Powering Zinc: Energy Availability, Affordability, and Decarbonizing the Zinc Value Chain

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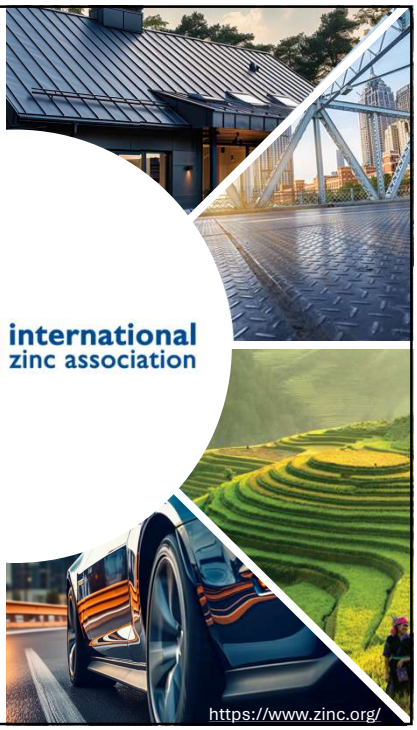
ILZSG Spring meetings, 22 April 2026



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International Zinc Association (IZA)

- Not-for-profit organization
- Represents 60% of the worldwide zinc production, 80% in Western hemisphere
- Offices: USA, Europe, India, China
- Membership includes more than 200 companies representing: mining, refining, first use, and recycling

IZA Mission

Provide global leadership, coordination, and value on strategic issues for the zinc industry, including market development, license to operate, communications, and sustainability.

In practical terms:
IZA coordinates positive initiatives for zinc that are best done collectively at local, regional, and global levels.

https://www.zinc.org/who-we-are/

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1. **Zinc enables the energy transition**
2. Carbon footprint of zinc production
3. Let's talk about zinc recycling
4. Summary

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Enabling the Energy Transition

Zinc plays a critical role in enabling green technologies such as solar and wind power.

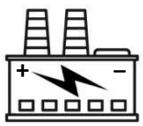
Zinc coatings extend the life and durability of electrical grids.

Zinc coatings ensure that wind turbines meet their intended design life.

Zinc coatings support solar structures and co-products Ga, Ge and In provide power.

Zinc batteries supply grid backup, long-duration storage, and mobility applications.

Most mass production EV's rely on zinc-coated steel for safety, longevity and low cost.



Zinc electrolyzer capacity could be adapted to deliver significant battery capacity for 6 or more hours daily.

1.Source: McKinsey, CRU, International Zinc Association

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Solar Zinc

- A 100MW solar park – capable of powering tens of thousands of homes – requires roughly 240 tons of zinc.
- Zinc co-products Ga, Ge and In are used in solar cells to create advanced semiconductor materials improving the efficiency of photovoltaic devices.

31 Ga Gallium

32 Ge Germanium

49 In Indium

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Energy Resilience with Zinc-Based Batteries

- Zinc has been developed across a wide range of chemistries and applications.
- Hybrid systems offer potential for zinc to meet most critical needs.

NICKEL ZINC → ZINC ION → RECHARGE ALKALINE → ZINC BROMINE FLOW → ZINC AIR

High power density; Short duration storage

ZINC BATTERY INITIATIVE

High energy capacity; Long duration storage

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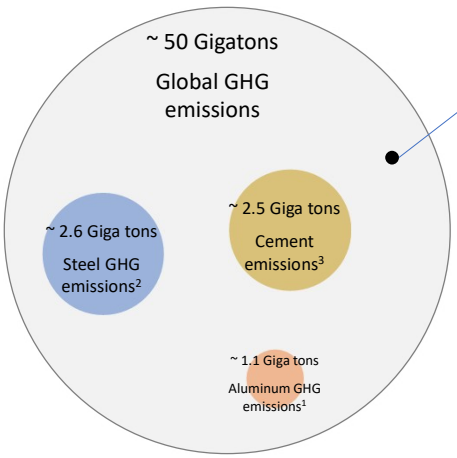
Baseline Carbon Footprint of Global Zinc Industry



~ 54 M tons
Zinc GHG emissions

- Includes zinc mining, refining, first use goods production, remelting, and recycling

Sources:
1. ASI Issue Brief, 2022
2. iea.org
3. irena.org

[2023]

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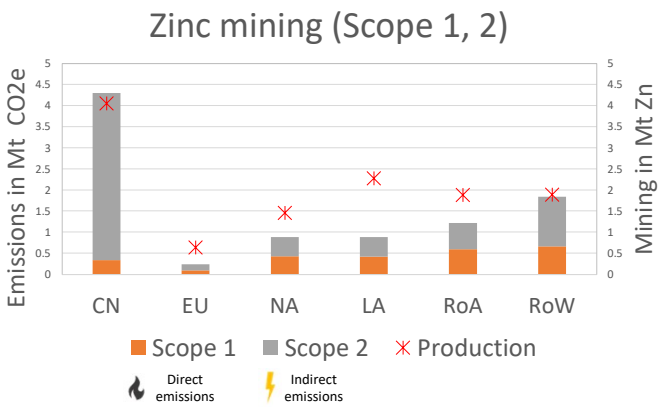
Zinc Mining is Highly Electrified



- Zinc ore is mined in open pit and in underground mines
- Zinc ores carry Pb, Cu, Ag, Au, In, Ge, Ga, Cd, As

CN: China, EU: Europe, NA: North America, LA: Latin America, RoA: Rest of Asia, RoW: Rest of the World

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ICMM

Insights from ICMM's Innovation for Cleaner, Safer Vehicles (ICSV) initiative

ICMM members' goal: "getting zero carbon solutions for mobile equipment ready at global scale by 2030 with the aim of full adoption by the industry by 2040"

https://www.icmm.com/insights-icsv-initiative

Impact Opportunities Mining

- Electrification of diesel powered mine haul trucks
- Availability of low-carbon electricity

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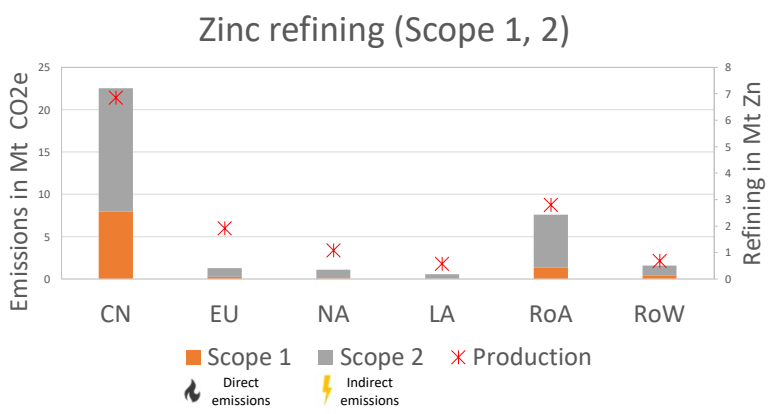
Zinc Refining is Highly Electrified



- The main route for primary zinc production is the roast-leach-electrowinning process.
- By- and co-products: In, Ge, Ga, Ag, Pb, Au

CN: China, EU: Europe, NA: North America, LA: Latin America, RoA: Rest of Asia, RoW: Rest of the World

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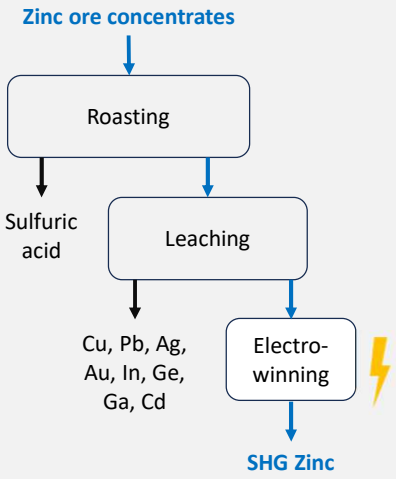
Impact Opportunities Refining

Roast-leach-electrowinning route (95% of all zinc produced):

- ➢ Availability and affordability of low-carbon electricity (Scope 2 emissions)



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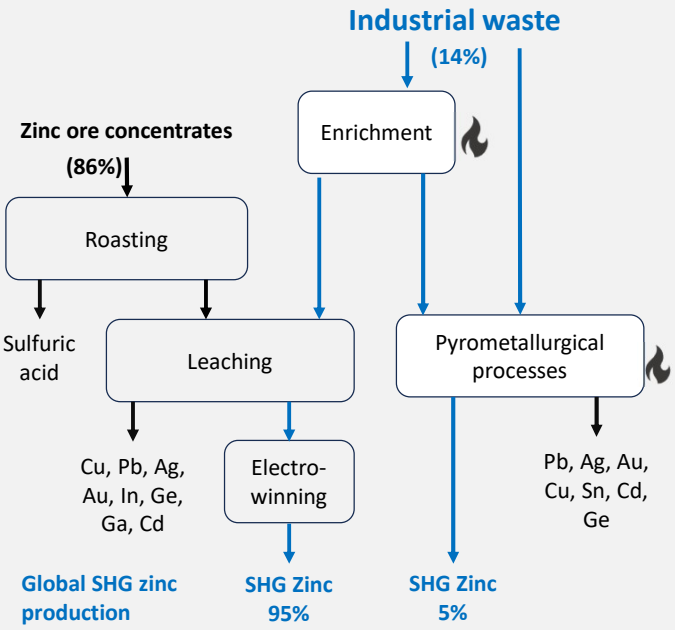
Impact Opportunities Refining

- Pyrometallurgical processes using carbon as a reductant:
  - Alternative reductants such as hydrogen
  - Carbon capture technologies
  - Innovative process developments



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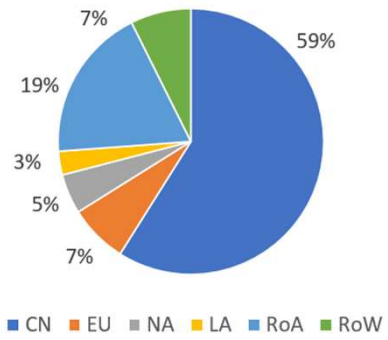
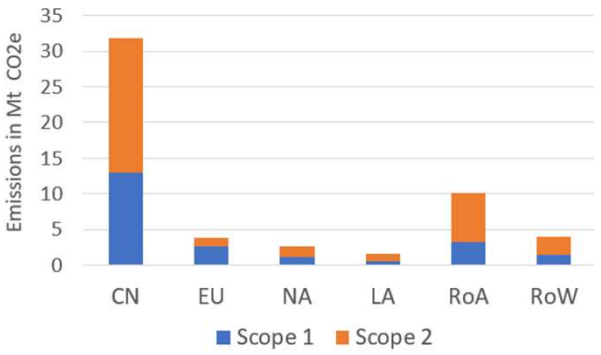
GHG Emissions from Zinc Production

Per region [2023]



Per scope



ILZSG, Skarn, Fraunhofer ISI

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Region/Country – Level Strategies

Strategy	China	Europe	USA
Decarbonize Power Production	X	X	
Decarbonize pyrometallurgical processes		X	
Maximize by-product recovery (CRM)	X	X	X
Zero industrial waste	X		

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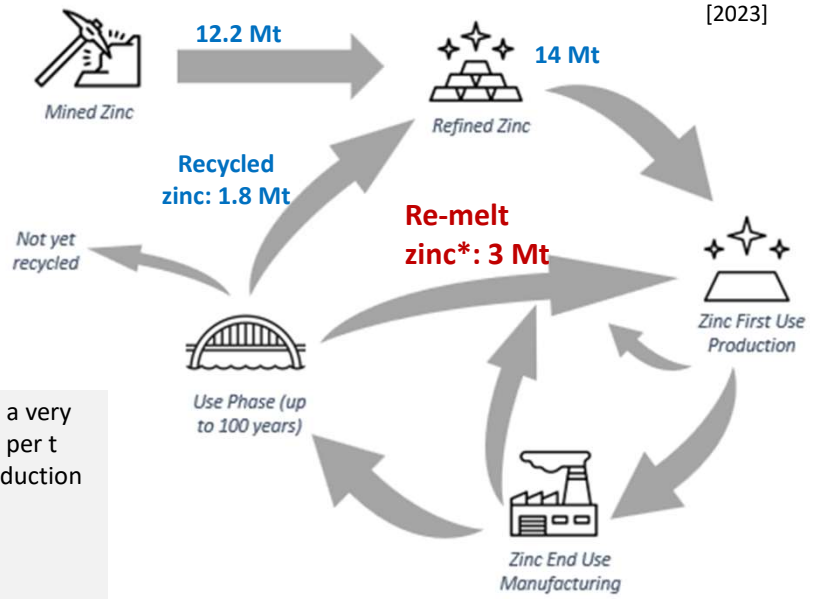
Zinc Recycling Pathways

[2023]



- Zinc is re-melted from zinc scrap at a very low carbon footprint (ca.0.6 t CO_2e per t zinc) compared to primary zinc production (3.5 t CO_2e per t zinc)
- Considered in ILZG statistics
- Not considered in ILZSG statistics

* Very conservative number

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Summary

- Zinc enables the energy transition.
- Zinc production is highly electrified and hence dependent on affordable low-carbon electrical power.
- The zinc industry recycles critical and valuable metals from industrial waste securing raw material supply and minimizing landfilling.
- Re-melting zinc scrap has a low carbon footprint compared to primary zinc production

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