

INDUSTRY OVERVIEW

The information and statistics presented in this section and other sections of this document, unless otherwise indicated, were extracted from different official government publications and other publications, and from the industry report prepared by Frost & Sullivan, an independent market research and consulting company that was commissioned by us, in connection with this [REDACTED]. The information from official government sources has not been independently verified by us, the Sole Sponsor, [REDACTED], any of their respective directors and advisers, or any other persons or parties involved in the [REDACTED], and no representation is given as to its accuracy.

SOURCES OF INFORMATION

We engaged Frost & Sullivan, an independent market research consultant, to conduct an analysis of, and to prepare a report on Global and China’s solid waste and hazardous waste recycling industry for the use in this document, which was commissioned by us for a fee of RMB390,000. In compiling and preparing the F&S Report, Frost & Sullivan adopted the following assumptions: (i) the social, economic and political conditions of China and other countries discussed will remain stable during the forecast period, (ii) global and China’s government policies on solid waste and hazardous waste recycling industry will remain consistent during the forecast period, (iii) global and China’s solid waste and hazardous waste recycling industry will be driven by the factors which are stated in the report in the forecast period. Except as otherwise noted, all of the data and forecasts contained in this section are derived from the F&S Report. The Frost & Sullivan Report has been prepared by Frost & Sullivan independently without any influence from us or other interested parties.

ANALYSIS OF SOLID WASTE AND HAZARDOUS WASTE RECYCLING MARKET

Definition and Classification of Solid Waste and Hazardous Waste Recycling Market

The solid waste and hazardous waste recycling market encompasses the collection, processing, and conversion of solid waste as well as hazardous waste into reusable materials or energy. This market aims to reduce environmental impact, conserve natural resources, and convert waste resources into valuable ones in compliance with strict regulatory requirements.

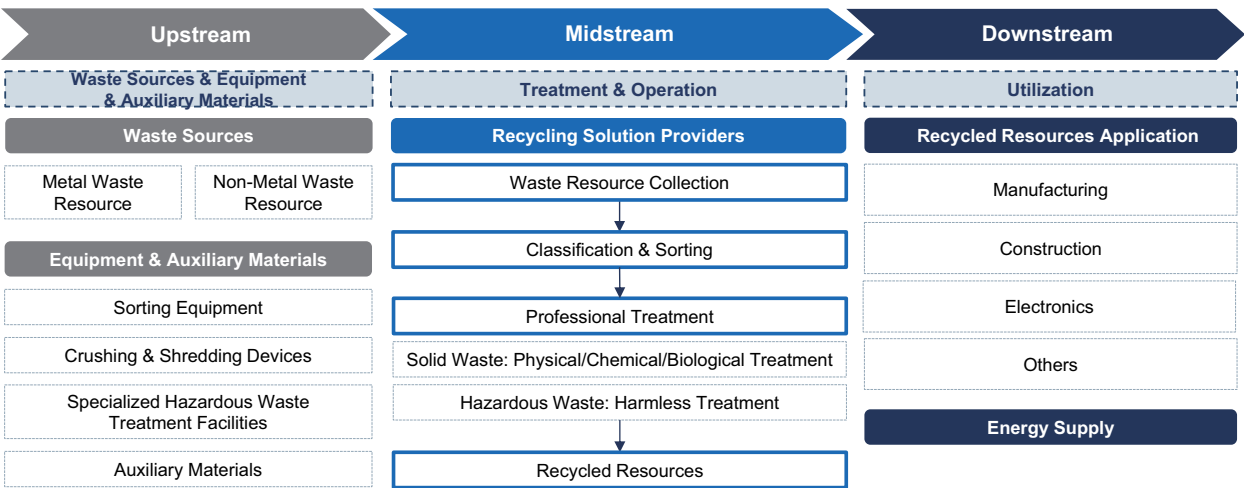
The solid waste and hazardous waste recycling market can be classified into metal resource recycling market, non-metal resource recycling market, and waste-to-energy incineration market.

Value Chain of Solid Waste and Hazardous Waste Recycling Industry

The upstream of the solid waste and hazardous waste recycling industry consists of waste sources, such as metal and non-metal waste resource, as well as equipment and auxiliary materials. The recycling solution providers in the midstream provide treatment and operation services, covering waste resource collection, classification, sorting, and treatment. The downstream includes recycled resources application and energy supply.

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Value Chain of Solid Waste and Hazardous Waste Recycling Industry



Source: Frost & Sullivan

Market Size of China Solid Waste and Hazardous Waste Recycling Market

Driven by policy support, such as the expansion of “Waste-Free City” pilots and strengthened enforcement of extended producer responsibility (EPR), the solid waste and hazardous waste recycling market in China has seen significant growth in the past 5 years, the market size of which increased from RMB1,597.4 billion in 2020 to RMB2,147.9 billion in 2024, with a CAGR of 7.7%. Looking forward, due to continuous structural optimization and technological innovation, the solid waste and hazardous waste recycling market in China is expected to increase from RMB2,414.6 billion in 2025 to RMB3,504.3 billion in 2029, representing a CAGR of 9.8% during the period.

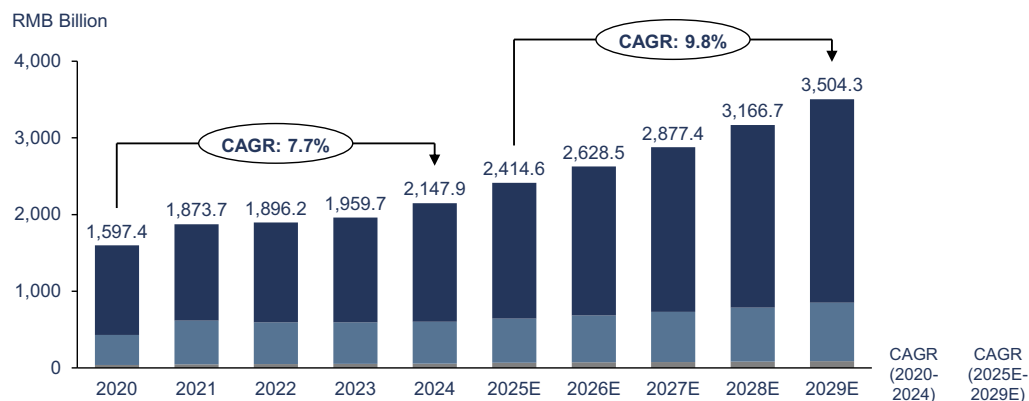
The metal resource recycling market in China increased from RMB1,168.9 billion in 2020 to RMB1,546.2 billion in 2024, with a CAGR of 7.2%, primarily due to the implementation of national strategies for green development and strategic resource security. In the future, the landscape will be shaped by innovation-led high-quality development as well as supply-demand integration. The metal resource recycling market in China is expected to reach RMB2,653.9 billion in 2029, representing a CAGR of 10.6% from 2025 to 2029.

The non-metal resource recycling market in China was primarily driven by an urgent push to construct a nationwide recycling infrastructure, catalyzed by top-level strategies such as “Dual Carbon” goals and the enforcement of waste import bans. Its market size grew from RMB391.4 billion in 2020 to RMB546.1 billion in 2024, with a CAGR of 8.7%. Looking ahead, market drivers are shifting towards fostering high-quality, technology-intensive, and economically integrated growth. The non-metal resource recycling market size in China is expected to reach RMB762.7 billion in 2029, representing a CAGR of 7.3% from 2025 to 2029.

Supported by policy imperative to eliminate urban waste landfills and build foundational disposal capacity, the waste-to-energy incineration market size in China has seen dramatic growth, which increased from RMB37.1 billion in 2020 to RMB55.6 billion in 2024, representing a CAGR of 10.6% during the period. Looking ahead, the market landscape is characterized by the move towards high-efficiency operation and technology upgrades to enhance power generation efficiency, alongside the diversification of fuel sources. The waste-to-energy incineration market size in China is expected to reach RMB87.8 billion in 2029, with a CAGR of 6.9% from 2025 to 2029.

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Solid Waste and Hazardous Waste Recycling Market Size (revenue breakdown by service types), China, 2020-2029E



	2020	2021	2022	2023	2024	2025E	2026E	2027E	2028E	2029E	CAGR (2020- 2024)	CAGR (2025E- 2029E)
Metal Resource Recycling	1,168.9	1,257.0	1,302.0	1,367.6	1,546.2	1,771.7	1,945.6	2,147.3	2,381.3	2,653.9	7.2%	10.6%
Non-Metal Resource Recycling	391.4	571.0	544.8	539.1	546.1	575.7	611.1	653.3	703.3	762.7	8.7%	7.3%
Waste-to-Energy Incineration	37.1	45.7	49.4	53.0	55.6	67.3	71.9	76.8	82.1	87.8	10.6%	6.9%

Source: Frost & Sullivan

Market Size of China Metal Resource Recycling Market

Based on metal types, the metal resources can be categorized into base metals, precious metals, and other metals.

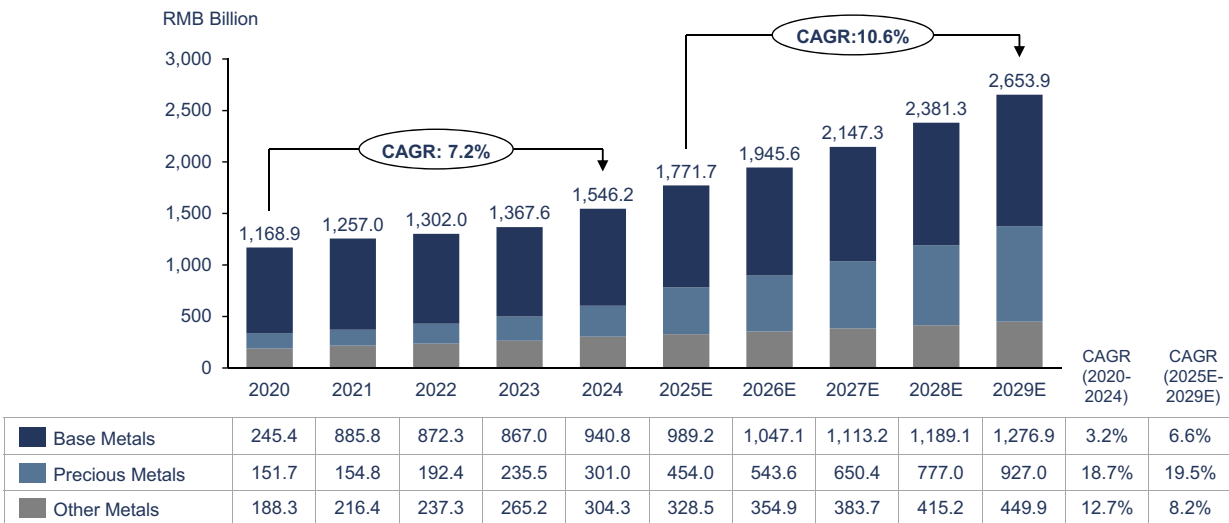
Base metals, mainly include iron, manganese, copper, aluminum, lead, zinc, tin, nickel and antimony, accounted for the greatest portion of the metal resource recycling market, which is primarily driven by the national imperative to reduce dependence on imported primary ores, compounded by the need to meet ambitious “Dual Carbon” goals, which made energy-efficient recycling a strategic necessity. The base metal resource recycling market size in China increased from RMB828.9 billion in 2020 to RMB940.8 billion in 2024, with a CAGR of 3.2% during the period. Propelled by structural optimization, technological innovation, and industry consolidation, the market size is expected to increase from RMB989.2 billion in 2025 to RMB1,276.9 billion in 2029, representing a CAGR of 6.6% from 2025 to 2029. Among base metals, the recycled copper market size increased from RMB79.0 billion in 2020 to RMB135.1 billion in 2024, representing a CAGR of 14.4%, and is expected to reach RMB231.8 billion in 2029, with a CAGR of 10.9% from 2025 to 2029. Also, the recycled lead market size grew from RMB25.8 billion in 2020 to RMB40.0 billion in 2024, representing a CAGR of 11.6%, and is expected to reach RMB61.1 billion in 2029, with a CAGR of 10.1% from 2025 to 2029. The recycled antimony market size increased from RMB1.6 billion in 2020 to RMB7.8 billion in 2024, representing a CAGR of 48.1% during the period, and is expected to reach RMB21.4 billion in 2029, with a CAGR of 15.3%.

Precious metals, including gold, silver, and platinum-group metals, are the second major category in China’s metal resource recycling market, and its market size increased from RMB151.7 billion in 2020 to RMB301.0 billion in 2024, with a CAGR of 18.7% during the period. The sector’s future growth will be amplified by the rapid growth of high-tech industries and the need for high-purity materials, coupled with sophisticated technological breakthroughs for efficient extraction from new waste resources, ensuring maximum value recovery and supply chain security in a competitive global market. The precious metal resource recycling market size is expected to increase from RMB454.0 billion in 2025 to RMB927.0 billion in 2029, representing a CAGR of 19.5% during the period. Among precious metals, the platinum-group metal recycling market size increased from RMB4.6 billion in 2020 to RMB8.4 billion in 2024, with a CAGR of 16.6%, and is expected to reach RMB23.2 billion in 2029, representing a CAGR of 23.3% from 2025 to 2029.

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Others metals include bismuth, lithium, tungsten, cobalt, etc. The explosion of domestic new energy vehicle and renewable energy sectors created an urgent demand for a variety of metals as well as end-of-life solutions for their products, such as batteries and motors. Looking ahead, the focus will be on building a secure domestic closed-loop supply chain for these critical materials, mitigating geopolitical risk and price volatility risk. The market size of other metal resource recycling market grew from RMB188.3 billion in 2020 to RMB304.3 billion in 2024, with a CAGR of 12.7% during the period, and is expected to reach RMB449.9 billion in 2029, representing a CAGR of 8.2% from 2025 to 2029. Among other metals, the recycled bismuth market size increased from RMB0.3 billion in 2020 to RMB1.1 billion in 2024, representing a CAGR of 34.9% during the period, and is expected to reach RMB4.1 billion in 2029, with a CAGR of 19.2% from 2025 to 2029.

Metal Resource Recycling Market Size
(revenue breakdown by metal types), China, 2020-2029E



Source: Frost & Sullivan

Market Size of Global Solid Waste and Hazardous Waste Recycling Market

The global solid waste and hazardous waste recycling market between 2020 and 2024 was primarily propelled by stringent and evolving regulatory frameworks alongside significant corporate sustainability commitments, such as the adoption of EPR regulations in the EU and North America. The global solid waste and hazardous waste recycling market grew from RMB5,086.7 billion in 2020 to RMB6,189.3 billion in 2024, with a CAGR of 5.0%. Looking ahead, market drivers are transitioning from establishing compliance framework to achieving economic and environmental efficiency through deep technological integration. The global solid waste and hazardous waste recycling market is expected to reach RMB9,122.3 billion in 2029, representing a CAGR of 8.1% from 2024 to 2029.

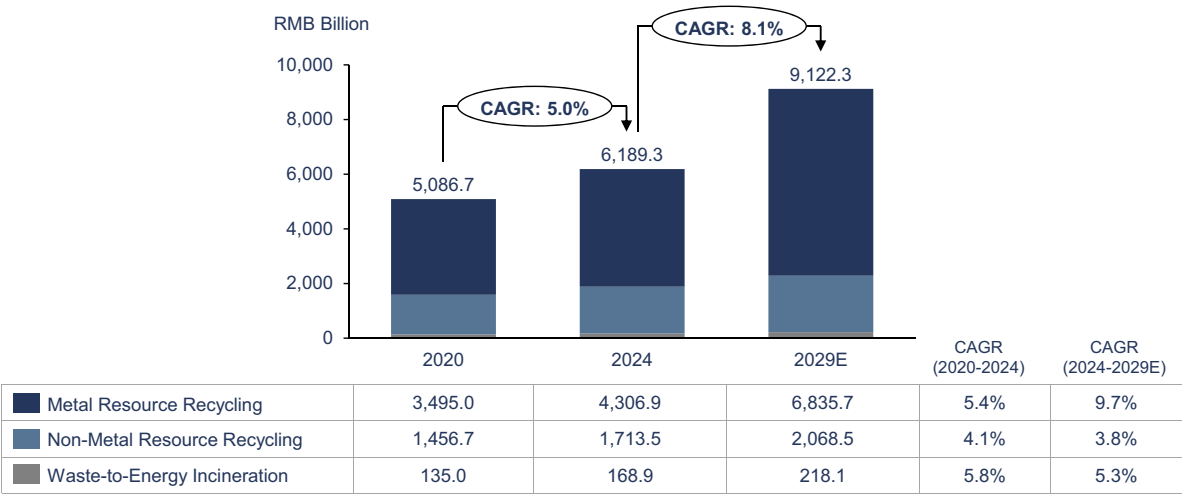
Metal resource recycling, which accounted for the biggest portion of the global solid waste and hazardous waste recycling market, recorded stable growth in the past 5 years, propelled by global policy push towards national resource security and a collective energy transition. Its market size increased from RMB3,495.0 billion in 2020 to RMB4,306.9 billion in 2024, with a CAGR of 5.4%. Driven by continuous supply chain optimization and structural integration, the global metal resource recycling market size is expected to reach RMB6,835.7 billion in 2029, representing a CAGR of 9.7% from 2024 to 2029.

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Non-metal resource recycling market globally is primarily driven by escalating global policy frameworks aimed at decoupling economic growth from virgin material use, as well as corporate sustainability commitments to reduce carbon footprints. Its market size increased from RMB1,456.7 billion in 2020 to RMB1,713.5 billion in 2024, with a CAGR of 4.1%. The dynamics is expected to shift from basic collection to creating high-value secondary raw materials that meet stringent quality standards. The non-metal resource recycling market size globally is anticipated to reach RMB2,068.5 billion in 2029, representing a CAGR of 3.8% from 2024 to 2029.

Driven by the urgent need to manage escalating municipal solid waste volumes and reduce landfill dependence, countries across the globe are directing capital towards waste-to-energy facility upgrades and decarbonizing industrial operations. The waste-to-energy incineration market size globally increased from RMB135.0 billion in 2020 to RMB168.9 billion in 2024, representing a CAGR of 5.8% during the period. The market size is expected to reach RMB218.1 billion in 2029, with a CAGR of 5.3% from 2024 to 2029.

**Global Solid Waste and Hazardous Waste Recycling Market Size
(revenue breakdown by service types), 2020-2029E**



Source: Frost & Sullivan

Market Size of Southeast Asia Solid Waste and Hazardous Waste Recycling Market

Between 2020 and 2024, the solid waste and hazardous waste recycling market landscape in Southeast Asia was marked by the policy shift from being a passive waste importer to actively controlling cross-border waste flows, which reshaped the market toward greater self-sufficiency. Its market size grew from RMB118.2 billion in 2020 to RMB174.9 billion in 2024, with a CAGR of 10.3%. Driven by the formalization and scaling of circular systems, as well as significant capital deployment into advanced infrastructure and technologies, the solid waste and hazardous waste recycling market size in Southeast Asia is expected to reach RMB390.5 billion in 2029, representing a CAGR of 17.4% from 2024 to 2029.

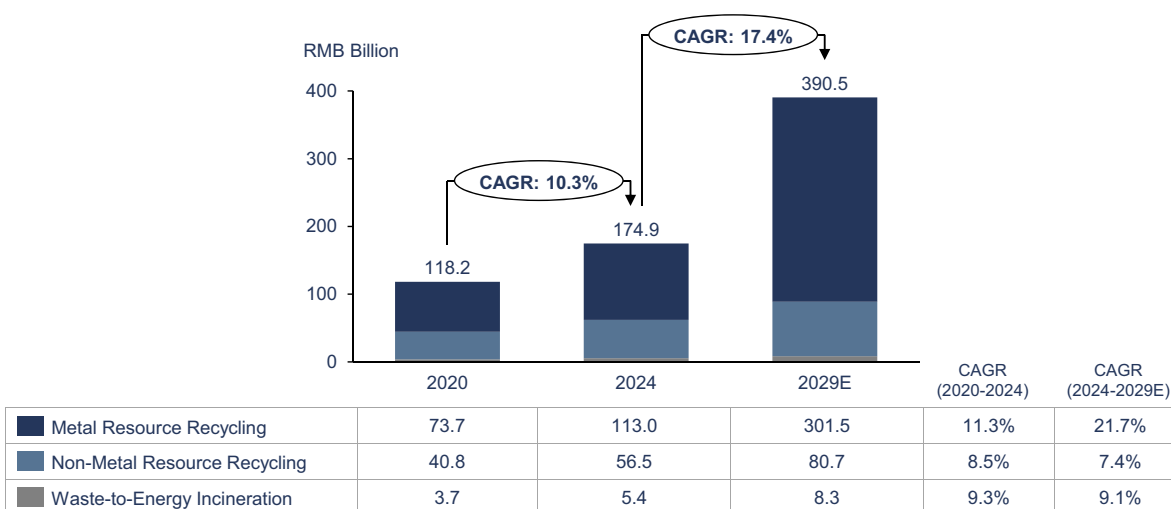
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Southeast Asia’s rapid economic and urban growth significantly increased domestic consumption and the generation of end-of-life metal scrap, particularly from electronics, which created a foundational supply base for the local metal resource recycling market. The metal resource recycling market size in Southeast Asia increased from RMB73.7 billion in 2020 to RMB113.0 billion in 2024, with a CAGR of 11.3%. Looking ahead, regional policy evolution from the ASEAN Framework for a Circular Economy and national regulations will be central in shaping and formalizing the market. The metal resource recycling market size in Southeast Asia is expected to reach RMB301.5 billion in 2029, representing a CAGR of 21.7%. For example, Malaysia mandates domestic processing of rare earths to develop magnet industry, while Thailand solidifies its role as a regional aluminum scrap hub with significant foreign investment.

The non-metal resource recycling market in Southeast Asia in the past 5 years was primarily driven by the establishment of high-level regional policy vision, with many countries restricting low-quality waste imports and seeking innovative solutions to handle domestic waste. Its market size grew from RMB40.8 billion in 2020 to RMB56.5 billion in 2024, representing a CAGR of 8.5% during the period. In the future, the market landscape will be driven by executing policy into tangible economic value and technological innovation. The non-metal resource recycling market size in Southeast Asia is expected to reach RMB80.7 billion in 2029, with a CAGR of 7.4% from 2024 to 2029. For example, Thailand leads in integrating plastics recycling into its manufacturing sector, while Indonesia is pivoting towards systematic waste management, stimulating its development in resources recycling and organic waste processing.

Fueled by policy shift to a more sustainable waste management framework as well as urgent need for advanced disposal solutions, the waste-to-energy incineration market in Southeast Asia has seen significant growth. Its market size increased from RMB3.7 billion in 2020 to RMB5.4 billion in 2024, with a CAGR of 9.3% during the period. Future driver will be the integration of waste-to-energy into national industrial and energy security strategies, supported by strategic foreign investment in infrastructure and technology partnerships. The waste-to-energy incineration market size in Southeast Asia is expected to reach RMB8.3 billion in 2029, with a CAGR of 9.1% from 2024 to 2029. For example, Indonesia stands as one of the most ambitious players and launches a massive national plan to build a number of waste-to-energy plants, while initiating major international tenders to attract foreign investment and expertise.

**Southeast Asia Solid Waste and Hazardous Waste Recycling Market Size
(revenue breakdown by service types), 2020-2029E**



Source: Frost & Sullivan

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Market Drivers of Solid Waste and Hazardous Waste Recycling Market

- ***Diversification of Recycling Resources:*** The market is driven by the expansion of waste resources to materials beyond traditional ones. The industry now encompasses complex and valuable resources from sectors such as electronics, construction, textiles, and new energy field. This diversification is not only driving the aggregate recycled volume, but also capturing high-value materials, such as platinum-group and bismuth, and addressing critical resource security concerns. It transforms waste management from a cost-centric disposal service into a strategic resource recovery sector, integral to global circular economy ambitions.
- ***More Stringent Environmental Regulations:*** The regulatory landscape of the solid waste and hazardous waste recycling industry globally is evolving from simple guidelines to active, legally-binding frameworks that create and enforce market demand for recycling. Policies such as the Guiding Opinions on Further Strengthening Environmental Management of Hazardous Waste and Strictly Preventing and Controlling Environmental Risks issued by the Chinese government, aiming to internalize end-of-life costs into product design and finance collection systems, are continuously rolled out to compel industries to adopt compliant treatment solutions, shifting waste management from a voluntary practice to a mandatory operational and strategic imperative for corporations.
- ***Technological Advancement Enhancing Treatment Efficiency:*** Technological innovation is the critical enabler that makes advanced recycling economically feasible and environmentally superior. Process spans biologically-based treatments for organic waste, advanced chemical processes for complex plastics, and artificial intelligence for precise material sorting. For hazardous waste, novel resource recovery techniques are setting new standards for safety and efficiency. These advancements collectively enhance the purity and value of recovered materials, reduce energy consumption, and enable the treatment of previously non-recyclable or complex waste resources.

Development Trends of Solid Waste and Hazardous Waste Recycling Market

- ***Strengthening Industrial Chain Synergy:*** A key development trend is the deepening vertical integration and horizontal collaboration across the waste recycling value chain. Companies are moving beyond isolated operations to form strategic alliances that connect waste sourcing, logistics, processing, and end-market applications. This synergy aims to create closed-loop systems, enhance resource security, and optimize the economics of recycling. The focus on building resilient, efficient, and traceable industrial ecosystems can better respond to market fluctuations and regulatory demands, thereby elevating the entire industry’s operational stability and value capture.
- ***Business Expansion of Chinese Companies to Emerging Economies:*** Leading Chinese resources recycling corporates are increasingly exporting their integrated technological and operational expertise to emerging economies, particularly Southeast Asia. This expansion is driven by the pursuit of new growth markets, the global expansion of circular economy models, and participation in international infrastructure projects. By establishing facilities and partnerships abroad, these companies are not only accessing new waste streams and resources, but also facilitating the global diffusion of advanced recycling standards and practices, shaping waste management frameworks in rapidly developing regions.

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COMPETITIVE ANALYSIS OF SOLID WASTE AND HAZARDOUS WASTE RECYCLING MARKET

Ranking of Recycled Copper Companies in the Hazardous Waste Recycling Market in China

In 2024, the total recycled copper revenue contributed by companies in the hazardous waste recycling market in China reached RMB56.7 billion. Based on recycled copper revenue of RMB5.2 billion in 2024, the Company ranked the third among companies in the hazardous waste recycling market in China, with a market share of 9.2%.

TOP 5 Recycled Copper Companies in the Hazardous Waste Recycling Market
(by revenue), China, 2024



Source: Company reports, Frost & Sullivan

Note: Company A is a company headquartered in Zhejiang Province, China, and listed on the Shenzhen Stock Exchange, was established in 2004 and primarily specializes in environmental protection and clean energy equipment manufacturing.

Company B is a company headquartered in Guangdong Province, China, and listed on the Shenzhen Stock Exchange, was established in 2008 and primarily specializes in hazardous waste disposal and renewable resource recycling.

Company C is a company headquartered in Jiangxi Province, China, was established in 2019 and primarily specializes in nonferrous metal smelting.

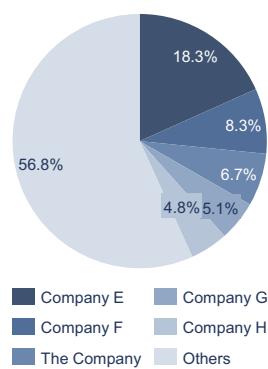
Company D is a company headquartered in Anhui Province, China, and listed on the Shenzhen Stock Exchange, was established in 1999 and primarily specializes in advanced copper-based materials and carbon materials.

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Ranking of Recycled Platinum-Group Metal Companies in the Hazardous Waste Recycling Market in China

In 2024, the total recycled platinum-group metal revenue contributed by companies in the hazardous waste recycling market in China reached RMB8.0 billion. Based on recycled platinum-group metal revenue of RMB0.5 billion in 2024, the Company ranked the third among companies in the hazardous waste recycling market in China, with a market share of 6.7%. Furthermore, the Company is among the few companies in the industry that cover the recycling of major types of platinum group metals, including platinum, palladium, rhodium, ruthenium, and iridium.

TOP 5 Recycled Platinum-Group Metal Companies in the Hazardous Waste Recycling Market (by revenue), China, 2024



Rank	Company	Recycled Platinum-Group Revenue (Billion RMB)	Market Share
1	Company E	1.5	18.3%
2	Company F	0.7	8.3%
3	The Company	0.5	6.7%
4	Company G	0.4	5.1%
5	Company H	0.4	4.8%
	Others	4.5	56.8%
	Total	8.0	100.0%

Source: Company reports, Frost & Sullivan

Note: Company E is a company headquartered in Yunnan Province, China, and listed on the Shanghai Stock Exchange, was established in 2000 and primarily specializes in precious metal functional materials and compound production.

Company F is a company headquartered in Jiangsu Province, China, and listed on the Shenzhen Stock Exchange, was established in 2005 and primarily specializes in precious metal recycling and comprehensive utilization services.

Company G is a company headquartered in Guangdong Province, China, and listed on the Shenzhen Stock Exchange, was established in 2001 and primarily specializes in urban mining resource recycling and new energy material manufacturing.

Company H is a company headquartered in Guangdong Province, China, and listed on the Shenzhen Stock Exchange and Hong Kong Stock Exchange, was established in 1999 and primarily specializes in industrial and municipal waste resource utilization and harmless treatment.

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Ranking of Recycled Bismuth Companies in the Hazardous Waste Recycling Market in China

In 2024, the total recycled bismuth revenue contributed by companies in the hazardous waste recycling market in China reached RMB895.0 million. Based on recycled bismuth revenue of RMB303.3 million in 2024, the Company ranked the first among companies in the hazardous waste recycling market in China, with a market share of 33.9%.

TOP 5 Recycled Bismuth Companies in the Hazardous Waste Recycling Market
(by revenue), China, 2024



Source: Company reports, Frost & Sullivan

Note: Company I is a company headquartered in Henan Province, China, and listed on the Shanghai Stock Exchange, was established in 2000 and primarily specializes in lead, zinc, and precious metal smelting.

Company J is a company headquartered in Hunan Province, China, and listed on the Shanghai Stock Exchange, was established in 1993 and primarily specializes in zinc, lead smelting and alloy products.

Company K is a company headquartered in Hunan Province, China, and listed on the Shenzhen Stock Exchange, was established in 1993 and primarily specializes in cemented carbide and tungsten, molybdenum, tantalum, niobium production and deep processing.

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Ranking of Recycled Antimony Companies in the Hazardous Waste Recycling Market in China

In 2024, the total recycled antimony revenue contributed by companies in the hazardous waste recycling market in China reached RMB368.0 million. Based on recycled antimony revenue of RMB67.8 million in 2024, the Company ranked the first among companies in the hazardous waste recycling market in China, with a market share of 18.4%.

TOP 5 Recycled Antimony Companies in the Hazardous Waste Recycling Market
(by revenue), China, 2024



Source: Company reports, Frost & Sullivan

Entry Barriers of Solid Waste and Hazardous Waste Recycling Market

- Licensing and Regulatory Barrier.** New entrants of the solid waste and hazardous waste recycling industry in China faces licensing and regulatory barriers. Obtaining solid waste and hazardous waste operation licenses involves complex, multi-year approval processes from environmental authorities at various levels. And the industry is subject to strict compliance requirements under evolving policies. New entrants must navigate a comprehensive regulatory framework that includes environmental impact assessments, facility siting approvals, and ongoing compliance monitoring, which creates a major barrier for them.
- Technology Barrier.** The industry faces significant technological barriers due to the complex and diverse nature of waste sources. Solid waste and hazardous waste requires specific treatment processes involving physics, chemistry, biology, and other interdisciplinary technologies. Additionally, treating solid waste and hazardous waste with characteristics such as toxicity or corrosiveness requires specialized equipment and accumulated expertise to ensure safety and compliance. New entrants lack the long-term R&D capabilities and practical experience to develop efficient, economical, and environmentally compliant treatment solutions quickly.