

ZINC RECYCLING

Closing the Loop

Zinc is an essential element for all living organisms. Its unique metallurgical and chemical properties have also made it the material of choice for an extensive range of applications in modern society. At the end of their useful life, the zinc recovered from these products can be recycled without loss of its characteristics or value.

Current Uses of Zinc

Refined zinc is used in a variety of applications. Galvanizing represents the largest first use of zinc – coating steel to provide corrosion protection (about 60% of total consumption; Figure 1). Other markets for zinc include alloying with copper (brass) or aluminum (die casting), rolled zinc sheet, compounds such as zinc oxide (used in fertilizers, paint, rubber, and pharmaceuticals) and many other applications. While uses have not significantly changed over time, zinc consumption has more than doubled in the last 40 years. Most of this growth has occurred in applications with long effective lifetimes, such as galvanizing, alloys, and rolled zinc, where the products may stay in service up to 100 years. Primary end use markets for these products include building and construction, transportation, industrial, electronic, and agricultural applications.

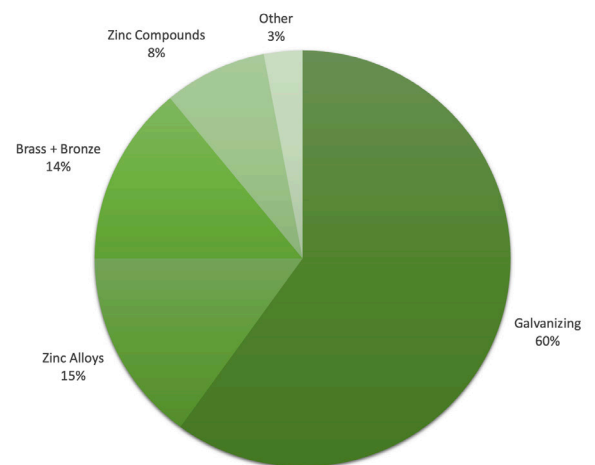


Figure 1: Global refined zinc consumption by first use

Sources for Zinc Recycling

A systematic life cycle for zinc is illustrated in Figure 2. Zinc containing products such as galvanized steel become a source of recycling feedstock at the end of their useful life (“old scrap”). These products are collected and processed based on scrap availability, metal composition (e.g., purity, alloy, etc.) and ease of processing. Additionally, due to potential losses during manufacturing and fabrication (e.g., drosses, residues, off-cuts, etc.), zinc becomes available for recycling during the processing phase (“new scrap”). Depending on the composition of the recycling source being available, it can either be re-melted or returned to the refining process.

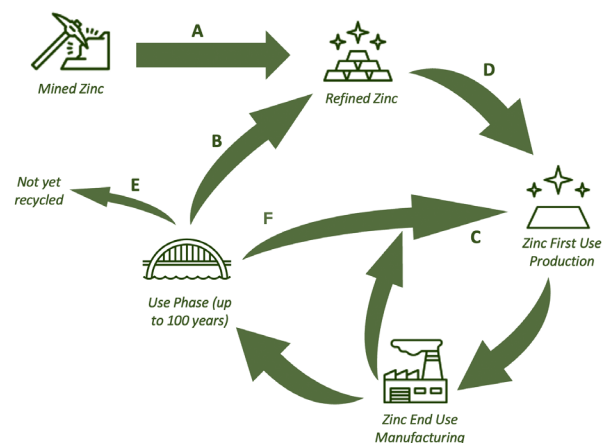


Figure 2: 2050 Zinc recycling loops (simplified).

Recycling Rates

Approaches commonly used to assess recycling rates for zinc are Recycled Content (RC), Recycling Input Rate (RIR),

and End of Life Recycling Rate (EoL RR). Recycled Content is the proportion of raw material from recycled sources in a given product. For metals, recycled content can be considered for the refined metal (refined RIR) or the sum of all material going into fabrication (RIR). The global average refined RIR for Special High-Grade Zinc in 2019 was about 11% (recycled feed materials combined with ore concentrate as feedstock at the smelter). When considering the sum of all material used to produce zinc-bearing goods, the global average RIR increases to 39%. The difference being defined by zinc that can simply be re-melted (Figure 2 and Table 1). The Recycling Input Rate shows how much zinc used today originates from recycled sources compared to zinc coming from mined ore.

Indicator	Description	Estimated global recycling rate	
		2010	2019
Recycled Content, Recycling Input Rate (RIR) (B+C)/(A+B+C)	Fraction of zinc scrap (new and old) in the total metal use in fabrication and manufacturing	22%	39%
Refined Recycling Input Rate B/(A+B)	Fraction of zinc from old scrap in the production of refined (SHG) zinc	6%	11%
End of Life (EoL) recycling rate (B+F)/(B+F+E)	Fraction of zinc recycled relative to the amount of zinc available at end of product life	27%	34%

Table 1: Typical recycling rate indices (letters relate to Figure 2) (Fraunhofer ISI 2022, Resources, Conservation & Recycling 180).

The End-of-Life Recycling Rate (EoL RR) illustrates the amount of zinc that is recycled compared to the amount of zinc becoming available for recycling at the end of life (“old scrap”). It is estimated that a global average of 34% of available zinc at the end of life was recovered and recycled in 2019 (Table 1). The EoL RR varies strongly between developed and developing regions due to the lack of mature recycling networks and regulatory initiatives directed at reducing industrial waste. The EoL RR is useful for identifying areas for waste management optimization and to assess the benefits of policy measures.

Recycling rates are significantly higher for zinc metal products such as galvanized steel, zinc sheet roofing and brass, while some products are not recycled due to the dispersive nature of their use (zinc oxide used in pharmaceutical products or fertilizers).

How Much Zinc is Recycled Today?

In 2019, 13.5 Mt of SHG zinc have been produced. 1.5 Mt of which originate from recycling zinc from galvanized steel. In addition, about 6 Mt of zinc were recycled from new scrap, old scrap, and from industrial wastes and by-products (Figure 3). Since 2010, the tonnage of recycled zinc produced has doubled while the production of mined zinc remained almost constant.

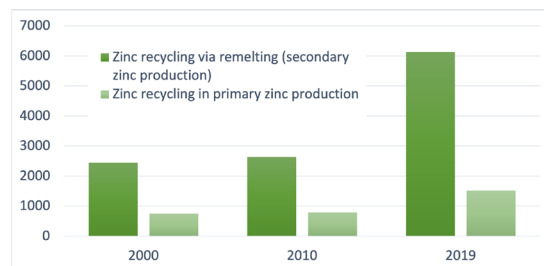


Figure 3: Recycling Input to Global Zinc Production (Thousands of tonnes).

What is the Zinc Industry Doing to Advance Recycling?

Due to the value of zinc as a commodity and regulatory changes promoting recycling, the zinc industry continues to advance technologies for recovering zinc from products at end of life and from industrial wastes. Examples:

- Improved technology enables zinc production from spent mine tailings, minimizing long-term disposal and associated potential impacts on people and environment.
- Over the next decade, zinc recycling from galvanized steel (steel mill dusts) will continue to increase and could more than double by 2050.
- Zinc recycling from various waste streams (municipal and industrial waste, and sewage treatment sludges) continues to increase.

In addition, the International Zinc Association (IZA) continually monitors information on the effectiveness of zinc recycling, facilitating joint efforts of all stakeholders to unleash recycling potentials through their recycling programs. These include regular updating of the zinc stocks and flows model as well as future demand and availability scenarios.

Available Recycling Factsheets



ZINC | international zinc association

Email: info@zinc.org

Website: www.zinc.org

