



# Circular Economy: Reimagining Waste



September 2023

# AGENDA



Executive Summary



Circular Economy

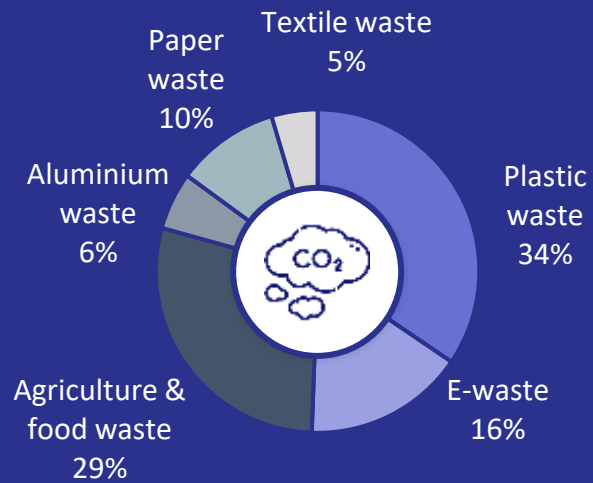


Use cases: By Different Waste Categories

- Carbon Emission
- Food Waste
- Agricultural Waste
- Plastic Waste
- E-waste
- Aluminium Waste
- Paper Waste
- Textile Waste

# Executive Summary

**Carbon Emission per Ton of Different Waste Categories**



The significant contributors to carbon emissions are primarily the Plastic and Agriculture & Food waste sectors.

In response to rising emissions and waste reduction goals, businesses are adopting the principles of the circular economy:



Unilever has launched its laundry product manufactured from **captured carbon**.

Oushaba is extracting materials from **e-waste** and incorporating them into their jewelry.



Salt & Straw has developed ice-cream by using **food by-products**.

Bottega has launched its bag collection from **recycled paper**.



Sorbiforce is manufacturing sustainable batteries from **agricultural residue**.

Hublot manufactures watches from **aluminium** and coffee waste.



Adidas is incorporating **ocean plastic** in their shoes.

Rewoven is manufacturing clothes from **recycled textile waste** and plastic.



In this report, we have explored the concept of the circular economy and examined how businesses are reducing their environmental impact by repurposing waste materials to create market-ready products. Additionally, we have highlighted the growth of the recycling market in the coming years, emphasizing the adoption of innovative techniques by industry leaders.

# Circular Economy

According to the Ellen MacArthur Foundation Circular Economy is a system where materials never become waste and nature is regenerated.

## Recycling, Upcycling, and Downcycling

Different businesses are utilizing these strategies to maximize resource utilization, reduce waste, and promote sustainability.

### Upcycling

Transforming used materials into products of higher value or quality. For example, using old clothing to transform them into unique denim bags or accessories.

### Recycling

Turning used materials into new products of similar or lesser value. For example, creating new plastic bottles from recycled plastic pellets.

### Downcycling

Converting used materials into products of lower value/quality. For example, creating items like park benches, picnic tables, or decks from used plastic.

## Major Drivers of Circular Economy



### Environmental Concerns

There is a need to reduce extraction of raw materials, minimize waste, and promote the use resources efficiently to minimize the pollution and GHG emissions.



### Regulatory Compliance

Governments across the world are enacting regulations and incentivizing businesses to adopt sustainable practices to support the principles of circular economy.



### Consumer Demand

Consumers are becoming more conscious of the environmental impact of their purchasing decisions. They are increasingly seeking products and services that are environment friendly, sustainable, and socially responsible.

# Use Cases

## Waste Categories:

- [Carbon Emission](#)
- [Food Waste](#)
- [Agricultural Waste](#)
- [Plastic Waste](#)
- [E-waste](#)
- [Aluminium Waste](#)
- [Paper Waste](#)
- [Textile Waste](#)

# Carbon Emission

World greenhouse gas emissions annually: 49.8 gigatonnes CO<sub>2</sub>e

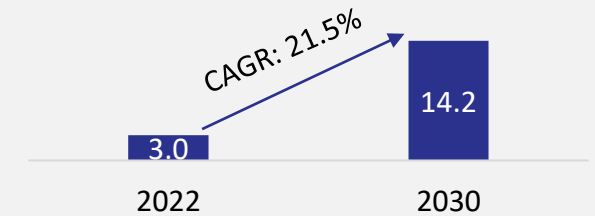
Carbon emission facts:






- **10 countries account for over two-thirds** of annual global greenhouse gas emissions including China, the USA, India, the EU, Russia, and Japan.
- **China holds the top position** releasing over **10 billion tons of CO<sub>2</sub>** annually.
- Energy consumption makes up 75.6% of the total greenhouse emissions, and the largest portion of these emissions, approximately **32%, can be attributed to heat and electricity.**

## Carbon Capture and Utilization

- Almost **2 billion tonnes** of carbon is captured every year

Carbon Capture Utilization and Storage Market (USD Bn)



Industry	Company	Use Cases	Details
Retail		Clothes	<ul style="list-style-type: none"> <li>• H&amp;M launched women's <b>clothes made from LanzaTech CarbonSmart polyester.</b></li> <li>• LanzaTech takes carbon from steel mills, traps it in a bioreactor, and then uses microorganisms to further transform it into CarbonSmart polyester.</li> </ul>
Retail		Clothes	<ul style="list-style-type: none"> <li>• Walmart Inc. collaborated with the California-based start-up Rubi Laboratories to potentially convert <b>carbon dioxide from their supply chain into cellulose</b> to produce yarn for clothing. (in process)</li> </ul>
RE Equipment Manufacturing		Syngas	<ul style="list-style-type: none"> <li>• The company has developed a high-temperature co-electrolysis process that can <b>convert CO<sub>2</sub> into syngas.</b></li> <li>• The process further utilizes syngas to generate fuels and chemicals.</li> </ul>
FMCG		Laundry Capsule	<ul style="list-style-type: none"> <li>• Unilever launched its <b>laundry capsule made from captured carbon.</b></li> <li>• In this joint venture, it is working along with LanzaTech (which turns captured carbon into ethanol) and Indian Glycols (which turns ethanol into ethylene oxide, a key feedstock to make surfactants that are used in the production of laundry capsules).</li> </ul>
Environmental Services		Fuels	<ul style="list-style-type: none"> <li>• The company utilizes its <b>carbon capture technology and Air To Fuels process</b> to provide businesses with <b>low-carbon intensity fuels</b> for airplane, truck, shipping, or car fleets.</li> </ul>

# Food Waste

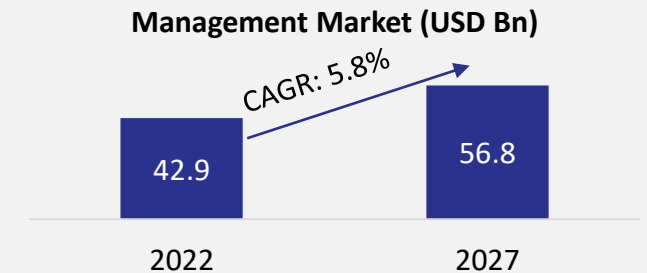
Global food waste generated annually: 931.0 Mn Tonnes

Food waste facts :

- **China is the most significant contributor** to food waste generating **91.6 Mn Tonnes annually**.
- Around the world, **one-third of the food produced** for human consumption is **wasted or lost**.
- Food waste accounts for **4.4 gigatons of GHG emissions**.

## Food Waste Management

- Of the total food waste, **14%** is recycled.



Industry	Company	Use Cases	Details
FMCG		Nutritional supplements	• A Canadian-based startup uses <b>leftover fruits and vegetables</b> to manufacture gluten-free <b>protein shakes and nutritional supplements</b> .
FMCG		Vegan Mayo	• In partnership with Whole Food Market and Ithaca Mucus, the company is creating <b>vegan mayo from aquafaba (boiled chickpea water)</b> and preventing it from seeping into sewage.
FMCG		Ice creams	• The company has created <b>ice cream flavors using different food processing by-products</b> . For example, using liquid whey in ice creams which is discarded during yogurt production.
Textile		Handicrafts and fiber	• Texfad has developed a technology to and utilize it to make premium-quality textiles and handicrafts.
Biotechnology		Bioplastic	• An Israeli-based startup is manufacturing <b>lactic acid and PLA Bioplastic from food waste</b> by using hydrolysis and microorganisms.
Entertainment		Electricity	• Disney World has an on-site biogas facility where they take <b>food waste and transform it into electricity</b> through anaerobic digestion.

# Agriculture Waste

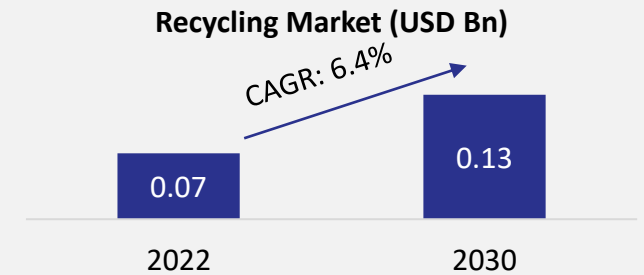
Global agricultural waste generated annually: > 5 Bn Tonnes






Agriculture waste facts:

- **China is the largest contributor** to agricultural waste.
- **India generates almost 500 Mn tons of farm waste** of which one-fifth is burnt every year.

## Agriculture Waste Recycling

- Of the total agriculture waste, **less than 20%** of it is recycled/reused.



Industry	Company	Use Cases	Details
Packaging	 <b>BIO-LUTIONS</b> Transforming the world of materials	Biodegradable packaging and tableware	• Bio-Lutions has created a <b>natural fibre from agricultural waste</b> using a mechanical technique that can be used to make tableware and packaging material.
Packaging	 <b>envoPAP</b> The Sustainable Materials Company	Sustainable paper and packaging	• Envopap is manufacturing <b>paper and packaging made from agricultural waste</b> such as bagasse.
Chemicals	 <b>VERTEX</b> BIOENERGY	Bioethanol	• Vertex is producing <b>bioethanol</b> using a fermentation process of sugars from <b>cereals which is agricultural raw material</b> .
Biotechnology Research		Biofertilizer	• US-based startup converting <b>cannabis stalk into biofertilizer</b> with the help of microbes.
Battery	 <b>SorbiForce</b> The Sustainable Battery	Sustainable Battery	• The company is manufacturing <b>batteries using sustainable resources like agricultural waste, such as straw</b> , and avoiding the use of metals.



# Plastic Waste

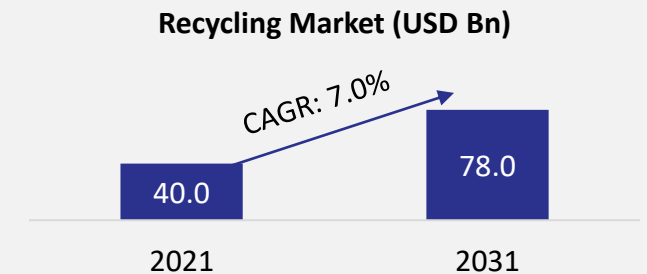
Global plastic waste generated annually: 379.0 Mn Tonnes

Plastic waste facts :

- The **USA is the largest contributor** to plastic waste.
- **1 in 3 fish caught** for human consumption **contains plastic**.
- **More than 8.0 Mn tonnes** of plastic enter the oceans every day.
- The **plastic waste is expected to triple** and reach **1 Bn metric tonnes by 2060**

## Plastic Waste Recycling

- Of the total plastic waste, **10%** is recycled.



Industry	Company	Use Cases	Details
Sustainable Raw Material		Shirts, skateboards, and sunglasses	• Bureo has developed a <b>yarn from post consumer recycled fishing net</b> that can be used to manufacture clothes, sunglasses, skateboards, and other goods.
Apparel		Shoes	• Adidas is manufacturing <b>shoes from recycled ocean plastic</b> in collaboration with Parley.
Apparel		Fashion accessories and footwear	• The company is using <b>plastic bottles, bags, and tires</b> to create trendy fashion <b>accessories and footwear</b> .
FMCG		Packaging	<ul style="list-style-type: none"> <li>• Lush is incorporating <b>recycled ocean plastic in their packaging</b>.</li> <li>• They have partnered with Ocean Legacy and are making use of 5% of their ocean plastic collection, which includes broken and abandoned oyster baskets, fishing ropes, and nets.</li> </ul>
Environmental Services		Floor tiles	• Indian-based startup is manufacturing <b>floor tiles from recycled plastic</b> .

# E-Waste

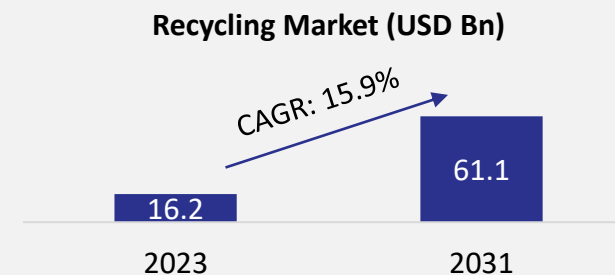
Global E-waste generated annually: 57.4 Mn metric Tonnes

E-Waste facts:

- The **largest contributors** to e-waste are **China, the United States, and India**.
- Currently, there is **more than 347 Mn metric tonnes** of unrecycled e-waste on Earth.
- Global e-waste volume is anticipated to grow **to 74.7 Mn metric tonnes by 2030**
- **Europe has the highest e-waste** collection and recycling rate, standing at 42.5%, while **Asia lags significantly with a rate of only 11.7%**.

## E- Waste Recycling

- Of the total E-waste, **18%** undergoes recycling.



Industry	Entities	Use Cases	Details
Art	SAATCHI ART	Sculptures, paintings, Photography	<ul style="list-style-type: none"> <li>• The company is transforming the <b>e-waste into different sculptures, artisans, and paintings</b>.</li> </ul>
Art	LEONARDO ULIAN	Artist	<ul style="list-style-type: none"> <li>• Italian artist Leonardo Ulian has created his <b>Technological Mandalas Series from E-waste</b>.</li> <li>• Leonardo Ulian converts technological systems into artistic creations by soldering varied electronic components into intricate patterns, evoking Buddhist spiritual symbols.</li> </ul>
Automobile	Vishnu Patel	Bike	<ul style="list-style-type: none"> <li>• Vishnu Patel repurposed <b>e-waste to create battery-operated two and three-wheelers</b>.</li> <li>• Their battery-operated vehicle can cover up to 35-45 km without any carbon emission.</li> </ul>
Luxury Goods & Jewelry	OUSHABA	Jewelry	<ul style="list-style-type: none"> <li>• The company is <b>extracting materials from e-waste</b> and incorporating them into their <b>jewelry</b>.</li> <li>• Their collection 'Connection Salvaged' showcases electronic waste sourced from discarded mobile phones, encompassing circuit boards, USB sticks, charging cables, and plugs.</li> </ul>
Sports	Envision RACING	Racing Car	<ul style="list-style-type: none"> <li>• The company has manufactured <b>racing cars from e-waste like vapes, iPhones, and circuit boards</b> in collaboration with British artist Liam Hopkins.</li> </ul>

# Aluminium Waste

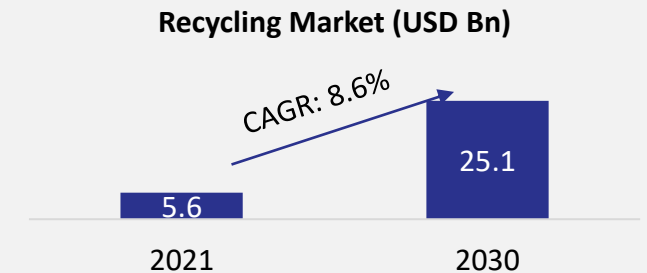
Global aluminium waste generated annually: 20.0 Mn Tonnes






Aluminium waste facts:

- **The USA leads as the world's top exporter** of aluminum scrap.
- Aluminium can be recycled endlessly without losing its quality.
- Aluminium waste can also be used to generate electricity.
- **Almost 70%** of all aluminium drinks' cans **are recycled globally**.

## Aluminium Waste Recycling

- Of the total aluminium waste, **75%** is recycled.



Industry	Company	Use Cases	Details
Apparel		Footwear	• The company has collaborated with Israeli start-up, Remeant to create 'Sleek Alchemist' sneakers whose upper part is made from upcycled aluminium foil and reflective glass.
Water Bottle		Bottle	• Re: Water is manufacturing its bottles from 100% recycled aluminium and generating 95% less energy as compared to virgin aluminium.
Automobile		Automobile	• The company is using upcycled aluminium into its cars by recovering premium automotive grade aluminium from scrapped vehicles.
FMCG		Cosmetic tube	• The brand is using Blue Tube Evo solution which is 95% derived from used aluminium tubes, cans, and aerosols in collaboration with Tubex Aluminium Tubes, a manufacturer of aluminium tubes.
Retail Luxury Goods and Jewelry		Watch	• The company uses recycled aluminium and coffee grinds to make hand watches.

# Paper Waste

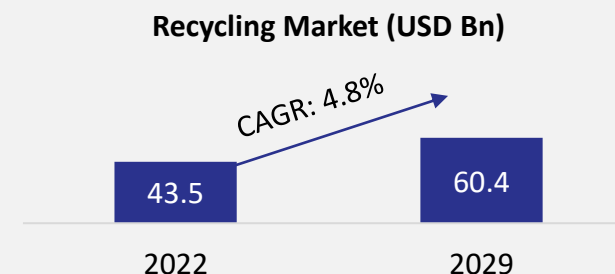
Global paper waste generated annually: 100.0 Mn tonnes






Paper waste facts:

- **China** is the largest contributor to paper waste.
- The **global consumption** of paper and paperboard is more than **400.0 Mn tonnes annually**.
- Each ton of **recycled paper can save up to 4000 kilowatts of energy, and 7000 gallons of water**.

## Paper Waste Recycling

- Of the total paper waste, **68%** is recycled.



Industry	Company	Use Cases	Details
Retail		Paper towel	<ul style="list-style-type: none"> <li>• The brand manufactures <b>paper towels from tree-free, FSC-certified recycled paper</b> and delivers in 100% plastic-free packaging.</li> </ul>
FMCG		Paper Packaging	<ul style="list-style-type: none"> <li>• Company's brands Old Spice and Secret have <b>launched all-paper packaging</b> for their aluminum-free deodorants in 500 Walmart stores.</li> <li>• The packaging contains <b>90% post-consumer recycled</b> content and 10% new paper fibers.</li> </ul>
FMCG		Notepad	<ul style="list-style-type: none"> <li>• Earthist is selling <b>notepads</b> manufactured from tree-free, <b>FSC-certified 100% recycled paper</b>.</li> </ul>
FMCG		Gift Wraps	<ul style="list-style-type: none"> <li>• The brand is using <b>100% post-consumer recycled paper</b> for flyers and gift wraps.</li> </ul>
Fashion		Bag	<ul style="list-style-type: none"> <li>• The brand has launched a new line of <b>handbags made from 100% recycled FSC-certified cardboard paper</b>.</li> <li>• The raw material undergoes a treatment involving aliphatic polyurethane film and microfiber fabric. This treatment enhances the paper-based bag by providing it with added protection and waterproof characteristics.</li> </ul>

# Textile Waste

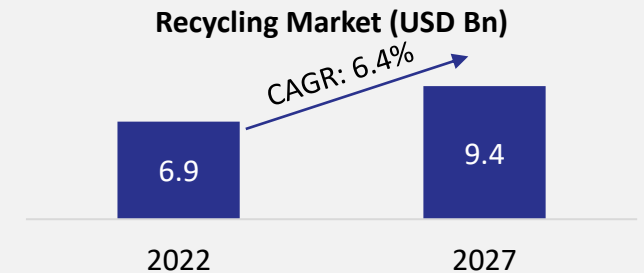
Global textile waste generated annually: 92.0 Mn Tonnes






Textile waste facts:

- **China is leading** by generating 20.0 Mn tonnes of textile waste per annum.
- More than **60% of the clothes manufactured contain plastic** like polyester, nylon, acrylic, and polyamide.
- Textiles account for **almost 10% of the annual dispersion of microplastics into the ocean.**

## Textile Waste Recycling

- Of the total textile waste, **12%** is recycled.



Industry	Company	Use Cases	Details
Textile		Cotton and Fiber blends	<ul style="list-style-type: none"> <li>• Uses textile waste to <b>create high-quality recycled cotton fiber.</b></li> <li>• Textile waste is cut and treated, non-textile elements are removed, and the resulting pieces are processed using a proprietary method to create Recover fiber.</li> </ul>
Textile		Fabric	<ul style="list-style-type: none"> <li>• The company is producing entirely <b>recycled fabric comprising 60% pre-consumer textile waste</b> and 40% plastic waste using a mechanical recycling technique.</li> </ul>
Chemical		Dye	<ul style="list-style-type: none"> <li>• The Swiss-based chemical company has introduced fiber colors technology that uses <b>textile waste to make dyestuff.</b></li> </ul>
Textile		Circulose sheets	<ul style="list-style-type: none"> <li>• The company developed a method that utilizes a mechanical recycling process to produce circular cellulose.</li> <li>• This process involves transforming <b>old garments into circulose sheets, which can then be further converted into natural textile fibers.</b></li> </ul>
Campaign		Denim Insulation	<ul style="list-style-type: none"> <li>• The Blue Jeans Go Green initiative gathers denim from across the US to prevent landfill waste and works with Bonded Logic, Inc. <b>to create UltraTouch denim Insulation for homes and buildings.</b></li> </ul>

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