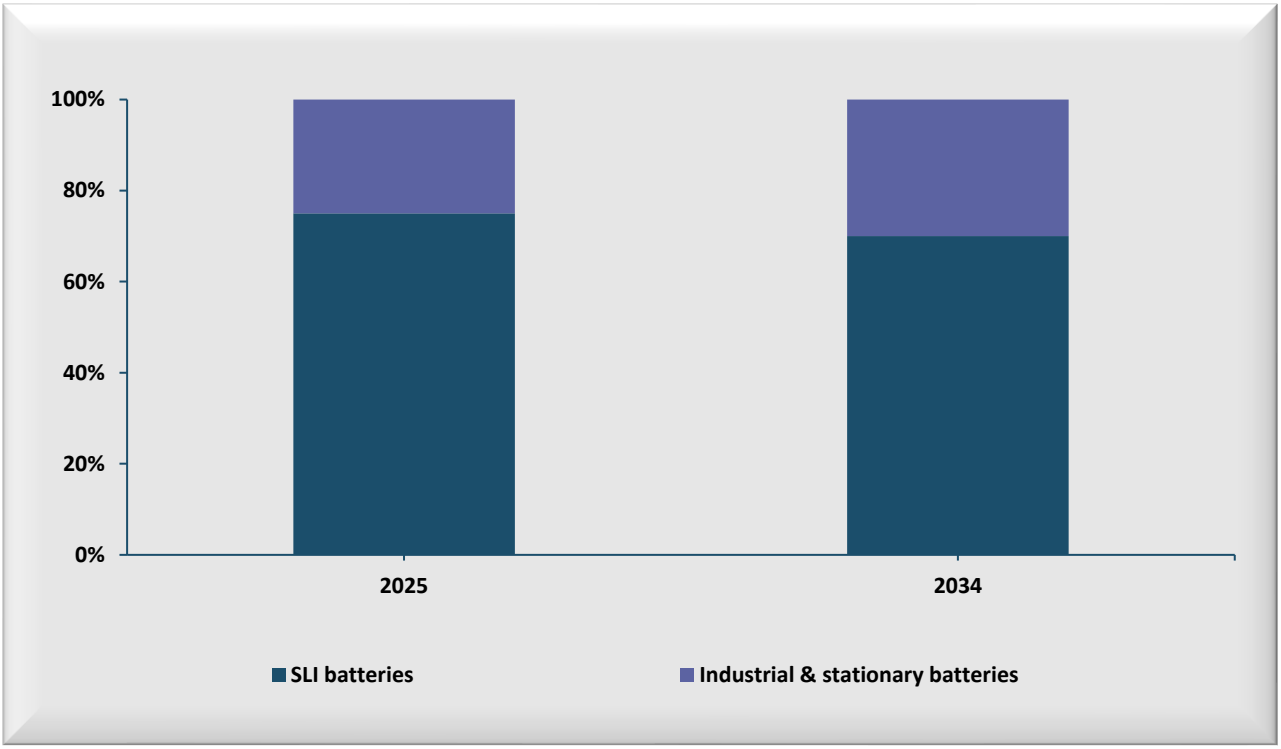
CHAPTER 3. # LEAD ACID BATTERY RECYCLING MARKET SIZE AND FORECAST BY BATTERY TYPE

3.1. Global Lead Acid Battery Recycling Share by Battery Type, 2025 & 2034

Table 16 Global Lead Acid Battery Recycling, by Battery Type Outlook, 2025 & 2034



3.2. SLI Batteries

Table 17 Lead Acid Battery Recycling Market Estimates & Forecast by Region 2021-2034, (USD Billion)

Region	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
North America	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Europe	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Asia Pacific	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Middle East & Africa	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Latin America	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Total	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%

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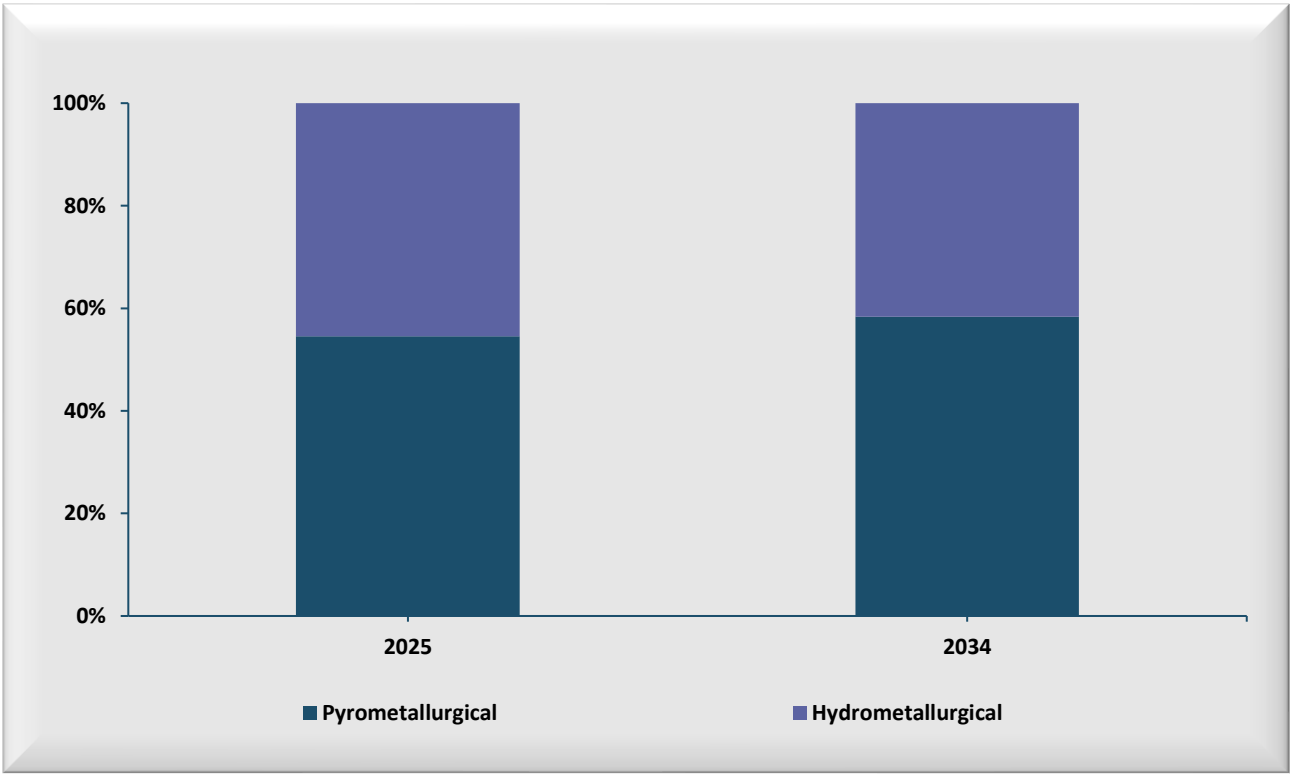
CHAPTER 4. # LEAD ACID BATTERY RECYCLING MARKET SIZE AND FORECAST BY RECYCLING PROCESS

4.1. Global Lead Acid Battery Recycling Share by Recycling Process, 2025 & 2034

Table 18 Global Lead Acid Battery Recycling, by Recycling Process Outlook, 2025 & 2034



4.2. Pyrometallurgical

Table 19 Lead Acid Battery Recycling Market Estimates & Forecasts by Region 2021-2034, (USD Billion)

Region	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
North America	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Europe	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Asia Pacific	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Middle East & Africa	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Latin America	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Total	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%

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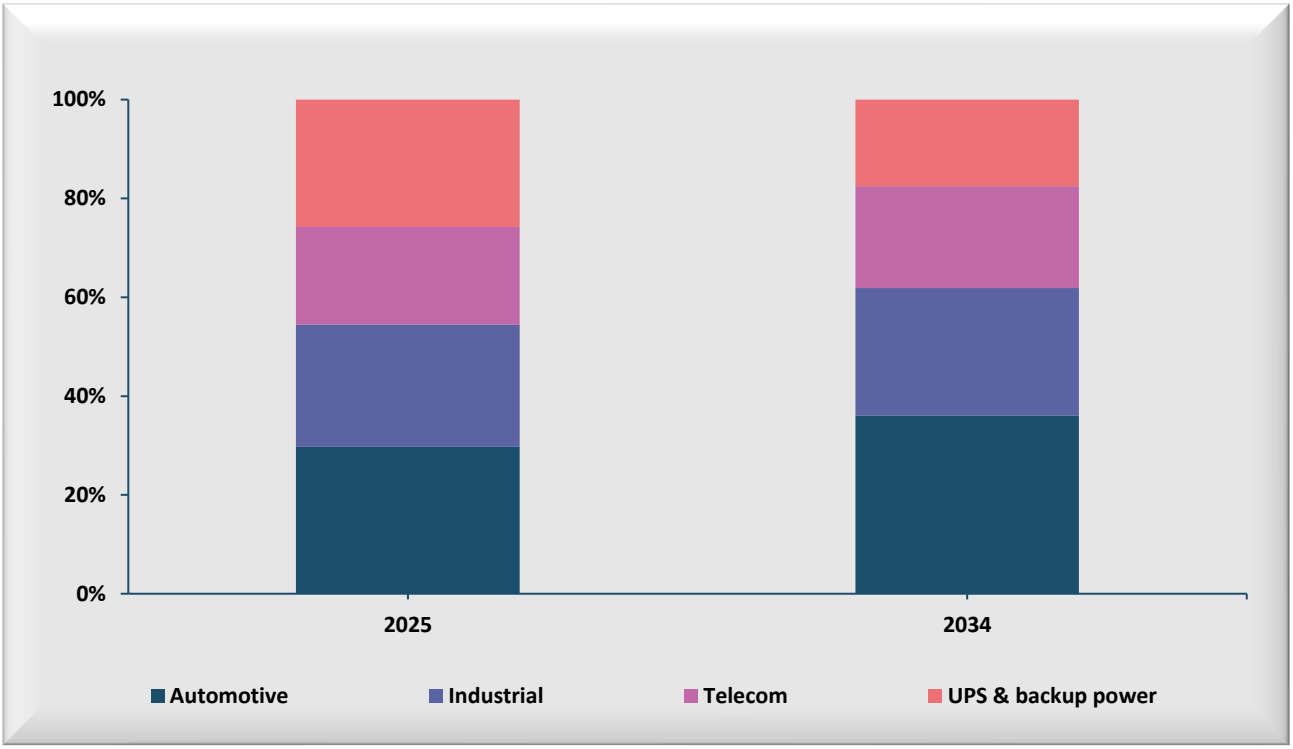
CHAPTER 5. # LEAD ACID BATTERY RECYCLING MARKET SIZE AND FORECAST BY END USER

5.1. Global Lead Acid Battery Recycling Share by End User, 2025 & 2034

Table 20 Global Lead Acid Battery Recycling, by End User Outlook, 2025 & 2034



5.2. Automotive

Table 21 Lead Acid Battery Recycling Market Estimates & Forecasts by Region 2021-2034, (USD Billion)

Region	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
North America	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Europe	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Asia Pacific	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Middle East & Africa	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Latin America	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Total	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%

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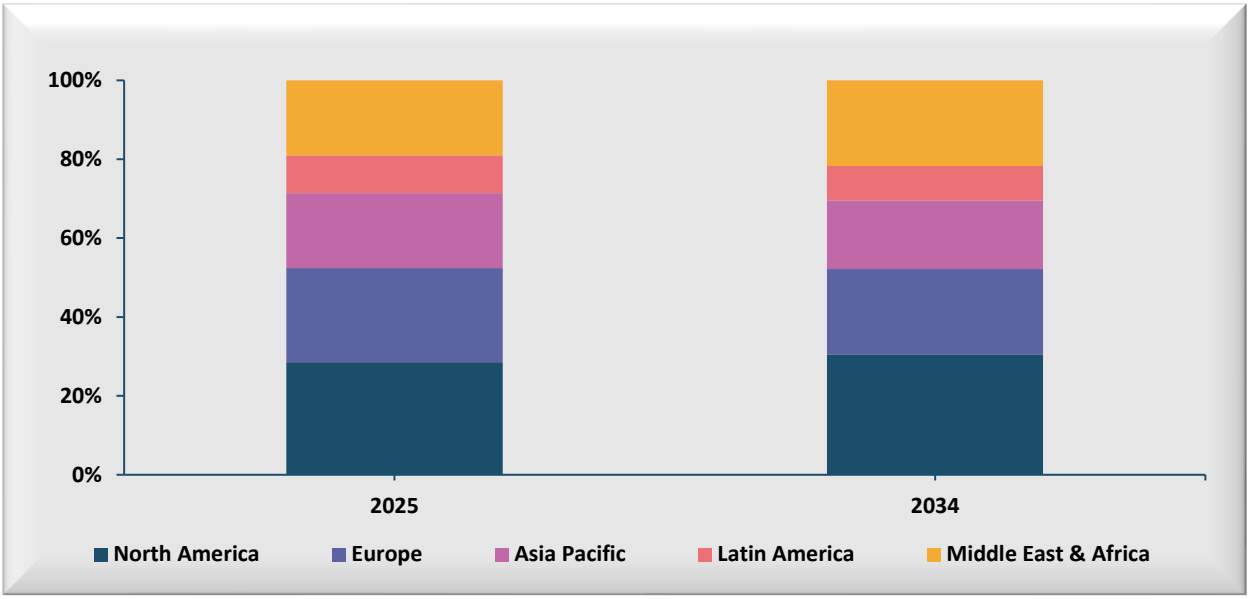
CHAPTER 6.

LEAD ACID BATTERY RECYCLING MARKET SIZE AND FORECAST BY REGION

6.1. Global Lead Acid Battery Recycling Market Share by Region, 2025 & 2034

Table 22 Global Lead Acid Battery Recycling Regional Outlook, 2025 & 2034



6.2. North America

Table 23 North America Lead Acid Battery Recycling Market, by Battery Type, 2021-2034 (USD Billion)

Battery Type	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
SLI batteries	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Industrial & stationary batteries	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Total	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%

Table 24 North America Lead Acid Battery Recycling Market, by Recycling Process, 2021-2034 (USD Billion)

Recycling Process	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
Pyrometallurgical	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Hydrometallurgical	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Total	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%

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Table 25 North America Lead Acid Battery Recycling Market, by End User, 2021-2034 (USD Billion)

End Use	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	CAGR (2026-34)
Automotive	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Industrial	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Telecom	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
UPS & backup power	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%
Total	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx%

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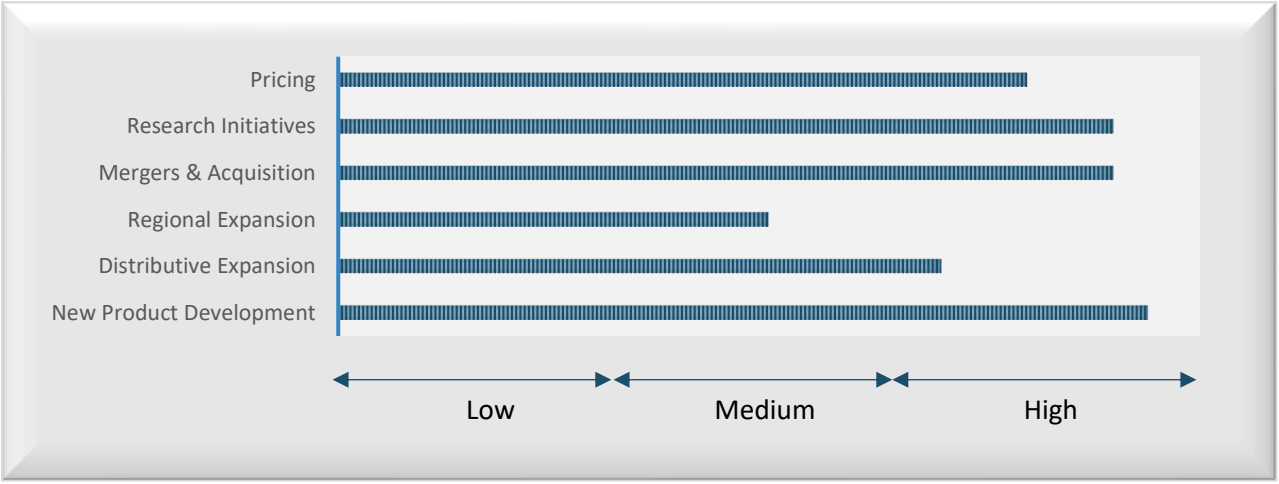
CHAPTER 7. COMPETITIVE LANDSCAPE

7.1. Strategy Framework

Table 26 Strategy framework



STRATEGY	SPEARHEADS
PRICING	--
DISTRIBUTIVE EXPANSION	--
REGIONAL EXPANSION	--
NEW DEVICE DISTRIBUTION CHANNELDEVELOPMENT	--
MERGERS & ACQUISITION	--
RESEARCH INITIATIVES	--

Several major players in the global place are Ecobat, Cirba Solutions, Clarios, East Penn Manufacturing Company, The Doe Run Company, Exide Technologies, Gravita India Ltd., Camel Group, Tianneng Group, GS Yuasa

The lead acid battery recycling market features a fragmented yet competitive landscape with a mix of global vertically integrated manufacturers and specialized recycling firms. Ecobat leads as the largest dedicated recycler with facilities across multiple continents, benefiting from economies of scale and extensive collection networks. Cirba Solutions and Clarios represent strong North American players, with Clarios leveraging its position as a leading battery manufacturer to secure captive feedstock through closed loop recycling. East Penn Manufacturing and The Doe Run Company operate advanced facilities in the U.S., focusing on high recovery rates and environmental compliance. Exide Technologies maintains a global footprint across over eighty countries, integrating recycling with new battery production. Gravita India Ltd. has emerged as a major force from Asia, utilizing eco-friendly technology to expand across three continents. Camel Group and Tianneng Group dominate the Chinese market, supported by local scale and government policies favoring formal

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recycling. GS Yuasa leads in Japan with advanced hydrometallurgical capabilities. Overall, competition centers on feedstock access, technology efficiency, and regulatory compliance.

7.2. Heat Map Analysis, 2025

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CHAPTER 8. COMPANY PROFILES

8.1. Exide Technologies

8.1.1. Company Overview

Exide Technologies is into stored energy solutions, with roots tracing back to 1888 as The Electric Storage Battery Company. Today, it operates as a standalone entity focused on sustainable battery systems after divesting its North American operations in 2020 to prioritize Europe, the Middle East, Asia, and Australia. The company emphasizes closed-loop recycling and advanced energy storage for diverse applications, integrating divisions like Automotive, Motion, Energy Solutions, and Recycling to drive innovation in mobility and infrastructure.

Exide's portfolio spans automotive batteries for passenger cars and light commercial vehicles, including AGM and EFB variants for Start-Stop systems. It also covers motorcycle, powersport, marine, and leisure batteries suited for caravans, campers, and nautical uses. Specialized offerings include batteries for electric mobility equipment, telecom backup power, and industrial traction systems for material handling and robotics. Advanced technologies feature absorbed glass mat designs, gel electrolytes for commercial vehicles, high-vibration resistance, and carbon-boosted grids for improved performance and lifespan. The Recycling division supports this ecosystem by reclaiming lead, plastics, and sulfuric acid through in-house smelters, enabling material reuse in new products and fostering a zero-waste approach.

Exide excels in closed-loop recycling, buying back used lead-acid batteries to process them in dedicated facilities. This process separates lead, polypropylene plastics, and electrolytes, with refined lead directly reused in manufacturing. Operations prioritize environmental safeguards, such as advanced emission controls and effluent neutralization, ensuring no discharge into water bodies or soil. Recycling centers handle slag and residues under pollution board oversight, conserving resources and minimizing ecological footprint across the battery lifecycle.

Exide maintains a strong presence in Europe with manufacturing and recycling plants in France, Spain, and other key markets. In Asia, particularly India via Exide Industries, it operates extensive facilities including smelters in states like Maharashtra and West Bengal. The Middle East and Australia round out its footprint, supported by a network of service centers and strategic alliances. This global setup facilitates tailored solutions for regional mobility and industrial needs while advancing sustainable practices.

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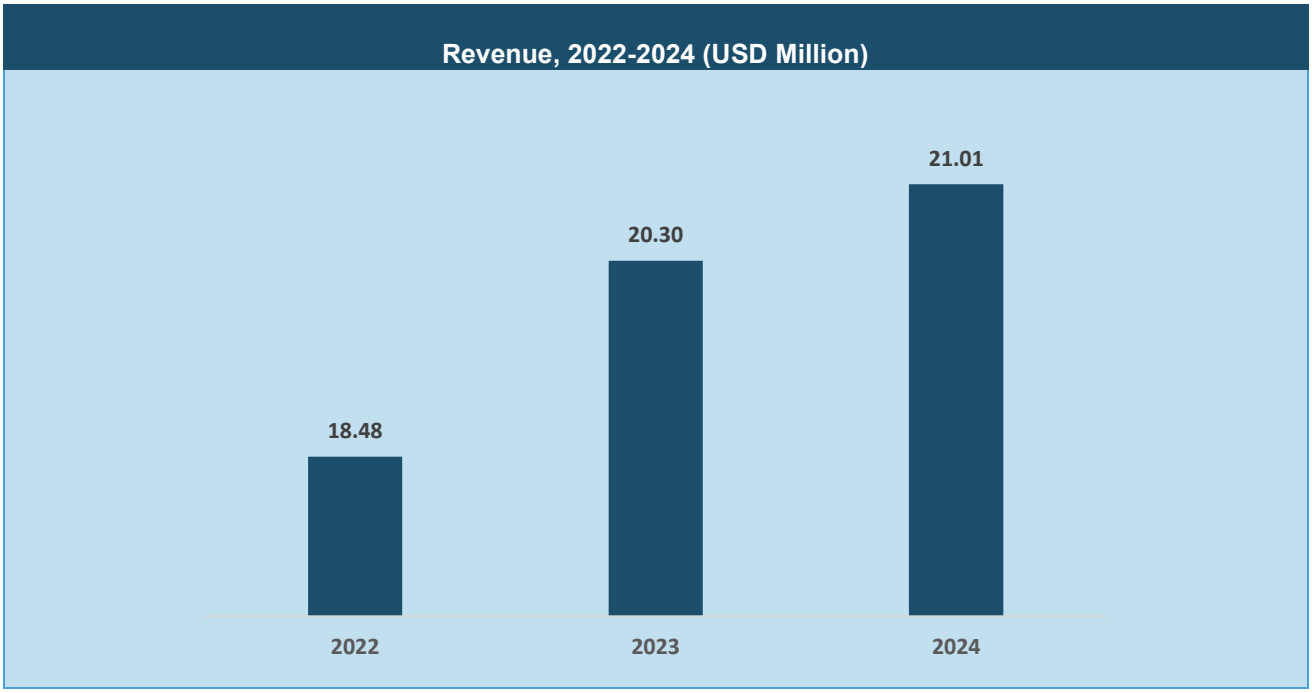
8.1.2. Financial Snapshot



Source: Company annual reports, SEC filings, Association publications, Polaris Market Research analysis

8.1.3. Product/ Services Benchmarking

Feature	Description	Benchmark Metrics
Sulphur Oxide Emissions	Advanced air pollution treatment systems	Zero emissions achieved
Effluent Treatment	Neutralization of waste sulphuric acid via ETPs	No water body contamination
Waste Disposal	Handling of slag, gypsum, lead residues	Supervised by State Pollution Control Boards, zero soil/groundwater risk
Material Recovery	Lead and polypropylene plastic reclamation	Refined lead reused in new batteries; plastics for containers (closed-loop)
Overall Impact	Integrated zero-waste ecosystem	Conserves resources, reduces GHG emissions, sets industry sustainability benchmark

8.1.4. Recent Developments

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CHAPTER 9. METHODOLOGY AND SCOPE

9.1. Research Methodology

We implement a mix of primary and secondary research for our market estimate and forecast. Secondary research Technology the initial phase of our study where we conduct extensive data mining, referring to verified data sources including independent studies, government and regulatory published material, technical journals, trade magazines, and paid data sources. This Technology the basis of our estimates.

For forecasting, the following parameters were considered:

- Market drivers and restraints along with their current and expected impacts
- Band Environment Medium scenario and expected developments
- Services Industry trends and dynamics
- Trends in consumer behavior

We have assigned weights to these parameters and quantified their market impacts using the weighted average analysis to derive an expected market growth rate.

All our estimates and forecast were verified through exhaustive primary research with Key Industry Participants (KIPs) which typically include:

- Market leading companies
- Raw material manufacturers
- System integrators
- API and software developers

The key objectives of primary research are as follows:

- To validate our data in terms of accuracy and acceptability
- To gain an insight into the current market and future expectations

9.2. Research Scope and Assumptions

- The report provides market value for the base year **2025** and a yearly **forecast till 2034** in terms of **revenue (USD Billion)**. The market estimates for each segment have been provided on a regional basis for the above-mentioned forecast period.
- The key Industry dynamics, regulatory scenario, major technological trends, and product markets are evaluated to understand their impact on the demand for the forecast period. The growth rates were estimated using correlation, regression, and time-series analysis.
- We have used the bottom-up approach for market sizing, analyzing key regional markets, dynamics, and trends for various battery type, recycling process, and end user. The global market has been estimated by integrating the regional markets.

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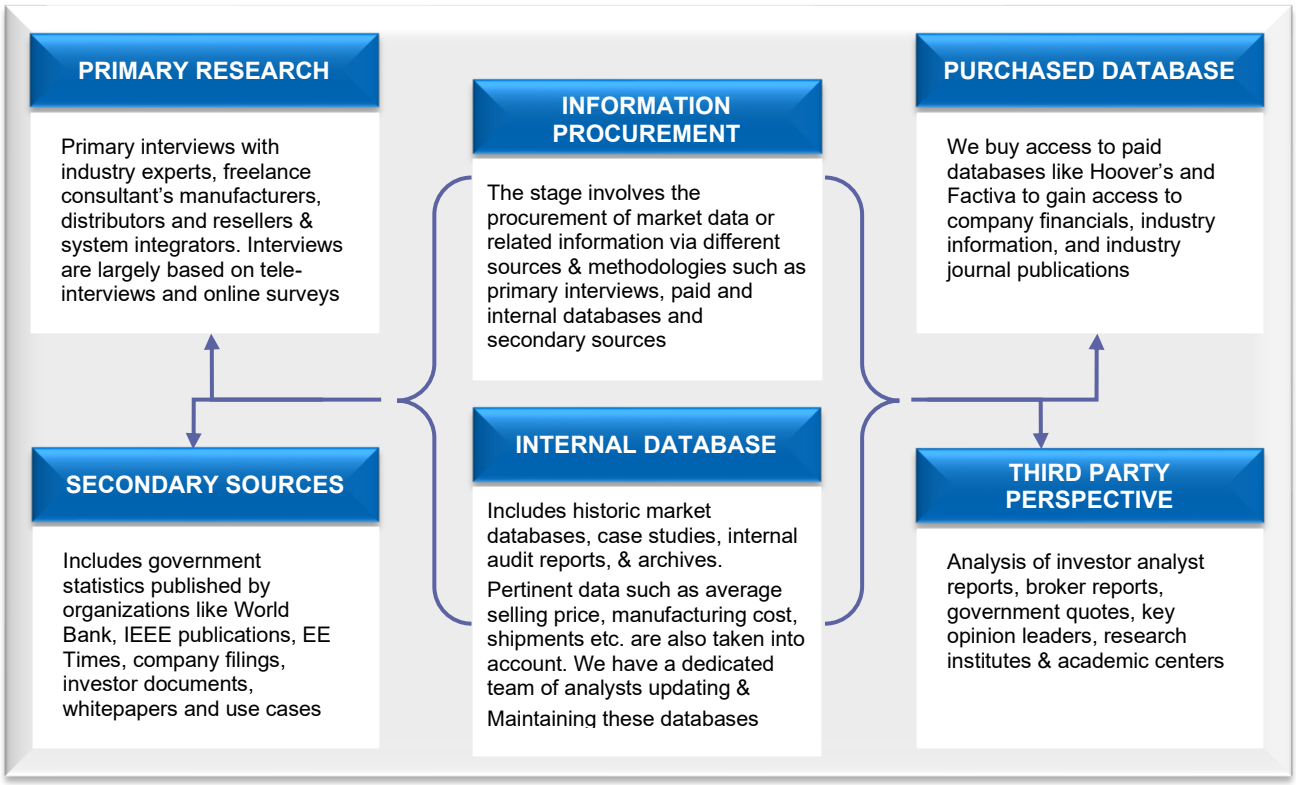
- All market estimates and forecasts have been validated through primary interviews with the key Industry participants
- Inflation has not been accounted for in order to estimate and forecast the market
- Numbers may not add up due to rounding off
- North America includes the U.S., and Canada
- Europe consists of EU-28, Central & Eastern Europe, along with CIS (Commonwealth of Independent States) countries
- **Turkey** is considered as a part of **Europe**
- Asia Pacific includes South Asia, East Asia, Southeast Asia, and Oceania (Australia & New Zealand)
- Latin America includes Central American countries and the South American continent
- **Middle East** includes **Western Asia** (as assigned by UN Statistics Division) and the **African continent**

9.3. Information Procurement

Table 27 Information Procurement



Information procurement is one of the most extensive stages in our research process. As illustrated in the figure above, the techniques can broadly be categorized into five sections, as stated below:

9.3.1. Purchased Database

- Includes company databases such as Factiva: This helps us compile metadata on historical sales volumes, prices, company revenues, and other Industry statistics. Also, it serves as an important step in market sizing, especially, in case of commodity-flow techniques

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- Other sources include SME journals, pertinent databases from third-party vendors to gain insights into:
- Usage rates
- Potential market-related statistics
- Information on unmet needs
- Regional expenditure pattern
- Investment information or opportunity-based statistics

9.3.2. Internal Database

- Includes our internal database of data points, collected as a result of previous research & studies and information made available via our database management team
- Also includes internal audit reports & archives

9.3.3. Secondary Sources

- A list of secondary sources along with the information extracted from them will be available in the final deliverable.
- Sources consulted during preliminary phase include ICIS, D&B, CFPA, U.S. EPA, and Company website
- Notable examples include white papers, government statistics published by organizations like UN Comtrade, World Bank, KoL publications, company filings, investor documents etc.
- Secondary databases are aimed at gathering market intel, historical statistics, product classifications according to SIC, NAICS, HS codes, and to understand trends available through public domains.

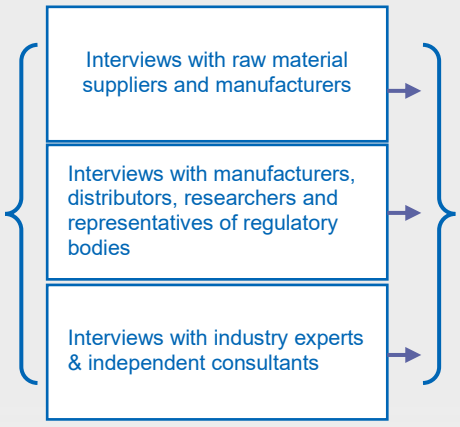
9.3.4. Third Party Perspective

- This section includes market derivation through investor analyst reports, broker reports, academic commentary, government quotes & wealth management publications.

9.3.5. PRIMARY RESEARCH

Table 28 Primary Research Pattern

The primary interviews and surveys derive directions from extensive secondary research. Secondary research is a continuous process and is conducted at each level along the value chain.



Interview Scope

- **Research tools: Questionnaire based research and telephonic discussions**
- **Database: Paid vendors, LinkedIn, Hoover's, Factiva, Sources extracted from previous pertinent studies**
- **Regional scope: All countries within the scope of the study. Interviews of KoLs from non-English speaking countries are conducted via our vendors and questionnaires**

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9.4. Information Analysis

9.4.1. DATA ANALYSIS MODELS

Information procured from secondary and primary initiatives are then, analyzed by using the following tools/models: (a partial list)

- Identifying variables and establishing market impact
- Establishing market trends
- Analyzing future opportunities and market penetration rates by understanding product commercialization, regional expansion etc.
- Analyzing changes in the Industry dynamics to establish future growth.
- Analyzing sustainability strategies adhered by market participants in an attempt to determine future course of the market
- Analyzing historical market trends and super-imposing them on the current and future variables to determine year-on-year trend.
- Keeping a track of technological advancements in individual segments
- Base numbers are established by analyzing the following:
- Company revenues and market share (this list generally includes the analysis of revenue published by publicly listed manufacturers)
- Derivation of market estimates via analyzing parent and ancillary markets
- Model selection: demand-based bottom-up approach and mixed approach (top down and bottom up)

Table 29 Primary research process

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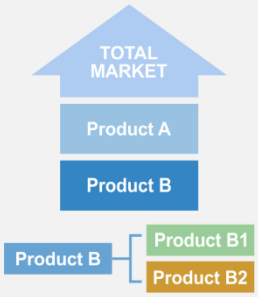
9.5. Market Formulation and Data Visualization

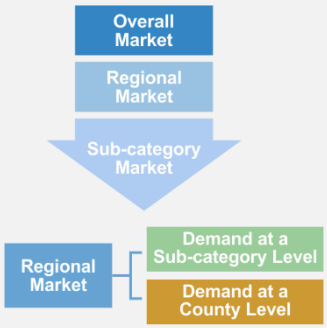
Table 30 Market research approaches – Bottom Up Approach



- Demand estimation of each product across countries/regions summed to from the total market
- Variable analysis for demand forecast
- Demand estimation via analyzing paid database, company financials either via annual reports or paid database
- Primary interviews for data revalidation and insight collection

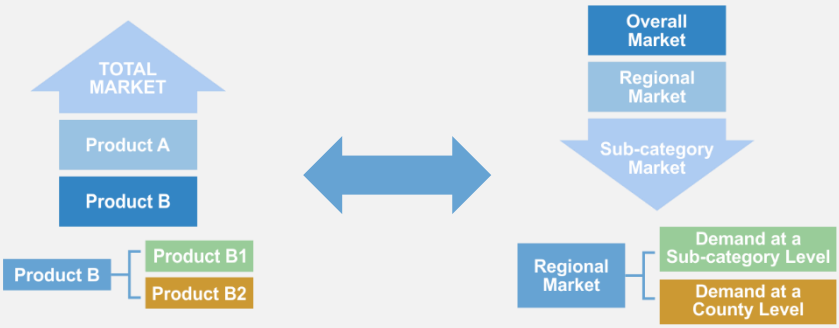
Table 31 Market research approaches – Top Down Approach

- Used extensively for new product forecasting or analyzing penetration level
- Tool used invoice product flow and penetration models
- Use of regression multi-variant analysis for forecasting
- Involves extensive use of paid and public databases
- Primary interviews and vendor-based primary research for variable impact analysis



Derived via commodity flow and demand / consumption models

Table 32 Market research approaches – Combined Approach



Derived via commodity flow and demand / consumption models

- Penetration modeling for products
  - Determining and forecasting penetration via analyzing product features, proposed pricing, availability of internal and external substitutes etc.
  - Heuristic estimation of year-on-year sales by conducting primary interviews with:
    - Manufacturers & distributors

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        - Industry experts & KoLs
        - Distributors
    - Product sizing and forecasting by following a diffusion model based on S-curve growth
- Analysis of current usage rates and dosage patterns to determine substitution rates
- Regression and variable analysis
    - Identifying variables and assigning impact to determine growth)
    - QFD modeling for market share assessment
    - Referring to historic data to establish base estimates
    - Using exponential smoothing for forecasting
- Epidemiology or user size-based penetration
    - Analyzing current needs and determining penetration to estimate market size or sales
    - Using unmet needs and capitalization rates to determine growth
- Trend analysis (based on year on year trending models)

9.6. Data Validation and Publishing

Some of the secondary sources used for this report

- World Bank
- International Monetary Fund
- White Papers and Research Journals
- Third-party Paid Databases
- Company Investor Presentations
- Company Annual Reports
- Hoovers

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CHAPTER 10. REPORT FAQS

10.1. How do I trust your report quality/data accuracy?

- We offer risk-free purchases. We will let you explore our report online through the conference without purchase commitment. You can also request a free sample to evaluate the report quality before making a purchase decision.
- Our portfolio of over 10,000 reports goes through rigorous quality checks and is based on robust models
- For client testimonials, case studies or additional questions, please reach out to us

10.2. My research requirement is very specific; can I customize this report?

- Yes, we offer free customizations within the research's scope
- 75% of our engagements are based on customized market reports
- Clients have free access to pre-sale analyst briefs to discuss requirements and recommendations

10.3. I have a pre-defined budget. Can I buy chapters/sections of this report?

- Yes, we sell sections of our reports
- You also have the option to buy excel & PPT versions of our reports.
- You may buy customized market intelligence based on your budget. We have a product to offer irrespective of the price point

10.4. How do you arrive at these market numbers?

- Our research methodology is a three-step cyclic process:
  - It starts with Information Procurement from internal DBs, paid primary and secondary sources
  - The second step is Data Analysis and Modeling
  - The third step is by Data Validation via Industry expert opinions
  - For a detailed research methodology, please request for a sample report.

10.5. Who are your clients?

- We cater three categories of clients: manufacturers and market participants, academicians, and investment banks and venture capitalists
- We service more than 950 clients annually. More than half of our clients re-engage us for additional reports and services.

10.6. How will I receive this report?

- The report will be delivered to you via PDF, Excel, PPT downloads

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CHAPTER 11. ADJACENT REPORTS

- **Battery Materials Market Size, Share, Trends, & Industry Analysis Report By Type (Cathode, Anode, Electrolyte, Separator, and Others), By Battery Type, By Application, and By Region – Market Forecast, 2025–2034**

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