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GLOBAL RECYCLING

*The Magazine for
Business Opportunities
& International Markets*



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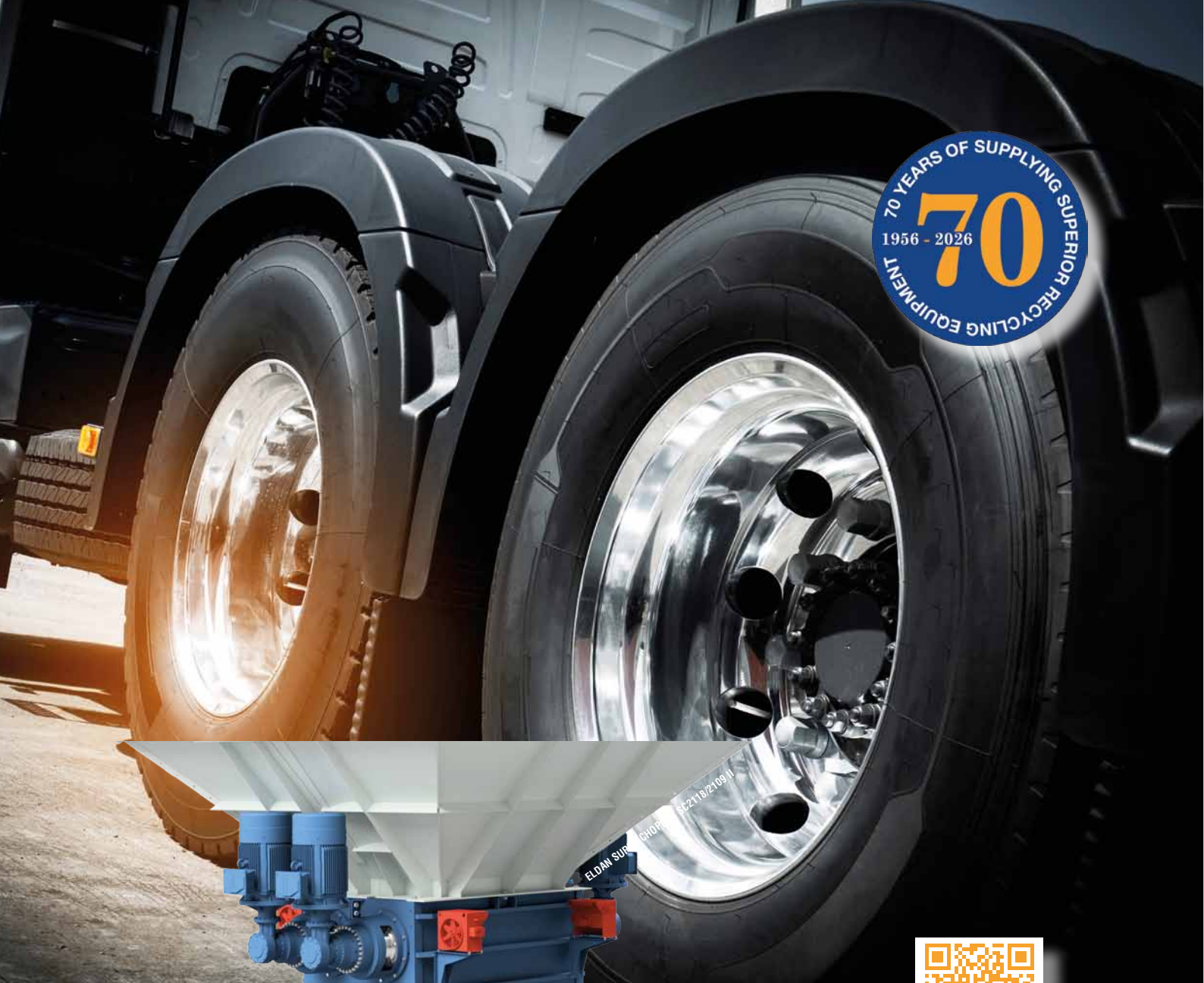
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Recycling Works: Greater Profitability Through New Applications



Brigitte Weber
Editor-in-Chief

Recycling as part of the circular economy is once again the center of the BIR World Recycling Convention & Exhibition Malaga 2026. The event will take place from 25-27 October, 2026. According to the organizers of the Bureau of International Recycling, there will be two days of high-level business and market insights with more than 1,500 delegates expected to attend from 70 countries.

At that event, the plastics market will also be an important topic. In July this year, Henk Alsema, President of the BIR Plastics Division, told in the "World Mirror" that trading activity had slowed, while competitively-priced imported materials continued to exert pressure on the European market. He expected demand to recover during September. However, the direction of virgin polymer prices and the broader economic outlook would influence purchasing behavior.

The research and consulting firm DataM Intelligence provided a more optimistic outlook: the global plastic recycling market would reach 39.97 billion US-Dollar in 2026, and is projected to reach 84.86 billion US-Dollar by 2035. Regarding Europe, Lars Enge, EVP and Head of Tomra Recycling, also took an optimistic view of business opportunities. The European Packaging and Packaging Waste Regulation (PPWR) is expected to drive growing demand for recycled content, particularly in high-value plastic applications, he is convinced. "At the same time, expectations around quality, traceability and recyclability are becoming more demanding. Together, these developments are changing the economics of recycling."

Moreover, there is the Austria-based Plastic is Fantastic Association, founded by ALPLA and other companies in the plastics industry in 2025. "Its goal is to join forces, strengthen international exchange, and work together to promote fact-based communication about plastics," one can read on its homepage. The association aims to promote the responsible use of the material, innovative circular economy solutions, and a nuanced public debate. "At the same time, it aims to increase appreciation for plastics and their importance in many areas of modern life."

More examples of potentially prosperous recycling in the future are to be found in this issue of GLOBAL RECYCLING. In Kenya, the government is convinced that investments in waste management and circular economy could provide commercial, socioeconomic and environmental returns (page 3). In Vietnam, the waste management market is expected to grow (page 5). By contrast, Norway's municipal recycling rate falls below its own claims and the continental average, but the country is well set to become a pioneer in the circular economy (page 18 onwards).

We hope you get a lot of new and useful information from reading this current magazine.

Yours

Brigitte Weber (weber@msvgmbh.eu)

P.S.: Starting next year, Marc Szombathy will take over editorial responsibility for GLOBAL RECYCLING. Many of you will already know him from his work with RecyclingPortal and EU-Recycling.



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Waste Management and Circular Economy:

INVESTMENT OPPORTUNITIES IN KENYA

The Kenyan government is convinced that investments in waste management and circular economy could be an opportunity for commercial, socioeconomic and environmental returns.

In 2021, the Republic of Kenya published the National Sustainable Waste Management Policy. In accordance with article 42 of the national constitution, “every person in Kenya is entitled to a clean and healthy environment and has a duty to safeguard and enhance the environment,” Keriako Tobiko, Cabinet Secretary of the Ministry of Environment and Forestry, stated in the preface of this document. Moreover, the national Vision 2030 says the country “aims to be a nation living in a clean, secure and sustainable environment hence lessen by half all environment related diseases”.

Therefore, addressing the waste management challenge effectively is an important step of the country on the way to a circular economy, which would create green jobs and wealth from the waste sector, and realize the nation’s sustainable development goals. “Sustainable waste management is also fundamental to delivery of each of the government’s ‘Big Four’ national priorities – the transformational agenda on housing, manufacturing, food and nutritional security and health care – and to Kenya’s leadership in the blue economy, with its focus on creating economic growth,

ensuring healthy waters and building safe communities”. In 2022, the Sustainable Waste Management Act was published in the Kenya Gazette Vol. CXXIV - No. 158 on 12 August 2022.

No systematically collected data, but estimates

As reported in 2021, the East African country generated an estimated 22,000 tons of waste per day calculated by assuming an average of per capita waste generation of 0.5 kilograms for a population of then 45 million; this meant an amount of eight million tons annually. According to extrapolations, 40 percent of the waste was generated in urban areas. However, at that time forecasts anticipated urbanization would increase by ten percent by 2030 and the urban population would be generating about 5.5 million tons of waste every year. “Past inventories estimate that 60 to 70 percent of waste generated is organic, 20 percent plastic, 10 percent paper, 1 percent medical waste and two percent metal. Inefficient production processes, low durability of goods, unsustainable consumption and production

patterns lead to excessive generation of waste,” the policy document stated. Due to the absence of systematically collected data on waste streams in Kenya, the main sources of waste were households, manufacturing, commerce, health care, agriculture, waste treatment, construction industry and mining waste. The municipal waste was often unsorted and contaminated – the problem is still relevant up to today. “Despite efforts to encourage reuse, recycling and recovery, the amount of solid waste generated remains high and appears to be on the increase,” the information said.

At that time, approximately 40 percent of the population in many parts of major cities received waste management services; in areas of low income and informal settlements, there were no waste collection systems at all. “All counties in Kenya currently have uncontrolled waste dumpsites where leachate pollutes waterways and underground aquifers, and where burning waste emits toxic air and noxious fumes that contaminate the air,” the policy paper described the situation. “There is no systematic waste segregation at the source and the recovery of recyclable items like plastics, papers, glass and metals is done by informal waste picker groups who recover only a fraction of the total recyclable materials, mostly directly from the dumpsite. Informal waste pickers at these dumpsites are exposed to toxic chemicals (from batteries and other waste and burning plastics) air pollution and pests that spread disease.”

There is recycling

Regarding recycling, initiatives existed across the country in 2021. For example, waste pickers were organizing into cooperatives. The same applied to programs to create jobs in waste collection, sorting and recycling for youth and women. “In some areas, Kenyan entrepreneurs have launched small scale production of organic compost from organic waste. Small-scale, artisanal recycling of glass, plastic and metal is converting some waste into crafts for the domestic and international market.”

The Kenyan county governments were also active and had contracted private waste management firms to collect garbage, transport and dispose waste and other related services. Many counties also supplied bins, liners and collection bags. At that time, in wealthier areas, waste was collected twice a week, while in middle-income areas, it was collected once a week, and in low income and margin areas there was no waste collection at all. “Franchising systems for waste collection have been tried by a number of counties whereby a county is zoned, and private sector firms assigned to deliver waste management services to the designated zones and are in charge of both fee and waste collection,” the policy paper gave account. “This approach has not been efficient as the firms compete for contracts in the wealthier areas but decline to service poorer areas and are vulnerable to corruption.” The system would rely on the under-resourced public sector for enforcement.

Moreover, waste recycling companies had indicated that extracting recyclable materials was often impossible in practice, as most household waste had not been sorted; cleaning recyclables that have been comingled with waste would be expensive. In 2021, recycling companies were also faced with challenges including opaque regulatory requirements, a multiplicity of licenses and charges, lack of distinction in licensing of waste collection and recycling companies. Additionally, a lack of sufficient controls at recycling sites were frequently leading to their use as dumpsites rather than materials recovery centers. “The high level of privatization of waste management services by counties without proper regulation and enforcement has also led to uncoordinated delivery of waste services to citizens,” the paper stated. “Strict regulation and enforcement of waste services provision by the private sector in Kenya is crucial.” The described situation is changing with the policy developments, including the Sustainable Waste Management Act and Extended Producer Responsibility (EPR) frameworks, which are helping to create a more enabling environment for investment.

Deal: Plastics Recycling

In March this year, Kenya International Investment Conference took place in Nairobi. The conference, organized by Invest Kenya (the Kenyan investment authority), aimed to position the African country as a preferred international investment destination, sign strategic deals and highlight Kenya’s investment opportunities. As reported by the state authority, the event was a success: It was opened with the announcement of over 2.9 billion US-Dollar in investment deals expected to create more than 63,000 direct jobs across the country. According to Invest Kenya, this would reflect growing investor confidence in Kenya’s economy and long-term growth outlook. Among the deals regarding the key sector manufacturing, which secured nearly 600 million US-Dollar, was plastics recycling as a business chance. Further deals related to fertilizer production, textiles, solar panel manufacturing, and glass production.

 investkenya.go.ke

The multi-million Dollar opportunity

Today, Kenya has the potential to position itself as the anchor of the circular economy in East Africa and the wider region, the country's investment authority is convinced. As underlined, Kenya's waste streams would represent a significant and untapped economic opportunity.

Research by the National Environment Management Authority (NEMA) would suggest that by 2030, the country could unlock economic gains from the circular economy. A value of about 730 million US-Dollar is expected from agro-food, plastics, construction, electrical and electronic equipment (EEE) and e-waste, plus general waste. Furthermore, 335 million US-Dollar are projected from secondary material sourcing. As also estimated, the export could grow by 40 million US-Dollar.

A current prospect titled "Waste Management and Circular Investment Opportunity in Kenya", published this year by the country's Ministry of Investments, Trade and Industry in tandem with the national investment authority Invest

Kenya, would set out where and how private capital could accelerate the country's circular economy and waste transition over the next years. It was developed by a collaboration between Invest Kenya, Systemiq, a system change company systemiq.earth, ALN Kenya, an alliance of leading law firms aln.africa and TakaTaka Ni Mali, an organization dedicated to connections in the waste management ecosystem in Kenya takanimali.org.

As emphasized, the prospect is intended to support more coordinated action between policymakers, investors, businesses and development partners. It would identify four investor archetypes across circular value chains, outline the enabling policy landscape, and present a pipeline of scalable opportunities – providing practical pathways for investor engagement and clarity on what needs to happen to move from ambition to implementation in building a more resource-efficient and inclusive economy.

investkenya.go.ke/wp-content/uploads/2026/03/202603_Invest-Kenya_Sector-pack_Waste-Management_Circular-Economy_vPublish.pdf

Vietnam:

WASTE MANAGEMENT MARKET TO GROW

The market research firm IMARC estimates that the Vietnam waste management market will reach 12.9 billion US-Dollar by 2034, exhibiting a growth rate (CAGR) of 6.60 percent during 2026-2034. In 2025, this sector was valued at 7.2 billion US-Dollar. "The rising shift toward sustainable construction practices, escalating waste volumes, increasing international pressure to meet environmental goals, and the integration of smart technology solutions for waste collection represent some of the key factors driving the market," the multinational company stated.

According to the information, Vietnam's market is experiencing significant growth driven by the increasing waste generation due to rapid urbanization and industrialization. Moreover, stricter waste management regulations and policies, driven by

the Vietnamese government's active promotion of environmental sustainability, are expected to positively influence market growth. "Apart from this, the heightened awareness among the population about the importance of proper waste disposal and recycling has catalyzed market growth. Additionally, extensive investments in the waste management sector due to increasing emphasis on circular economy practices, including waste-to-energy initiatives, repre-

sent another major growth-inducing factor." This enumeration does not cover all the reasons identified: The rising corporate social responsibility initiatives have also augmented the demand for eco-friendly waste management practices. "Along with this, the rapid expansion of the tourism industry and the escalating need for sustainable waste disposal solutions are propelling market growth". Moreover, there are international collaborations and investments in waste management infrastructure and technologies, which are contributing to market growth, as well as favorable government incentives and subsidies encouraging private sector participation, escalating waste volumes and the need for efficient disposal methods.

imarcgroup.com/vietnam-waste-management-market



A “TIRE-TO-TIRE”-PROJECT FOR EUROPE

The project partners BASF, Pirelli, Pyrum and Synthos have started a “tire-to-tire” circular economy initiative in Europe, “driving the development of an industrial ecosystem designed to increase the use of recycled materials derived from end-of-life and scrap tires”. One of the objectives is to reduce reliance on virgin raw materials. Pirelli coordinates the project.

As reported, the process draws on end-of-life tires collected across Germany, from some driver retail outlets and motorsport activities, as well as scrap tires collected from Pirelli’s Breuberg plant. “They are processed through an industrial chain designed to maximize their inner value, converting them into secondary raw materials – including synthetic rubber – certified under the ISCC PLUS scheme. This ensures traceability along the value chain and enables the circular materials’ reintroduction into the manufacturing of new Pirelli tires, maintaining their highest standards of quality and performance,” the four partners emphasized in July this year. “Within this process, Pyrum converts end-of-life and scrap tires through a pyrolysis process – a high-temperature thermal decomposition of materials in the absence of

oxygen – into two valuable secondary raw materials: recovered carbon black (rCB) and tire pyrolysis oil (TPO). The recovered carbon black is upgraded in quality and directly reintroduced into Pirelli’s European production, partially replacing virgin carbon black.”

The TPO is delivered to BASF, where it is co-fed with fossil-based feedstock into the production process of chemical products such as butadiene and styrene. “A mass balance approach enables attributing the recycled content to the ISCC PLUS-certified Ccycled products. These circular materials are then used by Synthos to produce ISCC PLUS-certified synthetic rubber for

high-performance tire applications, which Pirelli reintroduces into its production processes, closing the loop.”

According to the European companies, the project would perfectly reflect that a single company acting alone could not achieve genuine product circularity. “It requires creating industrial ecosystems involving players with complementary expertise, each contributing to different phases of the transformation process around a shared material loop. Through collaboration and the combination of technological innovation, material science, and certified processes, the partners, driven by Pirelli, build a coordinated system in which materials are recovered, transformed and reused by maximizing their inner value.” The European “tire-to-tire” project would represent “the most comprehensive application of this approach to date, demonstrating how end-of-life tires can become a valuable resource within a structured and traceable industrial loop”.



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Photo: MSV-Archiv

RARE EARTH MAGNETS MARKET TO GROW

According to the latest study by Persistence Market Research, the global rare earth magnets market is expected to be valued at 15.8 billion US-Dollar in 2026 and is projected to nearly double by 2033 reaching 30.4 billion US-Dollar. “This remarkable growth is primarily driven by increasing demand for electric mobility, expanding renewable energy infrastructure, rapid industrial automation, and continuous innovations in high-efficiency electronic devices,” the provider of this market report emphasized.

As countries worldwide would prioritize carbon neutrality and energy-efficient technologies, rare earth magnets are emerging as one of the most strategic materials supporting the next generation of clean energy and advanced manufacturing systems.

🌐 persistencemarketresearch.com/samples/35599

OPTIMISTIC OUTLOOK FOR BATTERY RECYCLING ON A GLOBAL SCALE

According to DataM Intelligence, the global battery recycling market, which was valued at 3.39 billion US-Dollar in 2025, is projected to reach 40.72 billion US-Dollar by 2035, expanding at a CAGR (compound annual growth rate) of 28.3 percent from 2026 to 2035.

“The market has emerged as one of the fastest-growing segments within the circular economy, driven by the rapid adoption of electric vehicles (EVs), expanding battery energy storage systems (BESS), and increasing demand for critical minerals such as lithium, nickel, cobalt, graphite, and manganese,” the market research and consulting firm informed. “Investors

are increasingly focusing on advanced battery recycling technologies that recover high-value materials, reduce dependence on virgin mining, and strengthen domestic critical mineral supply chains. Supportive government regulations, extended producer responsibility (EPR) policies, and sustainability commitments from automotive and battery manufacturers are further accelerating investment in large-scale recycling infrastructure.”

Investment momentum would continue to strengthen as battery manufacturers, automotive OEMs, recycling companies, and mining firms expand recycling capacity through strategic partnerships, acquisitions,

and next-generation hydrometallurgical and direct recycling technologies. Recovery rates were improved due to developments in closed-loop battery recycling, AI-powered battery sorting, black mass processing and material extraction. At the same time, environmental impact and production costs declined. “Looking ahead, the growing volume of end-of-life EV batteries, advances in second-life battery applications, and increasing localization of battery supply chains are expected to create significant commercial opportunities,” DataM Intelligence emphasized.

datamintelligence.com/download-sample/battery-recycling-market?sai-v

THE GLOBAL FOOTWEAR RECYCLING MARKET

According to BCC Research LLC, the global footwear recycling market is projected to grow from 1.5 billion US-Dollar in 2025 to nearly 3.0 billion US-Dollar by 2031, advancing at a compound annual growth rate (CAGR) of 11.6 percent over the forecast period 2026–2031. The company has identified accelerating regulatory mandates and mounting ESG-driven brand commitments as the central forces reshaping the economics of footwear end-of-life management.

collection infrastructure, processing facilities, and digital traceability platforms. However, execution risk is real: footwear’s multi-material complexity – up to 60 distinct materials per shoe – keeps processing costs elevated, while underdeveloped reverse logistics in developing markets limits collection volumes. High capital expenditure requirements for commercial-scale facilities create barriers to entry but also protect returns for incumbents.”

Companies with proprietary sorting technology, established brand partnerships, and scalable take-back infrastructure – such as TerraCycle and TEXAID Schweiz AG – were positioned to capture disproportionate market share as regulatory pressure intensifies.

bccresearch.com/market-research/environment/footwear-recycling-market.html

“Investors should view the global footwear recycling market as an early-stage industrial opportunity with a credible, regulation-anchored demand floor and significant upside as chemical recycling and AI-enabled sorting technologies mature,” BCC Research is convinced. “The doubling of market size from 2025 to 2031 implies sustained capital deployment across



TURNING CITY WASTE INTO BIO-BASED END PRODUCTS

At the end of July, the European project SOWISE+ (Solid Organic Waste into Sustainable End-Products) was launched in Italy. It aims to demonstrate a first-of-its-kind multipurpose bio-refinery for the valorization of urban bio-waste and post-consumer absorbent hygiene products into advanced bio-based materials and products. By combining waste management, biotechnology, material science, industrial demonstration and stakeholder engagement, the 24 project partners from seven European countries aim “to create a lighthouse



Photo: SOWISE+

example for integrated urban-industrial symbiosis across Europe”. SOWISE+ runs until 30 June 2031 and

is co-funded by the European Union.

sowiseplus.eu

USA RARE EARTH TO STRENGTHEN ITS EUROPEAN PARTNERSHIP

USA Rare Earth, Inc. announced that it has entered into definitive agreements to acquire strategic minority stakes in Carester SAS, a French leader in rare earth processing and separation. InfraVia – acting through its Critical Metals Fund, seeded by the French State as an anchor investor alongside private institutional capital – is acquiring a similar stake in Carester

alongside USA Rare Earth. The agreements would finalize the strategic investment and commercial framework the parties announced in April 2026, the information said. “In addition to targeting healthy returns, USA Rare Earth and its subsidiary Less Common Metals Europe will have the ability to purchase a portion of Carester’s oxide output from its Caremag facility.

USA Rare Earth will have access to Carester’s engineering capabilities and related intellectual property for separation, processing, and recycling. In turn, Carester will have access to USA Rare Earth feedstock sources, including Serra Verde and the Round Top deposit in Texas.”

usare.com, carester.fr

SERVICE AGREEMENT FOR RECYCLING SOLAR PANEL MANUFACTURING MATERIALS

Comstock Inc. has entered into a Solar Material Recycling Services Agreement with Illuminate USA LLC. Under the new agreement, Comstock Metals will provide comprehensive recycling services for solar panel materials from Illuminate USA’s advanced manufacturing operations in Pataskala, Ohio. “The services include safe transportation, sorting, and envi-

ronmentally responsible recycling for a broad range of solar panel manufacturing byproducts.”

While Illuminate USA operates the largest single-site solar panel manufacturing facility in North America, Comstock operates a growing, strategically positioned national recycling network to serve customers through-

out the broader Midwest, one of the larger and most centrally located solar markets in the country. The agreement would further position the two companies as leaders in the solar panel recycling and advanced manufacturing industries, respectively.

illuminateusa.com
comstock.inc

ZETON TO DESIGN AND BUILD MODULAR PLASTIC-TO-OLEFINS PLANT FOR REFINITY

USA-based firm Refinity, a company transforming hard-to-recycle plastic waste into chemical intermediates, has selected Canada-based Zeton Inc. to complete final detailed engineering plans for, and to build and deliver, a 10,000 ton-per-annum modular waste plastics-to-olefins commercial demonstration plant.

For Refinity, which is part of Innventure, Inc., this is an important step toward advancing its commercialization strategy for circular olefin production sited alongside third-party petrochemical steam crackers. The company plans to supply circular feedstock to the ethylene and propylene markets worth 300 billion US-Dollar as well as

the polyethylene and polypropylene plastics markets, which are estimated at 400 billion US-Dollar. Zeton's modular, factory-built approach would be expected to provide Refinity with a repeatable plant design required to scale the business, the information said.

refinity.com, zeton.com

INDIA: SHIP RECYCLING TONNAGE AT ALANG GREW IN THE FIRST HALF OF THE YEAR

As reported by BigMint, an Indian platform for price reporting, market intelligence and consulting for commodities, India's ship recycling industry increased recycled volumes at Alang by 16 percent year-on-year to

569,000 light displacement tons (LDT) in 2026. One year earlier it was 491,500 LDT, "despite vessel arrivals remaining broadly unchanged at 51 ships compared with 52 ships" in the first half of 2025. As per BigMint, larger tankers

and container ships, rather than higher vessel arrivals, drove the increase in dismantling volumes.

bigmint.co

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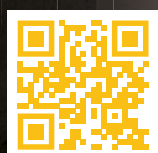
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Eugenio Bascuñan, Industrial Manager at Recupac

New Plastics Recycling Regulations in Latin America:

RECUPAC AND LINDNER DEMONSTRATE A SUCCESSFUL PATH FORWARD IN CHILE

New regulations in Chile, Colombia and, most recently, Brazil are introducing mandatory recycling and extended producer responsibility targets, reshaping the economics of the plastics industry across the region. In Chile, Recupac, part of the Coipsa Group, demonstrates how advanced technology, process control and strategic partnerships can transform post-consumer plastic waste into high-quality recycled raw materials.

The Latin American plastics recycling industry is undergoing a major transformation, driven by a structural shift: The growing number of regulations requiring manufacturers and importers to return the plastic they place on the market back into the production cycle. In October 2025, Brazil enacted Decree No. 12,688/2025, regulating the reverse logistics of plastic packaging and establishing two key targets: a recovery rate, measuring the collection and proper treatment of plastic packaging, and a recycled content index, which introduces a mandatory minimum recycled content of 22 percent from 2026 onwards, with non-compliance subject to fines of up to BRL 50 million.

Brazil is following a path already established by its neighboring countries. Since 2016, Chile has enforced the REP

Law (Law No. 20,920), targeting a 32 percent plastic recovery rate by 2026, while Colombia adopted Law 2232 in 2022, requiring PET bottles to contain a minimum of 50 percent recycled content, rising to 90 percent by 2030. The regional trend is clear: increasingly ambitious recycling targets and legally driven demand for recycled materials are creating new opportunities for companies such as Chile's Recupac and technology partners like Lindner Washtech.

From waste management to material

Recupac, the waste management division of the Coipsa Group, has spent more than 35 years building its role in Chile's circular economy. The company serves approximately 500 customers and manages more than 150,000 tons of waste annually. Its latest milestone is its LDPE recy-

cling facility in San Bernardo, with a production capacity of 500 tons per month, where recycled pellets already replace approximately 40 percent of the virgin resin used in new plastic film production.

“At Recupac, we play a well-defined role within Chile’s circular economy by helping our customers become more competitive through integrated waste management focused on maximizing material value with full traceability and a circular approach,” explains Macarena Hadad, Business Development Deputy Manager at Recupac. According to her, the LDPE project emerged from the realization that simply managing this material was no longer enough. “We saw an opportunity to go one step further by transforming it into a new recycled raw material capable of re-entering manufacturing processes.”

The key to consistent, high-quality recycled

Transforming post-consumer plastics – heterogeneous, contaminated materials from highly variable sources – into consistently high-quality recycled pellets requires rigorous process control at every stage: from collecting materials directly from customers, through sorting and baling operations, to secondary quality inspection and the recycling line itself, including shredding, washing, drying and extrusion.

The washing stage creates a clean and homogeneous material stream that integrates seamlessly with the downstream Erema extrusion line, Lindner’s long-standing technology partner in plastics recycling. “The quality of the final pellet depends on how well both processes work together. It is not simply about achieving excellent washing or extrusion individually, but about maintaining a fully integrated, continuous and controlled process from start to finish using state-of-the-art technology,” she summarizes. According to Recupac, the results are reflected in both product consistency and operational reliability. “The implementa-

tion of this recycling line has represented a significant step forward. Today, we operate a far more stable process with higher cleaning efficiency, more consistent pellet quality and greater operational efficiency,” says Bascuñan, emphasizing that these improvements provide greater confidence in meeting increasingly demanding customer and industrial application requirements.

Lindner expands its presence in Latin America

Beyond the technology itself, both Recupac executives emphasize the importance of the close partnership established with Lindner throughout the project. “Local support has been essential. I would describe our collaboration with Lindner as one built on mutual cooperation and continuous support.”

The Recupac project reflects a broader strategic direction at Lindner and Lindner Washtech, a specialist in plastics washing technologies that continues to expand its portfolio of solutions to meet the increasing quality requirements of recycled plastics.

To support this growth throughout the region, the company established Lindner subsidiary in 2025, with headquarters in São Paulo, Brazil, under the leadership of Frederico Hartmann. The new subsidiary strengthens Lindner’s regional presence by providing local technical support, project development, and commercial assistance.

As the circular economy continues to expand and regulations increasingly promote the use of recycled content across Latin America, Lindner reinforces its commitment to serving as a strategic partner for the regional recycling industry.

🌐 lindner.com

🌐 recupac.cl

Photos: Lindner-Recyclingtech GmbH



SUBSTANTIAL FUNDING TO RECOVER MORE CRITICAL RAW MATERIALS

The Italian company Circular Materials, which recovers strategic metals from industrial wastewater, has raised 11.8 million Euro in SAFE Financing. Investors include CDP Venture Capital, the European Innovation Council Fund, EIT RawMaterials, 360 Capital, Corbites, and Lumar S.r.l., with the operation being supported by independent law firm Bonelli Erede.

As reported, the funding will support the company's next phase of growth as it moves from industrial validation towards broader commercial deployment of its recovery platform. "Proceeds will primarily be used to advance the development of its next Circular Materials Hub in Ferrara, strengthen operational capabilities, and support the continued scale-up of its proprietary Supercritical Water Precipitation (SWaP) technology." According to the company, its technology is designed to recover more than 99 percent of dissolved metals from complex industrial wastewater streams while reducing the generation of hazardous sludge.



Photo: Circular Materials

Founded in 2019, Circular Materials has developed a process that treats industrial wastewater containing dissolved metals and recovers secondary raw materials that can be reintroduced into industrial supply chains. "The company's technology is designed to address a growing challenge facing European industry: the loss of strategic metals through wastewater treatment processes and the increasing need for

more resilient sources of critical raw materials." The Italian firm currently operates its first industrial facility in Padua. Earlier this year, the facility achieved End-of-Waste status under the EU Waste Framework Directive, enabling materials recovered through the process to re-enter industrial supply chains as secondary raw materials.

circularmaterials.it

GONDOLA RAILCARS BUILT FROM RECYCLED STEEL

The internationally active Greenbrier Companies, Inc. has announced the completion of 50 gondola railcars built as part of a pioneering circular economy collaboration with SSAB Americas and Alter Trading Corporation. "The effort demonstrates how lower-emissions steel, innovative railcar design, and closed-loop recycling can work together to reduce environmental impact while supporting industrial supply chains," the USA-based company emphasized.

The railcars were manufactured using SSAB Zero steel, produced from recycled steel using fossil-free electricity and designed to achieve near-zero fossil carbon emissions. Greenbrier incorporated the material into railcars, adding high-strength steel to reduce overall car weight while maintaining structural integrity and enhancing durability. "The lighter-weight design increases payload capacity, improves transportation efficiency, and helps reduce lifecycle emissions," the com-

pany informed. The railcars would be delivered to Alter, "where they will begin service transporting recycled metals, including end-of-life steel, to SSAB's steelmaking facility in Iowa. There, the material will be melted and transformed into new steel products, creating a continuous recycling loop that keeps valuable materials in use and reduces reliance on virgin raw materials."

gbrx.com

COLLABORATION TO RECYCLE MEXICAN POST-CONSUMER PLASTIC PACKAGING

Selected streams from Mexico's flexible and multilayer plastic waste, a category estimated at approximately 1.5 million tons annually, advance to testing for circular feedstock evaluation.

Canadian company Aduro Clean Technologies Inc. has announced that its collaboration with Mexican ECOCE, A.C., a non-profit civil association, has advanced the selected post-consumer flexible plastic packaging streams in Mexico. Now they are moving into a Hydrochemolytic Technology (HCT) test campaign to evaluate their conversion into liquid hydrocarbon products for downstream circular plastics applications.

The collaboration, announced in December 2025, is structured as a phased, data-driven evaluation of flexible plastic packaging collected through recovery systems in Mexico.

"Phase 1 drew on ECOCE's ongoing national feedstock mapping program, conducted for its member companies, from which the parties completed the selection of candidate material streams for the next stage of work. Led by ECOCE, the mapping identified multiple post-consumer flexible packaging streams and assessed them for estimated availability, collection routes, physical form, contamination profile, and preparation requirements. The work identified candidate streams with sufficient available volume to support an industrially relevant evaluation and with material characteristics that warrant advancement to HCT testing," Aduro gave account.

According to the information, approximately 1.5 million tons of flexible plastic packaging are generated annually in Mexico. ECOCE's work with leading food and beverage companies, representing more than 400 brands,

would give the collaboration practical relevance to packaging value-chain priorities and the need for credible circularity options for difficult-to-recycle flexible packaging. "The objective is to build an evidence-based understanding of how selected flexible packaging streams can move through a circular value chain: from post-consumer collection and characterization, through feedstock preparation and HCT conversion, to liquid hydrocarbon products for evaluation by petrochemical and polymer value chains." Results from the next phase would give Aduro and ECOCE the technical and economic evidence to help assess material suitability, product quality, scale-up requirements, and future commercial options for returning difficult-to-recycle flexible packaging to the plastics value chain.

adurocleantech.com

ecoce.mx

WELTEC BIOPOWER TO DELIVER BIOENERGY LANDMARK FACILITY IN AUSTRALIA

The Queensland-based vegetable business Kalfresh has signed an agreement with the German company Weltec Biopower to design and build a bioenergy facility in Kalbar, South-East Queensland. The facility will anchor the new Scenic Rim Agricultural Industrial Precinct. The project will be delivered in three stages. The first stage involves constructing a large digester, measuring 31.48 metres in diameter and 8.8 metres in height, together with a digestate storage tank. The facility will be supported by Weltec's newly implemented control system. As underlined, the partner-

ship would unlock the paddock-to-power potential of Kalfresh's vertically integrated business, which would turn crop residues, processing offcuts and agricultural waste into several renewable by-products. "A by-product,

a nutrient-rich digestate, will be returned to farms as a bio-fertilizer, advancing Kalfresh's long-term vision of circular agriculture." The new Scenic Rim Agricultural Industrial Precinct will co-locate advanced food manufacturing on a 40-hectare site fronting the Cunningham Highway and approximately one hour from Brisbane. It will feature 16 serviced lots, including three occupied by Kalfresh, with access to on-site renewable power and circular waste services.



kalfresh.com.au/bioenergy/

weltec-biopower.com

DENOVIA SIGNED STRATEGIC FRAMEWORK FOR GLOBAL INDUSTRIAL SCALE

Denovia Inc., a Canada-based developer of molecular recycling technology, announced that it has executed a strategic technology licensing and commercialization framework agreement with a major international polyester materials producer. The partner interested in advanced depolymerization technology designed to break PET and polyester waste down into reusable chemical monomers has not been mentioned.

“The agreement marks a significant step in Denovia’s transition toward industrial-scale commercialization,” the company gave account. It would establish a structured pathway to evaluate, validate and potentially deploy its proprietary technology within the partner’s established polyester recycling and manufacturing operations, “beginning with engineering and commercial validation and targeting an initial commercial facility with annual processing capacity in the tens of millions of pounds”. Subject to successful technical and commercial validation, feedstock availability, required approvals, financing, mutually



Denovia's advanced depolymerization platform. Photo courtesy of Denovia.

acceptable economics and definitive agreements, the framework would identify a potential future multi-facility deployment opportunity capable of scaling to billions of pounds of material annually.

As reported, the parties plan to assess how Denovia’s technology could complement existing recycling and manufacturing capabilities, targeting complex feedstocks that conventional mechanical recycling can struggle to handle. Potential materials include post-industrial polyester waste, textile waste, contaminated or mixed polyester streams, automotive-related polyester materials and other challenging PET- or polyester-containing feedstocks. “The signed framework includes legally binding provisions concerning intellectual property,

confidentiality, public disclosure, non-exclusivity, costs, governing law, a condition precedent and related matters,” Denovia emphasized. “It also records the parties’ present commercial intentions and a phased roadmap for contemplated initial deployment and potential expansion.”

Furthermore, the framework would not require either party to construct a facility, process a minimum volume, enter into a definitive technology license, or expand. “Those milestones remain subject to successful validation and applicable definitive agreements. Denovia retains exclusive ownership of its proprietary technology and intellectual property throughout the collaboration.”

 denovialabs.com

Photo: Denovia



CHINESE TECHNOLOGY FOR WASTE PLASTIC PYROLYSIS LINE TO PRODUCE SAF

Chinese company Niutech Technology Group Co., Ltd, specialized in industrial continuous pyrolysis technology, has signed a sales agreement “with a global energy major for an Industrial Continuous Waste Plastic Pyrolysis Production Line”. It would run on the company’s proprietary patented pyrolysis technology and deliver “safe, environmentally sound

operation with a single-unit processing capacity of 10,000 to 50,000 tons per year”. As reported, the agreement marks Niutech’s first entry into the customer’s equipment supply chain and the start of a long-term partnership. “As part of its sustainability commitments, the customer has steadily expanded investment in renewable energy in recent years and made

Sustainable Aviation Fuel (SAF) a strategic priority. Under the agreement, Niutech’s technology and equipment will be deployed to upgrade a large refinery owned by the customer. Once complete, the refinery will have an integrated capability from pyrolysis oil to hydrotreated SAF.”

 niutechpyrolysis.com

JOINT FORCES TO BUILD A NEW INDEPENDENT PLATFORM FOR WASTE MANAGEMENT

Two companies, Seenons and Junkbusters, intend to strengthen circular waste management across Denmark, Sweden and Germany. Junkbusters, a Danish-born waste management company operating in these three markets, with expertise in construction and demolition waste, will become part of the Netherlands-based Seenons Group.

Together, both companies would combine full-service waste management, local expertise and tech-enabled solutions to help organizations reduce waste, increase circularity and gain greater transparency into their waste streams, the information said. For their customers and partners in all three countries, operations would remain unchanged; the integration would take place gradually.



From left to right: Steffen Rasmussen, Mark Fromholt, Stijn Smetzers and Joost Kamermans

As underlined, this partnership marks another step in the Dutch company's ambition to build a leading indepen-

dent platform for transparent and sustainable waste management. "Following earlier expansions into Belgium, Denmark, Switzerland and Sweden, Seenons continues to scale its European network, supported by investors including Fortino Capital and Invest-NL, who share Seenons' belief that impact and commercial success go hand in hand, and that major societal challenges are solved by building strong companies with healthy business models." Both investors believe reducing waste and accelerating circularity requires solutions that combine technology, data and strong local execution. "This acquisition reflects the type of mission-driven growth they are committed to supporting."

 seenons.com

 junkbusters.dk

Photo: Seenons/Junkbusters



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GREYPARROT RAISED NEW FUNDING FOR AI WASTE INTELLIGENCE PLATFORM

According to the UK-based company, the money will scale Greyparrot's AI waste intelligence platform to make secondary materials measurable, recoverable and investable worldwide. The investment would follow a significant milestone for its AI, which had detected more than one trillion waste objects.

The 27 million US-Dollar in Series B funding, led by technology investor Omar Mir, will help the company scale its technology to abate over one million tons of waste by 2030. "The funding comes as the waste and packaging sectors face growing pressure to improve recovery, demonstrate

compliance and provide more reliable information on material flows," the information said. "Greyparrot's AI camera systems, known as Analyzers, are installed above sorting belts in recycling facilities across more than 20 countries. They identify materials, products and brands in real time, giving operators continuous data on the composition and movement of waste through their facilities." The company's customers include waste and recycling companies – for example WM, Circular Services, Veolia, Biffa and FCC – as well as brands wanting to understand how packaging performs after disposal. This also applies to consumer goods companies including

Unilever, L'Oréal and Kenvue. They use Greyparrot's Deepnest platform "to inform redesign, compliance and exposure to fees under Extended Producer Responsibility (EPR) schemes and the EU Packaging and Packaging Waste Regulation (PPWR)". The same verified data would be beneficial for regulators, national waste audits and statutory reporting. "In a UK first, the Environment Agency accepted Greyparrot AI-derived waste composition data for statutory compliance reporting in Q1 2026, in submissions from customers Biffa and FCC," the AI waste intelligence company gave account.

 greyparrot.ai

RUF HAS A NEW SUBSIDIARY IN THE USA

German briquetting system manufacturer RUF Maschinenbau GmbH & Co. KG has opened a new subsidiary in North Ridgeville (Ohio) with 2,800 square meters of production and office space for RUF US Inc.

Around ten years ago, RUF invested in a building of its own for the first time, close to the current site. "Since then, up to ten employees there have primarily handled sales and service for US customers," the company informed. "As revenue rose steadily, driven in particular by sales of mid-sized systems, the idea emerged of setting up a dedicated assembly line specifically for these briquetting presses. Now it has been achieved. Just in time for the official opening of the site on August 13, 2026, the first RUF 5.5 machines were completed."

RUF Managing Director Roland Ruf and US CEO Jim Weist expect to assemble

around ten briquetting presses in North Ridgeville in the very first fiscal year. "Interest in RUF machines has been incredibly high already. With the

new building – perfectly equipped for service work and featuring its own assembly line, paint shop, and test-run and final-acceptance station – we can now respond to customer needs even faster and better. Demand is therefore sure to keep rising, we will grow, and we will hire additional employees accordingly," Jim Weist was cited.

RUF US Inc. currently employs twelve permanent employees. Within a good five years, management expects to gradually increase this number, in line with demand, to 40 to 50. Recent developments suggest that this target is as realistic as the underlying business plan. This plan also provides for quadrupling the total number of machines assembled in Ohio. "In addition to the RUF 5.5, we will also be assembling other machine types," Jim Weist is certain.

 rufgroup.com



USA:

RSTREAM AND GILLETTE STADIUM PARTNER ON WASTE

Automated sorting at the point-of-collection helps advance waste diversion, operational efficiency, and sustainability after matches, concerts and other events. According to rStream, through the company's partnership with Gillette Stadium, its AI-powered sorting system is processing the stadium's full waste stream on-site, separating recyclables, compostable materials, and trash with approximately 99 percent accuracy. The partnership also supports Gillette Stadium's "ongoing commitment to operational excellence and sustainability by transforming one of the most labor-intensive behind-the-scenes operations into a more efficient, data-driven process".

Large, high-traffic venues generate tons of mixed waste during a single event, much of which has traditionally been sorted manually after guests leave. "The process is labor-intensive, physically demanding, and often limits how much material can ultimately be recycled or composted," the company, founded in 2021 out of research at the University of Massachusetts Amherst,



Photo: rStream

rStream's AI-powered sorting system – a 30-foot integrated conveyor and sorting platform – combines computer vision, precision actuation, and machine learning to automatically separate the full waste stream at the source

underlined. "At Gillette Stadium, rStream's system automates that process by moving waste across conveyor belts where AI-powered cameras identify materials and precision sorting actuators separate them into recycling, compost, and trash streams within 24 hours of each event. Recyclable and organic materials are recovered, and

the remaining post-sorted waste is sent to waste-to-energy facilities."

By mid-July this year, rStream sorted out 479,000 individual recyclable objects across seven full-stadium events, the information said.

rstreamrecycling.com

STEINERT INTENSIFIES ITS PRESENCE IN MEXICO

German-based Steinert GmbH, a sorting and separation technologies specialist for the recycling and raw material industries, is broadening its activities in Mexico. Increased market proximity and enhanced service capabilities would support the company's continued growth in the Mexican recycling and mining industry. "The move to Mexico reflects the growing importance of the Mexican market for the waste management, metal processing and mining industries and reinforces Steinert's commitment to developing long-term partnerships with local operators," the internationally active company informed. The aim is to respond more directly to customers' requirements throughout the entire life-cycle of their sorting and separation systems – supported by a dedicated warehouse and local spare-parts availability. As reported, a major recent project demonstrates the Mexican market's potential. The manufacturer has been selected to design and supply the separation equipment for DIMECA's new ferrous metal recovery line in central Mexico. "The company is a leading scrap metal processor and will use advanced Steinert separation and recovery technologies to process up to 20 tons of material per hour." The new line is designed to increase operational efficiency and to maximize the recovery of secondary raw materials.

steinertglobal.com



NORWAY: ROOM FOR IMPROVEMENT

Wanting to does not mean being able to. Norway's municipal recycling rate clearly falls below its own claims and the continental average.

The Circularity Gap Report 2020 on Norway was merciless: "Currently, 97.6 percent of materials consumed each year never make it back into the economy. Norway also has one of the highest per capita consumption rates in the world at 44.3 tons per person." But it was not hopeless: "With a long history with renewable energy and plastic recycling, Norway is well set to become a pioneer in the circular economy."

At first glance, it certainly does not look like pioneering. "The Early Warning Report for the 2025 Waste Targets" of the EFTA Surveillance Authority offers: "Norway is at risk of missing the 2025 targets to prepare for re-use and recycle 55 percent of its municipal solid waste, and the material-specific target to recycle 50 percent of its plastic packaging waste." Additionally the missed landfilled municipal rate only reached 3.1 percent instead of ten.

According to the European Environment Agency, the amounts of municipal waste Norway generated in 2022 were among the highest in Europe. Furthermore, Norway reported that 59.8 percent of building and construction waste was prepared for reuse or recycled in 2022. This is approximately ten percentage points below the 70 percent target. All in all and according to the official statistics, Norway produced 10,969,000 tons of waste, including 2,812,000 tons (26 percent) by construction and construction activities, 1,911,000 tons (17 percent) by industry, 1,847,000 tons (17 percent) by service industries, 2,210,000 tons by "other or unspecified industries" and 2,188,000 tons (20 percent) by private households in 2024. Updated statistics speak of 2,131,206 tons of privately produced waste in June 2026.

There are doubts about the numbers. According to the Early Warning Report 2025 released by the EFTA Surveillance Authority, Norway incinerated around half of all municipal

waste (57 percent in 2021 and 51 percent in 2022), while around 30 percent was diverted towards preparation for re-use and material recycling and an additional ten percent composted or digested.

Scarce information on processed waste

Data regarding the quantity of processed waste is scarce. While Statistics Norway reports that a total of 7,113,000 tons of waste were treated in waste treatment plants in 2024 – comprising 746,000 tons treated biologically, 1,434,000 tons treated biologically, and 4,933,000 tons “landfilled and used as filling compound and cover material”. Information on further processing reveals that, out of 692,670 tons, 423,911 were incinerated, 194,379 were sent for material recovery, and 52,985 tons were landfilled.

Furthermore, a diagram of Norway’s material flow indicates the treatment of 16.0 (likely 16,000 tons) of biomass, 214.9(00 tons) of fossil fuels, 2.2(00 tons) of metal ores, 98.5(00 tons) of non-metallic minerals, and 4.3(00 tons) of “extracted and cycled materials in Norway.” Another scheme on “Norway’s domestic extraction” in 2022 is dominated by fossil fuels – natural gas and crude oil – accounting for 65 percent of the total. Non-metallic minerals, primarily used in construction, held steady at 30 percent. Biomass and metal ores made up five percent and one percent of domestic extraction, respectively. But neither further information nor precise details are provided regarding the subsequent use of these materials.

Waste generation lower than economic growth

The European Environment Agency commented: “The building and construction sector is the largest source of waste in Norway today. The volume of waste from industry has risen slightly since 2012, while the volume of waste from households has been fairly stable throughout this period.” But the Agency also emphasized: “When comparing total waste generation in absolute terms with GDP and population growth, total waste increased by seven percent, which is lower than the population growth of 12 percent and GDP growth of 9 percent since 2010.” In the long run, some of Norway’s environmental targets are waste-related

goals stating, respectively, that “the trend in waste volumes shall be significantly lower than economic growth” and “material recycling of waste shall increase.” According to the Circularity Gap Report Dashboard, the economy between 2018 and 2022 grew by 35 percent, whereas waste production by only 2.6 percent. And with a recycling rate of 38 percent in 2022, Norway even ran by ten percent lower than the continental average.

Treatment methods on the move

Following the Circularity Gap Report 2025, recycling was the most utilized method, accounting for 4.6 million tons or nearly 38 percent of total waste treatment – mostly of mineral, solidified and recyclable wastes and secondly recyclable wastes. Energy recovery represented 4.1 million tons or 34 percent consisting in particular of the treatment of mixed ordinary wastes. Landfilling stood for the treatment of 2.1 million tons or 18 percent of primarily mineral and solidified wastes. Other waste disposal – amounting to one million tons or nine percent – concentrates mainly on mineral waste and sludge. And backfilling accounted for 156.000 tons or one percent. In total and compared to former treatment quota, recycling improved by two percent since 2018, energy recovery stayed constant, landfilling declined by two percent, and backfilling sank by three percent. Other waste disposal increased by seven percent compared to 2018.

“Waste volumes from the construction and civil engineering sectors have fluctuated significantly in recent years. Following an increase in 2022 and a sharp decline in 2023, we are seeing an increase again in 2024. This is most likely due to heavier materials – such as asphalt, concrete, and brick – within the industry in 2024,” explains Manju Chaudhary, Senior Adviser at Statistics Norway. And adds that household waste accounts for the second-largest volume, showing a slight increase in 2024 compared to 2023. Summarizing the Norwegian waste treatment balance, the Circularity Gap Report Norway 2025 shows a recycling rate of 38 percent, 34 percent for energy recovery, a landfill rate of 18 percent, backfilling of one and incineration of 0.3 percent, and 9 percent of other methods.

Statistical disbelief

There are doubts about the numbers. According to the Early Warning Report 2025 released by the EFTA Surveillance Authority, Norway incinerated around half of all municipal waste (57 percent in 2021 and 51 percent in 2022), while around 30 percent was diverted to preparation for reuse and material recycling, and an additional ten percent was composted or digested. Researchers at the Norwegian University of Science and Technology (NTNU) were even

“Norway is well set to become a pioneer in the circular economy.”

more critical. Their analysis in 2024 showed that 65 percent of all collected and processed waste in 2019 was incinerated – an increase from 49 percent in 2009. The study also found out that 70 percent of waste incinerated could have been recycled. And in some years, the country obviously recycled less than what the authorities reported: While Statistics Norway declared a material reuse and recycling rate of 44 and 41 percent in 2009 and 2019, the NTNU researchers found statistics showing a recycling rate of 28 and 29 percent for the same years.

Below the targets

Be that as it may: The 2025 waste target report of the EFTA Surveillance Authority reported a municipal solid waste recycling rate of 41 percent in 2022, which is 14 percentage points below the 2025 target of 55 percent. On packaging waste, Norway reported a total recycling rate of 58.3 percent for 2021, which is 6.7 percentage points below the 2025 target of 65 percent. And the country generates 27.5 kilograms (kg) of e-waste per capita – totaling 149 kilotons and thus ranking among the highest globally – formally collected and recycled are only 72 percent of this waste. For comparison: Slovakia reached 92.4 kg in 2023, the EU average 82.2 kg.

Azortum is a full-service technology company delivering waste sorting and solutions for waste recycling. In a blog on Norway it showed the wrong decisions and the challenges of waste management in this country. Besides of overstated official recycling rates – as mentioned by the NTNU researchers – and unnecessarily high waste incineration quota the article criticized the low material recovery of plastics and draws attention on emerging waste type streams: For example, the import of nitrous oxide (N₂O) canisters grew between 2020 and 2022 from two to 232 tons.

The points of criticism by Tomra in 2025, the global reverse vending, recycling, and sensor-based sorting solutions company and manager of Norway's deposit-return scheme, went one step further. To close the infrastructure gap, expanding industrial sorting capacity would be essential. A circular economy needs a holistic system and no single solution. Carbon capture and storage should be combined with extensive sorting. And circular economy should be framed not as an environmental obligation, but as an industrial strategy. A stronger focus on industrial infrastructure, technological development, and export opportunities is needed.

Recognition

"We must move away from a throwaway economy and toward one where we repair, reuse, and share resources",

declared Minister of Climate and Environment Andreas Bjelland Eriksen in May 2025, after the "Expert Group for the Assessment of Policy Instruments to Promote Circular Activities" had delivered its report. The paper stood under the motto "Ikke Rett Fram" ("Not a straight path") and was asked to suggest reforms in the tax and fee system. Key proposals of the 79 recommendations included alignments with the EU, a plastic packaging fee, a repair initiative for electronics, a textile tax and an extended producer responsibility.

Three weeks after the presentation of the Ikke Rett Fram-paper, another expert group handed over its results on "Critical and Strategic Raw Materials in Norway" to the Minister of Trade and Industry. One of the key findings of the expert's report was that "Norway's process industry is strong in the most energy- and capital-intensive and technologically advanced segments", applying among others, to aluminum, ferroalloys, silicon, nickel, cobalt, zinc, and silicon carbide. By improving the Norwegian industry, "European value chains for renewable energy, digital technologies, and the defense industry" could be strengthened "at a time when critical raw materials are gaining increased geopolitical importance".

Outstanding results

An example of an improving industry delivers the e-waste sector. According to the National E-waste Monitor 2025, Norway is the world's leading nation in Waste Electrical and Electronic Equipment generation per capita. However, the country has established an efficient collection system, successfully gathering 72 percent of generated e-waste.

The same applies to the beverage sector. Norway for example, achieves outstanding results in the recycling of single-use beverage containers like plastic bottles (97 percent) and cans (93 percent), compared to the overall recycling rate for all household waste of around 44 percent. The collection rate even reached 98 percent in 2024, the German Handelskammer announced. Recently, one of the world's most modern plastic waste sorting facilities also began operations in Norway, with a capacity of around 90,000 tons per year.

According to the Handelskammer in July 2026, Norway is leveraging its connection to the European Single Market and increasingly adopting requirements from the EU Circular Economy Action Plan. Experts see particularly significant opportunities – among others – in repair, reuse and sharing models. That opens up interesting perspectives not only for German companies: "Technologies, digital solutions, and business models that close material cycles and use resources more efficiently are in demand."

South Korea:

DISCARDED CLOTHING AND TIRES TO RETURN AS VALUABLE RESOURCE MATERIALS

In July this year, the South Korean Ministry of Climate, Energy and Environment (MCEE) and the Korea Environmental Industry & Technology Institute announced they are officially launching a national research and development (R&D) project to recycle waste clothing and used tires into high-quality, valuable raw materials.

As reported by the MCEE, it is planned to invest a total of 73 billion South Korean Won (converted about 50 million US-Dollar) from this year (2026) through 2030 to promote the following projects:

- development of flagship recycling technologies to address the waste clothing problem (more than 17 million US-Dollar)
- and development of technologies to secure high-quality raw materials from waste tires and commercialize products (nearly 33 million US-Dollar).



Regarding textiles, the goal is to establish a circular resource system for waste clothing. According to the ministry, the project will promote “the development of an AI-based automated waste clothing sorting and screening system and technologies for converting waste clothing into recycled materials and products”. Aim is an AI-based fiber material sorting and classification system with an accuracy of over 95 percent, which is to support “the development of technologies to turn waste clothing and textile waste into raw materials for recycling into

clothing, automotive interior materials, and construction and civil engineering materials”. Regarding waste tires, technologies will be developed to secure high-quality recycled raw materials and to produce tires using recycled materials. “The project will also advance technologies for pre-treating waste tires through shredding and other processes prior to pyrolysis to recover high-quality recycled carbon black, as well as technologies that enable the use of more than 15 percent recycled carbon black in the production of new tires”. In this way, the ministry intends to strengthen the circular use system by encouraging the recycling of waste clothing and waste tire materials through this technology development. It also expects this effort to contribute to achieving the Nationally Determined Contribution (NDC) and to enable a proactive response to overseas environmental regulations, including the EU Ecodesign Regulation.

Photo: MSV, AI-generated

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Sweden:

FIRST CIRCULAR ROADMAP FOR SOLAR PANELS

Sweden may need to manage up to 150,000 tons of end-of-life solar panels a year by around 2060. Therefore, Swedish partners across the value chain have presented the country's first circular roadmap for solar panels.

Solar power is becoming one of Sweden's fastest-growing sources of electricity. However, the number of end-of-life solar panels is also expected to increase significantly. Scenario analyses from RISE Research Institutes of Sweden indicate that Sweden may need to manage between 40,000 and 150,000 tons of end-of-life solar panels per year by around 2060 – at the upper end, more than the total amount of electrical and electronic waste collected in Sweden in 2024. “The challenge is Europe-wide: according to the European Commission, the EU could face more than 20 million tons of cumulative end-of-life solar panels by 2050. At the same time, findings from the CircSolar project^{*)} and research at KTH Royal Institute of Technology show that panels removed from service should not automatically be regarded as waste. Many are still functional and could potentially remain in use, while others need repair or recycling.”

Based on these findings, Axfoundation, KTH Royal Institute of Technol-



Panels taken out of service vary in their potential for continued use, repair, or recycling. The CircSolar roadmap describes how the condition of panels can be assessed and how they can be managed further along the value chain

ogy, El-Kretsen, Svea Solar, Stena Recycling and Remondis have developed a circular roadmap for solar panels in Sweden. As reported, it identifies three key priorities: extend the lifetime of functioning panels, develop specialized recycling that keeps materials in circulation, and strengthen extended producer responsibility, traceability and data on future panel flows.

Regarding extended producer responsibility, “all companies placing solar

panels on the Swedish market need to contribute to their future collection and treatment on equal terms. Stronger traceability and better data on future panel flows are also needed to enable long-term planning.”

Sweden could build recycling capacity step-by-step using specialized recycling for solar panels, which is being developed in Europe. As Swedish volumes increase, the country could build its own capacity through investments in domestic infrastructure. Recycling companies such as Remondis and Stena Recycling are already preparing for these future material flows.

As underlined, the roadmap “also points to a need for coordinated action from government and public authorities to make it easier and more economically viable to reuse functioning panels, strengthen investment in high-value recycling, and ensure that extended producer responsibility works in practice”.

ax-images.b-cdn.net/uploads/2026/08/Circular-Roadmap-for-Solar-Panels-in-Sweden.pdf

^{*)} CircSolar, launched in 2023, is a collaborative project involving KTH Royal Institute of Technology, Axfoundation, Svea Solar, El-Kretsen, Stena Recycling and REMONDIS. The project is co-funded by Vinnova, Sweden's innovation agency.

Photo: Axfoundation

NEW PARTNERSHIP

German company WeSort.AI and UK-based company Kaizen Recycling Ltd. are working together: Kaizen is the official partner for WeSort.AI across the United Kingdom and Ireland. The collaboration introduces X.Sort, an AI- and X-ray-based system designed to identify and remove lithium-ion batteries at the front end of waste processing operations – before they can reach high-risk equipment.

wesort.ai, kaizenrecycling.co.uk

Nigeria:

MORE RECYCLING TO KEEP MORE VALUE

The West African country will enforce the recycling of plastic bottles from 2028. As reported – inter alia – by the non-profit organization Recycling Association of Africa (RAA), the Federal Republic of Nigeria has established the regulation under the National Environmental (Plastic Waste Control) Regulations in 2026. In this way the country aims to strengthen its domestic recycling industry and encourage investment in local collection and processing capacity. The new rules for plastic packaging require recycled PET (rPET), which has to

consist of 25 percent locally sourced recycled content by January 2028; in the beginning of the year 2030 the share has to be 50 percent. The regulations also include stronger producer responsibility measures like reporting and monitoring systems to improve plastic waste management.

Objective of this policy is to support local certified recyclers, reduce dependence on imported recycled materials and keep more value within the Nigerian economy, the Nigerian National Environmental Standards and Regula-

tions Enforcement Agency (NESREA) was quoted. The organization has “responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria’s natural resources in general and environmental technology including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines”.

🌐 raafrica.org, nesrea.gov.ng

CLOSING THE FOOTWEAR LOOP

The project “Closing the Footwear Loop” was a major initiative led by Fashion for Good, bringing together 17 leading fashion and footwear brands and their existing circularity programs to tackle the complex challenges of circularity in the footwear industry. The Netherlands-based organization unites the fashion ecosystem to transform and build a regenerative industry.

The report with the same name as the project “dives deep into the material flow, composition analysis and condition of post-consumer footwear waste, capturing the on-ground findings from our pilots with CETIA, Matoha, Picvisa, and The 8 Impact, and translating them into actionable insights for the industry,” Fashion for Good highlighted the results of the initiative. Some of the findings are:

- 50 percent of post-consumer footwear waste is non-rewearable
- 46 percent of post-consumer foot-

wear waste is rewearable, and the remaining four percent is contaminated, hindering rewearability and recyclability

- 90 percent of rewearable footwear is exported, mostly to the UAE, China, and Pakistan



- 24 percent of shoes classified as non-rewearable had no physical damage
- 37.7 percent of non-renewable sole materials were unidentifiable by NIR scanning

“The project also piloted what we believe to be one of the first three dedicated footwear sorting technologies, developed by Matoha, CETIA, and Picvisa,” Fashion for Good gave account. “Moreover, with France being the frontrunner EU country with a footwear-specific EPR scheme, we worked with The 8 Impact and successfully recycled sports shoes and sneakers using EPR feedstock, demonstrating that closed-loop recycling for these archetypes is technically possible.”

■ The report can be downloaded at fashionforgood.com/case-study/closing-the-footwear-loop/

More Circularity in the Fashion Industry:

RECYCLABLE AND VIRTUALLY UNBREAKABLE MANNEQUINS

Belgian family-owned company Bonami has created Bonplast, a proprietary material that makes window mannequins fully recyclable while also being engineered to remain in use for years.

At the end of such a mannequin's life-cycle, the material can be used again to make a new mannequin or another display product, the manufacturer assured. Production offcuts would also be repurposed into personalized, durable clothes hangers. "The result is a closed-loop approach designed to keep material in circulation and minimize waste." As emphasized, Bonami's circular design would also address everyday challenges on the shop floor. Bonplast mannequins are:



The Bonplast material is designed to combine long-term durability with full recyclability and closed-loop reuse

- Virtually unbreakable: helping stores maintain polished displays without common chips, breaks or missing fingers.
- Lightweight: making mannequins easier for retail teams to move and reposition.
- Faster to dress: thanks to a magnetic assembly system that helps save time during visual-merchandising changes.
- Shaped for presentation: with a considered fit that helps garments look their best on the shop floor.
- Designed for circularity: so material can return to use in a new mannequin or another display product.

 bonami.be

Photo: Bonami

TEXTILE RECYCLING MARKET TO GAIN MOMENTUM

As per Market Research Future analysis, this sector is currently experiencing a notable transformation driven by increasing environmental awareness and the need for sustainable practices.

According to the market analysis company, the textile recycling market size was estimated to be worth 8.75 billion US-Dollar in 2025 and is expected to grow to 16.58 billion US-Dollar by 2035, exhibiting a compound annual growth rate (CAGR) of 6.6 percent during the forecast period 2025 – 2035. Some results are:

- Technological advancements in recycling processes are enhancing efficiency and output in the textile recycling market.
- North America remains the largest market, while the Asia-Pacific region is emerging as the fastest-growing area for textile recycling initiatives.
- Cotton continues to dominate as the largest segment, whereas polyester and polyester fiber are witnessing rapid growth in recycling applications.
- Key market drivers include technological innovations in textile recycling and increasing environmental awareness among consumers.



 marketresearchfuture.com/reports/textile-recycling-market-11863

Photo: MSY, AI-generated

LITHIUM-ION BATTERY RECYCLING MARKET TO SURGE

The global lithium-ion battery recycling market is entering a rapid expansion phase as electric vehicle adoption, energy storage deployment, and demand for critical battery materials continue to accelerate. According to the latest study by Persistence Market Research, this sector is expected to be valued at 7.3 billion US-Dollar in 2026 and is projected to reach 31.8 billion US-Dollar by 2033. This would mean a compound annual growth rate (CAGR) of 23.4 percent until 2033. “The market is being shaped by the rising volume of end-of-life batteries, growing concerns about raw material availability, stricter environmental regulations, and increasing investments in circular battery supply chains,” the company, specialized in creating research studies, gave account.

As expected, Asia Pacific was identified to remain a critical region for the market because of its extensive battery-manufacturing ecosystem, rapidly expanding electric vehicle industry, and large consumer electronics sector. “China has established a particularly strong position across battery production, electric vehicle manufacturing, and battery material processing, creating favorable conditions for large-scale recycling activities,” Persistence Market Research informed. “Other countries in the region are also increasing investments in EV infrastructure and energy storage, which will generate additional volumes of used batteries over time.” Europe and North America were also experiencing strong market development, supported by environmental

regulations, EV adoption, domestic battery manufacturing initiatives, and investments in critical mineral supply chains. This trend is not yet as strong in Latin America and the Middle East & Africa, where opportunities are gradually emerging as electric mobility and renewable energy storage expand.

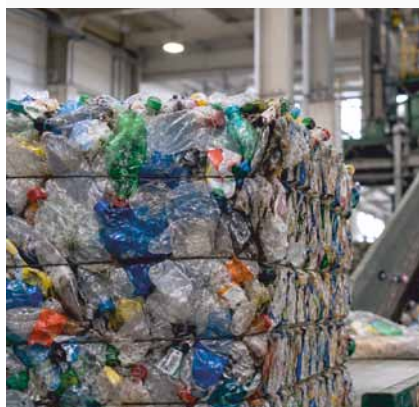
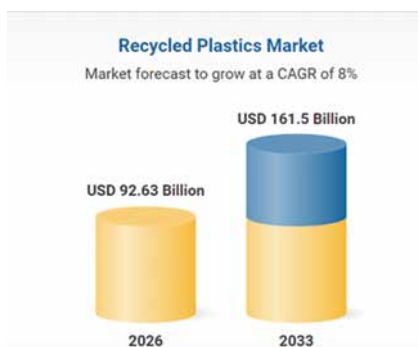
“Regional differences in battery chemistry, collection infrastructure, regulations, and processing capacity will influence competitive strategies, but the global trend toward localized and circular battery supply chains is expected to benefit recycling companies across major markets,” the report provider prognosticated.

[persistencemarketresearch.com/samples/36728](https://www.persistencemarketresearch.com/samples/36728)

GOOD OUTLOOK FOR RECYCLED PLASTICS

Market report provider ResearchAndMarkets.com has added a new report to its offerings, titled “Recycled Plastics Market by Source, Process, Plastic Type, Type, End-Use, and Region – Global Forecast to 2033”. As forecasted, the global market is projected to grow from 92.63 billion US-Dollar in 2026 to 161.50 billion US-Dollar by 2033. The market expansion would be supported by rising demand across packaging, textiles, building and construction, automotive, electrical and electronics, and other end-use industries.

As stated, packaging is projected to remain the largest end-use industry. Its leading position reflects the accelerating transition to sustainable packaging solutions, increasingly stringent



restrictions on single-use plastics, and circular economy initiatives introduced by fast-moving consumer goods companies and major retail chains. The industrial recycles segment, by type, is expected to account for the second-largest share of the recycled plastics market during the forecast period, the information said.

“Growth is being driven by sustainable manufacturing practices in the automotive, construction, electronics, and textile industries. Companies in these sectors are incorporating recycled plastics into production processes to advance environmental targets, improve resource efficiency, and reduce operating costs.”

[researchandmarkets.com](https://www.researchandmarkets.com)



TEN YEARS TO THE RECYCLER

The length of time e-bike batteries remain in circulation before reaching a recycling plant has so far largely been a matter of estimation. A field study of 1,937 batteries at ACCUREC-Recycling GmbH in Krefeld now provides the first figures from day-to-day operations. It supports the EU's assumption of around ten years and shows why raw data from a growing market suggest too short a lifetime.

Why lifetime determines the collection rate

From 2028, EU Member States must collect 51 percent of waste batteries from light means of transport; from 2031, the figure rises to 61 percent. This group consists chiefly of e-bike batteries. Percentages alone, however, say nothing about how many tons must actually be collected. What matters is the quantity they refer to.

Until now, the reference quantity has been the mass sold in the three preceding years. For a product that is used for ten years or more, this is the wrong approach. Selling large volumes today immediately increases the quantity placed on the market, but the corresponding waste batteries will not arise until the 2030s. As a result, the collection rate appears lower than the system's actual performance. The EU Batteries Regulation itself acknowledges this problem and

obliges the Commission to revise the calculation method by 18 August 2027.

The European Commission's Joint Research Centre (JRC) has proposed a different approach to the calculation. Instead of asking how much was sold in previous years, it asks how much is actually available for collection: Available for Collection, or AfC for short. It is calculated in three steps (see box). The first is the decisive one: based on past sales figures and an assumed lifetime, it estimates how many batteries reach the end of their use in a given year and are available for collection at all.

The result therefore hinges directly on a single assumption. If the assumed lifetime is too short, the calculation reports the quantities too early; if it is too long, too late. Precisely here, no data had been available. The values used stem

What the EU Batteries Regulation Requires

Regulation (EU) 2023/1542 introduces, for the first time, dedicated collection targets for light means of transport batteries: 51 percent from 31 December 2028 and 61 percent from 31 December 2031. The Commission must revise the method used to calculate these rates by 18 August 2027, explicitly taking into account market growth and the increasing lifetime of the products.

from surveys of experts and industry associations. The JRC itself describes the situation as particularly difficult and intends to update its default values as soon as field studies become available. Moreover, the specifications are not internally consistent. In one place they state ten years; in another, a table from which only around 5.3 years can be derived arithmetically. The official assumption thus effectively lies somewhere between 5.3 and ten years.

Field study at ACCUREC: 1,937 batteries from four countries

Between August and November 2025, 44 large containers were fully sorted at the ACCUREC-Recycling GmbH site in Krefeld and 4,649 batteries were recorded individually, 4,631 of which belonged to the light means of transport group, predominantly e-bike batteries. They came from the collection schemes of the Netherlands, Belgium, Denmark and Finland.

The type plate and casing of every battery were photographed. The images were processed by optical character recognition and automatically transferred into data fields. The manufacturing date could either be read directly from the type plate or reconstructed from the serial number, as many manufacturers encode the year and calendar week of production there. A comparison with manually verified reference data yielded accuracy rates of 99.2 percent for the manufacturer and 99.5 percent for the date. In the end, a reliable date could be determined for 1,937 batteries, or 42 percent of the total.

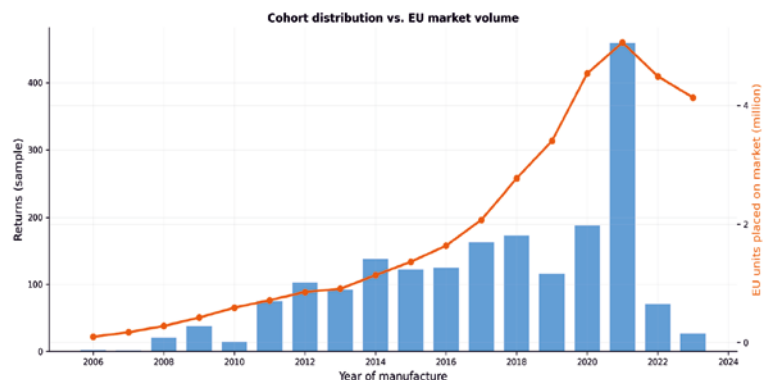
The missing 58 percent are unlikely to be distributed at random: older batteries and those with poorly legible labels

are particularly affected. Therefore, the analysis had to rest on one assumption, namely that the age of these 58 percent does not differ systematically from that of the dated batteries. This cannot be verified with the available data. The assumption thus remains one of the key uncertainties of the result.

What was measured is not the technical lifetime of a cell but the return age: the time between manufacture and receipt at the recycling plant. It covers the entire use phase, but also storage in cellars and garages and the time spent in the collection system. For the EU's calculation, this is precisely the right quantity, since there too storage time counts towards lifetime. The unweighted mean is 7.82 years, the median 7.30 years. The oldest battery in the field study was 19 years old.

The market is growing faster than the returns

This raw value describes the reality of what arrives at the plant. As an estimate for an entire sales generation, however, it is too low, for a simple reason: the market has grown strongly within a short time. According to figures from the European bicycle industry association CONEBI (Confederation of the European Bicycle Industry), e-bike sales in the EU have increased more than twentyfold within roughly a



The bars show the manufacturing years of the 1,937 dated batteries; the line shows European e-bike sales in each year. The two curves run largely in parallel: the returns initially mirror the annual sales volumes, not the durability of the batteries

Graphics: Niklas Schiffigen

How the Collectable Quantity Is Calculated

1. Waste Generated: Based on past sales figures and an assumed lifetime, an estimation is made of how many batteries reach the end of their use in a given year. The summation covers twice the length of one lifetime.
2. Deductions (complementary flows): Quantities that do not reach the official collection system are deducted, for example through export, residual waste or continued use in other applications.
3. Rate: The mass collected divided by the quantity available for collection after these deductions.

decade and a half, from a few hundred thousand units in the mid-2000s to a good five million in the record year 2021, followed by a slight decline (see Figure 1).

This is directly reflected in the sample. The manufacturing year 2021 alone accounts for 459 batteries, or 22.6 per cent of all dated units. With five million bikes sold, even a small share of early failures produces high absolute return numbers. The large volumes placed on the market most recently therefore dominate the statistics and pull the mean downwards, even though only a fraction of them has returned at all.

This is more than a statistical subtlety. Because the strong sales years 2020 to 2022 are still young measured against a lifetime of around ten years, most of these batteries are still in use today or sitting unused at home. The real wave of returns is yet to come, and it will meet a market that continues to grow according to the JRC scenarios.

Lifetime: 7.8 years become 10.9

To correct this distortion, each observation was weighted by the sales volume of its manufacturing year. Batteries from early years with low sales count more heavily; batteries from later years with high sales count less. The basis is the three-year smoothed sales volume of the respective manufacturing year. A battery from 2009 is thus weighted around 25 times as heavily as one from 2023.

This shifts the picture considerably. The return age adjusted for sales volumes rises to 10.88 years, a difference of around three years. The empirical finding is thus close to the EU's reference value of ten years. It supports this assumption without proving it, as the closeness depends on the chosen weighting scheme and on early manufacturing years represented by only a few units.

The methodological lesson is just as important. Return figures from a growing market should only be compared with regulatory assumptions after this correction. Without it, the ten-year value would wrongly appear far too high.

A contradiction in the simplified table

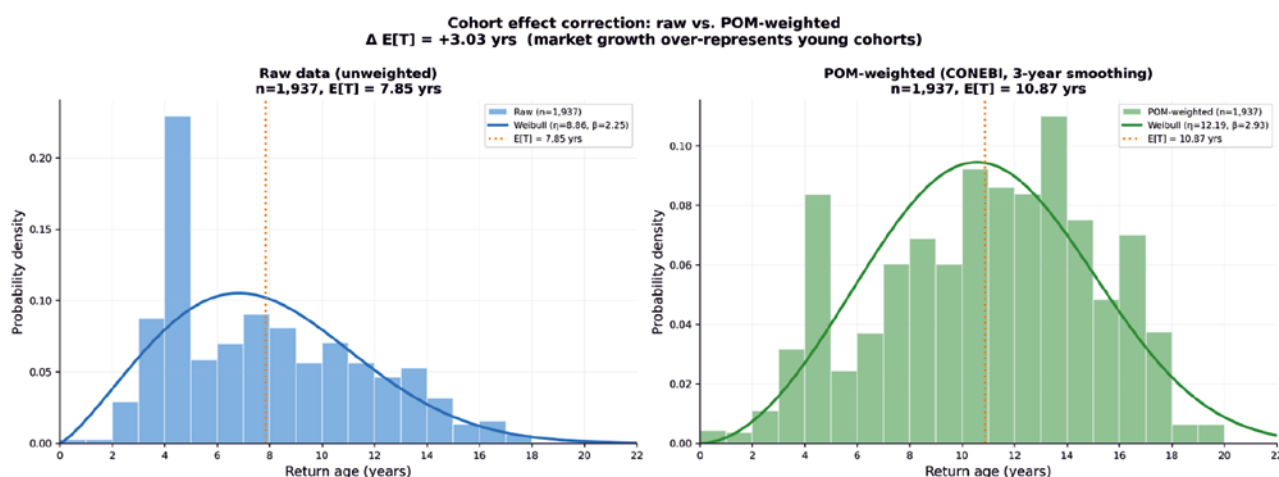
For Member States without data of their own, the JRC specification contains a simplified table. It specifies what share of a sales generation returns after one year, after two years, and so on, and it is headed by the reference value of ten years. Adding up its shares, however, yields a mean of only around 5.3 years. Moreover, the table ends after 13 years, although the associated formula sums over a period of 20 years.

The field data collected at ACCUREC do not fit this. Around 12 percent of the unweighted and around 35 per cent of the weighted returns are older than 13 years and would go unaccounted for in a calculation based on this table. A statistical test confirms the deviation.

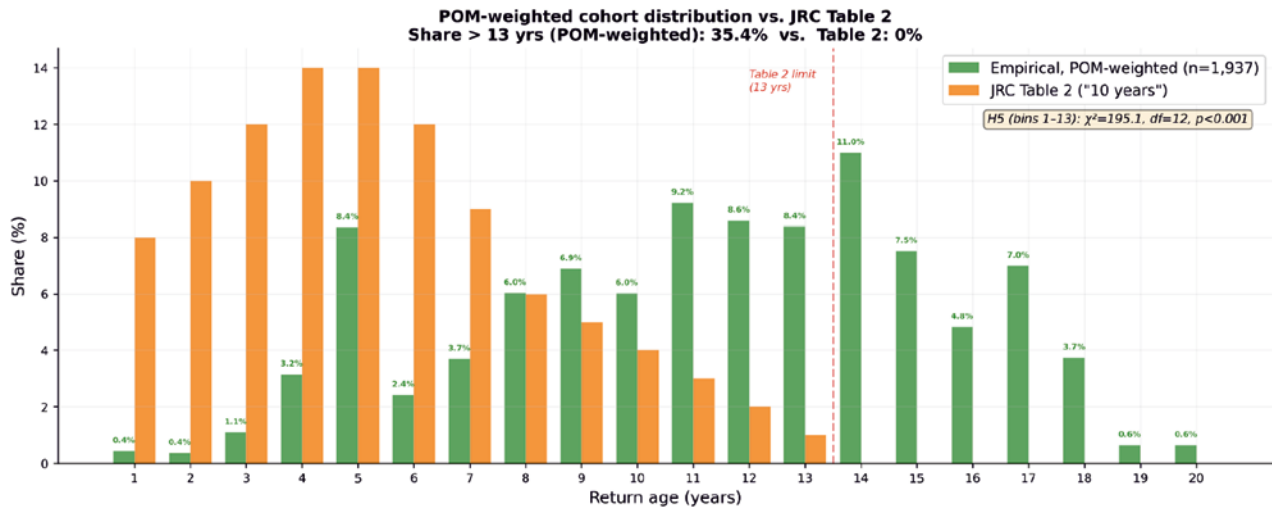
A look at the manufacturers' regions of origin also shows how heterogeneous the products in this segment are: In the returns examined, batteries from European manufacturers show a mean age around three years higher than batteries from Asian manufacturers. This finding is expressly preliminary. It permits no conclusions about product quality or durability, since usage profiles, price segments, distribution channels and return routes are not taken into account. It does show, however, that a single lifetime value for the entire segment remains a rough simplification.

Looking ahead: What this means for the volumes

How much this assumption matters is shown by a comparative calculation using the JRC's medium demand



Left: the raw distribution of return ages; right: the same data after weighting by the sales volume of the respective manufacturing year. The mean rises from 7.85 to 10.87 years

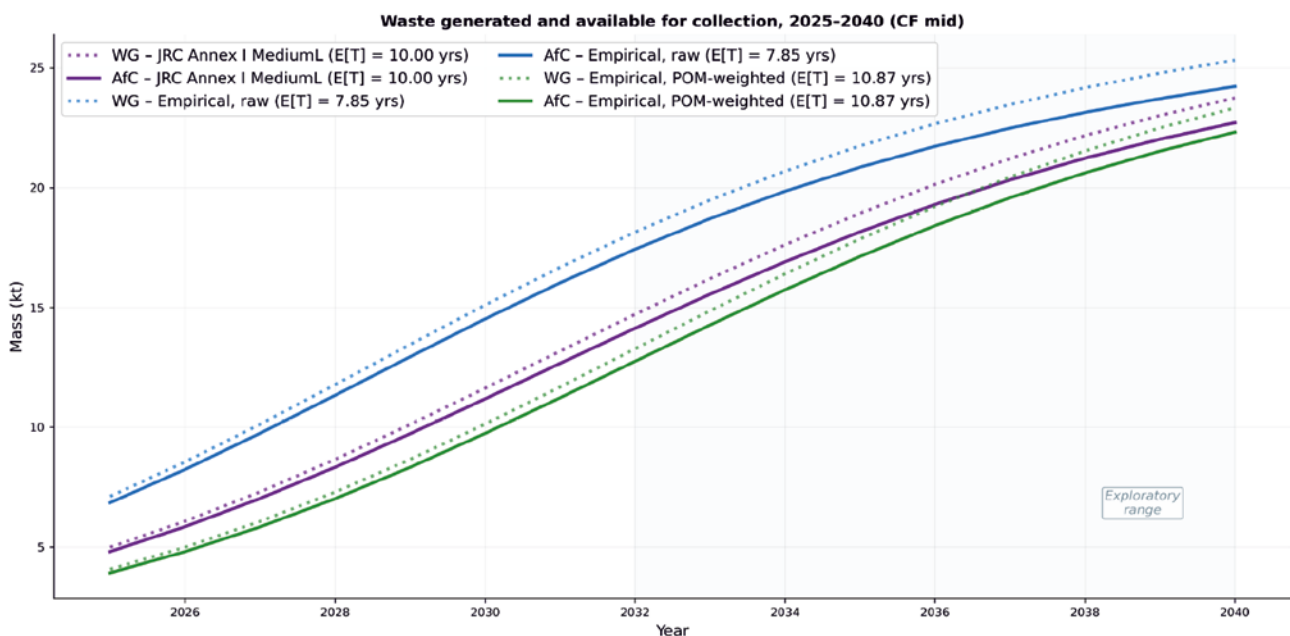


Weighted distribution of return ages (green) compared with the simplified table (orange). Around 35 per cent of the weighted returns lie beyond the 13-year cut-off; in the table, the share is zero

scenario. According to it, the mass of e-bike batteries placed on the market annually across the EU rises from around 12,200 tons in 2020 to around 28,800 tons in 2040. Depending on the scenario, the 2040 value lies between 16,400 and 46,700 tons. Inserting in turn the ten-year reference value, the raw value of 7.85 years and the adjusted value of 10.87 years into this calculation reveals a clear pattern: In the short term the effect is large; in the long term it disappears. For 2028, the raw value yields around 36 percent more waste than the reference value; for 2040, the three variants, at around 25,300, 23,700 and 23,300

tons, are only about seven percent apart. The assumption keeps the total quantity the same but changes when the waste shows up. For collection and recycling capacity, this timing is everything.

From this total volume of waste, the amount that does not enter the official collection system is deducted. For this purpose, new technical data currently being compiled for the drafting of the delegated acts were used: a combined deduction of around five per cent for repurposing and export. Across the EU, this would leave around 22,000 to



Calculated waste generated and collectable quantity in the EU up to 2040 under three lifetime assumptions. The curves converge in the long term. In the short term, around a third of the volume separates them

24,000 tons per year collectable by 2040, compared with around 4,100 to 7,100 tons in 2025. At a collection rate of 61 percent, this would correspond to around 13,500 to 14,700 tons per year that would have to be collected, a multiple of the quantities reported to date. These are not forecasts but comparative calculations. They depend on the demand scenario and on deductions that have not yet been finally determined.

What should follow from this

Two points can be incorporated directly into the forthcoming revision.

First, the correction for the quantity placed on the market each year should be made mandatory. Anyone deriving lifetimes from return or recycling data in a growing market must factor out the differing sales volumes and disclose the remaining uncertainties. This includes the fact that quantities placed on the market most recently are not yet fully visible in the returns, and that collection routes do not deliver a random sample. Unweighted and adjusted values must be reported side by side to ensure transparency about raw data and analytical method.

Second, the data base should be broadened before values are readjusted. Because lifetime moves short-term volumes so strongly, a robust value requires return data from several countries, sites and collection routes. The returns of a single recycling plant, including those examined here, are not sufficient. Precisely this kind of field evidence is what the JRC has envisaged for updating its values. Such studies, which should have high statistical relevance, need to be commissioned and funded.

Conclusion and outlook

The study provides a first empirical anchor for a value that had previously largely been estimated. The return age of 10.88 years, adjusted for sales volumes, supports the EU's assumption of around ten years. The simplified table in the JRC study on AfC volumes, by contrast, should be reviewed, its mean aligned with the reference value and its time horizon extended. Alternatively, it should be explicitly labelled as illustrative.



The limits of the study must be clearly stated. The data come from a single recycling plant with a north-west European catchment area, 58 percent of the batteries could not be dated, and the more recent manufacturing years are inevitably under-represented. Robust values require data from several countries and collection routes, ideally combined with a measurement of battery condition on arrival. Only then can use, storage and time spent in the collection system be separated from one another.

Only one year remains until the calculation method is revised. Using this time to underpin the lifetime empirically is considerably less costly than later measuring collection rates against quantities that never arose in this form.

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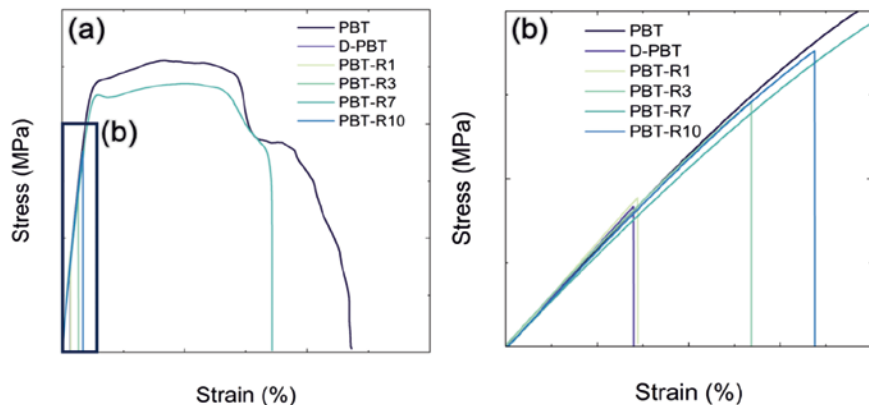
About ACCUREC-Recycling

ACCUREC-Recycling GmbH is a medium-sized, technology-driven company with sites in Mülheim an der Ruhr and Krefeld. Since 1995 it has been developing recycling processes for all common battery systems and implementing them on an industrial scale, with a focus on low-emission, safe technologies and high raw-material recovery. Every year, more than five million kilograms of critical and industrial raw materials are recovered from waste batteries. Recent annual turnover was around 25 million euros, and the company employs around 100 people.

EFFECTIVE RECYCLING BY REPAIRING DAMAGED PLASTICS AT THE MOLECULAR LEVEL

According to scientists at Japanese Tohoku University, plastic recycling could become far more effective thanks to a new technique that restores the strength of damaged engineering plastics by repairing them at the molecular level.

The researchers have developed a method to restore the mechanical strength of degraded polybutylene terephthalate (PBT), a durable engineering plastic widely used in automotive parts, electrical components, and industrial products. By adding a chemical compound known as a chain extender (called PPDI) during recycling, they were able to reconnect broken polymer chains and recover the material's strength to a level close to that of new plastic. As underlined, the findings would address one of the biggest challenges facing plastic recycling. "Many plastics gradually weaken during use as heat and moisture break apart the long molecular chains that give them their strength. Although these materials can be melted and re-molded, conventional recycling methods often fail to restore their original mechanical performance, limiting how they can be reused." Furthermore, the team also found a clear relation-



Restoration of Plastic Strength Through Molecular Chain Recombination

ship between molecular weight and mechanical strength. "By analyzing the recycled material using tensile testing, gel permeation chromatography, infrared spectroscopy, and end-group analysis, they showed that the recovered strength follows a Fox-Flory-type relationship," the university gave account. "This means the future performance of recycled plastics can be predicted from their molecular characteristics rather than relying on trial-and-error processing."

"This study demonstrates that recycling can be approached scientifically," Hiroki Kurita, Associate Professor of Tohoku University's Graduate School

of Engineering, was quoted. "By understanding how molecular weight affects mechanical strength, we can transition from empirical methods of recycling to predictive ones."

The researchers would hope their approach would contribute to a more circular materials economy by enabling high-performance plastics to be reused instead of discarded, Tohoku University stated. "As demand for sustainable manufacturing continues to grow, repairing polymers at the molecular level could help reduce plastic waste, conserve valuable resources, and extend the lifespan of engineering materials." tohoku.ac.jp

Source: Otsuka et al.



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THE NEW GENERATION OF THE SENNEBOGEN 822 G FOR EFFICIENT MATERIAL HANDLING

For more than 30 years, Entsorgungswirtschaft Soest GmbH (ESG) has been responsible for the recycling and disposal of waste from the Soest district. Approximately 66 employees process more than 150,000 metric tons of waste annually from the district's 14 cities and municipalities. To manage material flows reliably and cost-effectively over the long term at its Werl and Erwitte sites, ESG is investing in two new Sennebogen 822 G material handlers. The machines will replace two proven Sennebogen 818 E models, which are being taken out of service after more than ten years of daily use.

The new material handling machines perform key tasks in feeding processing plants, loading recyclable materials and waste, and handling materials within the facility. High handling capacity, reliability, and short work cycles are crucial prerequisites for cost-effective plant operation.

Proven technology consistently refined

The decision to choose the Sennebogen 822 G is based on many years of



The two new material handling machines are used daily to feed materials into plants, as well as to load and transfer a wide variety of materials

positive experience. The two 818 E models we've had so far have proven their reliability and cost-effectiveness over many years. With the new G Series, ESG is committed to the consistent further development of its proven material handling technology. Both machines have a reach of ten meters and are equipped with an integrated weighing system. This allows material

quantities to be measured directly during handling, eliminating the need for additional process steps. The equipment is complemented by a dozer blade on the undercarriage and a protective ventilation system that reliably shields the operator and the cab from dust – an important advantage in daily use at waste disposal and recycling facilities.



The spacious, glass-enclosed cab offers excellent all-around visibility and helps drivers handle materials safely and precisely

The new SENcon control system provides additional ease of use. It allows for individually configurable machine functions and helps operators work intuitively, efficiently, and comfortably throughout the workday.

Operators confirm better visibility and greater ease of use

Right after the training session, the operators were particularly impressed by the improved all-around visibility. "We're really thrilled with the new Sennebogen 822 G. The clear visibility from the cab, in particular, makes our work much easier and safer. It allows

us to maintain a full overview of the material and our surroundings at all times. That makes our day-to-day work a lot easier.”

Especially at recycling centers and waste disposal facilities with continuous material handling and heavy truck traffic, optimal visibility improves both workplace safety and the efficiency of daily operations. At the same time, the ergonomic layout of the controls makes the transition to the new generation of machines easier.

Modern Handling Technology for Municipal Waste Management

By investing in two Sennebogen 822 G material handling machines, ESG is sustainably modernizing its material handling equipment at its Werl and Erwitte sites. The machines seamlessly take over the tasks of their predecessors and lay the groundwork



With its two SENNEBOGEN 822 G machines, ESG is investing in modern material handling technology to ensure reliable operations at its Werl and Erwitte sites

for reliable, cost-effective, and high-performance material handling in municipal waste management. The project was supported by Schlüter für

Baumaschinen, the regional Sennebogen sales partner.

 sennebogen.com

UPDATED SHREDDER FOR ORGANIC WASTE MANAGEMENT

USA-based company Power Knot LLC, a provider of on-site organic waste management solutions, has announced the relaunch of its BCG product line, alongside the release of the updated BCG-150 shredder. “The BCG shredder product line is designed for commercial and industrial applications that require bulky or difficult

materials to be reduced into smaller, more manageable pieces,” the internationally active company underlined. “Using powerful cutting knives, the BCG shredder efficiently reduces material size to simplify handling and prepare materials for downstream processing. The series can process a wide range of materials, including food

waste, animal bones, meat processing byproducts, fruit and vegetable waste, agricultural waste, and other materials requiring size reduction.” The BCG shredder series can operate independently or as part of a complete waste management system.

 powerknot.com/bcg



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PET RECYCLING IN PAKISTAN

PET producer Novatex Ltd. has expanded its product portfolio by investing in bottle-to-bottle recycling of collected post-consumer PET bottles. The company is now producing bottle-grade recycled PET at its facility in Quaid-e-Azam Business Park near Lahore, using the recoSTAR PET 215 art bottle-to-bottle recycling system supplied by Austrian recycling technology specialist Starlinger.

According to Rizwan Diwan, CEO at Novatex Ltd., the company wants to support its partners PepsiCo, Coca-Cola and others to meet their circularity targets. “The produced rPET has all the necessary food-contact certifications and is being used by all major brands. In addition, the government of Pakistan is pushing hard to eliminate single-use plastics and plastic waste.” With the Starlinger bottle-to-bottle recycling system, the company is able to produce up to 3,000 kilograms of food-contact rPET per hour, which amounts to an annual production output of more than 24,000 tons. Novatex sources the post-consumer PET bottles mostly from municipal curbside collection across Pakistan.

The produced rPET chips are used in the company’s own PET preform production or sold on the local and international market. Pakistan does not yet have a national mandatory recycled content quota for plastic packaging comparable to the EU’s Packaging and Packaging Waste Regulation (PPWR); thus, brand owners – in Pakistan mainly PepsiCo – are leading the path for rPET inclusion.

Pakistan’s Roadmap to reduce plastic waste

As reported by Starlinger, studies and surveys estimate that Pakistan generates around 3.12 million tons of plastic waste annually, of which only



four to nine percent is recycled. With plastic use increasing by 15 percent annually – largely driven by single-use products – and plastics making up almost 40 percent of the solid waste in the Indus River, the country is confronted with environmental and public health challenges.

Pakistan’s efforts to tackle plastic waste, however, are still evolving; a fully consolidated framework with binding national laws has not yet been established. In the last year, the country has moved from plastic bans and pilot initiatives in individual provinces toward a more coordinated national approach, but implementation remains uneven. In April 2025, the Government of Pakistan, together with the United Nations Development Programme and the World Economic Forum, launched the National Plastic

Action Partnership (NPAP) Roadmap, which is currently the most important framework for plastics waste management at the national level. The roadmap aims to reduce plastic pollution, improve waste collection and recycling, expand circular plastic solutions, integrate informal waste pickers, promote public awareness, and encourage sustainable packaging and business models.

To this effect, Pakistan is moving towards a national system to make companies responsible for the waste created by their packaging. Food and beverage companies, NGOs, recyclers and packaging producers have formed the so-called CoRE Alliance and, in 2025, joined government representatives in calling for a national Extended Producer Responsibility (EPR) framework. Under such a model, companies bear the cost of collecting, recycling and safely disposing of their packaging waste. The producer responsibility organizations for handling this, however, have yet to be established.

“The produced rPET has all the necessary food-contact certifications and is being used by all major brands.”

 starlinger.com
 novatex.com

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ADVANCED RECYCLING CONFERENCE

November 17 – 18, 2026, Cologne (Germany)

Organized by the nova-Institut GmbH, this conference is to answer all questions regarding advanced recycling technologies and renewable chemicals, building blocks, monomers, and polymers based on recycling. As emphasized by the organizers, “the unique concept of presenting all advanced recycling solutions and related topics at one event will guarantee a comprehensive and exciting conference experience, including technologies such as extrusion, dissolution, solvolysis, enzymolysis, pyrolysis, thermal depolymeri-



sation, gasification, and incineration with Carbon Capture and Utilisation (CCU)”. By bringing together all relevant topics and experts, the event would provide a framework for new partnerships, ideas, approaches, and value chains.

advanced-recycling.eu

STEP BY POLLUTEC

December 1 – 2, 2026, Paris (France)

STEP by Pollutec is Europe’s new event for ecological transformation, bringing together industrial players, eco-industries, local authorities, and investors ready to accelerate the transition. Its mission: to make decarbonation and the circular economy powerful levers of efficiency, performance, and competitiveness. The event stands under the patronage of Emmanuel Macron, President of the French Republic.

As underlined by the organizers, decarbonization and the circular economy are not only fundamental pillars of the ecological transition, they are also major levers for improving performance and competitiveness. They are therefore particularly crucial in times of increasing uncertainty about energy and raw materials. The new STEP by Pollutec event in December aims to bring this vision to life by offering solutions, alongside a program of conferences, case stud-

ies, and experience-sharing sessions. “STEP is for professionals who want to implement an efficient strategy for the ecological transformation of their organization,” the organizers described the intention. “Over two days, it will present a panel of solutions that contribute to the low-carbon economy (energy efficiency and sufficiency, waste heat recovery, electrification of processes, thermal renewables, etc.) and promote circularity (eco-design, saving resources – water and raw materials, recycling, recovery, etc.).

The event will also bring together various actors specializing in assisting with and supporting these approaches (specialized consulting firms, financial firms, insurers, etc.).” Moreover, the event would address current issues and respond to today’s key challenges.

stepbypollutec.com

WORLD REUSE & RECYCLING FORUM

November 30 – December 3, 2026, Shanghai (China)

WRF Asia 2026 will spotlight cutting-edge technologies and global policy trends through a high-level conference and exhibition, the congress organizer ICM AG informed.

Across the Asia-Pacific region, the industry is rapidly transforming amid stricter regulations, fast-evolving battery technologies, and a growing emphasis on local recycling and circu-

lar economy solutions, driven by ESG digitalization and shifting geopolitical dynamics.

 events.icm.ch/event/WRF-2026/

EUROPEAN RECYCLING CONFERENCE

March 18, 2027, Brussels (Belgium)

At the European Recycling Conference (ERC) next year, recyclers, policymakers, manufacturers, circular economy experts and industry leaders will come together as some of Europe's biggest circular economy files move from political negotiation to implementation, with attention turning to whether Europe can build the markets needed to deliver on its ambitions. For the first time in its

history, ERC 2027 will feature three stages, allowing for a broader range of sectors, diverse voices, and more

targeted discussions throughout the day, as announced by the organizers. When registration opens, further information on the program, speakers, sponsorship and exhibition opportunities, and practical arrangements will follow.

 recyclingeurope.org/event/9th-european-recycling-conference-erc-2027/



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