

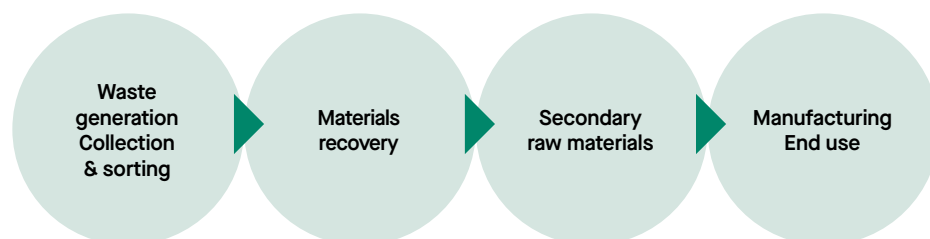
Materials recovery

CLIMATE & EFFICIENCY INVESTMENTS



Decarbonising materials recovery: A strategic imperative

By 2050, demand for secondary raw materials is expected to rise significantly as economies shift towards circular and low-carbon production systems. Rapid urbanisation and consumption are generating increasing volumes of waste. Materials recovery converts these waste streams into valuable secondary materials that can obviate or at least delay the need for energy-intensive primary resource extraction. Globally, more than 2 billion tonnes of municipal solid waste are generated annually, and this figure could reach 3.9 billion tonnes by 2050, according to the World Bank.¹ However, circularity remains limited: Only about 6.9%² of materials used globally come from recycled sources, highlighting the large gap between resource consumption and recovery. As a key link between waste generation and secondary material supply, materials recovery plays a critical role in reducing lifecycle emissions, conserving natural resources, and supporting the transition to a low-carbon economy.



Materials recovery

Materials recovery involves processing waste streams using primarily electricity powered equipment with additional energy for transport or specialised treatments to convert them into secondary raw materials that can be reintroduced into manufacturing and production systems.

From a greenhouse gas (GHG) perspective, materials recovery activities generate **Scope 1 and Scope 2 emissions**.

Key emissions drivers in materials recovery

Scope 1 – Direct emissions

Scope1 emissions in materials recovery mainly stem from on site fuel use in processing operations and mobile equipment such as loaders and forklifts, with smaller contributions from backup generators and other auxiliary machinery.

Scope 2 – Indirect emissions

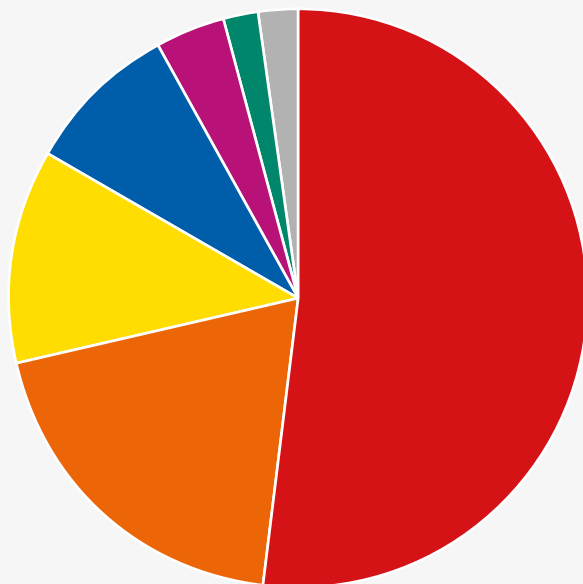
Scope2 emissions in materials recovery stem from purchased electricity used to power key recycling and sorting equipment, including separation systems, conveyors, magnetic separators, and optical sorting technologies.

¹ What a Waste 3.0

² 2025 The Global Circularity Gap Report | Deloitte Global



Key CO₂ emissions drivers Materials recovery



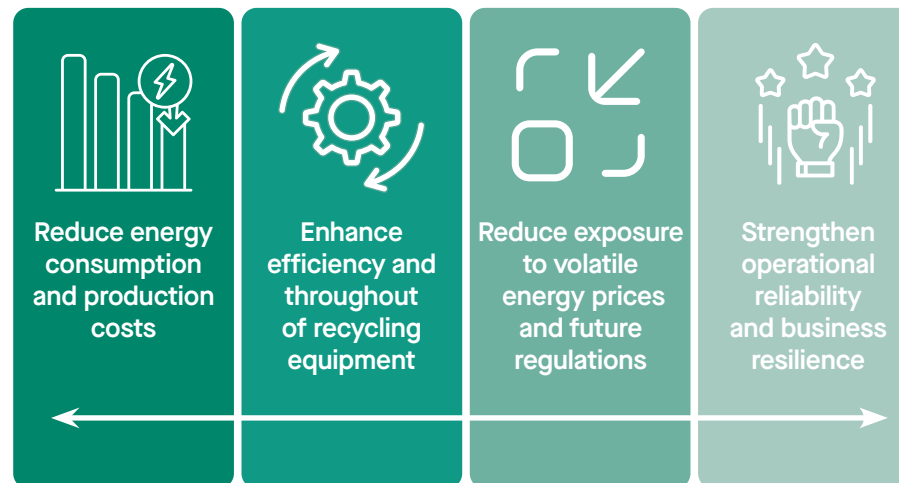
Key emissions drivers

- Machine drive 53%
- Facility HVAC 20%
- Facility lighting 12%
- Other facility support 9%
- Process cooling/ refrigeration 4%
- Onsite transportation 2%
- Miscellaneous 2%

Why decarbonisation matters

Reducing on-site emissions and improving energy efficiency provides materials recovery facilities with opportunities to lower operating costs and manage energy price volatility. Materials recovery operations rely heavily on electricity and fuel to power processes such as waste sorting, shredding, crushing, separation, washing, and material reprocessing. Upgrading equipment, optimising sorting technologies, recovering energy from waste streams, and integrating renewable energy can reduce emissions while improving efficiency and competitiveness.

By reducing Scope 1 and 2 emissions, materials recovery businesses can:



Decarbonisation Roadmap

Materials recovery				
Investment measure	Energy cost savings (%)	Payback period (years)	CO ₂ reduction potential	Benefits
CHP combustion engine	20%	3 - 4	●	Combined heat and power (CHP) engines generate electricity and heat from a single fuel, boosting efficiency, reducing energy waste, and lowering emissions. When powered by low-carbon fuels like biogas or hydrogen, they further support a cleaner energy system.
CHP gas turbine	20%	3 - 4	●	CHP gas turbines support net-zero goals by generating electricity and capturing waste heat, boosting efficiency. Powered by low-carbon fuels like biogas or hydrogen, they reduce emissions while providing reliable power and heat.
CHP fuel cell	20%	3 - 4	●	CHP fuel cells support net-zero goals by generating electricity with high efficiency and supplying useful heat. Their low carbon intensity, quiet operation, and low maintenance enhance energy efficiency compared to conventional combustion systems.
Battery electric vehicles (BEVs)	50%	5 - 6	✓	Electric vehicles offer higher energy efficiency through advanced battery systems and regenerative braking, reducing overall energy consumption during operation. They offer a clean solution for transporting products, reducing fuel costs, and improving operational sustainability.
Electric forklifts	50%	2 - 3	✓	Electric forklifts are battery-powered material-handling vehicles used to move ingredients, trays, and finished products within bakery facilities. They offer high energy efficiency by converting stored electrical energy directly into motion with minimal losses. This efficiency reduces fossil fuel use and CO ₂ emissions.
Loaders	25% - 45%	4 - 5	●	Energy-efficient loaders contribute to lower greenhouse gas emissions, reduced noise pollution, and compliance with increasingly stringent emissions regulations.

CO₂ reduction potential ● Very low ● Low ● Medium ✓ High

Decarbonisation Roadmap

Investment measure	Energy cost savings (%)	Payback period (years)	CO ₂ reduction potential	Benefits
PV self-consumption	Up to 100% Based on the system capacity and electricity demand	6 - 7	✓	A PV (photovoltaic) system converts sunlight into electricity for on-site use. It provides clean, renewable energy to power production, refrigeration, and other operations, reducing reliance on grid electricity and lowering operational costs. Pairing a PV system with battery storage enables multi-shift companies to rely on renewable electricity while reducing exposure to electricity price volatility.
Li-ion batteries	Case-specific	4 - 8	Case-specific	Lithium-ion (Li-ion) batteries are energy storage systems that store electricity and release it when needed. Their energy-saving potential comes from maximising the use of on-site renewable electricity, reducing reliance on grid power during peak periods. This not only supports emissions reduction but also delivers tangible cost savings through improved energy management and lower operating expenses.
Industrial process chiller	20% - 30%	Over 10 years	●	Industrial process chillers provide precise temperature control to maintain product quality and protect equipment. Their efficient operation reduces energy consumption, promoting more sustainable industrial operations.
Water source heat pumps	20% - 30%	Over 10 years	●	Water source heat pumps are systems that use water as a medium to efficiently transfer heat for heating and cooling. They help companies reduce energy consumption and operational costs while lowering greenhouse gas emissions.
Air-to-air heat pumps	15% - 25%	Over 10 years	●	Air-to-air heat pumps provide efficient heating and cooling by transferring energy rather than generating it. Their high efficiency reduces electricity consumption, contributing to more sustainable building operations.
Air-to-water heat pumps	10% - 20%	Over 10 years	●	Air-to-water heat pumps are systems that extract heat from the air to provide efficient heating and hot water. They help companies reduce energy use, cut costs, and lower emissions.
Ground source heat pumps	15% - 25%	Over 10 years	●	Ground source heat pumps are systems that use the stable temperature of the ground to provide efficient heating and cooling. They help companies reduce energy consumption, lower costs, and cut greenhouse gas emissions.

CO₂ reduction potential ● Very low ● Low ● Medium ✓ High

Investment measure	Energy cost savings (%)	Payback period (years)	CO ₂ reduction potential	Benefits
Ventilation system	10% - 20%	Over 10 years	●	A ventilation system manages the flow of air by bringing in fresh air and expelling stale or contaminated air to maintain a healthy indoor environment. By reducing energy use and improving air quality, efficient ventilation systems support lowering a facility's overall carbon footprint.
Building insulation materials	50%	4 - 5	✔	Building insulation reduces heating and cooling costs, boosts energy efficiency, and supports decarbonisation by lowering emissions and environmental impact.
LED lighting	5% - 10%	5 - 6	●	LED lighting provides high-efficiency illumination with lower energy consumption compared to conventional lighting solutions. Its reduced electricity demand supports decarbonisation and enhances building performance.

For more detailed information on how to reduce costs and lower your CO₂ footprint, along with additional measures tailored for your business, contact the bank.

