NEWSLETTER

Global Recycling and Waste Management Market

GLOBAL M&A PARTNERS

RIóN MERGERS AND ACQUISITIONS

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CONTENTS

The global recycling and waste management market has been in the spotlight in recent years. With sustainability a key focus, notably achieving a circular economy, major megatrends like waste management awareness, recycling methods, garbage management, and the introduction of AI and advanced technologies have been creating a rapidly changing environment for the industry.

This report covers:

- Overview of the recycling and waste management industry
- Growth drivers, challenges, and market trends
- Technological advancements in the industry
- Market segments, size, general and M&A Trends of individual segments
- Overview of recycling machinery manufacturers
- Policies and regulations across regions
- Key players in the market
- M&A deals and Public Comps analysis within this space

Structural shifts in the industry will have a significant impact on the global economy in the years to come.

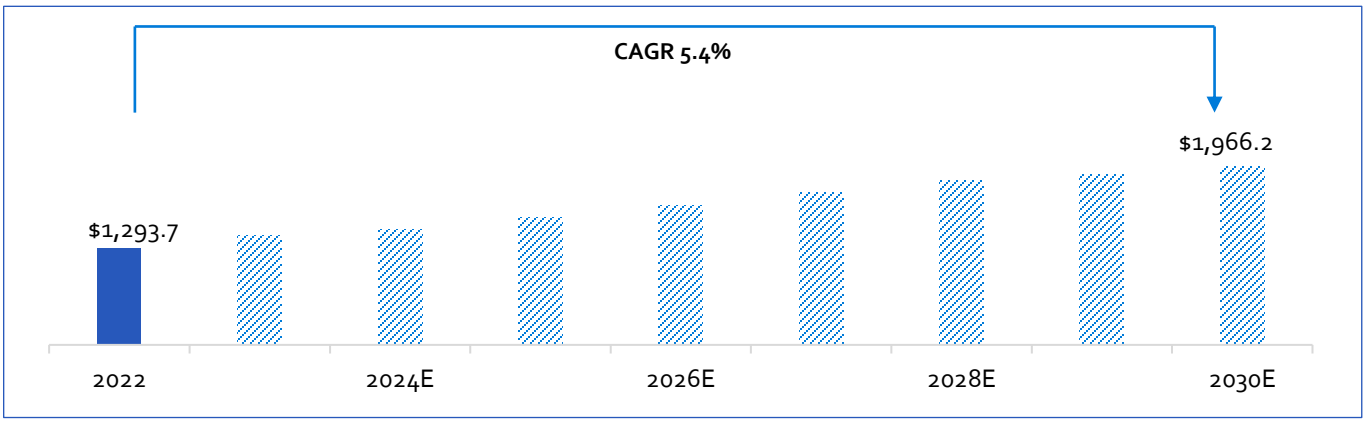
NEWSLETTER

1.1 Introduction

Waste management, particularly recycling, is a priority of global decision-making leaders. Transitioning to sustainable waste management by companies, individuals, organizations, and governments will reduce greenhouse gas emissions, tackle the problem of ocean plastics and others, and create a circular economy. GDP growth is forecast to fall to a three-decade low of 2.2% annually by 2030. If countries adopt sustainability-focused policies, potential growth could be increased by approximately 0.7% to an annual average rate of 2.9%. By 2030, sustainability-focused policies could deliver an extra 4% of GDP.

The global waste management market size was $1,293.7 bn in 2022 and is expected to reach $1,966.2 bn by 2030 at a CAGR of 5.4%[1].

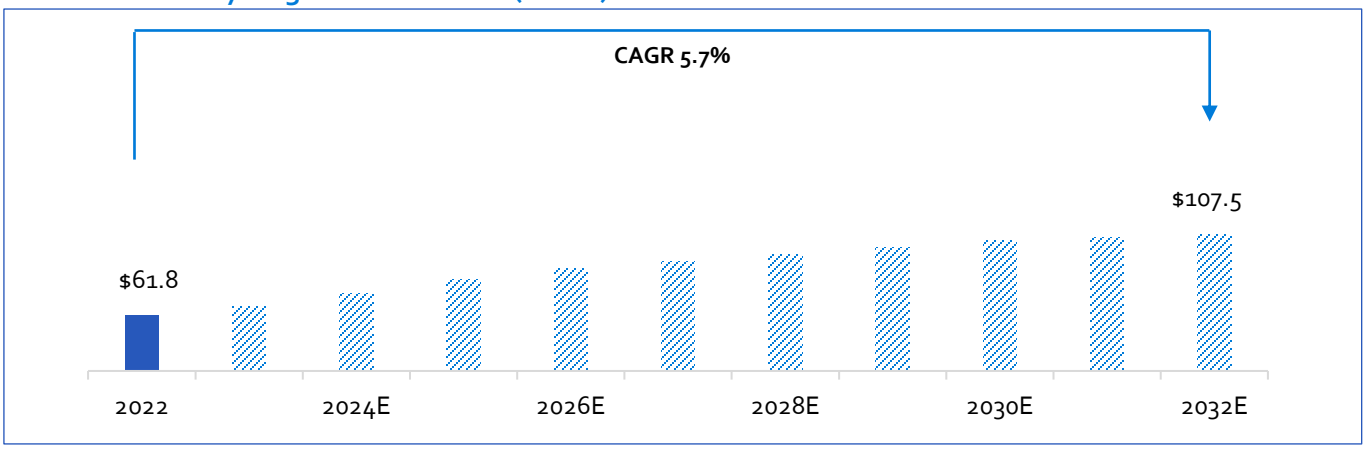
Global Waste Management Market (in $bn)



Recycling is the economic sector involved in the recovery of valuable resources from waste. This includes numerous different materials such as paper, plastics, metals, glass, construction materials, and electronic goods. Subsequently, recycled materials are then reintroduced into manufacturing processes, reducing demand for primary natural resources and minimizing environmental impacts.

The global waste recycling services market size was $61.8 bn in 2022 and is expected to reach $107.5 bn by 2032 at a CAGR of 5.7%[2].

Global Waste Recycling Services Market (in $bn)



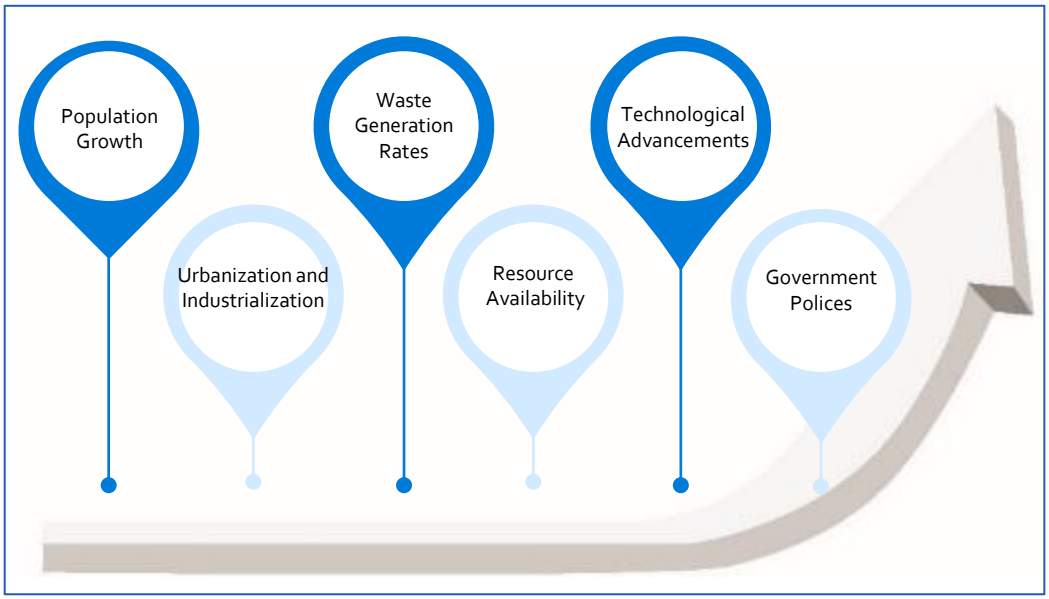
Source(s): Grand View Research, World Bank

Recycling – Factors & Types of Waste

The recycling industry is engaged in the recovery of valuable resources from waste. These processes comprise all kinds of materials, including paper, plastics, metals, glass, construction materials, and electronic goods. Consequently, the output of the industry is fundamental in the transition to circular economies and the reduction of natural resource needs.

- Transitioning to circular economies is increasingly at the top of political agendas providing institutional support.
- Sector companies' position in the value chain gives them a unique ability to support sustainable adaptation by making recycling/reusing economically efficient.

Factors Influencing Market Growth



Types of Waste to Recycle

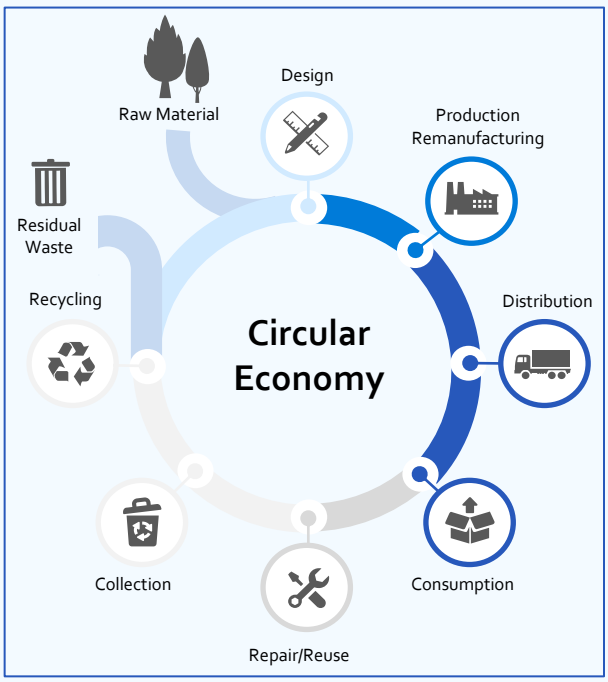
Source(s): 1Spherical Insights & Consulting, Global Newswire, PwC

Role of Recycling Toward a Circular Economy

A circular economy is designed restorative and regenerative in the entire value chain. It is about the optimization of value circulation, not the prevention of waste generation. It is a continuous positive development cycle that preserves and enhances natural capital, optimizes resource yields, and minimizes system risks by managing finite stocks and renewable flows. The circular economy loop starts from sourcing raw materials and designing the manufacturing process to reuse and utilize the resources with minimal waste at the end.

Recycling and waste management are central to the transition toward a circular economy. In the face of current environmental challenges, recycling won't be enough to eliminate waste production, but it will reduce the impact our activity has on the environment.

Recycling helps to deliver circular economy objectives through many channels:



- **Resource conservation and waste reduction**: Recycling allows the extraction of secondary raw materials from waste instead of extracting and processing new raw materials, which reduces the pressure on natural resources, minimizes waste, and helps to conserve them;
- **Energy and emission savings**: By reducing energy consumption in producing new materials, recycling contributes to lower greenhouse gas emissions and helps combat climate change;
- **Economic opportunities**: Recycling fosters economic growth and job creation as materials are reused, remanufactured, and recycled. It promotes local economic development by supporting a more localized supply chain and reducing dependence on imports;
- **Sustainable consumption and production**: By embracing recycling, businesses and consumers contribute to a more sustainable society and align with the principles of a circular economy;
- **Innovation and technological advancements**: Technological improvements and innovation, such as advanced sorting systems, chemical processes, and material recovery techniques, enhance the efficiency and effectiveness of recycling processes; and
- **Collaboration and stakeholder engagement**: Effective recycling systems rely on proper waste management infrastructure, supportive policies and regulations, public awareness, and active participation from all stakeholders and promote collective action toward sustainable waste management.

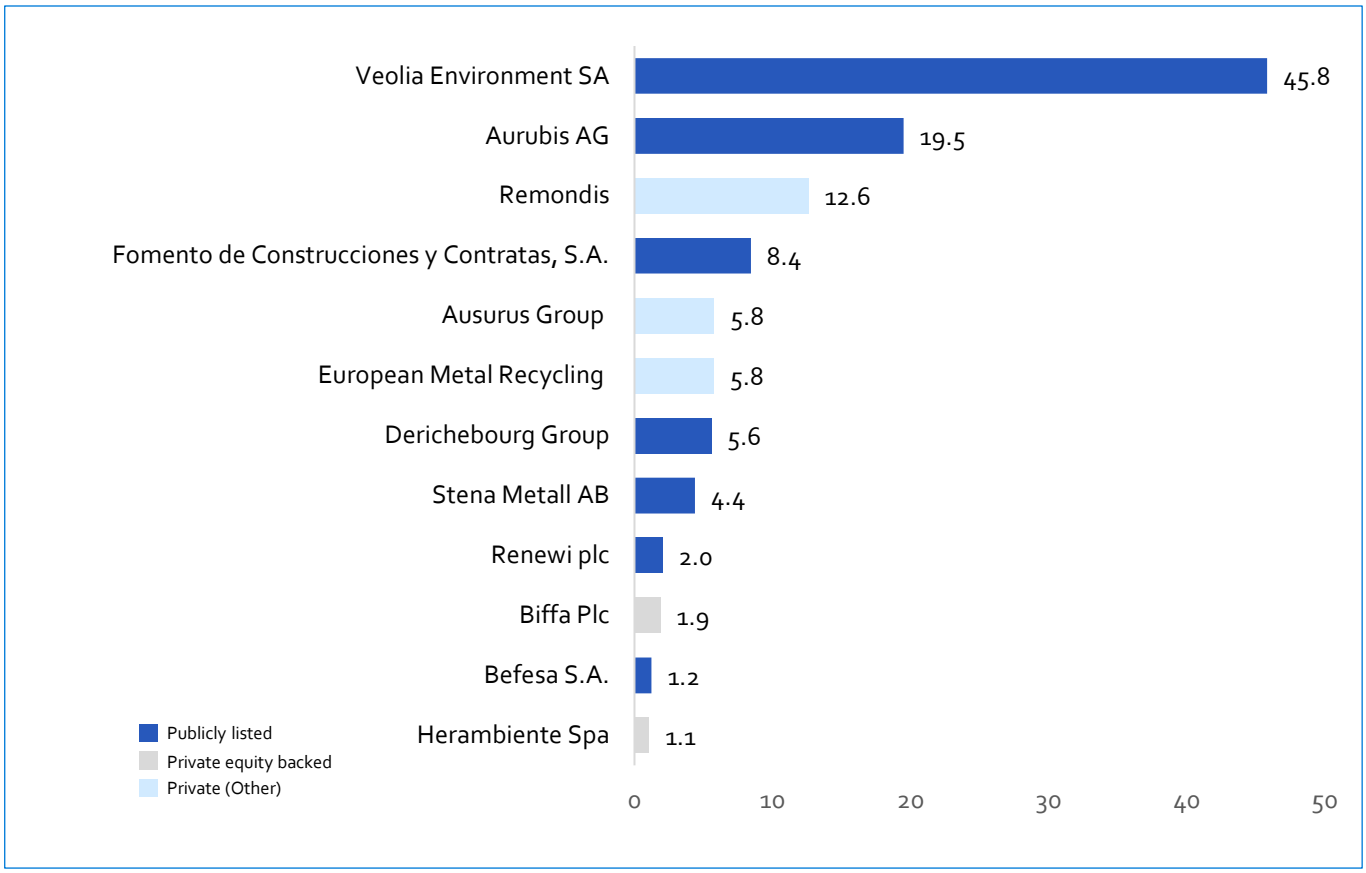
Source(s): Ellen Macarthur Foundation, Deloitte

1.2 Recycling and Waste Management Market Structure

Europe

The leading recycling and waste management companies in Europe by revenue are listed below. France-based Veolia Environment Group reported revenue of $45.8 bn for the year ended December 2022. Aurubis AG is one of the leading multi-metal recycling companies in the world. Spain-based FCC Group, involved in waste management, reported revenue of $8.4 bn for the year 2022.

Europe: Leading Companies in Waste Management and Recycling (in $bn for FY'22)



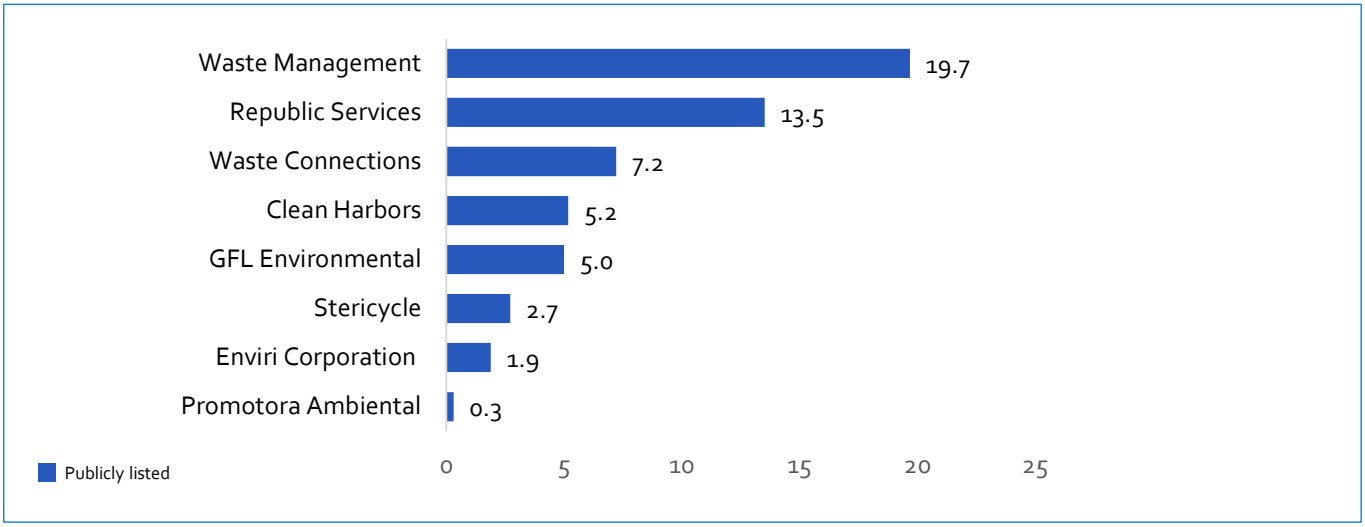
Source: Capital IQ

Source(s): Statista, Capital IQ.

North America

The leading recycling and waste management companies in North America by revenue are listed below. The largest waste management company in the US is Waste Management Inc., headquartered in Texas. The company reported a revenue of $19.7 bn in 2022. Republic Services, headquartered in Arizona, ranks second on the list with a reported revenue of $13.5 bn for 2022.

Leading Companies in Waste Management and Recycling (in $Bn for FY'22)

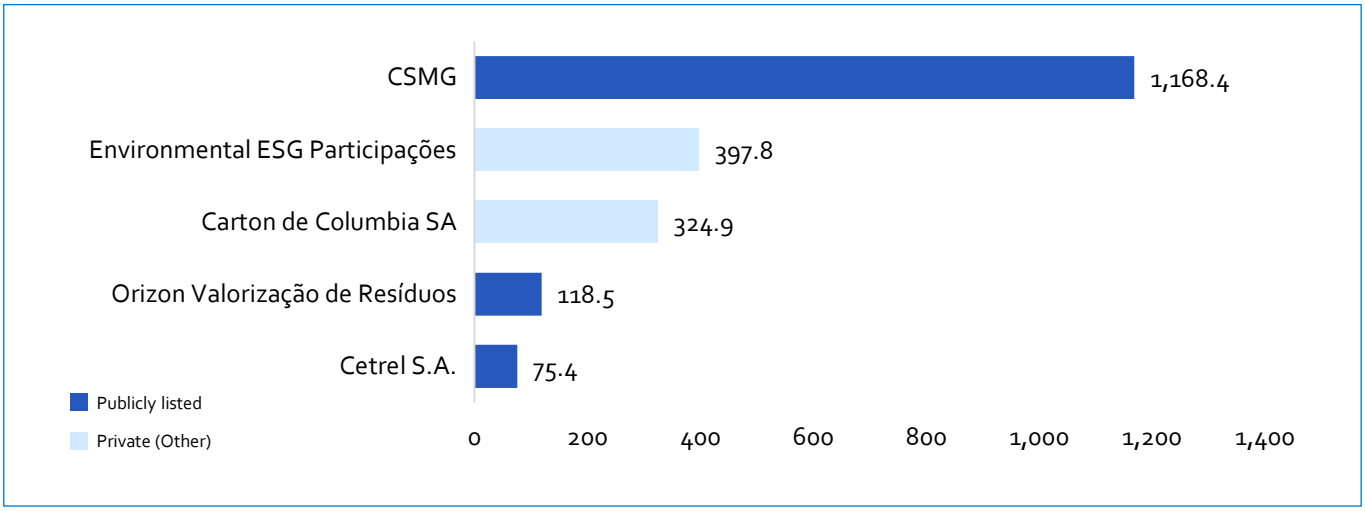


Source: Capital IQ

South America

The leading recycling and waste management companies in South America by revenue are listed below. The largest waste management company in South America is Companhia de Saneamento de Minas Gerais (CSMG), which reported revenue of $1.2 bn in 2022.

Leading Companies in Waste Management and Recycling (in $Mn for FY'22)



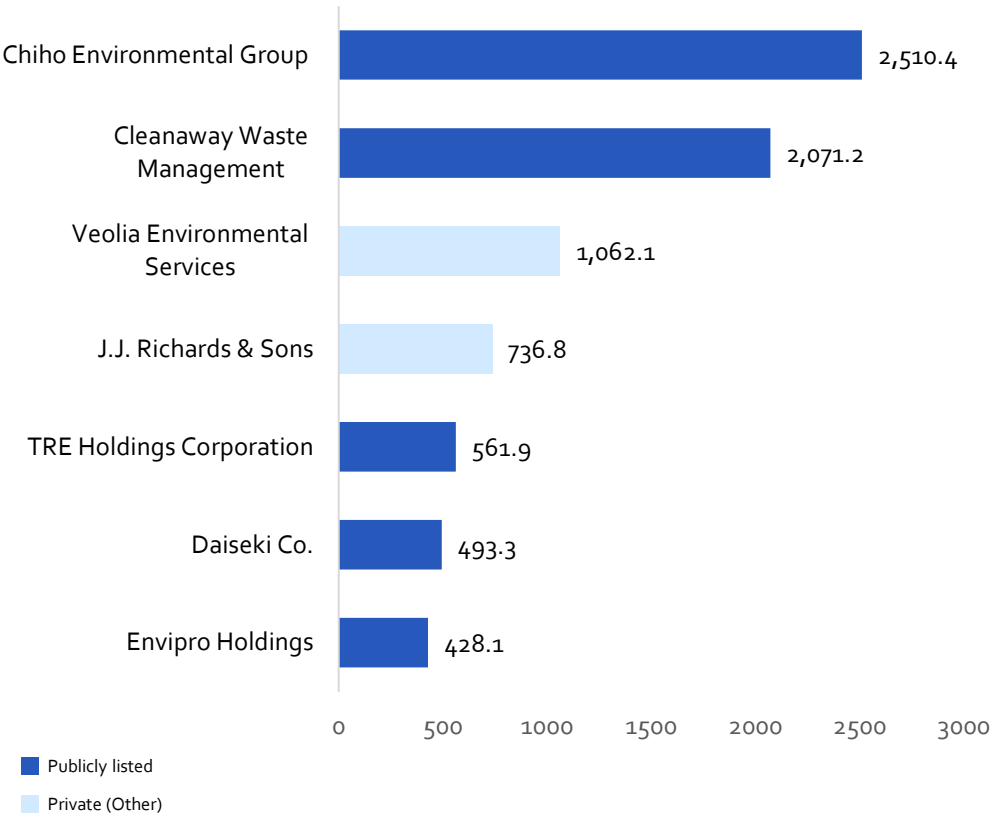
Source: Capital IQ

Source(s): Statista, Capital IQ, Forbes, Circular Innovation Hub, Global Waste Index 2022

Asia Pacific

The leading recycling and waste management companies in Asia-Pacific by revenue are listed below. The largest player in the market by revenue is Chiho Environmental Group, headquartered in Hong Kong, which reported revenue of $2.5 bn in 2022. Cleanaway Waste Management ranks second in the list, headquartered in Australia, and reported revenue of $2.1 bn in 2022.

Leading Companies in Waste Management and Recycling (in $Mn for FY'22)



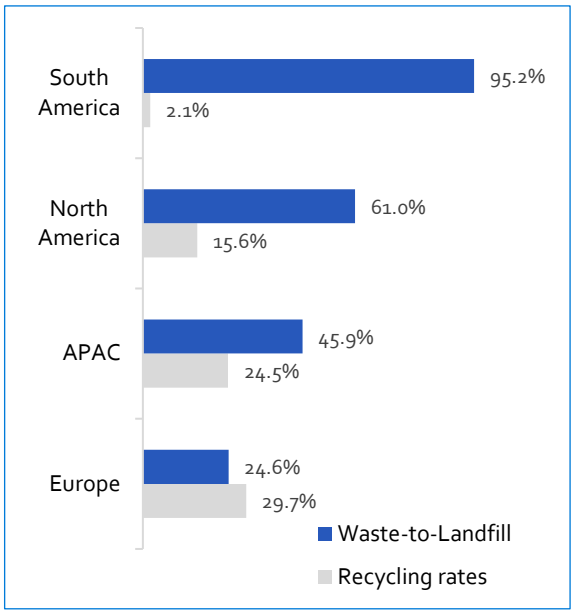
Source: Capital IQ

Source(s): Capital IQ, Global Waste Index 2022

1.2.1 Recycling Rates Across Regions

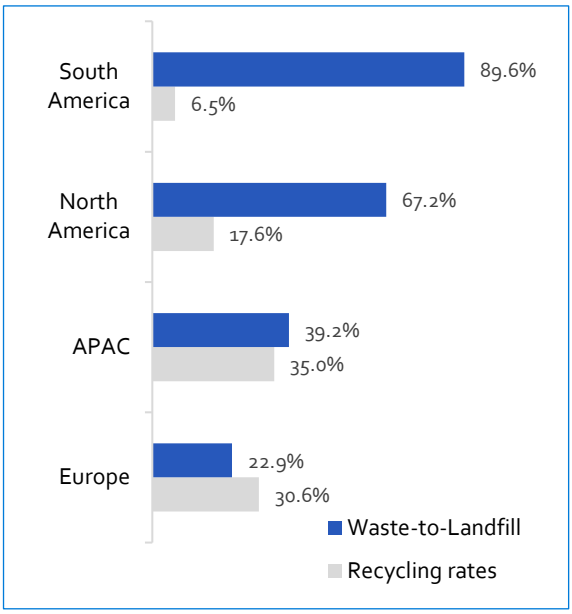
The Global Waste Index 2019 and 2022, provides data for the 36 biggest waste-producing nations in the world and ranks these nations' waste management industries, based on waste generation per inhabitant in a country and its destination. The source used by the index includes OECD Municipal waste data, Eurostat Municipal waste data, and World Bank global waste management data.

Recycling and Waste-to-Landfill Rates 2019[1]



Source: Global Waste Index 2019

Recycling and Waste-to-Landfill Rates 2022[1]



Source: Global Waste Index 2022

Landfills are a significant source of methane, a potent greenhouse gas. Methane emissions from landfills are 23 more powerful than CO_2 emissions. Alongside resource and environmental conservation, reducing waste-to-landfill has significant climate change benefits. Europe is the most advanced region diverting waste from landfill, with only 22.9% of waste production ending up in landfills in 2022. 89.6% of waste production in South America ends up in landfills. Whilst the direction of travel is generally favorable, North America recorded a 6.2 percentage point increase in waste going to landfills from 2019 to 2022. The APAC region recorded the most notable improvement over this period, decreasing waste to landfill by 6.7 percentage points.

All regions successfully increased recycling rates in the three years to 2022. Whilst South America remains the least advanced region in this respect, recycling only 2.1% of waste produced in 2019, it more than trebled its recycling rate in this period. Recycling also advanced significantly in the APAC region, where recycling rates increased by 10.5 percentage points. More modest improvements were recorded in Europe and North America.

Whilst global activity is heading in the right direction, significant opportunities to reduce waste going to landfills and to increase recycling rates remain.

Source(s): Capital IQ, Global Waste Index 2022, OECD Statistics
1. Figures based on estimates and averages of certain set of countries in each region according to the available data. Europe: 27 EU member countries; North America: US, Canada, Mexico; South America: Chile, Colombia, Costa Rica, APAC: Australia, New Zealand, Japan & Korea

1.3 Opportunities in the Market

Recycling Infrastructure Development
Cardboard and paper make up approximately 60% of the material processed at our single-stream MRFs, and the opening of new paper mills that rely on recycled inputs.

Technology Adaptations
Plasma gasification is a smart waste management technology. It uses plasma to heat waste at high temperatures to produce hydrogen gas and a glass-like substance.

Waste-to-Energy Conversion
For every 100 pounds of MSW in the US, about 85 pounds can be burned as fuel to generate electricity. Waste-to-energy plants reduce 2,000 pounds of garbage to ash, weighing 300 and 600 pounds, and the volume of waste by about 87%. This ash can be also be reused in construction processes.

Plastic Recycling
Companies can focus on developing advanced recycling technologies to improve plastic recycling efficiency and explore alternatives to single-use plastics.

Education and Awareness
Companies as well as public institutional bodies can develop initiatives to raise awareness, provide educational materials, and promote sustainable behaviors which will help support sector growth.

Recycle and Reuse of Non-Biodegradable Waste
Several companies, especially from the FMCG industry, focus on reducing packaging waste by eliminating unnecessary parts, reducing packaging size, or recycling materials to offset virgin plastics. For instance, Walmart focuses on reducing packaging and waste by encouraging customers to use reusable bags, minimizing food waste, offering refillable packaging, etc.

1.4 Challenges in the Market

The E-waste Segment
The increasing levels of e-waste, low collection crates, non-environmentally sound disposal, and treatment of this waste pose significant risks to the environment and even human health.

The Landfill Segment
The lack of adequate infrastructure for landfills and waste disposal results in serious environmental issues, including littering and illegal dumping.

The Residential Segment
Residents from large housing units, such as apartment complexes, and areas of individual houses use different ways of separating wastes before disposal, making segregation difficult and time-consuming.

Recycling or Disposal of Batteries
The process of recycling or disposal of batteries is costly and risky, as it is prone to generate harmful emissions, making it difficult to recover and reuse.

Recycling of Construction Materials
As the waste from construction and demolition, like debris, is usually heavy and of varied materials, it is often mismanaged and has high transportation costs.

Source(s): Forbes, Deloitte, Waste Management World, Gartner

1.5 Innovation in the Industry

The emerging waste management trends meet the industry's growing demand for autonomous operations, digitalization, and sustainability. The industry is increasingly automating waste sorting, collection, and disposal processes. To aid this, startups develop robotic recyclers that sort waste using AI-backed algorithms. Drones monitor landfills to measure air quality and detect radiation. Some other waste management trends include innovative composting and advanced recycling.

Practices

Recent practices rely on tools like spreadsheets, papers, calendars, unintegrated software, and other essentials to accomplish the checklist of relevant jobs. Here are some features that could be useful:

- **Data Accumulation**: A waste management app may permit users to track every local body and collect waste-related data.
- **Reduce Paper Needs**: Waste collection management using apps can diminish the traditional waste management system's need for paper or spreadsheets.
- **Automation of Waste Management Tasks**: Waste verification and monitoring in various areas, including its collection, separation, conversion into resources, and power generation.
- **Finding Dumpsters Using Geolocation**: Geolocation can be integrated into waste apps to help users find a nearby dumpster to dump their household waste.
- **Support Service**: Users could report complaints regarding delayed garbage collection in nearby areas.

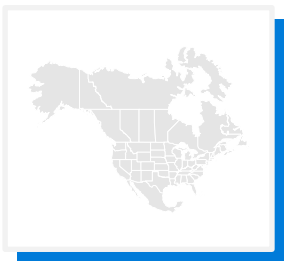
Technology

Smart waste management uses integrated technology to make the entire process cost-effective, efficient, and environment-friendly. Some trending technologies for waste that encourage future innovation include:

- **E-waste Kiosks:** Kiosks are installed in different areas to properly dispose of their waste and get cash for it. In Europe, these bins are used for different materials, including batteries, textiles, and general waste.
- **AI Recycling Robots:** Robotic systems assist governments, businesses, and NGOs in attaining recycling rates and supplying maximum volumes of post-consumer recycled material.
- **AI Waste Sorting:** AI-waste sorting helps separate waste materials according to categories and accelerates the recycling process.

Source(s): Forbes

1.5.1 Innovation across Regions

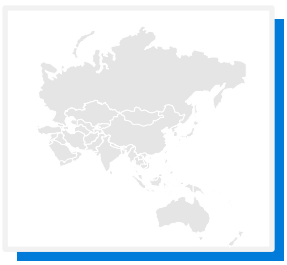


North America

- In Texas, The Houston Recycling Collaboration, between the City of Houston, ExxonMobil, LyondellBasell, Cyclyx International, and FCC Environmental Services, works to decrease the amount of plastic sent to landfills.
- In the US, landfills use drones to monitor their operations.
- Across Canada, the government has set up the Waste Wizard app and online platform, through which residents can understand how to dispose and sort waste and recycle such items.

South America

- In the Municipality of Renca (Chile), GPS tools and remote surveillance cameras in waste collection trucks improved the efficiency of waste collection route control activities, strengthened operator transparency, and generated communication channels with end users.
- In Columbia, companies like Plásticos Ojara, have created an internal recycling line with Weima shredding technology to reduce expensive raw material purchases and optimize production.



APAC

- Kameoka City, Japan, introduced the zero-litter project, as part of which the city administration installed IoT-enabled smart recycling kiosks called SmaGO.
- In Australia, regulations are designed to reduce 80% of plastic waste entering the Australian environment by 2030. The service offered by RecycleSmart[1], a home collection system to dispose of recyclable plastics, is one such example of an initiative in Australia.

Europe

- Companies like Bigbelly and Sensoneo offer innovative technologies solutions across Europe, including Ultrasonic bin sensors in parts of Spain, and ultrasonic bin sensors in semi-underground containers in parts of Cyprus.
- In Denmark, wireless data from mobile devices, GPS in buses, and sensors in sewers and garbage cans are used to assess the city in real-time.
- Norway, uses disruptive technologies to digitalize its operations.
- RecoTrace, the multi-polymer data collection system, records data on both European plastics recycling volumes and recycled plastics and is recognized by the Circular Plastics Alliance (CPA).

Source(s): Global Waste Index 2022, IADB Blogs, Retail Insight Network, Qathet Canada, Smart Bin, Recycling Magazine, Plastics Europe
1. After the collapse of RedCycle, a home collection service associated with local city authorities, Recycle Smart provides a similar service and has collaborations with companies like APR Plastics that transform waste into recycled products.

1.5.2 Innovative Software

The recycling sector is adapting to Internet of Things (IoT) solutions as a priority to improve sector performance. Chemical recycling and recycling robots are other trends after IoT, as they enhance recycling efficiency. The sector further innovates in waste valorization, green waste management, and material lifecycle extension, as such innovation generates value for recyclers and diverts a significant amount of solid and organic waste away from landfills and incinerators. Recycling facilities also leverage big data, analytics, and AI to optimize classification, sorting, and picking at recycling facilities and streamline waste logistics.

- **Upper Route Planner**: A waste management software solution that uses a fully automated process to reduce waste pickup time and boost efficiency.
- **Oscar Pocket app**: Intuitive AI, designed by a Canada-based technology maker, launched a beta version of an app called Oscar Pocket, which uses an AI interface to help users sort their trash and recycle it through text prompts. The company plans to collaborate with recyclers, packaging companies, and municipalities to make its newest sorting app more accurate.
- **Sensoneo**: A leader in smart waste solutions offers services like waste and collection monitoring, route planning, factory waste management, take-back systems, and deposit return scheme integration. Solutions by Sensoneo are adopted in countries across Europe, including Madrid, Prague, and the Czech Republic.

1.5.3 Innovation Adopted by Companies

Technological advancements unlock the hidden potential of the existing industrial practices, thus helping businesses reach a point where humans cannot. Recycling technologies aid in addressing the growing environmental concerns and increase awareness toward more sustainable practices.

- **AMP Robotics**: In a sign of the proliferation of AI-driven recycling, AMP partnered with Waste Connections to deploy 25 robots across its materials recovery facilities in the US, the company's largest order to date.
- **TOMRA Agreement**: TOMRA, the world leader in waste transformation; INEOS Styrolution, the global leader in styrenics; and EGN Entsorgungsgesellschaft Niederrhein, a leading recycling company, signed a project to convert post-consumer polystyrene (PS) waste into recycled polystyrene for food packaging applications via sorting technology.
- **Interzero**: Resourcify, a digital platform for waste management and recycling, and Interzero, a circular service provider, announced a partnership for efficient waste management, disposal, and recycling with a joint digital solution called Zero Waste Manager. Recycling partners from Interzero's network can place their orders and report their performance data through the platform, thus going fully digital and saving cost and time.

Source(s): Global Waste Index 2022, Ellen Macarthur Foundation, Upper Inc, Waste Dive, Waste Management World, Resourcify

1.6 Recycling in Industrial Processes

Industrial recycling is the process of re-incorporating valuable secondary materials generated from industrial processes into newly manufactured products. Depending on the waste produced by an industry, companies can reuse the waste in manufacturing new products or sell it to another company that can use it.

Examples of recyclable industrial waste are:

- Scrap and residuals from production processes like foundry sand, produced by steel, iron, and aluminum foundries.
- Coal combustion products that are used as substitutes for sand, gypsum, and gravel in building materials. They are also used in wallboards, cement, concrete, flowable and structural fill, and grout.
- Construction and demolition debris like glass, wood, metals, plastics, concrete, fixtures, furniture, and pipes.
- Other examples include recovered products, after the end of their useful life, including appliances, motor vehicles, and tires.

Process of Industrial Recycling

Companies Involved in Industrial Recycling

Several companies and budding startups are utilizing the waste and revamping it into new sustainable products.

TerraCycle provides industrial recycling services for distribution centers, warehouses, or production facilities, helps reach zero-waste goals, and finds solutions for typically hard-to-recycle materials.

Expertise: The company analyzes waste materials to determine the right way to process them, keep a check of regulatory requirements, record collection of waste, sort, clean, and process materials, and turn them into raw materials. Furthermore, the company sells it to manufacturing companies that produce end products, which may include products like outdoor furniture and decking, plastic shipping pallets, storage containers and bins, tubes for construction applications, and flooring tiles.

Region Footprint: TerraCycle currently operates in 21 countries and has over 35 Material Recovery Facilities (MRFs) worldwide with offices in the US, Canada, Brazil, the UK, Europe, China, South Korea, Japan, and Australia, alongside the Global Foundation in Thailand

Source(s): Clean-up News, Mass Challenge

1.7 Relevant Recycling Market Segments

Type	Market Size	Segment Covers	Trends	Challenges
Metal	$231.3 bn in 2022, projected to grow to around $397.7 bn by 2032 at a CAGR of 5.7%	Ferrous and non-ferrous	A rise in manufacturing plants and growth in the automotive, appliances and other related industries	The increasing complexity of products makes recycling difficult
Paper	$50.75 bn in 2022, projected to grow to around $61.09 bn by 2028 at a CAGR of 3.8%	Containerboards, newsprint, and tissues	Ensuring proper segregation and recycling of paper waste for better treatment	Scarcity of the channel for collecting wastepaper
Construction & Demolition	$122.86 bn in 2022, projected to grow to around $158.44 bn by 2029 at a CAGR of 3.74%	Soil, sand, and gravel, concrete, bricks and masonry, metal, and wood	Sustainable waste management and predicted waste generation to help minimise C&D waste	Hindrance in workflow due to inefficient bodies and local authorities
Plastic	$41.2 bn in 2022, projected to grow to around $66.7 bn by 2030 at a CAGR of 7.1%	Polyethylene terephthalate, polyethylene, polypropylene, polyvinyl chloride, etc.	Reduction in environmental impact from plastic production by imposing a ban on single-use plastics	Separation of varying densities of plastic materials
Glass	$4.6 bn in 2022, projected to grow to around $6.31 bn by 2028 at a CAGR of 5.5%	Glass cullet, crushed glass, and glass powder	Companies are shifting towards eco-friendly packaging such as recycled glass, as an alternative to virgin glass	Lengthy and tedious supply chain comprising many intermediaries, making the supply chain process highly complex
Battery	$1.4 bn in 2022, projected to grow to around $17.1 bn by 2030 at a CAGR of 37.7%	Lead, lithium, nickel, cobalt, copper, aluminium, graphite, zinc, etc.	Lithium-ion batteries gained popularity due to their high energy density and longer lifespan compared to other batteries, resulting in an increased volume of waste	High cost of recycling and dearth of technologies

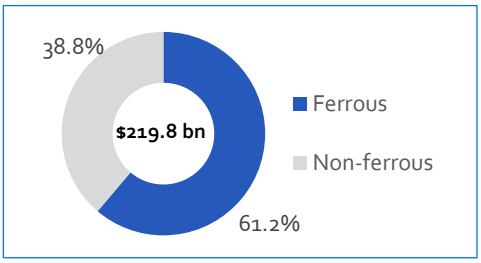
Source(s): Markets and Markets, Global Newswire, Research and Markets, Market Data Forecast, Market Research Future, Polaris Market Research

1.7.1 Metal Recycling Market

The global metal recycling market size was $231.3 bn in 2022 and is projected to be $397.7 bn by 2032 at a CAGR of 5.7% from 2023 to 2027. Metal, in general, is either ferrous or non-ferrous. Ferrous metal recycling is expected to grow and account for the largest revenue share at 61.2%.

1. Asia Pacific is the world leader in metal recycling. Among the Asian countries, China is the largest steel producer and produced 996.3 mn tons in 2019, accounting for roughly 53% of crude steel production worldwide.
2. Steel emerged as the dominating product segment in 2022 and had a volume share of over 79%. Steel recycling contributed around 40% of the total production in the same year.

Market Growth of Segments

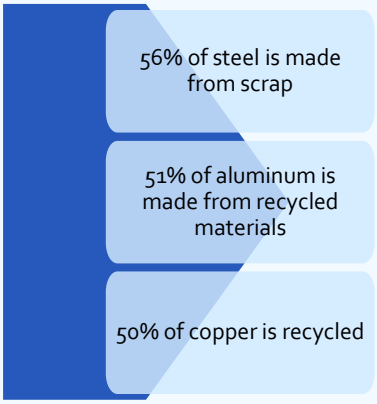


Trends in Metal Recycling Market

Driving greater circularity is a key lever for public and private sector players to improve their sustainability. Industry leaders globally are setting strict goals to increase their use of recycled materials in manufacturing.

1. **Critical Raw Material (CRM) Act**: The EC set out CRM as an ambitious recycling agenda to counter Europe's over-dependence on supplies of raw and refined strategic materials from China and as a step toward turning metal recycling into a core component to meet rising demand for metals across industries.
2. **Increase in Aluminum Recycling**: Hydro, a Norway-based industrial company, plans to recycle more post-consumer aluminum scrap (from discarded products) as part of a commitment to reach net-zero emissions by 2050. Meanwhile, Novelis, an American industrial aluminum company, has pledged to increase its use of recycled aluminum, which accounts for 61% of its inputs.

Recycling Pattern in the EU

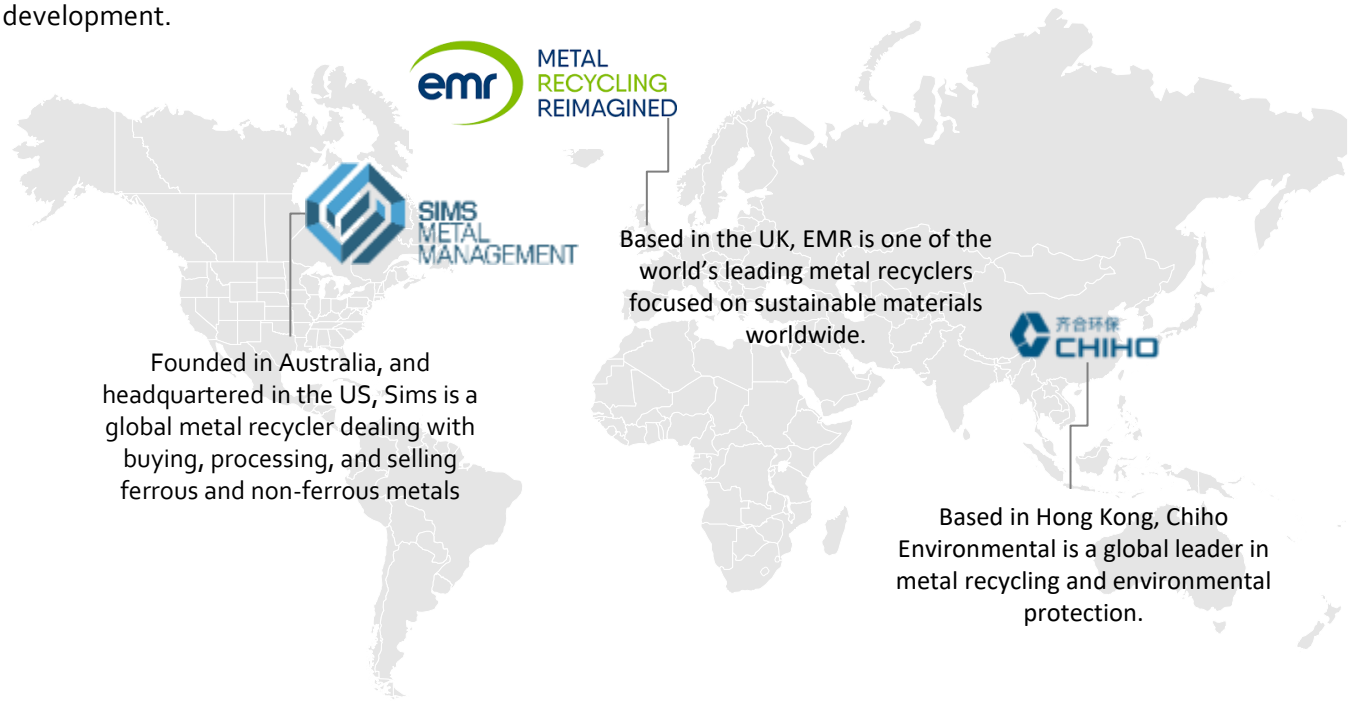


3. **Introduction of Electric Arc Furnaces (EAF)**: With the rise in concerns over the impact of mining on the environment, metal producers are constantly striving to reduce carbon emissions by introducing scrap-based EAF. EAF steelmaking in the US results in 75%[1] less carbon emissions than traditional steelmaking and is the greenest, safest, and most energy-efficient method to produce the metal.
4. **Focus on Decarbonization of Metals**: Metals like steel and aluminum are integral in society's green energy transformation for sustainable construction, electric vehicle production, and renewable energy infrastructure. Using recycled materials and replacing carbon anodes with inert anodes in metal-making are technological solutions to drive decarbonization.

Source(s): Mckinsey, White Case, BCG, KPMG, Deloitte, Global Newswire, Precedence Research
Note: 1. As per study by CRU Group

Key Players

In metal recycling, large steel producers have relevant operations in the sector and play a key role in its development.



Recycler-Producer Integration and Technology

Metal recyclers and material producers are mainly integrated into the industry and grow with technology development. This helps to reduce costs, optimize operations, and promote a circular economy.

Mining and metal recycling, with integration, is closer than perceived. Physical sorting techniques and technologies developed in the recycling industry are used in mining as well. For instance, sensor-based ore sorting technologies developed by companies like STEINERT and TOMRA have been used to preconcentrate material streams to mineral processing plants for over a decade.

In metal recovery, hydrometallurgical and pyrometallurgical processes developed in primary metal production can feed back into secondary production. For example, flotation – a staple beneficiation process in mining—is being investigated for separating the black mass of batteries into different fractions. Metso Outotec is one such example. The company signed an agreement in December 2021 to divest its metal recycling business, which specializes in physical sorting and separation but retains its expertise in metallurgy and refining.

The nature of the methods used in virgin metal extraction processes and the recovery of metals from e-waste or batteries are very much alike. However, certain additional treatment measures need to be developed and modernized, including standards. Metso Outotec's Ausmelt process has been successfully applied to secondary copper recycling at a Kosaka Smelting & Refining Co. smelter in Japan with a multi-stage bath smelting practice that treats a range of non-sulfide secondary feed materials.

Source(s): SIMS Metal, Aurubis, European Metal Recycling, The Intelligent Miner

M&A Trends – Metal Recycling

Metal recycling provides an opportunity to meet the rising demand for metals and alleviate inflationary pressures, whilst creating more circular and resilient supply chains. Countries that are heavily dependent on imports of minerals, metals, and crucial decarbonization inputs, seek as many sources of supply as possible, whilst onshoring more refining and production to minimize the harm of potential interruptions in supply.

Date	Buyer	Target	Deal Synopsis
Mar-23	CMC	RMG Roane Metals Group LLC	Based in the US, acquired to enhance the security and supply of inputs for its steelmaking operations
Dec-22	ArcelorMittal	Riwald recycling	Based in Netherlands, acquired scrap metal recycling business in line with Arcelor's decarbonisation strategy
Dec-22	ArcelorMittal	Zremex	Based in Poland, acquired scrap metal recycling business, to enhance its ability to source scrap steel
Mar-22	ArcelorMittal	John Lawrie Metals	Based in Europe, acquired the steel recycling business as part of its strategy of increasing the use of scrap steel to lower CO_2 emissions from steelmaking
Nov-21	Cliffs	Ferrous Processing & Trading Co.	Based in the US, acquired to grow and expand presence
Sep-21	Advantage Metals Recycling	Garden St. Grossman	Based in the US, acquired to expand production at existing mills and to support in building new mills
Nov-21	BlueScope	MetalX Steel scrap processing operations	Based in the US, acquired to ensure a steady supply of raw material

Going by the M&A trends in metal recycling, the sector seems to have more backward or vertical integration rather than consolidation with the recycling of other materials. The integration of companies like Zimmer, which operates a ferrous and nonferrous scrap metals recycling business, and Steel Dynamic, a steel producer and metals recycler in the US in 2020, to improve the sourcing of raw materials and grow the presence of metal recycling across regions, supports the vertical integration in the sector.

Source(s): Whitecase, Rio Tinto, CMC, PR Newswire, Eurometal, Lexology, Kuusakoski

1.7.2 Paper Recycling Market

The global paper recycling market is expected to grow to around $61.1 bn by 2028, a CAGR of 3.8%. The key focus in this segment is around packaging waste, which accounts for most of the waste production.

Sustainability in Packaging

Sustainability, particularly regulatory and public concerns around single-use packaging waste, is combining with other powerful trends to drive major changes in consumer packaging. Regulators are moving on the issue, and fast-moving consumer goods (FMCG) companies and retailers are proactively making bold commitments to improve the sustainability of their packaging and fundamentally rethink their packaging systems.

The widespread use of single-use packaging containers has resulted in a heavy burden on the environment, and the management of packaging waste is facing a crisis due to two unresolved challenges:

- **Packaging Recyclability**: Large amounts of packaging produced today cannot be recycled in existing recycling systems. This is especially true for multi-material packaging, which poses a significant and unresolved challenge in recycling.
- **Packaging Recycling & Leakage**: Recycling rates for plastic packaging are relatively low. In the US, for example, waste is generally managed with low leakage but recovery rates for packaging and food-service plastics are about 28%.

Regulations around Packaging Waste

Regulators around the world are adopting various approaches for minimizing and managing packaging waste.

Regulation Examples

Australia
- ● Focus on optimizing recovery and recycling of packaging
- ○ Target of 100% packaging to be recyclable, compostable, or reusable

China
- ● Banned/limited imports on packaging waste in 2017
- ○ Proposed to ban single-use plastic bags by 2022

India
- ● Legislation favors recyclable substrates and formats
- ○ Pushing for an increased number of awareness campaigns and collection points

Canada
- ● Canada-wide Strategy for Sustainable Packaging
- ○ Implementing the Strategy on Zero-Plastic Waste (passed in 2018), with a 2030 goal

European Union
- ● Packaging-and-waste directive
- ○ Implementing a ban on selected single-use plastics

US
- ● Important jurisdictions implementing bans on plastic bags
- ○ Introducing bills around reducing single-use-packaging waste and increasing recycling

● Regulation currently in place ○ Recent moves/next steps on sustainability regulations

Source(s): McKinsey, Research and Markets

Key Players

The paper recycling market supply-demand is fluctuating because of unpredictable and volatile prices. Pulp prices and the need for eco-friendly packaging options influence the market. To stay competitive, companies invest in new technologies, efficient inventory procurement, securing raw materials, and maintaining growth through strategic planning tailored to specific countries.

Based in the UK, DS Smith is a leading provider of sustainable packaging solutions, paper products, and recycling services worldwide.

Based in Ohio, Grief offers recycling services and sustainable packaging solutions across 200+ locations

Based in Australia, Visy is a recycling and packaging firm and a global leader in packaging and resource recovery

Recycler-Producer Integration and Technology Development

The paper recycling market comprises diverse players, including recyclers and producers of paper, cardboard, packaging solutions, paper pulp, wastepaper recyclers, and material recycling facilities (MRF).

In the market, MRF competes against wastepaper dealers. The biggest MRFs are usually owned by solid waste companies, such as WM. However, many quasi-MRF operations are owned by public-private partnerships. Most of the paper waste comes from office buildings and homes to these facilities. MRFs handle the processing and sorting of this material. Recently, FCC Environmental Services installed an AMP Robotics robotic sorter at its MRF in Texas, enabling residential paper cup recycling.

Paper producers are fully integrated with their collections and converting operations However, some have built paper mills without being integrated, especially on the sales side, which may face overcapacity issues. For example, Finnish specialty paper maker Ahlstrom is considering divesting its Stenay plant in France, which produces one-side coated specialty papers for specific uses in the packaging sector due to overcapacity.

With the increase in the trend for sustainable packaging, companies are investing in R&D for new technologies. Lightweight paper packaging is also preferred because it reduces carbon footprint. In late April'23, Huhtamaki, a Finland-based global packaging producer, launched mono-material technology called Blueloop Packaging to support increased efficiency and ramp-up recycling streams for paper and plastics. It has three options: paper, polyethylene (PE), and polypropylene (PP) retort, wherein its PP and paper applications have at least a 90% mono-material share

Source(s): EIRI India, Grief, Waste 360, DS Smith, Visy, Recycling Today, Recycling Product News, Europe Wire News

M&A Trends – Paper Recycling

Trends in paper recycling revolve around sustainability efforts, reducing carbon footprint, and promoting the use of recycled materials for packaging. Organizations involved in the paper industry focus on measures to optimize paper management at every step of a continuous recycling loop, which ranges from paper and board manufacturing, its conversion into products and prints, through to its collection, sorting, and recycling. After the ban in China on old corrugated containers (OCC) and other scrap paper grades, India, Thailand, and Indonesia are new destinations for Americans and Europeans to export OCC and other paper grades for recovered paper. As per the developments in recycled-content mill capacity, Asia is building new facilities, whereas Europe is converting machines in its existing mills from graphic to brown-grade production.

Date	Buyer	Target	Deal Synopsis
Jan-23	NORTHSTAR RECYCLING		Acquired by Northstar Recycling, to integrate and offer centralized solutions for waste streams.
Jul-22	SCG PACKAGING	PEUTE GROUP	Based in the Netherlands, acquired to bolster all levels of its packaging business
Jan-22	Faerch	PACCOR	Based in the Germany, acquired to leverage its joint innovation and recycling technologies for circular food packaging.
Jan-22	FOR TALENTS TRANSMISSION & CROISSANCE	PAPREC	Based in France, For Talents acquired minority stake in the Paprec group

The big players in the market and paper mills like DS Smith, a provider of sustainable packaging solutions, paper products, and recycling services, follow practices at its mills like wastewater management and waste-to-energy to decrease fresh use of water and produce energy from waste generated by papermaking, respectively.

In 2023, the Confederation of European Paper Industries (CEPI) collaborated with other European associations to decarbonize the European paper sector and achieve energy savings in paper manufacturing.

Companies like Amazon introduced Frustration-Free Packaging in 2021, a program for vendors to deliver products inside smaller, easy-to-open, recyclable cardboard boxes with less packaging material to reduce paper and non-recyclable material consumption.

Going by the trends in M&A for paper recycling, the sector follows more backward or vertical integration than consolidation with the recycling of other materials. Examples can be seen in companies like DS Smith, where the focus is also on reducing the use of plastics in packaging material and finding innovative ways, like seaweed, to lessen plastic dependence.

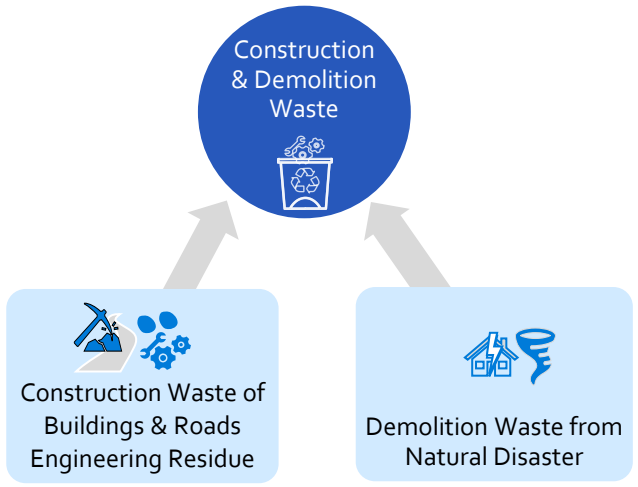
Source(s): EIRI India, Grief, Waste 360, DS Smith, Visy, Recycling Today, Recycling Product News, Europe Wire News

1.7.3 Construction and Demolition Waste Recycling Market

The global construction and demolition waste (CDW) recycling market is expected to grow around $158.4 bn by 2029 at a CAGR of 3.74%. Annual construction waste is expected to reach 2.2 bn tons globally by 2025. CDW is the leftover material from construction, refurbishment, and road and building demolition. It is a mix of inert, non-inert non-hazardous, and hazardous waste.

- According to the World Green Building Council report, the construction industry is responsible for approximately 40% of the world's carbon emissions and generates 30% of global waste.
- Additionally, building demolition is responsible for a significant amount of waste. It is estimated that more than 500 mn tons of construction and demolition waste is generated globally annually.
- Countries worldwide are focused on and considering measures to boost the recycling rate in construction and demolition (C&D) for the wider society to meet circular economy goals.
- The recycling rate for waste materials like wood or metals is around 25.9%, while approximately 33.6% ends up in landfills and 40.5% is reused.

Types of Construction & Demolition Waste



Trends in the CDW Market

The key players and regions globally are adopting practices to minimize waste from construction and demolition and are using appropriate recycling methods to process the generated waste.

New C&D Recycling Ordinance by Nashville, US

To address its growing construction and demolition waste stream, the city has outlined a five-year plan to introduce new recycling minimums for the material generated from the commercial building sector.

Robot Technology in Zurich

The robot technology has been installed to sort through 180,000 metric tons of discarded C&D materials and bulky household waste annually. The technology can identify and recover materials like concrete and stone for concrete production, wood and plastics, and some metals

Increase in Sorting Plants

In Europe, with an increase in regulations in the sector and a shift from downcycling to recycling and upcycling, companies like Stadler Anlagenbau, a Germany-based sorting equipment provider, are setting up new sorting plants across Europe to sort advanced municipal solid waste (MSW)

Growth in Asia Pacific

As per Fortune Business Insights, Asia Pacific is the fastest-growing region in the market. Within the region, India is expected to grow at the fastest rate in the coming years due to the establishment of new and enhanced recycling facilities in the country, focused on green buildings and eco-friendly construction. Processing plant by SSN Innovative Infra is one such example

Source(s): BlueWeave, CD Recycler, Global Newswire, Green Thinking Review

Key Players

The construction and demolition (C&D) recycling market is crucial for sustainable waste management, as it collects, sorts, and processes C&D waste into valuable resources. Reusing materials in new construction projects and other applications conserves natural resources and reduces environmental impact. Increasing construction activities and the need for sustainable practices are driving the C&D market growth.

Recycler-Producer Integration and Technology Development

The C&D industry generates tons of waste annually. However, less than half of the total waste is recycled due to undeveloped markets or the risk of contamination in fiberglass, foam insulation, or asbestos. Extended producer responsibility measures and the integration of technology startups that offer waste collection services are effective methods to reduce the production of C&D waste.

Recycled cement and concrete materials are utilized in new buildings and construction, either as reusable modules or as materials that can be broken down and incorporated into new building materials. In Nordic countries, construction companies are building new structures using concrete from demolished buildings. Technology like one invented by a Norwegian startup Loopfront, which develops a collaborative waste-to-resource platform, allows construction companies to reuse construction materials.

Construction companies aim to make the design and manufacture of construction products more durable, recyclable, and easier to reuse as per the regulations of the respective government. Contractors and the whole construction value chain must be involved to reduce waste. For instance, by using more sustainable construction methods, such as timber construction, wherein suppliers can offer bio-based materials like wood, straw, flax, and hemp, demolishers can ensure that building materials are reused at the highest possible grade.

Source(s): Global Waste Index 2022, Ellen Macarthur Foundation, Upper Inc, Waste Dive, Waste Management World, Resourcify

M&A Trends – C&D Recycling

Reusing and recycling C&D materials benefits the circular economy, as it helps to divert significant levels of waste away from landfills and mitigates the need to extract new raw materials from the earth. This further helps to reduce environmental degradation for products at the start and end of life. Trends in C&D recycling revolve around repurposing materials to reduce waste, reduce carbon footprint, and promote sustainability.

1. Consolidation with other sectors like plastics and paper can be seen in C&D. In 2022, Waste Management announced a joint venture with Tailwater Capital to upcycle plastic and paper scrap into construction and other building materials.

2. Players in construction material extraction and supply are integrating with companies with technology to reduce carbon emissions using recycled materials. Recently, SigmaRoc, the specialist quarried materials group, announced a strategic partnership with Material Evolution, an advanced materials company producing low-carbon cement from industrial waste streams, to develop a range of low-carbon concrete products and drive sustainable innovation.

   — To reduce the CO_2 intensity of concrete, Heidelberg Materials acquired The SEFA Group, the largest fly ash recycling company in the US, for use in concrete products in the US and grow its portfolio of sustainable products, technologies, and customer-focused solutions on the path to Net Zero.

3. Companies involved in C&D are focusing on repurposing materials to reduce waste while being energy- and cost-efficient. Companies like Northstar Clean Technologies reprocess waste asphalt shingles to target three main sectors: road paving, flat roof manufacturing, and new shingle manufacturing.

4. To drive a circular economy in the construction industry, sustainable solutions companies like Holcim, acquired Sivyer Logistics, a producer of recycled construction and demolition waste (CDW) for the London construction market, to make cities more sustainable.

   — In January 2023, CEMEX, acquired a 51% stake in Israel-based SHTANG Recycle LTD., a construction, demolition, and excavation waste, (CDEW) recycling company, to strengthen its business in developed markets through bolt-on acquisitions in businesses with strong circular and sustainable attributes.

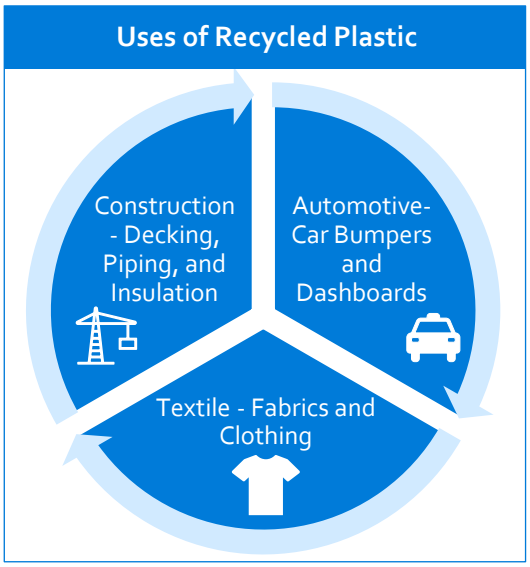
As the sector is adapting to new ventures and looking forward to innovations, M&A trends show consolidation with the recycling of other materials like plastic and paper. Companies like Renewi collect C&D waste like rubble, wood, and bulky waste, along with other kinds of waste, and process it into new products like bricks, desks, chairs, and curtains.

Source(s): Waste Management, Renewi, Visual Capitalist, Heidelberg Materials, Holcim, Cemex, RTS, CDE Asia

1.7.4 Plastic Recycling Market

The global plastics recycling market is expected to growth in the next eight years, according to the Market Research Future report. The market will probably grow above 50%, from $41.2 bn in 2022 to $66.7 bn in 2030.

- The key factors driving the market growth are the increasing awareness regarding the negative impact of plastic waste on the environment and the growing need to curb carbon emissions.
- Governments are enforcing stringent regulations and taking innovative initiatives to promote recycling.
- The invention of advanced technologies, such as pyrolysis and chemical recycling to recycle plastic waste, is expected to provide lucrative opportunities for the plastic recycling market growth in the coming years.
- Lack of infrastructure and limited investment in plastic recycling initiatives in developing countries is expected to restrain market growth.



Pledges and Regulations around Plastics

Momentum toward greater sustainability and types of recycling regulations vary from region to region.

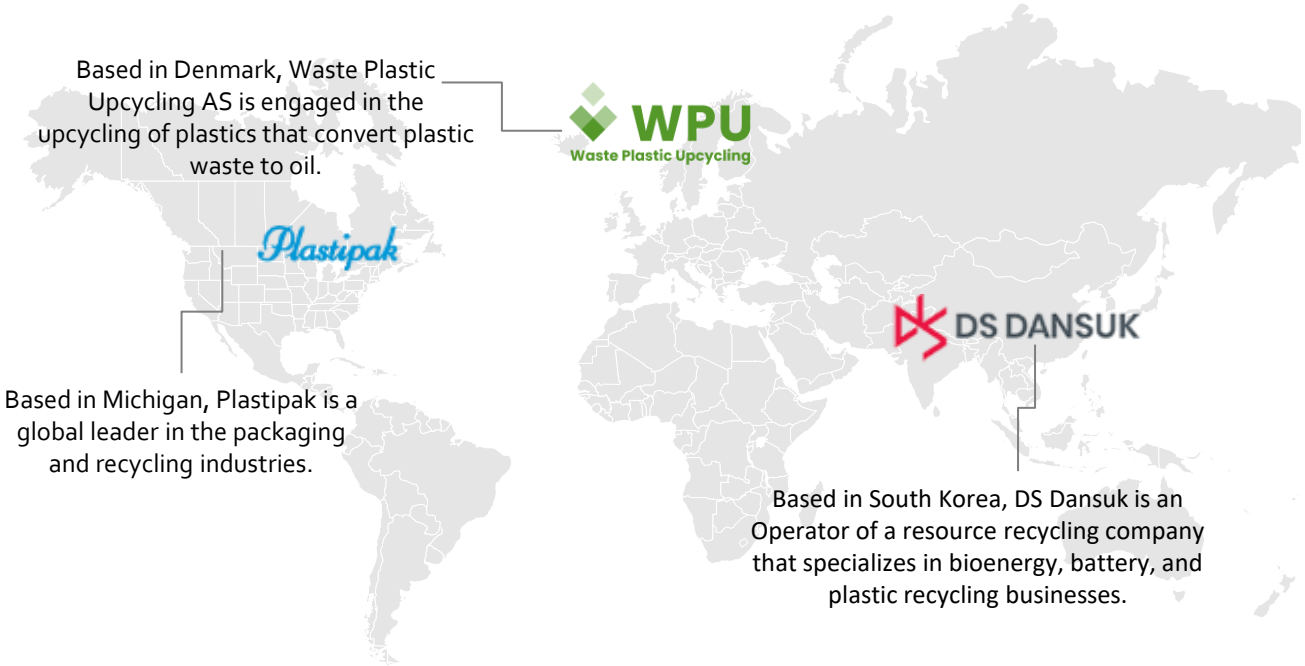
Pledges and Regulations on Plastics, by region — **Sustainability Momentum** Low High

	Types of pledges and regulations			
	Consumer Packed Goods Commitments and Focus	Taxes & Extended Responsibility (EPR)	Single-use Plastics (SUP) Regulation	Recycling Regulations
China	Recycle content	EPR in implementation	Requires biodegrade for bags and food-service plastics	Waste import ban
North America	Packaging recyclability and recycled content	CA: Province-level EPR US: State-level EPR in process	CA:2022 ban US: State-level bag bans	CA: RB[1] 100% by 2030 US: State-level regulations
Developed Asia and Australia	PET bottles and waste reduction	EPR schemes widespread	Bag ban in Japan and in parts of Australia	JP and KR: RR[2] 60–70% by 2030 AU: RC[3] 20%, RR 70%, and RB 100% by 2025
Europe	Recycled content and reducing virgin plastics	EU: Plastic tax (€800 per metric ton) carbon taxes EPR	EU: SUP ban on 10 items	EU: RC 30%, RR 55%, and RB 100% for plastic packaging by 2030
Rest of the World	Varies	EPR Schemes	India: State-level regulations	Turkey: RR targets Brazil: RC 75% Indonesia: 70% reduction in marine plastic by 2025

Source(s): Waste Management World, Mckinsey
Note: 1. RB: Recyclability, 2. RR: Recycling Rate, 3. RC: Recycled Content

Key Players

The plastic recycling market has gained significant importance in addressing the plastic waste crisis. It collects, processes, and reuses plastic waste, thus reducing reliance on virgin plastic production and mitigating environmental impact. With support from governments, businesses, and consumers, the market fosters a circular economy and promotes responsible plastic use for a more sustainable future.



Recycler-Producer Integration and Technology Development

Governments and associations globally are implementing initiatives and funds to curb plastic pollution and promote plastic recycling focused on Extended Producer Responsibility (EPR). The funds from the EPR scheme go into recycling to meet the established targets and create an infrastructure to recycle, reuse, and refill.

To sustain and grow recycling, companies need to manufacture plastic products and packaging compatible with recycling, consumers need to put recyclables in the recycling bin, and agencies need robust recycling infrastructure to collect, sort, and process that material. Companies also partner with recyclers like Veolia to build a dedicated PET recycling plant, enabling them to increase recycled PET bottle content. This increases collection, local plastic recycling and provides customers with more environment-friendly plastic bottles.

Producers and communities are focusing on reducing single-use plastics and promoting initiatives to minimize plastic waste. Material like plastic bags, although of low value, if reused, can substitute the purchase of trash bags and tote bags. For example, The Clean Refill store in Columbia is helping the community prevent plastic waste by allowing customers to bring in empty bottles and fill them with the store's supplies.

Companies are finding innovative ways to reduce and recover low-value plastics, such as drinking straws, single-use shopping bags, and plastic wraps or films used in online shopping and food delivery packages, as recycling them is not cost-effective. Tridi Oasis, a plastic recycling startup in Jakarta, through chemical recycling, plans to decompose plastic materials via chemical reactions or high heat and turn it into materials as an alternative to fossil fuels.

Source(s): Global Waste Index 2022, Ellen Macarthur Foundation, Upper Inc, Waste Dive, Waste Management World, Resourcify

M&A Trends – Plastic Recycling

Recycling of plastic is promoted as a solution to the plastics crisis engulfing humanity. Despite all the pledges to use more recycled material, only 9% of plastics are ultimately recycled while the rest end up in landfills, oceans, or are dumped. Companies and organizations focus on improving this by cutting their GHG emissions associated with plastics manufacturing and reducing waste.

Apart from being a big issue globally, plastics landing in oceans and rivers harm the marine environment. Companies, such as The Ocean Cleanup in the US and Big Blue Ocean Cleanup in the UK, focus on ways to recycle plastic waste from the ocean and rivers. These companies use cameras powered by AI to scan the ocean's surface for plastic and calibrate the team's computer models to understand the parts to target.

Trends show that most of the efforts in recycling have been around common plastics like HDPE, for example, plastic bottles. However, with time, LPDE plastic, which is usually used for packaging materials like blow film and cling wraps, is also gaining focus.

Early Recycling

- Organizations like The Waste and Resources Action Programme (WRAP), a climate action NGO, are involved in various initiatives to reuse and recycle waste generated mainly from textiles, plastics, and paper. For example, in Northern Ireland, WRAP partnered with Bryson Recycling to undertake trials regarding bottle cap recovery within the UK dairy and beverage sectors, to avoid littering, and increase the recycling rate.

ZARA

- Fashion brands are focusing on sustainability by converting used plastics into clothes, shoes, and other products. Veja, based in Brazil, is the first sneaker brand to sneakers with fabric entirely made from recycled plastic bottles.

H&M

- Renowned brands like Zara, H&M, Levis, and Adidas are focusing on conscious clothing by reducing water consumption, using recycled materials, and recycling and reusing all boxes, bags, and other materials. Retailers like Walmart are also promoting efforts to recycle all packaging received and obtain a zero-waste certification by selling it to recyclers.

LEVI'S

- Currently, less than 1% of clothes are recycled as clothing. To improve these statistics, organizations are lining up to unlock innovations in the field and increase the potential for more clothes to be recycled. Recently, WRAP and other signatories, with the support of Defra and Welsh Government funding of Textiles 2030, won £4m Innovate UK funding to deliver a pilot of automated sorting technologies for non-wearable post-consumer textiles recycling for more clothes to be recycled.

End-of-Life Recycling

- Inclination toward a circular economy in the plastic industry, the use of recycled plastic products, and energy conservation while recycling plastics are some budding industry trends. For example, Dow Corporate, a petrochemical company, signed an agreement with Fuenix Ecogy Group, a plastics-recycling company, to expand its capabilities in recycling and circular economy solutions for plastics.

DOW

- To support waste-to-energy initiatives and utilize end-of-life plastics, companies like Siemens partnered with Plastic Energy to transform end-of-life plastics into recycled oils to make new plastic products, such as food-grade packaging, and help divert plastic scrap from landfills and incineration.

fuenix

Source(s): DOW, Recycling Today, WRAP Org., BBC News, Big Blue Ocean Cleanup, The Ocean Cleanup, Earth Org., Sustainability Magazine, Reuters

M&A Trends – Plastic Recycling

LDPE Recycling

More recently, new initiatives have come into play on low-density polyethylene (LDPE) plastic, which is usually used for packaging materials like blow films and cling wraps. Companies are collaborating to get the best out of LDPE plastic waste to facilitate a material reduction in GHG emissions through the replacement of first-hand raw materials with recycled LDPE. For example, in Europe, companies like Repeats Group, are building new plastic recycling plants with investment from Ara Partners, which uses mechanical recycling to produce recycled LDPE flakes that are suitable for commercial and industrial applications.

Similarly, to utilize ocean plastic waste, Chase Plastics, Summit Systems, and Ocean Integrity recently announced a partnership to collect and recycle LDPE waste recovered from the ocean and hope to ensure a circular economy for recovered plastics.

As LDPE recycling gains focus, there are three profiles of consolidators recognized in the industry. These profiles along with examples of companies that participate in the LDPE recycling sector are listed below.

1 **Recyclers, of other materials**

To deliver new recycling capabilities for its customers and provide circular solutions for films and clear plastic wrap, companies involved in waste management and recycling of diversified materials like plastic, municipal waste, and metal among others, are consolidating with LDPE recycling companies.

Date	Buyer	Target	Deal Synopsis
Sep-22	WM	natura PCR	Acquired Natura PCR, a company involved in LDPE recycling and processing facilities to produce LDPE raw material

2 **Current manufacturers of LPDE products – vertical integration**

Companies involved in recycling materials like paper are consolidating with LDPE recycling companies for recycled raw materials and widening market share through vertical integration.

Date	Buyer	Target	Deal Synopsis
Jul-22	SAICA	manu packaging U.K.	Manupackaging, the producer of environmentally sustainable films, announced its cooperation with Saica Natur Cycle Plus, to classify and recycle LDPE

3 **Current producers of LDPE raw materials**

Companies involved in the production of LDPE raw materials are collaborating with LDPE recycling companies to lower dependence on recycled materials, enhance market potential, and contribute to climate change mitigation.

Date	Partnership	Deal Synopsis
Sep-23	SCGC Sirplaste	SCGC and Sirplaste Portugal Invest in Recycling Technology and New Machinery to Accelerate High Quality Odorless HDPE PCR Resin Production

Going by the M&A trends for plastic recycling, the sector follows more backward or vertical integration than consolidation with the recycling of other materials. However, companies involved in paper and packaging also focus on reducing plastic waste, and thus examples of consolidation with the recycling of other materials can also be seen in the plastic recycling sector.

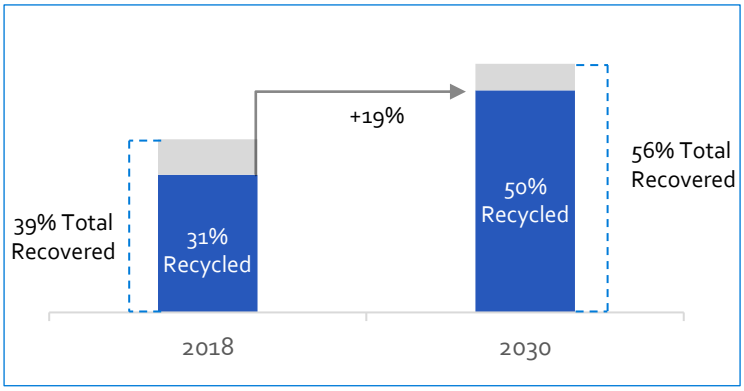
Source(s): PR Newswire, Packaging Europe, Avangard Innovative, SAICA Group, Sirplaste, SCG Chemicals

1.7.5 Glass Recycling Market

The global glass recycling market is expected to grow to around $6.3 bn by 2028 at a CAGR of 5.5%, according to a Market Data Forecast report. Glass is infinitely recyclable, capable of being continually reused without a loss in quality or purity, and most consumers know and trust glass. However, the US does not recycle nearly as much glass as it could, due to which the country's glass-recycling rate has hovered around 33% for many years. In Europe and some US states with bottle deposit laws, average glass-recycling rates are closer to 70%, which shows the possibility of improvement in glass recycling rates in the coming years.

- If the US were to achieve a 50% glass-recycling rate, it would divert millions of tons of material from landfills annually while reducing greenhouse gas emissions by about 1.4 million metric tons, i.e., equivalent to taking 300,000 cars off the road.
- As per BCG, the US can follow a ten-year plan to achieve the targets by ensuring no bottle is left behind, transforming the glass recycling system, and creating user-friendly deposit-return programs.

Glass Recovered and Recycling Rate in the US



Source: BCG

Trends in the Glass Recycling Market

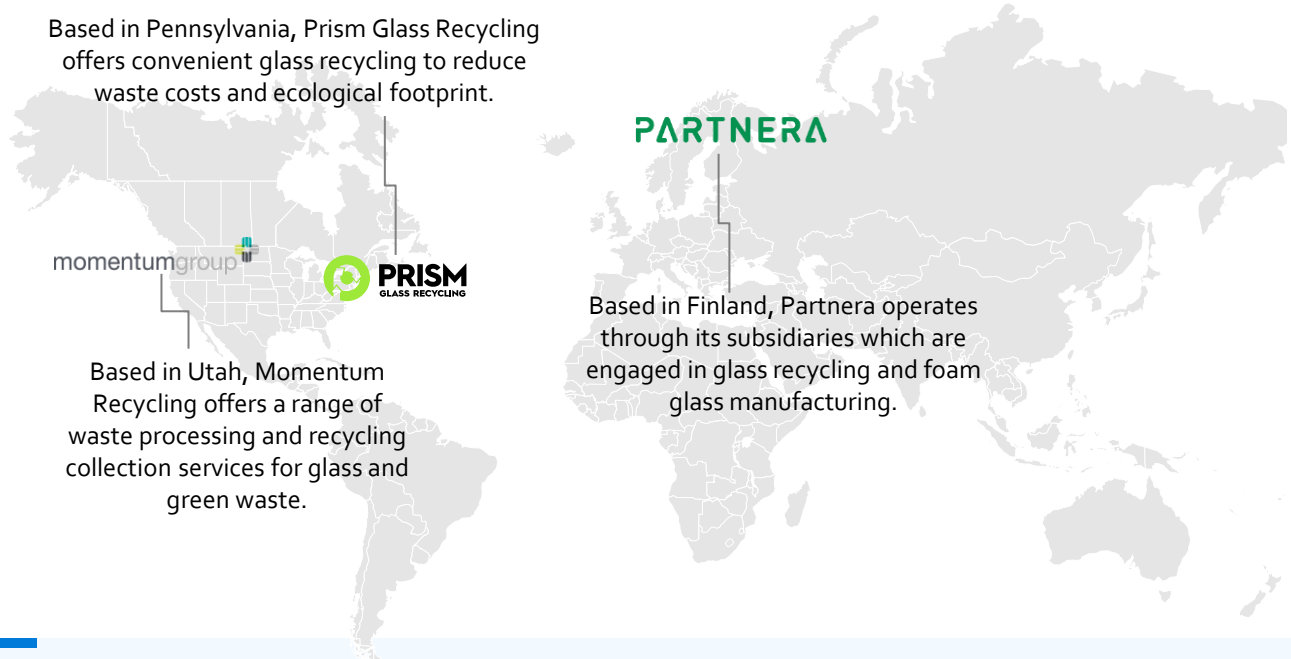
The key players and regions across the globe are moving to better technology and methods to recycle glass to reduce energy consumption and carbon emissions. Since consumers are moving toward eco-friendly products, the use of recycled glass is increasing. Europe is the largest market for recycled glass due to the region's strong focus on sustainability and circular economy principles.

- **Increase in Application of Recycled Glass:** Countries in Europe, Turkey, and Brazil utilize recycled glass in various industries. For example, Portugal uses recycled glass for manufacturing building blocks and coating in construction, Norway in the automotive industry, Turkey uses it as an ingredient to manufacture ceramic tiles and floors, and Brazil for producing sporting goods like soccer balls.
- **Improved Technology:** Companies like PICVISA, involved in the glass recycling sector, design and manufacture optical separation equipment such as ECOGLASS and ECOGRITS. These use advanced AI and ML algorithms to efficiently sort and process glass waste. Companies are also working on widening their scope of recycled glass by discovering new applications. One of their recent projects uses eco grit glass for ship cleaning of Zamakona Yards.
- **Glass Ambassador Program in Malaysia:** Owens-Illinois BJC, a Malaysia-based company, is involved in manufacturing bottles and jars, launched this program to increase awareness around the circularity of glass, stimulating social impact, energizing economic development, advancing manufacturing aptitude, and achieving a sustainable future. Glass Ambassadors promote the benefits of recycling glass, educating the public about O-I BJC's use of recycled glass to make new glass containers.

Source(s): BCG, Glass Worldwide, PICVISA

Key Players

The glass recycling market is vital for promoting sustainability and reducing environmental impact. It collects, processes, and reuses glass, conserving energy and resources. Governments, businesses, and consumers support glass recycling, driving its growth as an eco-friendly waste management solution.



Recycler-Producer Integration and Technology Development

Glass is an infinitely recyclable material, inert, and does not cause ocean pollution, waste, and food contact issues like other materials. Contrastingly, others depend on far-flung global supply chains, present waste problems if not recycled, or need future inventions to be widely recycled or recyclable. However, with glass, there are no such challenges.

Recyclers and producers aim to increase recycled content rates across the enterprise to reduce waste and curb carbon emissions. The Ohio-based company, O-I Glass, boasted that its closed-loop recycling programs preserved more than 152,000 cubic meters of landfill space, 116,000 tons of raw materials, and the energy equivalent to power 4,300 homes annually. The company focuses on advancing glass circularity by partnerships and new such programs.

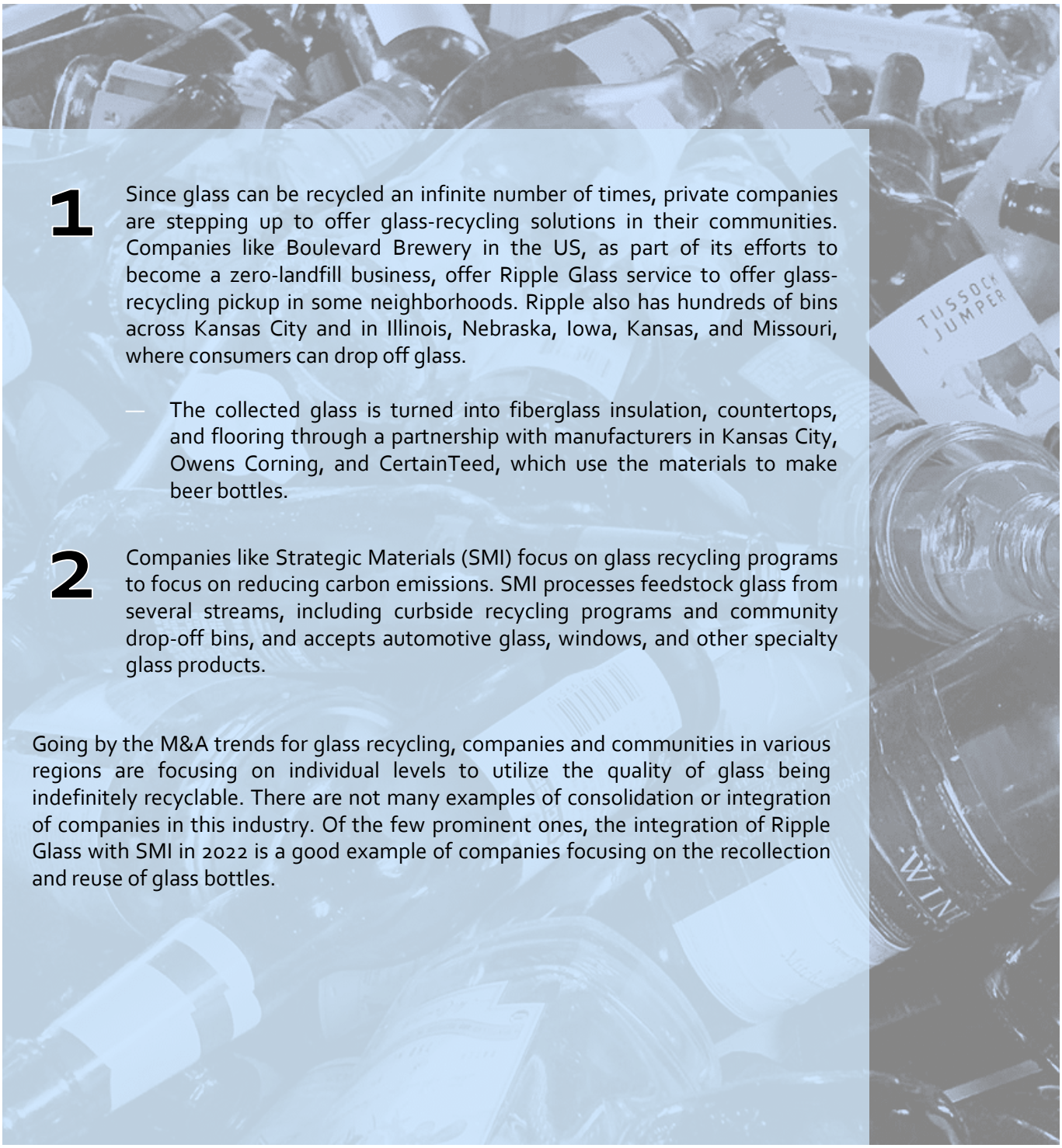
Several major glass manufacturers and drinks brands have designed lightweight glass containers to limit GHG emissions. For example, multinational drinks and brewing company, AB InBev designed a 150g 330 ml beer bottle in 2021, i.e., a 17% reduction from the previous design.

Public-private partnerships and investments by consumer brands are helping to build momentum and spur investment in glass recycling initiatives. Companies like Van Dyk or Machinex have developed equipment to clean up the residual contamination from the MRF glass stream and improve the economics of the commodity for the community with better investments.

Source(s): Global Waste Index 2022, Ellen Macarthur Foundation, Upper Inc, Waste Dive, Waste Management World, Resourcify

M&A Trends – Glass Recycling

Companies and groups are building community solutions, providing infrastructure investments for glass recycling, and conducting educational campaigns to promote the collection of glass and the importance of recycling. For example, in 2022, Romanian glass recycling company Greenglass Recycling invested €10m ($11.3m) to develop a post-consumer glass waste recycling plant in Romania, modernize its existing facilities, and increase the production capacity of recycled material.



1. Since glass can be recycled an infinite number of times, private companies are stepping up to offer glass-recycling solutions in their communities. Companies like Boulevard Brewery in the US, as part of its efforts to become a zero-landfill business, offer Ripple Glass service to offer glass-recycling pickup in some neighborhoods. Ripple also has hundreds of bins across Kansas City and in Illinois, Nebraska, Iowa, Kansas, and Missouri, where consumers can drop off glass.

   - The collected glass is turned into fiberglass insulation, countertops, and flooring through a partnership with manufacturers in Kansas City, Owens Corning, and CertainTeed, which use the materials to make beer bottles.

2. Companies like Strategic Materials (SMI) focus on glass recycling programs to focus on reducing carbon emissions. SMI processes feedstock glass from several streams, including curbside recycling programs and community drop-off bins, and accepts automotive glass, windows, and other specialty glass products.

Going by the M&A trends for glass recycling, companies and communities in various regions are focusing on individual levels to utilize the quality of glass being indefinitely recyclable. There are not many examples of consolidation or integration of companies in this industry. Of the few prominent ones, the integration of Ripple Glass with SMI in 2022 is a good example of companies focusing on the recollection and reuse of glass bottles.

Source(s): Waste Dive, Business Insider, Packaging Gateway

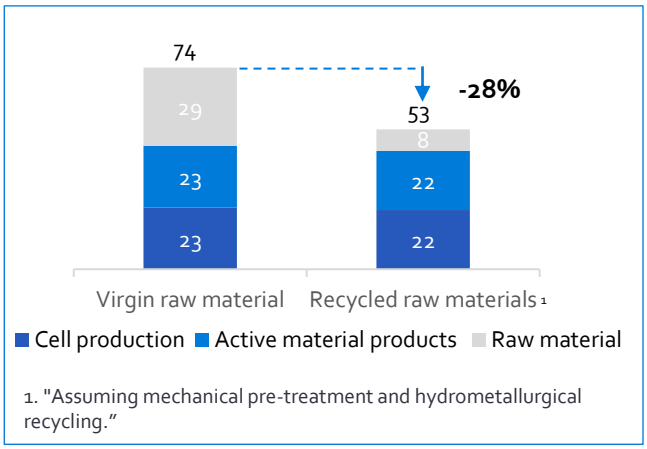
1.7.6 Battery Recycling Market

The global battery recycling market is projected to reach $54.3 bn by 2030 at a CAGR of 10.5% from 2023 to 2030. Electric mobility is increasing globally, contributing to the need for electric vehicle (EV) batteries. This demand has led to considerable growth in battery production, with over five terawatt hours (TWh) per year of gigafactory capacity expected globally by 2030.

Factors Fueling Industry Growth

- **Technological Progress**: Helps scale and mature processes, enables higher recovery rates, lowers greenhouse-gas footprints, and improves economics. Research and innovation project grants, such as the EU's European Battery Alliance and the US National Science Foundation Phase II Small Business Innovation Research grants, promote recycling.
- **Supply-Chain Stability Considerations**: Prioritized by various automotive OEMs and cell producers to secure local (recycled) raw material volumes at stable prices. For instance, VW has partnered with Redwood Materials in the US and GM with Li-Cycle and Cirba Solutions.

Comparison of emissions from batteries made of virgin vs. recycled raw materials (kgCO2e per kWh)



1. "Assuming mechanical pre-treatment and hydrometallurgical recycling."

Source: Mckinsey Battery Insights

- **Decarbonization and Ethical Supply-Chain Targets**: Automotive OEMs have set these targets, leading to a preference for recycled battery materials over newly mined ones. Considering the former is characterized by about four times lower carbon emissions, the carbon-emissions footprint per kilowatt-hour (kWh) of battery cell capacity produced is over 25% lower.

Trends in the Battery Recycling Market

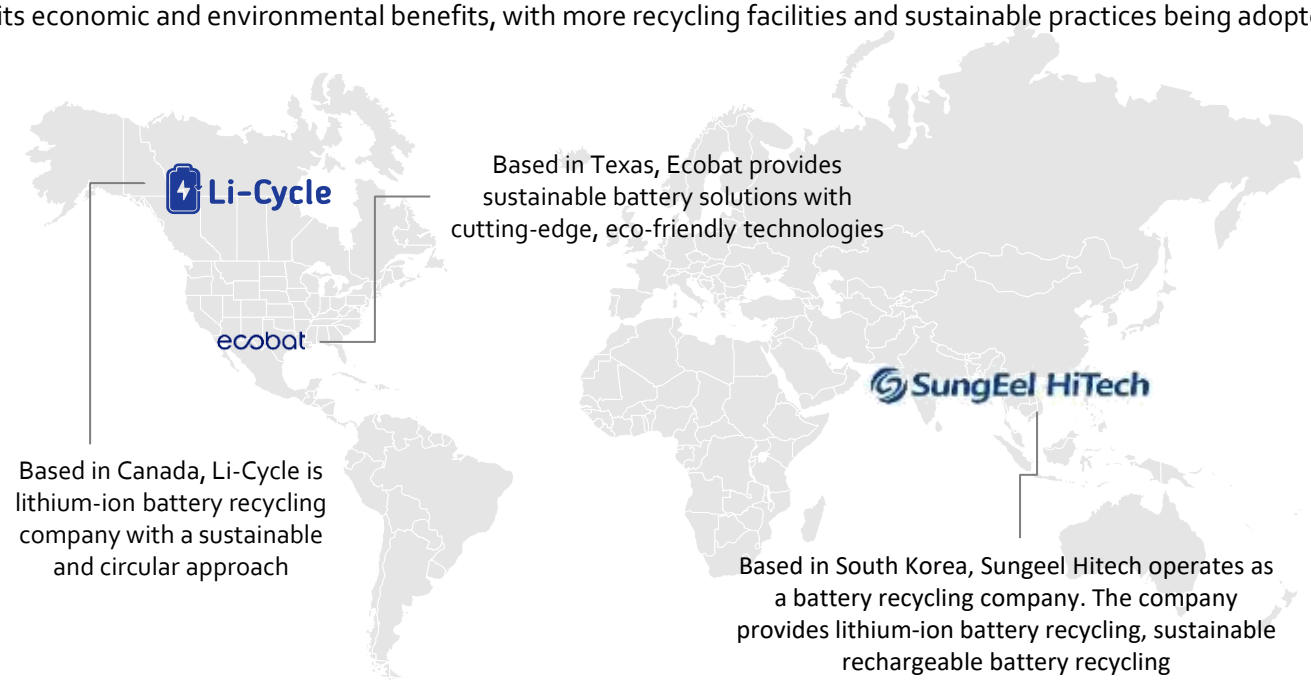
The battery recycling market is gaining traction as EV value chains evolve toward long-term sustainability goals amid future raw material shortages and environmental, social, and governance (ESG) concerns. Global battery recycling pre-treatment capacity reached ~1.6 mn tons per year of recycling inputs, with China accounting for 80% of the total market.

- **Battery Recycling in Europe**: A key lever in ensuring cost reduction and risk mitigation around looming raw material supply constraints. Building the ecosystem presents a significant opportunity to grow in technological complexity and diversity. Asian and North American players like RecycLiCo, EcoGraf, and Attero recycling are filing patents to establish their license to operate in battery recycling in Europe.
- **Battery Recycling in North America**: In Berkeley County, South Carolina, Battery Material Campus plans to recover cathode and anode materials from end-of-life lithium-ion batteries. Additionally, in Ontario, Canada, Electra Battery Materials started its demonstration plant to recover cathode materials and graphite from the black mass using its hydrometallurgical process.
- **Increase in Recycling Plants**: With battery recycling in demand, many market players are setting up recycling plants across regions. For example, SK Innovation and SungEel HiTech formed a joint venture to build a battery recycling plant in Korea, the US, and Europe. The first plant is expected to be built in Korea, with operations starting in 2025.

Source(s): Mckinsey, EY, Rho Motion

Key Players

The battery recycling market has grown significantly due to the increased demand for electronic devices and electric vehicles. Recycling batteries extract valuable materials for reuse and reduce hazardous waste, addressing environmental concerns and resource scarcity. This industry expansion is driven by the recognition of its economic and environmental benefits, with more recycling facilities and sustainable practices being adopted.



Based in Texas, Ecobat provides sustainable battery solutions with cutting-edge, eco-friendly technologies

Based in Canada, Li-Cycle is lithium-ion battery recycling company with a sustainable and circular approach

Based in South Korea, Sungeel Hitech operates as a battery recycling company. The company provides lithium-ion battery recycling, sustainable rechargeable battery recycling

Recycler-Producer Integration and Technology Development

The demand for electric vehicles is accelerating rapidly and so is the need for EV batteries. As these batteries reach end-of-life, significant growth opportunities in the recycling space are emerging.

Growth in EV battery volumes, as they approach their end-of-life, with over 100 mn vehicle batteries expected to be retired in the next decade. With this challenge comes an opportunity – to scale a supply chain that is more stable, more resilient, more efficient, and more sustainable than that of the fossil-fuel and internal combustion engine (ICE) vehicle industry.

Recyclers engage in cross-value chain partnerships and create groups of specialized companies, such as battery logistics experts, black mass producers, and metal refiners, which operate together under a partnership agreement to provide an end-to-end recycling solution. The partnership between Veolia and Solvay is one such example from Europe.

In-house OEM recyclers at cell manufacturers and automotive OEMs allow on-premises recycling of cell production scrap and end-of-life batteries to ensure a closed loop while maintaining battery material ownership and supply-chain visibility. Several Western auto OEMs have also launched internal battery recycling initiatives, with some even working on pilots, such as Tesla and VW, usually with the strategic ambition to learn about the market.

Source(s): Global Newswire, Ecobat, Businesswire, Mckinsey

M&A Trends – Battery Recycling

In battery recycling, M&A trends across regions and sectors because the application of batteries has increased tremendously over the years. The approach to recycling has swiftly changed, which has enabled recyclers to dissolve metals and separate them from battery waste effectively. Recycling facilities can now recover nearly all cobalt, nickel, and over 80% of lithium from used batteries and manufacturing scrap left over from battery production. Recyclers plan to resell those metals at prices similar to the mined materials. Battery recycling factories are expected to create a supply of materials the world needs to meet its climate goals.

- Companies integrate with mining and battery manufacturers for expansion, tapping into massive markets and decarbonizing the supply chains of increasingly scarce natural resources. For example, in 2022, Comstock acquired LiNiCo to synergize with LiNiCo's pioneering extraction technologies to produce lithium and other electrification products from both recycled batteries and virgin natural resources.

- Government departments are increasing their funding for battery recycling to improve awareness, expand R&D in battery recycling, and improve the supply chain of critical materials for relevant markets. Recently, the Department of Energy in the US announced $192M for battery recycling, with a focus on consumer electronics recycling, a new advanced battery R&D consortium, and the continuation of lithium-ion battery recycling, to secure a domestic supply chain of raw materials.

- The EV market's advancement is dependent on the supply of batteries and with resources being scarce, the focus on battery recycling has increased over time to find a solution and support the growing EV market. Companies like Redwood Materials, one of the battery recycling industry's dominant players, partnered with automakers like Toyota, Ford, and Volvo, to collect, refurbish, and recycle batteries and battery materials to send them to the respective battery plant and support the growth of the EV infrastructure.

- Vertical integration among automakers is another trend in the sector, where big companies are investing in startups along the entire lifecycle, from battery cell technology to recycling. Companies like Volkswagen Group, formed a new company, PowerCo, to manage its global battery business, from raw materials to recycling, and plans to build battery factories in Europe. In the last five years, $42B in venture capital and growth equity have been invested in the sector, according to a TechCrunch and PitchBook analysis.

    - Another such example in the technology sector is Segi Retech, the South Korean lead-acid recycler acquired by KPS, a display technology company, to branch out to lithium-ion battery recycling. KPS plans to expand overseas for battery collection via the acquisition of recycling technology.

- In Asia, organizations are consolidating with companies dealing with other materials, like metal and construction, to diversify and expand. Recently, a mid-sized construction company IS Dongseo entered the battery recycling market through Town Mining, a company with technologies and patents in recycling scrap produced from battery production as battery materials, to grow the battery recycling business as the core business of its ESG management.

Going by the M&A trends for battery recycling, companies are consolidating vertically and with companies involved in recycling other materials, mainly metals and electronic waste. As the sector is significantly new, more expansion and integration are expected in the coming years. Recycling batteries is essential for the availability of raw materials and resources and for the growth of the battery market.

Source(s): Technology Review, Global Newswire, Waste Dive, Tech Crunch, Circular Energy, Donga

1.8 Recycling Equipment and Machinery Market

The global recycling equipment market size is expected to reach $41.42bn by 2030 from its estimated market value of $27.2bn in 2022. The market is expected to grow at a CAGR of 5.4% from 2023 to 2030. Manufacturers in the market are making efforts to provide solutions at competitive prices by forming alliances with engineering solution providers, focusing on forward integration, and expanding their regional presence.

Market Trends

- **An increase in government initiatives is driving the market growth**: The governments of various countries are focusing on recycling infrastructure which is beneficial for the recycling equipment market.
- **Recycled materials desirable for businesses wanting to cut costs**: Demand for recycled materials is rising due to their low prices compared to virgin materials thus making it an attractive option to manufacturers.
- **Plastic recycling equipment and machinery market**: Adoption of automation, advanced self-cleaning filters, compact, and modular designs, and machinery that meet high production capacity are some of the major trends noticed in this industry.
- **Metal recycling equipment and machinery market**: Increasing demand from the automotive, aerospace, packaging, and construction industries is expected to drive up demand for recycling scrap metals as these can be recycled multiple times.

Recycling Equipment Industry Developments

Industry consolidation is a trend in the recycling equipment manufacturing industry. The tightening of government regulations on waste management, technological advancements, and increasing market demand for effective recycling solutions have played a significant role in facilitating M&As. However, the market is scattered and there are more small players in the market than big companies.

- In July 2023, Next Generation Group, a leading provider of unique plastic life solutions, acquired a majority share in HydroDyn, a renowned technology provider specializing in plastic waste cleaning and purifying. The collaboration is focused on expansion and leveraging efficient end-to-end plastic recycling solutions that address the evolving needs of customers in the recycling machinery market.
- In May 2023, Previero, a provider of recycling solutions based in Italy was acquired by Ambienta, an asset management company through an LBO, to reap the benefits of Previero's extensive experience in the recycling sector and to build its portfolio.
- In December 2022, a pilot facility for the chemical recycling of acrylic resin was built by Sumitomo Chemical as a significant effort in the most recent advancements in plastic recycling equipment.
- In September 2022, Doppstadt entered into an equal partnership with the private investor Custos Vermögensverwaltungs GmbH for future growth and expansion.

Source(s): Research & Markets, Modern Plastics Global, Genius Plas, Transparency Market Research, Recycling Magazine, FYB

1.8.1 Key M&A Transactions in the Market

The main transaction in the recycling equipment manufacturers' space is in Europe in the last 3 years.

Date	Target	Country	Description	Buyer
Jul-23	HydroDyn Systems		Provider of plant technology and services intended for recycling plastic waste	Ingka Investments, Next Generation Recyclingmaschinen
May-23	PREVIERO N.		Developer of machinery and recycling plants designed for the grinding of plastic, and rubber	Ambienta (Mauro Roversi)
Sep-22	Doppstadt Beteiligungs		Manufactures systems and shredding technologies for mobile and stationary use	Custos Vermögensverwaltungs GmbH
Oct-20	LSM Engineering		Manufacturer of waste recycling equipment and machinery intended to offer customers and distributors around the globe	Enterprise Ireland
Jun-20	Ecosteryl		Manufacturer of medical waste treatment and recycling machines intended to minimize the carbon footprint	Société Régionale d'Investissement de Wallonie
Mar-20	Houston Natural Resources (HNR)		Develops natural resources with innovative technologies in tandem with oil field waste disposal and recycling	Ludvik Holdings

Source(s): Research & Markets, Modern Plastics Global, Genius Plas, Transparency Market Research, Recycling Magazine, FYB

2.1 Synopsis on Regulatory Landscape

Regulations and policies by governments and environmental organizations like the United Nations Environment Programme (UNEP) act as a step toward awareness, preservation, and action against the increasing waste and promote recycling of materials.

Region	Key Policies and Regulations		
United Nations	**Policies by the UNEP[1]** • Act as important enablers, such as development planning, taxation reforms, and Extended Producer Responsibility rules • Promotes circular economy as it creates synergies & interacts with NESD[3] and SDG[4] concepts	**Domestic policies to drive circular economy** • Public investment as a tool for societal transformation • Market-based instruments (e.g., fiscal policy) • PPPs[5] instruments for R&D or investments	**International policies to drive circular economy** • Trade agreements • International standards • International agreements on monitoring and evaluation indicators
North America	**Steps by EPA2 for recycling:** • Draft National Recycling Strategy • Recycling Pledge • Basel Convention	**Handling of hazardous waste and voluntary program for secondary material** • Resource Conservation and Recovery Act (RCRA) • Strengthen Secondary Materials Markets	**Regulation for E-waste recycling** • Responsible Recycling (R2) • e-Stewards certification programs
South America	**Examples of policies across regions** • Chile's Law on Extended Producer Responsibility • Peru's Law No. 30884 regulates single-use plastics	**Regional Collaborations** • The Environmental Alliance of America • The Pacific Alliance (Chile, Colombia, Mexico, and Peru) • LatitudR, a joint group of civil society	**Plastic Pacts** • The Chilean Plastics Pact • Colombia Plastics Pact
Europe	**New Proposal for Packaging Directive (PPWD)** • Ensuring economical reusable or recyclable packaging by 2030 • New packaging rules to address recyclability, reusability, size, and uptake of recycled content	**European Strategy for Plastics** • Single-use Plastics Directive (SUPD) with ban on such products • Circular Economy Action Plan • Plastic Waste Legislation	**End-of-Life Vehicles Directive (ELV)** • Addresses management of end-of-life vehicles to promote material recycling and recovery • Imposes obligations on producers to treat ELVs in an environmentally sound manner
Asia-Pacific	**China** • Solid Waste Law • Waste Sorting and Recycling Initiatives • Extended Producer Responsibility • Waste-to-Energy	**Japan** • 3R Policy promotes recycling of small waste electrical and electronic equipment • Container and Packaging Recycling Law • Home Appliance Recycling Law	**Australia** • National Waste Policy targets to reduce total waste generated by 10% per person by 2030 • Recycling Modernisation Fund • Hazardous Waste Regulations

Source(s): 1. United Nations Environment Programme (UNEP), 2. US Environmental Protection Agency (EPA)
Notes: 2. NESD: New Economics for Sustainable Development, 3. SDG: Sustainable Development Goals; 5. EPA: Public-private partnerships

3.1 Selected Profiles

In addition to acquisitions by the main public companies, the industry has seen notable activity by several private companies, including multiple with private-equity backing. The below list comprises highly acquisitive players in the market that primarily provide recycling services and waste management across Europe, America, and Asia Pacific.

Ticker: EPA:VIE
Market Capitalization
€21.30 bn

HQ: France

Founded in 1853, **Veolia**, a world leader in the market, offers waste management, collection, disposal, and treatment services, recyclable products and refractories, and industrial cleaning and facilities management services.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Jul-19	DCLM	Hazardous waste operation in South Africa	Acquired to increase presence in Africa.
Apr-21	SUEZ	Fully integrated business operating along the entire waste value chain	Acquired to create the French world champion of ecological transformation

Private Equity
Platinum Partners

HQ: Spain

Founded in 1990, **Urbaser** is an environmental solutions company specializing in waste collection and street cleaning services for the municipality. In October 2021, Platinum Equity acquired Urbaser for €3.5 bn.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Nov-22	NOVO LITIO	The first EV lithium battery recovery and recycling company in the Iberian Peninsula.	Miguel Temboury and Toni Massot presented the new company Novolitio

Private Equity
Energy Capital Partners

HQ: UK

Founded in 1912, **Biffa** is the leading integrated sustainable waste management company. It provides collection, treatment, recycling, and technologically-driven energy generation services.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Apr-23	ESTEARTH	Recycler of PET plastic	Acquired to expand further capabilities in closed-loop food grade plastic recycling,

Source(s): Veoilia, Urbaser, Platinum Equity, Biffa, Infrastructure Investor

Key Acquisitive Players

Private Equity
EMK Capital

HQ: UK

Founded in 1994, **Reconomy** provides a comprehensive, tech-enabled waste management service to various sectors, delivered through a nationwide network of pre-approved supply partners.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Jun-23	ecofficiency	Waste and materials management solutions provider	Acquired to increase depth of services offered in UK.
May-23	ukwsl	Sustainability consultants and managers, offers services across hospitality, distribution and other sectors	Acquired to further strengthen market-leading position in the commercial waste sector

Private Equity
Macquarie

HQ: Ireland

Founded in 1990, **Beauparc** is an essential services corporation offering renewable energy and commercial waste management solutions and recycling collection.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Mar-23	PEAK WASTE RECYCLING LTD	Provide waste services to customers throughout Derbyshire	Acquired to further expand in the UK, 10th business acquired by Beauparc since 2016
Oct-21	JWS	Waste and recycling services company	Acquired to add growth to company's UK strategy

Private Company

HQ: Germany

Founded in 1934, **Remondis** is a global environmental leader, operating in 30+ countries with 500 facilities, emphasizing resource efficiency in water, recycling, and sustainable waste management, handling millions of tons of waste yearly.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Jun-23	Järnmalmer	Offers recycling, dismantling, and transport services	Acquired 100% of Järnmalmer T. Malmer Aktiebolag's shares.
Jun-23	Gebr. Scholten B.V.	Skip hire and waste management company in Beverwijk	Acquired through its subsidiary

Source(s): Reconomy, EMK Capital, Beauparc, Remondis, Euwid Recycling

Key Acquisitive Players

Private Equity
ABRIS Capital

HQ: Romania

Founded in 2002, **Green Group**, backed by ABRIS capital, evolved to become a major integrated recycling park in Europe, with a business model that addresses Romania's plastic waste challenges through comprehensive recycling waste management and valorization.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Apr-23	ŽALVARIS	Lithuania's largest industrial waste management company	Acquired as a pivotal move within its €200M investment plan for the region.
Aig-22	ECSO	Lithuanian low-density polyethylene (LDPE) recycling company	Acquired to enter the polyolefin recycling market, diversifying its plastic recycling portfolio beyond PET.

Family-Owned
The Petithuguenin Family
(Majority shareholder)

HQ: France

Founded in 1994, **Paprec Group** is a prominent environmental services company specializing in recycling and waste management, particularly in collecting, sorting, and processing various materials for clients across France.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Mar-23	PRIVACIA	Provides collection and recycling of waste from service sector businesses	Acquired to develop regional presence
Oct-21	dalkia wastenergy	Specialist waste-to-energy subsidiary	Acquired with an aim to expand further into the waste-to-energy (wte) market.

Private Equity
IFC, EBRD, and PFR

HQ: Poland

Founded in 2011, **Elemental Holding Capital Group** sources and manufactures raw materials from waste electrical equipment, automotive catalysts, and non-ferrous metals sustainably. Its operations span 35 countries in Europe, Asia, and North America.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Jun-23	Colt Recycling	Electronics recycler and ITAD provider	Acquired to expand its abilities to provide electronics recycling and ITAD services.

Source(s): Green Group, Euwid, Paprec, Elemental, Recycling Today, Natixis,

Key Acquisitive Players

Ticker: NYSE:RSG
Market Capitalization
$45.60B

HQ: US

Founded in 1996, **Republic Services** is a leading North American waste disposal company. It specializes in non-hazardous solid waste collection, recycling, and sustainable environmental solutions for 14 million customers to preserve a cleaner, safer, and healthier world for future generations.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Jun-23	GFL	Operations include recycling, collection and disposal assets	Acquired Colorado and New Mexico operations for expansion of cycling, waste and environmental solutions

Private Equity
Goldman Sachs Asset Management, Capricorn's Technology Impact Fund

HQ: US

Founded in 2017, **Redwood Materials** focuses on recycling lithium-ion batteries and producing battery materials for electromobility, aiming to establish a closed-loop supply chain within the US.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Mar-23	REDUX	Leading EU battery recycler	Acquired as per expansion plans in Europe to support mission of creating a closed-loop battery supply chain

Parent Company
FCC

HQ: US

Founded in 1911, **FCC Environmental Services** is a leading global waste management company. It operates in 35+ countries with a strong commitment to sustainability and community support.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Feb-22	PREMIER WASTE SERVICES	Offers solid waste management and recycling activities in the United States	Acquired Premier Waste Services, and made inaugural venture in the US

Source(s): Republic Services, PR Newswire, Redwood Materials, FCC Environmental Services, Waste Advantage, Reuters, Fortune

HQ: US

Owner
Clint & Kolby Cornejo

Founded in 2009, **Allmetal Recycling** is a prominent non-ferrous and ferrous metal recycler, offering comprehensive recycling services to various sectors alongside providing new steel products through its sister company, AMR Steel & Supply.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Apr-23	Heavy Metal Recyclers Inc.	Metal buying and demolition business with multiple locations in Kansas	Acquired to expand its operations which resulted in an increase of yard count to 10.

HQ: US

Ticker: NYSE:WCN
Market Capitalization
$35.44B

Founded in 1997, **Waste Connections** is a prominent North American integrated waste services company. It offers comprehensive waste management solutions across the US and Canada. It is known for its unique corporate culture and employee empowerment.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Aug-23		Offers waste management and disposal solutions	Acquired to provide strategic access to a major landfill and a significant waste-to-rail disposal network in the Northeast.

HQ: US

Ticker: NYSE:WM
Market Capitalization
$63.18B

Founded in 1968, **Waste Management (WM)** is a North American waste management and environmental services company. It offers comprehensive solutions from collection to disposal and operates with a vast network of facilities and a leading trucking fleet.

Recent acquisitions

Date	Target	Target Description	Deal Synopsis
Sep-22		An independent company that provide circular solutions for commercial plastic films and wraps.	Acquired a controlling interest in Avangard Innovative's US business, forming Natura PCR.

Source(s): Allmetal Recycling, Waste Dive, Waste Management, PR Newswire, Recycling Today

HQ: Japan

Ticker: TYO:9336
Market Capitalization
JPY 229.05B

- Founded in 1979, **Daiei Kankyo** is a waste-related business offering comprehensive services. It handles the collection, transportation, treatment, recycling, and disposal of general and industrial waste and valuable resource recycling.
- Since its listing in December 2022, Daiei Kankyo saw a 30% surge post its IPO, which made the company's Co-Founder and President Japan's newest billionaire with a net worth of $1B.

Date	Target	Target Description	Deal Synopsis
Apr-23	Asahi Koseki K.K.	Collection and disposal of refuse systems	Daiei acquired a 35% stake in Asahi Koseki K.K., making it an equity-method affiliate of Daiei Kankyo

HQ: Hong Kong

Ticker: HKG:0976
Market Capitalization
HKD 778.66M

Founded in 1995, **Chiho Environmental Group** is a global leader in metal recycling and environmental protection. It focuses on recycling, disassembling, and processing mixed metal scrap and recycling and reusing resources, with additional involvement in end-of-life vehicle recycling and e-waste treatment.

Recent stake sale

Date	Target	Target Description	Deal Synopsis
Aug-23	KALISCH Recycling	Mexico-based scrap recycling firm	Sold 50% stake to Canada-based American Iron & Metal (AIM)

Source(s): Daiei Kankyo, Chiho Environmental Group

4.1 Key M&A Transactions (Jan 2020-Nov 2023)

Date	Target	Country	Description	Buyer	Deal Value ($mn)	EV ($mn)	EV/ Revenue (x)	EV/ EBITDA (x)
Waste Management & Disposal								
Nov-23	Jiangyin Jinxiu Jiangnan Environmental Development		Offers waste treatment and environmental consulting services	Jiangyin Huarui Environmental Development	9.5	19.9		
Nov-23	Berjaya Enviroparks		Operator of a waste landfill facility to provide long-term solid waste management solutions	Naza Corporation Holdings	147.6	147.6	-	-
Nov-23	Repurpose It Pty Ltd		Offers waste management services	Palisade Impact	139.8	139.8	-	
Nov-23	WELLE Environmental Group		Offers waste leachate treatment, food and kitchen waste treatment, and municipal sewage treatment services, etc.	Changzhou Hejia Capital Management	24.7	787.5	2.6x	-
Oct-23	E-Idaman Sdn. Bhd.		Offers waste management services	Tuah Utama Sdn Bhd	27.9	56.9	-	-
Oct-23	Waste Consolidators		Provider of bulk waste collection services for business park owners, condominiums, and apartment complexes	Ally Waste (James Crawley)	6.0	11.8	-	-
Oct-23	Fielding Environmental		Offers chemical waste management services	GFL Environmental	-	-	-	-
Sep-23	SGEET		Provider of comprehensive organic waste management services and recycling solution	CSD Water services	5.9	11.7	5.3	-
Sep-23	Twin Bridges Waste & Recycling		Provider of waste management and recycling services	Casella Waste Systems	219.0	219.0	-	-
Aug-23	Agric Adubos E Gestao De Residuos Industriais E Comerciais		Operates as a waste management firm	Energisa Biogas	12.2	14.7	16.4	-
Jul-23	Attero		Engages in the recovery of raw materials from various waste flows and the production of sustainable energy	Ardian	238.1	238.1	-	-
Jul-23	Heritage-Crystal Clean		Provides parts cleaning, hazardous and non-hazardous waste, and used oil collection services to small and mid-sized customers	J.F. Lehman and Company	1,354.9	1,321.8	1.7	7.2
Jul-23	Groupe TGW		Provides management, recovery, and recycling of commercial waste services	Raise Invest	49.4	164.8	-	-
Jul-23	Jiyuan Zhongchen Environmental Technology		Engages in solid waste and hazardous waste acquisition, disposal, comprehensive utilization, and sales	Anhui Zhonghuan Environmental Protection Technology	17.4	24.8	-	-

Source(s): FactSet as of 30-Nov-2023

Precedent Transaction Analysis

Date	Target	Country	Description	Buyer	Deal Value ($mn)	EV ($mn)	EV/ Revenue (x)	EV/ EBITDA (x)
Waste Management & Disposal								
Jul-23	Hunan Airbluer Environmental Protection Technology		Provides environmental protection services	Hunan Fuchuan Private Investment Fund Management	15.3	304.0	5.2	33.8
Jun-23	GFL Environmental		Provider of recycling services	Casella Waste Systems	525.0	525.0	2.8	
Jun-23	Recycle Waste Services		Offers recycling, hauling, disposal, and waste diversion services	TraQiQ	26.7	26.7	1.2	-
Jun-23	Re Mat		Manufacturer of semi-finished products intended to recycle them from polyurethane waste deriving from industrial processing	Iren	3.8	3.3	1.4	
Jun-23	Assets of Consolidated Waste Services		Provides garbage collection and recycling services	Casella Waste Systems	219.0	219.0	-	-
Jun-23	Valoriza Servicios Medioambientales		Provides environmental services	Morgan Stanley Infrastructure	792.7	792.7	-	-
Jun-23	FCC Servicios Medio Ambiente Holding		Provides municipal services, and waste management services	CPP Investment Board	1,036.1	4,146.0	-	-
Apr-23	Geminor		Supplies waste products for recycling and energy recovery	-	7.6	19.1	-	-
Dec-22	Shanghai Changying Environmental Protection Services		Provides collection and comprehensive utilization of industrial waste and incineration of residues	Wuxi Xuelang Environmental Technology	24.0	120.0	-	-
Nov-22	Recycling Holding Volendam		Provides waste management services	SCG Chemicals	56.9	94.8	1.0	-
Oct-22	Colex Holdings		Provides waste management services	Bonvests Holdings	4.3	20.1	0.7	24.1
Sep-22	Waier Trading		Provides paper, plastic scrap, and scrap ferrous metal recycling services	KAF Investment Bank	2.2	2.2	1.4	-
Aug-22	Recycling and Waste Recovery		Provides recycling, recovery, and waste management solutions	Macquarie Asset Management	2,452.7	2,452.7	2.3	-
Jun-22	Biffa		Provides waste management services	Energy Capital Partners	2,019.7	1,972.8	1.2	9.5
May-22	GMP Exploitatie		Provides commercial waste and recycling management services	Renewi	64.9	64.9	1.4	6.1
Feb-22	Premier Waste Services		Offers roll-off, front load, compactor, and front load waste and recycling removal services	FCC Environmental Services	34	34	-	-

Source(s): FactSet as of 30-Nov-2023

Precedent Transaction Analysis

Date	Target	Country	Description	Buyer	Deal Value ($mn)	EV ($mn)	EV/ Revenue (x)	EV/ EBITDA (x)
Waste Management & Disposal								
Jan-22	Zhejiang Huge Environment		Provides domestic waste reduction and recycling services	Hangzhou Dadi Haiyang Environmental Protection	186.6	186.6	-	-
Jan-22	Paprec France		Offers recycling of paper, common waste, plastics, wood, metals, and electrical equipment	For Talents	171.4	-	-	-
Jul-21	Ferrovial's environmental services business in Spain and Portugal		Provides environmental services, waste collection, waste treatment, and recycling	PreZero International	1,221.2	1,221.2	1.01	7.9
Jul-21	KL Resources		Offers wastepaper, plastic and scrap metal collection, and recycling services	Opulent Capital	3.0	17.5	-	-
Jun-21	Ningxia Yineng Solid Waste Resource Development		Provides solid recycling and waste disposal services	China Resources and Environment	27.4	27.4	-	-
Jun-21	URBASER		Provides waste management and treatment services	Global Moledo	4,268.8	4,268.8	-	-
May-21	Collections business and certain Recycling assets of Viridor Waste Management		Offers recycling, renewable energy, and waste management services	Biffa	202.6	202.6	-	-
Mar-21	Solid Waste and Environmental Solutions Business of Terrapure Environmental		Provides industrial waste management, environmental, and recycling services	GFL Environmental	743.2	743.2	2.5	-
Mar-21	All of Dangjin business of Enbiotec		Comprises waste recycling business	E&Watersolution	39.0	39.0	-	-
Jan-21	SUEZ Groupe		Provides water, recycling, and recovery services	Ardian; CNP Assurances; Global Infrastructure Management; CDC Group; Meridiam	12,382.4	12,382.4	1.1	6.1
Jan-21	Luyi (Wujiang) Solid Waste Recycling and Disposal		Offers hazardous and solid waste management, and recycling services	Nantong Runhe Environmental Science and Technology	4.9	48.7	1.5	-
Jan-21	Geminor		Supplies waste products for recycling and energy recovery	Quantafuel	21.7	54.2	-	-
Jan-21	Chongqing Derun Environment		Provides renewable resource recycling, resource utilization, and waste disposal services	SUEZ NWZ	304.3	2424.6	-	-
Jan-21	Suez		Comprises Water Cycle Management, Waste Recycling and Recovery services	Veolia Environnement	27,725.7	27,862.6	2.5	13.2
Dec-20	Gaoyou Compro Environmental Resources		Provides industrial solid waste incineration, general waste recycling	Tianjin Capital Environmental Protection Group	58.6	58.6	-	-
Nov-20	Mag Group Management		Provides collection, transportation, processing, and recycling of municipal solid waste	CJSC Neva Energia; Veolia Vostock	158.5	158.5	-	-

Source(s): FactSet as of 30-Nov-2023

Precedent Transaction Analysis

Date	Target	Country	Description	Buyer	Deal Value ($mn)	EV ($mn)	EV/ Revenue (x)	EV/ EBITDA (x)
Waste Management & Disposal								
Oct-20	All Assets Of Green Remedies Waste and Recycling		Operates environmental and solid waste management and recycling services.	Quest Resource Management Group	18.5	18.5	-	-
Oct-20	Camo		Offers waste management services	Biffa	52.0	52.0	1.3	7.7
Sep-20	Séché Environnement		Engages in the management, recovery, and treatment of waste products for industrial and corporate customers	-	29.0	930.5	1.2	7.6
Sep-20	Recycling and Waste Recovery Activities in Sweden of Suez		Engages in recycling and Waste Recovery Activities	PreZero International	416.7	416.7	1.4	10.3
Sep-20	PAJU B&R Corporation		A construction waste disposal, collection, and recycling company, operates a building waste facility	INSUN Environmental New Technology	19.5	19.5	2.0	-
Jun-20	Six GRONE Plants of Human Unitec International		Operates waste recycling facilities	Palladium Investments	43.0	43.0	-	-
Jun-20	Certain assets of Waste Mgt. & Advanced Disposal Services		GFL acquired solid waste collection, transfer, recycling, disposal & additional assets portfolio	GFL Environmental	863.5	863.5	2.5	-
Jun-20	Shanghai Changying Environmental Protection Services		Engages in the collection and utilization of industrial waste, and incineration of residues	Wuxi Xuelang Environmental Technology; Xinsu Ronghe Fund	74.9	104.1	4.2	-
Mar-20	Såcab Åkericentral		Provides excavation, asphalt and hazardous waste and landfill, recycling services	Bellman Group	8.23	8.23	0.5	-
				Mean			**2.5x**	**12.2x**
				Median			**1.4x**	**7.9x**
Recycling								
Nov-23	Matsuda Sangyo (Thailand) Company		Engaged in collecting and recycling scraps containing precious and non-ferrous metals	SEAM Holdings (Thailand)	4.5	8.9	0.1x	
Nov-23	Abington Reldan Metals		Engages in the recycling and recovery of precious metals	Sibanye Stillwater Limited	211.5	211.5	0.6x	5.0x
Nov-23	Regency Technologies		Provides IT asset disposition and equipment recycling solutions	Iron Mountain	200.0	200.0	2.0x	-
Sep-23	Bond Contracts		Provider of waste management services	WasteCo Holdings	8.8	8.8	-	-

Source(s): FactSet as of 30-Nov-2023

Precedent Transaction Analysis

Date	Target	Country	Description	Buyer	Deal Value ($mn)	EV ($mn)	EV/ Revenue (x)	EV/ EBITDA (x)
Waste Management & Disposal								
Sep-23	NSL Green Steel Recycling		Provider of metal waste and scrap recycling services	JSW Steel	1.1	2.2	-	-
Sep-23	Heng Hup Holdings		Scrap ferrous metal trader	-	2.0	27.7	0.1	20.0
Sep-23	PROSHRED Baltimore		Provides paper and hard drive shredding, product destruction, and paper recycling services	RediShred Capital	4	4	2.0x	-
Aug-23	Electrical waste recycling plant of Shore Recycling		Operates as a recycling plant	Enva	12.8	12.8	-	-
Aug-23	Assets of Baltimore Scrap		Operates as a metal recycler	Sims Metal	177.0	177.0	-	-
Aug-23	Li-Cycle Norway		Engages in the lithium-ion battery resource recovery and lithium-ion battery recycling business	Li-Cycle Holdings	0.4	1.2	-	-
Jul-23	Jinsung Retech		Operates as a battery raw material recycling company	Lb Semicon	9.4	15.7	2.4	-
Jul-23	Intergreen Metals		Provider of metal waste recycling services	Unitrade Industries	14.4	28.2	-	-
Jul-23	Jiangxi Huanli New Energy Technology		Recycles waste lithium batteries and manufactures battery-grade lithium carbonate	Beijing Dinghan Technology Group	3.8	-	-	-
Jul-23	KL Resources		Offers waste paper, plastic and scrap metal collection, and recycling services	-	5.1	30.1	-	-
Jul-23	Yaan Baosheng Metal Material		Engages in recycling and processing of aluminum	Saftower Business Management	0.6	1.9	0.3	-
Jul-23	Iondrive Technologies		Developer and manufacturer of batteries intended to meet the energy storage needs	Southern Gold	0.8	0.8	-	-
Jun-23	Ningbo Huashun Yongheng Trade		Operates as a recycling company	-	11.1	11.1	-	-
Jun-23	Goodtech Environmental Solutions		Provider of water purification and biogas solutions	Nordic Construction Company	1.1	1.1	0.1	-
Feb-23	Segi Retech		Manufactures and supplies pure lead, antimonial lead alloys, and calcium lead alloys	KPS Corporation	20.9	20.9	-	-
Jan-23	Sonoco Sustainability Solutions		Manufacturer of consumer, industrial, healthcare, and protective packaging	Northstar Recycling Company	15.3	15.3	-	-

Source(s): FactSet as of 30-Nov-2023

Precedent Transaction Analysis

Date	Target	Country	Description	Buyer	Deal Value ($mn)	EV ($mn)	EV/ Revenue (x)	EV/ EBITDA (x)
Waste Management & Disposal								
Jan-23	In-Plas Recycling		Provides recycling, processing, and distribution of post-industrial scrap, pellets, regrind, and by-products.	Close the Loop	4.0	4.0	-	-
Jan-23	Town Mining		Provides collection, recycling, and selling scraps of nonferrous metals.	IS DongSeo	178.8	178.8	-	-
Jan-23	POSCO-HY Clean Metal		Provides recycling of lithium-ion batteries and related scraps.	POSCO GS Eco Materials	65.5	100.7	-	-
Dec-22	Zhongde Environmental Protection Technology		Provides treatment of solid waste and the comprehensive recycling of multi-metal complex mixtures.	Xi'an Dake Management Consulting	40.1	78.6	-	-
Dec-22	Riwald Recycling Beverwijk		Provides metal recycling services like iron turnings, beam iron, and clipping iron	ArcelorMittal	89.4	89.4	-	-
Oct-22	Recyclus Group		Provides solutions for the recycling of lithium-ion and lead-acid batteries	Technology Minerals	14.8	28.6	-	-
Oct-22	PlasCred		Provides waste plastic recycling services	Cover Technologies	3.2	3.2	-	-
Oct-22	ROCA ACERO		Operator of ferrous and nonferrous scrap metals recycling business	Steel Dynamics, Inc	-	-	-	-
Jul-22	Ouye Lianjin Renewable Resources		Offers recycling, processing, and selling steel scrap metal products.	Magang Holding	51.5	521.3	0.1	-
Jul-22	Peute Recycling		Provides paper and plastic packaging materials recycling services.	SCGP Solutions	79.5	-	-	-
Jul-22	Chun Yang International		Offers recycling services, including IT asset deposition, environmental education etc.	Golden Ponder Holdings	5.3	8.8	1.3	-
Jun-22	Resiclo		Provide plastics recycling services	Lamor Corporation	1.4	11.7	-	-
Jun-22	POLYTRADE		Operates as a recycling plastic processor company	Re.Group	121.9	121.9	-	-
May-22	Chapelle Darblay		Provides paper and cardboard recycling services	Veolia Environnement; Fibre Excellence Energie	10.1	10.1	-	-
May-22	Cedar Poly		Offers recycle services of high-density and low-density polyethylene	Deckorators	17.0	17.0	1.0	-
May-22	Operating Assets of Encore Recycling		Provide cardboard and paper recycling services	Schnitzer Steel Industries	64.0	64.0	-	-

Source(s): FactSet as of 30-Nov-2023

Precedent Transaction Analysis

Date	Target	Country	Description	Buyer	Deal Value ($mn)	EV ($mn)	EV/ Revenue (x)	EV/ EBITDA (x)
Waste Management & Disposal								
Apr-22	Recycling Hispania		Provides glass recycling services.	-	6.5	6.5	-	-
Mar-22	Cobat		Provides collection, storage, and recycling services.	Innovatec	2.6	13.1	-	-
Feb-22	TES-Envirocorp		Provides environmental engineering services	SK ecoplant	999.8	999.8	2.9	-
Jan-22	LINICO		Offers a battery metals recycling facility	Comstock	4.6	10.1	-	-
Dec-21	Sims Municipal Recycling		Provides metal and electronics recycling services	New York City Investment Fund; Closed Loop Partners	45.4	89.9	-	-
Dec-21	Assets of Atlantic Recycling Group		Provides transportation, waste management, renewing metals and equipment rental services.	Sims	37.0	37.0	-	4.2
Dec-21	Substantially all of the Assets of InStream Environmental		Provides waste stream management, recycling and maximized recovery analysis	Quest Resource Management Group	12.5	12.5	-	-
Dec-21	Heathland		Provides collection, recycling, and distribution of post-production plastic scraps	Trinseo	29.7	28.7	-	-
Dec-21	Jet Polymer Recycling		Providing plastic recycling services.	Advanced Drainage Systems	49.4	49.2	-	-
Dec-21	O F Resource Recovery Holdings		Provides resource recovery, recycling, reuse, and waste services	Close the Loop	2.2	1.8	-	-
Nov-21	Ferrous scrap steel recycling business of Metalx		Provides ferrous & nonferrous scrap processing, consulting, & management services	BlueScope Steel	240.0	240.0	-	-
Oct-21	PSC Metals		Offers processing and recycling ferrous and non-ferrous scrap metals	SA Recycling	323.0	323.0	-	5.4
Aug-21	Natural World Products		Provides recycling of household organic waste	MML Growth Capital	27.5	-	-	-
Aug-21	B-Mix Beton		Provides recycling of construction and demolition waste services	SigmaRoc	14.0	14.0	-	-
Aug-21	PRM Green Technologies		Offers collection of redundant IT equipment, data destruction, testing, and sorting	Restore	9.9	9.9	-	-
Jun-21	PET Recycling and Pelletization Facility in Pennsylvania, USA		Comprises Recycling and Palletization Facility	ALPEK	96.0	96.0	-	-

Source(s): FactSet as of 30-Nov-2023

Precedent Transaction Analysis

Date	Target	Country	Description	Buyer	Deal Value ($mn)	EV ($mn)	EV/ Revenue (x)	EV/ EBITDA (x)
Recycling								
Jun-21	Scotland's post-consumer plastics recycling facility (PRF) based in Grangemouth		Comprises plastics recycling facility	Biffa	14.2	14.2	-	-
May-21	Riverside, California plant of CarbonLite Holdings		Provides a plastic beverage bottle recycling facility	The Sterling Group	57.5	57.5	-	-
Apr-21	Amita Holdings		Provides recycling solutions	Pacific Metals	9.5	32.8	0.8	6.2
Mar-21	Rever Holdings		Offers metal and automobile recycling services	Takeei Corporation	232.3	168.4	0.6	-
Mar-21	Human N		Provides recycling solutions	Evergreen Fund 1	20.4	131.9	2.4	-
Jan-21	Chenzhou Xiongfeng Environment Technology		Engages in the recycling of waste resources and other materials	Dongjiang Environmental	65.7	93.9	0.4	-
Nov-20	Replast		Replast AS offers mechanical sorting and plastic waste recycling services in Norway.	Quantafuel	5.8	10.2	-	-
Oct-20	Jiangxi GEM Resources Recycling		Provides recycling and resource recovery of mineral resources	Wenzhou Dingxin Enterprise Management; Wenzhou Yingshang; Enterprise Management	15.8	225.6	-	-
Oct-20	Metals Recycling Plant of Mo-BRUK		Operates a ferrous and non-ferrous metals recycling and waste processing plant	-	3.2	3.2	8.0	-
Aug-20	Elemental Holding S.A.		Engages in the urban mining and recycling business	TESLA Recycling; Engel Foreign Food	3.0	206.7	0.2	4.1
Aug-20	Intergild Advanced Recycling Technologies		Offers e-waste recycling solutions	Magnetic North Acquisition	3.7	3.7	-	-
Aug-20	Single Stream Recyclers		Provides material recovery facility	Balcones Resources	40.9	40.9	-	-
Jun-20	Assets of Enviroplast		Operates plastic recycling equipment	Transcontinental	11.9	11.9	-	-
Mar-20	Viridor		Offers waste collections management, waste recycling, composting and other services	KKR	4,586.8	4,586.8	4.6	17.3
Mar-20	Zimmer		Offers ferrous and non-ferrous recycling and industrial waste collection services	Steel Dynamics	59.0	59.0	-	-
Jan-20	Evciler Kimya Madencilik ve Degerli Metaller Sanayi Ticaret		Operated as an e-waste recycling company	TESLA Recycling	4.0	8.2	-	-
				Mean			**1.5x**	**8.9x**
				Median			**0.7x**	**5.4x**

Source(s): FactSet as of 30-Nov-2023

Note: Selection Criteria – Targets in Recycling and waste management space across America, Europe, and Asia-Pacific with deal size >$1m

5.1 Public Comparable Analysis

Company	Market Cap ($mn)	Ent. Value ($mn)	EV/Sales			EV/EBITDA			P/E		
			2021A	2022E	2023E	2021A	2022E	2023E	2021A	2022E	2023E
Waste Management and Disposal											
Waste Management, Inc.	68,871	84,142	4.7x	4.3x	4.1x	16.4x	15.1x	14.4x	33.7x	29.7x	28.3x
Republic Services, Inc.	50,921	62,938	5.6x	4.7x	4.2x	18.7x	16.3x	14.4x	38.3x	32.6x	29.3x
Veolia Environnement SA	22,566	51,836	1.5x	1.2x	1.0x	11.7x	8.2x	7.4x	22.7x	18.3x	15.9x
Waste Connections, Inc.	34,924	41,958	6.8x	5.8x	5.2x	22.2x	19.0x	16.7x	41.3x	35.4x	32.4x
GFL Environmental Inc	10,626	17,520	4.3x	3.4x	3.2x	15.8x	13.6x	11.9x	86.7x	80.8x	33.8x
Fomento de Construcciones y Contratas, S.A.	6,129	12,296	1.6x	1.5x	1.3x	9.6x	9.2x	7.4x	11.4x	12.2x	11.7x
Clean Harbors, Inc.	8,744	10,817	2.8x	2.1x	2.0x	16.8x	10.9x	10.6x	43.8x	22.5x	23.4x
Stericycle, Inc.	4,346	6,092	2.3x	2.3x	2.3x	13.3x	14.1x	14.7x	21.5x	23.1x	25.7x
Casella Waste Systems, Inc. Class A	4,690	5,594	6.3x	5.2x	4.4x	26.7x	22.3x	18.9x	101.4x	82.4x	80.1x
Cleanaway Waste Management Ltd.	3,635	4,627	2.1x	2.0x	2.0x	12.0x	12.0x	10.1x	35.3x	37.5x	34.6x
TOMRA Systems ASA	2,920	3,343	2.6x	2.6x	2.5x	12.2x	14.0x	14.9x	23.4x	29.2x	34.7x
Companhia de Saneamento de Minas Gerais	1,441	2,129	1.9x	1.8x	1.6x	6.7x	5.5x	4.1x	13.5x	9.2x	5.4x
Enviri Corporation	471	1,952	1.1x	1.0x	1.0x	8.3x	9.4x	6.8x	21.3x	59.3x	NM
Seche Environnement SA	904	1,536	1.6x	1.5x	1.3x	7.9x	7.5x	6.5x	29.1x	18.9x	15.7x
Dongjiang Environmental Co. Ltd. Class A	802	1,475	2.4x	2.6x	NA	8.4x	15.9x	NA	32.8x	NM	NA
Renewi Plc	595	1,328	0.6x	0.7x	0.6x	4.4x	4.4x	4.9x	8.3x	7.5x	8.8x
Daiseki Co., Ltd.	1,352	1,259	2.5x	2.9x	2.8x	9.1x	9.1x	10.6x	20.4x	20.5x	22.0x
China Conch Environment Protection Holdings	433	1,050	4.0x	4.1x	3.8x	8.1x	10.3x	8.0x	4.7x	9.1x	7.7x
Orizon Valorizacao de Residuos SA	592	777	9.6x	6.4x	4.3x	28.7x	20.8x	7.5x	NM	NM	41.4x
Promotora Ambiental SAB de CV	236	401	1.5x	1.3x	NA	6.7x	6.4x	NA	NA	NA	NA
Nanjing Wondux Environmental Protection Technology Corp	226	258	1.6x	2.0x	NA	16.3x	33.4x	NA	NA	NA	NA
Mo-BRUK S.A.	258	245	5.3x	3.5x	4.0x	9.5x	6.2x	9.3x	9.6x	10.0x	12.8x
Lamor Corporation Oyj	91	129	2.1x	1.0x	0.9x	16.2x	6.6x	6.5x	48.5x	24.6x	12.3x
Perma-Fix Environmental Services, Inc.	99	103	1.4x	1.5x	1.2x	NM	NM	19.8x	NA	NM	58.4x
GRINO ECOLOGIC S.A.	55	70	NA	1.1x	NA	NA	7.5x	NA	NA	NA	NA
High			**9.6x**	**6.4x**	**5.2x**	**28.7x**	**33.4x**	**19.8x**	**101.4x**	**82.4x**	**80.1x**
Average			**3.2x**	**2.6x**	**2.6x**	**13.3x**	**12.4x**	**10.7x**	**32.4x**	**29.6x**	**26.7x**
Median			**2.3x**	**2.1x**	**2.3x**	**12.0x**	**10.6x**	**10.1x**	**26.3x**	**23.1x**	**24.6x**
Low			**0.6x**	**0.7x**	**0.6x**	**4.4x**	**4.4x**	**4.1x**	**4.7x**	**7.5x**	**5.4x**

Source(s): FactSet as of 30-Nov-2023

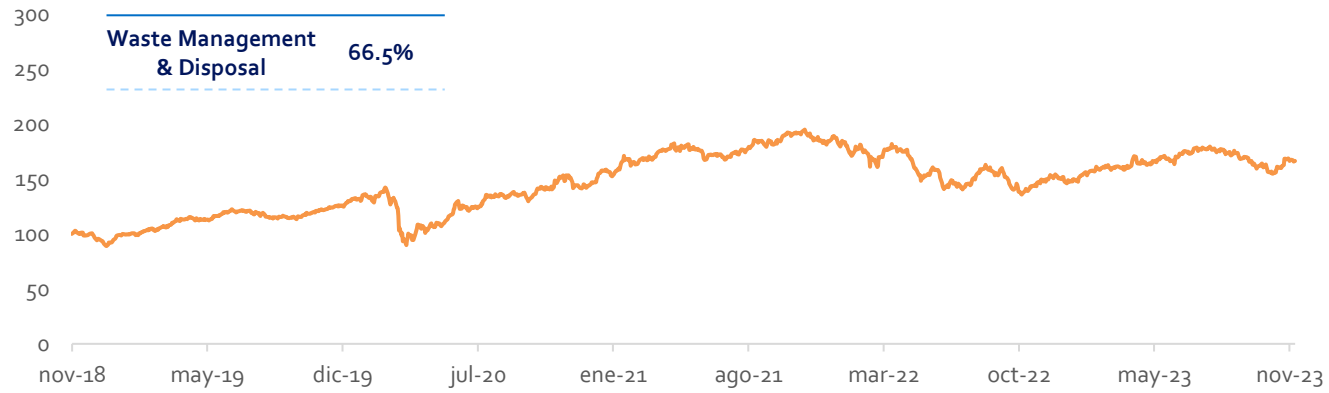
Public Comparable Analysis

Company	Market Cap ($mn)	Ent. Value ($mn)	EV/Sales			EV/EBITDA			P/E		
			2021A	2022E	2023E	2021A	2022E	2023E	2021A	2022E	2023E
Recycling											
Aurubis AG	3,718	3,454	0.2x	0.2x	0.2x	2.7x	2.7x	4.9x	11.1x	9.0x	10.6x
Befesa SA	1,404	2,100	2.2x	1.8x	1.6x	10.7x	14.2x	10.2x	12.3x	13.6x	23.6x
Daiei Kankyo	1,568	1,651	2.9x	3.3x	3.3x	9.4x	9.4x	NA	NA	NA	19.9x
Zhongzai Resource & Environment	904	1,431	2.7x	3.1x	NA	18.7x	43.7x	NA	19.0x	NA	NA
Schnitzer Steel Industries Inc	705	1,068	0.3x	0.4x	0.4x	3.5x	3.5x	7.9x	4.1x	6.6x	NM
Sungeel Hitech	972	1,048	8.2x	5.0x	5.1x	46.9x	23.3x	44.7x	NA	33.0x	75.2x
PureCycle Technologies	663	959	NA	NA	NM	NM	NM	NM	NM	NM	NM
TRE Holdings Corporation	399	613	1.0x	0.9x	0.9x	5.2x	5.2x	6.1x	NA	10.6x	11.0x
Rubicon Technologies	106	382	0.7x	0.6x	0.5x	NM	NM	NM	NA	NM	NM
Li-Cycle Holdings Corp.	157	375	NM	28.0x	NM	NM	NM	NM	NM	NM	NM
Hwaxin Environmental	472	344	2.9x	3.1x	NA	11.3x	15.0x	NA	NA	NA	NA
Insun Environmental New Technology	265	329	1.5x	1.8x	1.8x	6.3x	8.7x	8.6x	12.7x	NA	14.7x
Hangzhou Guotai Environmental Protection Technology	461	320	6.3x	5.7x	NA	13.9x	NA	NA	NA	NA	NA
Groupe Pizzorno Environnement SA	239	262	1.1x	1.1x	0.9x	5.8x	6.8x	4.5x	22.7x	12.1x	14.0x
Agilyx ASA	206	208	NM	12.6x	13.5x	NM	NM	NM	NM	NM	NM
Quest Resource Holding Corp.	142	201	1.3x	0.7x	0.7x	26.4x	13.5x	11.6x	25.3x	24.7x	35.3x
Chiho Environmental Group Limited	78	185	0.1x	0.1x	NA	1.4x	2.4x	NA	NA	NA	NA
Envipro Holdings, Inc.	129	150	0.3x	0.4x	0.4x	4.4x	4.4x	NA	7.0x	8.1x	13.0x
ALBA SE	120	138	0.3x	0.3x	NA	6.4x	7.7x	NA	10.5x	NA	NA
Pyrum Innovations AG	135	134	NM	NM	NM	NM	NM	NM	NM	NM	NM
Quantafuel AS	71	110	NM	19.7x	NA	NM	NM	NA	61.5x	NA	NA
Aurea SA	56	86	0.3x	0.3x	0.3x	3.7x	6.1x	10.8x	NA	16.9x	18.3x
Aqua Metals, Inc.	94	72	NM	NM	NM	NM	NM	NA	NM	NM	NM
PyroGenesis Canada, Inc.	64	70	2.8x	4.8x	NA	NM	NM	NA	NA	NA	NA
Polygreen Resources Co., Ltd.	18	23	2.4x	2.1x	NA	14.2x	12.8x	NA	NA	NA	NA
High			**8.2x**	**28.0x**	**13.5x**	**46.9x**	**43.7x**	**44.7x**	**61.5x**	**33.0x**	**75.2x**
Average			**2.0x**	**4.4x**	**2.3x**	**11.2x**	**11.2x**	**12.2x**	**18.6x**	**15.0x**	**23.6x**
Median			**1.3x**	**1.8x**	**0.9x**	**6.4x**	**8.2x**	**8.6x**	**18.6x**	**15.0x**	**23.6x**
Low			**0.1x**	**0.1x**	**0.2x**	**1.4x**	**2.4x**	**4.5x**	**4.1x**	**6.6x**	**10.6x**
Overall High			**9.6x**	**28.0x**	**13.5x**	**46.9x**	**43.7x**	**44.7x**	**101.4x**	**82.4x**	**80.1x**
Overall Average			**2.6x**	**3.5x**	**2.5x**	**12.4x**	**11.9x**	**11.2x**	**27.8x**	**24.9x**	**25.7x**
Overall Median			**2.1x**	**2.0x**	**1.7x**	**10.1x**	**9.4x**	**9.7x**	**22.1x**	**19.7x**	**21.0x**
Overall Low			**0.1x**	**0.1x**	**0.2x**	**1.4x**	**2.4x**	**4.1x**	**4.1x**	**6.6x**	**5.4x**

Source(s): FactSet as of 30-Nov-2023

5.2 Share Price Performance – Last Five Years

Waste Management and Disposal



We see that historically diversified players in Waste Management and Recycling have performed consistently over the years and seem to recover to pre-covid levels after a fall in 2020. Vertical Integration and services diversification constitute major advantages of this category. Companies are overcoming the challenges of inflationary pressures and are advancing mainly due to increased demand for smart innovations in waste management.

Recycling

In the case of recycling, the market reached a peak in FY'21 driven by an increase in climate pledges and commitments to reduce emissions by the adoption of advanced recycling solutions. However, the Ukraine conflict led to supply problems which impacted the growth. The companies faced several challenges in recent years, including high inflation and increased energy costs which impacted growth. Though there is an increase in demand for recycling, high processing costs, might impact further growth.

Waste Management & Disposal Recycling

Waste Management & Disposal: *WM, RSG, WCN, VIE, GFL, CLH, FCC, CWST, TOM, SRCL, CWY, CSMG3, 9793-JP, 002672-CN, NVRI, RWI, MBR, LAMOR, GRI, SCHP, ORVR3, 587-HK, 688178-CN, PASAB, PESI*

Recycling: *PCT, 9336-JP, 301203-CN, AGLX, GPE, PYRUM, QRHC, RBT, QFUEL, AURE, 8423-TW, NDA, BFSA, 365340-KR, LICY, 600217-CN, SCHN, 301265-CN, 9247-JP, 060150-KR, ABA, AQMS, 5698-JP, PYR, 976-HK*

Source(s): FactSet as of 30-Nov-2023
Note: Share price index to 100

6.1 Global Team

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Source(s): Global M&A Partners Website

6.2 Experience

Interstate Waste Services recapitalized by Littlejohn & Company and Ares.

Brown Gibbons Lang & Company

Advisor to the seller

BGL Announces the Sale of Summit Environmental Technologies to Alliance Technical Group.

Brown Gibbons Lang & Company

Advisor to the seller

The hazardous waste recycling company GB GmbH was sold to a German family office

IOM Advisory GmbH

Advisor to the seller

Pro Disposal USA acquired by Coastal Waste & Recycling a portfolio company of Macquarie Assets Management.

Brown Gibbons Lang & Company

Advisor to the seller

Sale of UK Waste Solutions, the UK's leading independent waste brokerage, to the Reconomy Group

Cooper Parry Corporate Finance

Advisor to the seller

GFL Environmental's Pennsylvania, Maryland & Delaware Solid Waste Operations acquired by Casella.

Brown Gibbons Lang & Company

Advisor to the seller

Fielding Environmental acquired by GFL Environmental.

Brown Gibbons Lang & Company

Advisor to the seller

GFL Environmental Colorado & New Mexico Solid Waste Operations acquired by Republic Services.

Brown Gibbons Lang & Company

Advisor to the seller

Circon Environmental acquired by Covanta.

Brown Gibbons Lang & Company

Advisor to the seller

ROCA ACERO S.A. de C.V. acquired by Steel Dynamics

Brown Gibbons Lang & Company & RIóN

Advisor to the seller

GFL Environmental Nashville, TN Solid Waste Operations acquired by WM.

Brown Gibbons Lang & Company

Advisor to the seller

Ecoserv, LLC acquired by CoLaTenTex

Brown Gibbons Lang & Company

Advisor to the seller

Texas Molecular acquired by VLS Environmental Solutions, a portfolio company of I Squared Capital.

Brown Gibbons Lang & Company

Advisor to the seller

Advisory to Atica on debt raising for shares buyback.

Banicol

Advisor

Sprint Waste Services acquired by GFL Environmental

Brown Gibbons Lang & Company

Advisor to the seller

NMS Capital recapitalized LDR Site Services

Brown Gibbons Lang & Company

Advisor to the buyer

New State Capital Partners acquired Wilmington Paper Corp.

Brown Gibbons Lang & Company

Advisor to the buyer

Keter Environmental Services, Inc. recapitalized by TPG Growth

Brown Gibbons Lang & Company

Advisor to the seller

Waste Division of Peoria Disposal Company acquired by GFL Environmental

Brown Gibbons Lang & Company

Advisor to the seller

Undisclosed

Sellside Advisor to ACV Enviro, a portfolio company of Kinderhook Industries

Brown Gibbons Lang & Company

Advisor to the seller

NEWSLETTER

6.2 Experience

Roy Strom Family of Companies' Refuse Services and Transfer Station Businesses acquired by Lakeshore Recycling Systems

Brown Gibbons Lang & Company

Advisor to the seller

Environmental Products & Services of Vermont, Inc. acquired by Miller Environmental Group, Inc.

Brown Gibbons Lang & Company

Advisor to the seller

Strength Environmental acquired by Valicor Environmental Services

Brown Gibbons Lang & Company

Advisor to the seller

Sale of Veriplast's French recycling business specialising in recycling of Low Density Polyethylen films to Oxxa.

Financière de Courcelles

Advisor to the seller

The sale of GAE Smith Group, trading as "Casepak" and "Oceala", to Reconomy Limited

Cooper Parry Corporate Finance

Advisor to the seller

The hazardous waste recycling company GB GmbH was sold to a German family office

IOM Advisory GmbH

Advisor to the seller

Lewis Clark Recycling & Disposal, LLC has been acquired by Waste Connections Inc. (NYSE:WCN)

Brown Gibbons Lang & Company

Advisor to the seller

Sale of Miller Environmental Group, Inc. (MEG) to GenNx360 Capital Partners

Brown Gibbons Lang & Company

Advisor to the seller

Global M&A assisted the seller in the sale of Tomra Compaction Group to San Sac group

Valentum Partners

Advisor to the seller

Sale of City Carting Holding Company, Inc. US based solid waste management and recycling company to Tunnel Hill Partners

Brown Gibbons Lang & Company

Advisor to the seller

Sale of Ecoserv Industrial Disposal, LLC to US Ecology, Inc. ("US Ecology")

Brown Gibbons Lang & Company

Advisor to the seller

Sale of EnviroServe to Savage Services ("Savage")

Brown Gibbons Lang & Company

Advisor to the seller

BGL advised on the sale of select, non-core hauling assets of Red River Waste Solutions Waste Connections (NYSE: WCN)

Brown Gibbons Lang & Company

Advisor to the seller

BGL advised on the sale of SouthWaste Services Holdings, a portfolio company of Rock Hill Capital Partners

Brown Gibbons Lang & Company

Advisor to the seller

Sale of select oilfield waste assets of Inland Environmental & Remediation, Inc. to RI-NU Environmental Service

Brown Gibbons Lang & Company

Advisor to the seller

Sale of select oilfield waste processing and disposal assets to Milestone Environmental Services LLC

Brown Gibbons Lang & Company

Advisor to the seller

Terra Renewal's Wastewater Residuals Division was acquired by Management and McLarty Capital Partners

Brown Gibbons Lang & Company

Advisor to the seller

Acquisition of Ecoentorno S.A E.S.P, Incineradores Industriales S.A E.S.P and Orco S.A by Altra Investments

Banicol

Advisor to the seller

Business portfolio evaluation of Estre, the largest waste management company in LATAM, and its equity participations

Cordaro

Advisor

Aventum Partners acted as advisor to Sponsor Capital and management in the sale of 100% of the shares in Tikomet Oy

Aventum Partners

Advisor to the seller

NEWSLETTER

RIóN MERGERS AND ACQUISITIONS

GLOBAL M&A PARTNERS

About Us

Established in 1999, Global M&A Partners is a leading international partnership of investment bankers specializing in mid-market transactions. We provide sector expertise, international scope, and deep local market knowledge and execution capabilities for our clients. We operate with local offices across 4 continents and have completed over 1,500 transactions during the last ten years, typically ranging from €50 to €500 million.