From Underground to Breaking New Ground

The Evolution of Polish Silver mining to Circularity in Zinc

Lisbon, October 2026

Disclaimer

The information, data, analyses, and conclusions presented in this presentation are provided for scientific and informational purposes only and reflect the views and interpretations of the author(s) based on the information available at the time of the presentation. While every reasonable effort has been made to ensure the accuracy, reliability, and completeness of the information presented, no representation or warranty, express or implied, is made regarding its accuracy, completeness, or suitability for any particular purpose.

The views and opinions expressed herein are those of the author(s) and do not necessarily reflect the views, policies, or official position of their affiliated institution(s), organization(s), or other entities, unless explicitly stated otherwise.

The information presented should not be construed as professional, legal, medical, financial, or other specialized advice, nor should it be relied upon as a substitute for independent professional judgment. Any use or interpretation of the information contained in this presentation is undertaken at the recipient's own discretion and responsibility.

Certain data, figures, materials, or third-party content included in this presentation may be subject to copyright, confidentiality, or other intellectual property rights. Such materials are presented solely for legitimate scientific, educational, or illustrative purposes, where applicable.

The author(s) reserve the right to update, amend, or correct the information presented as new evidence or data become available.

Agenda

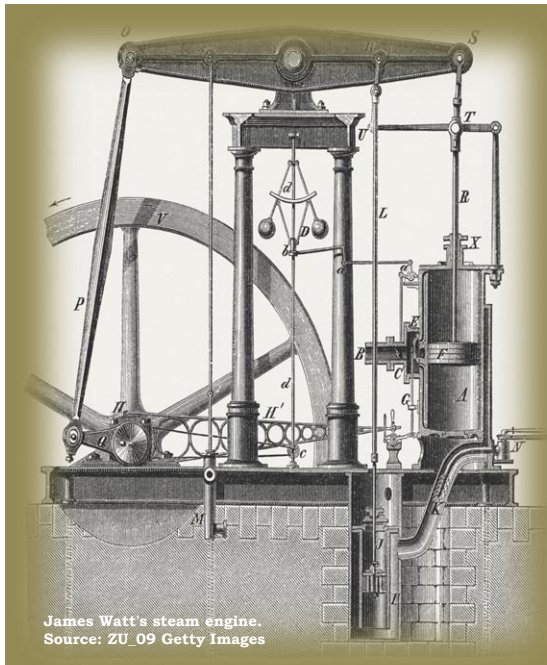
Part 1
Poland's Mining Heritage: Centuries of Innovation and Global Impact

Part 2
Zinc Smelting in Poland: Global Leadership and the Circular Transformation

Part 3
The Future of Polish Zinc: Leading the Circular Economy

Key Takeaways/Summary

Honouring our past, shaping our future.



James Watt's steam engine.
Source: ZU_09 Getty Images

Poland's Mining Heritage: Centuries of Innovation and Global Impact

FOUNDATIONS & THE SILVER AGE MEDIEVAL ERA 16TH CEN

Did you know?

The Military Secret of Olkusz Lead

During the **Swedish Invasion of Poland (1655–1660)**, the invaders deliberately **spared Olkusz and its local mines from destruction** to secure uninterrupted lead supplies for their own ammunition. The Swedes held the legendary underground engineering skills of our miners in such high regard that they **conscripted 30 Olkusz miners to dig strategic siege tunnels** under the besieged **Jasna Góra Monastery**, while forcing another 100 into fatal sapping operations in Kraków. Even 400 years ago, our unique metallurgical *know-how* decided the fate of historic European battles!

…vidence of early **ore extraction** in the … Miasteczko Slaskie region

…**d and silver mining** in the Olkusz …rt of an **10 century long mining**

…s the historic Bull of Gniezno (*Ex …o*), containing the first written record …*gentifossores*) near Bytom in Silesia

…ords of King Boleslaw the Shy grants portion of …s from **a Lead mine** in Olkusz area to a convent.

1528

Publication of the "Ordunek Górny", one of Europe's **first modern mining laws**, codifying miners' rights and establishing a highly structured framework for silver and leadmining and smelting

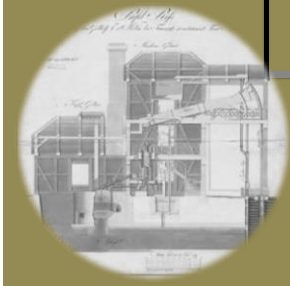
INDUSTRIAL REVOLUTION & GLOBAL LEADERSHIP
1788 – 1913

The Steam Age:
1788 activation of the first Newcomen steam engine in continental Europe at the "Fryderyk" Mine.

Market Dominance:
In the 19th century, the region provided nearly 50% of the global zinc demand.

50 %

Production Peak:
Regional mining and smelting activities reach their absolute historical peak just before the outbreak of World War I, concluding over a century of spectacular, uninterrupted industrial growth



Steam engine in Tarnowskie Góry (1788)
Source: The Metallurgy Museum of the Mała Panew Valley in Ozimek

Technological Breakthrough:
1798 horizontal retort process developed by J.Ch. Ruberg (The Silesian Method).

Civilisational Progress:
1884 Adolph Shaft Waterworks in Tarnowskie Gory – world-leading integrated mine water management system.

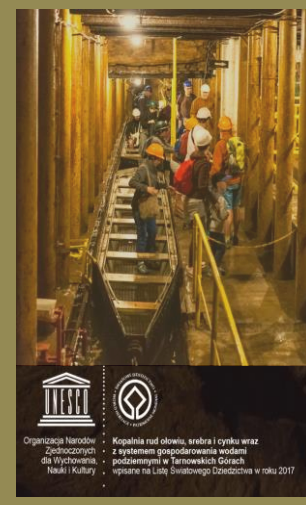
MODERN OPERATIONS & GLOBAL LEGACY
1945 – Today

1950 –1970 Post-War Expansion – Discovery of massive sulfide deposits and the consolidation of ZGH Bolesław

1975 Global Ranking – Poland reached its peak as the 6th largest zinc producer in the world

2017 Global Recognition – The Tarnowskie Góry underground system is inscribed on the UNESCO World Heritage List

2021 **END OF AN ERA (DECEMBER 31, 2020):** With the complete depletion of the *Olkusz-Pomorzany* mine, primary zinc-lead extraction in Poland officially came to a permanent end. **Since 2021, our domestic primary mining extraction stands at exactly 0 tonnes**.



MODERN ZINC AND LEAD MINING IN POLAND 1945–2020

ZGH BOLESŁAW HCM SA
Stalprodukt S.A.

Did you know?

Multi - Generation Scale of the Olkusz - Bukowno Basin (Pre-1958 Legacy)

- **70+ Active Mines on 7 Hectares:** In the 16th century, this dense industrial cluster bordered Olkusz, yielding **500–700 tons of lead annually** to supply European markets.
- **300 Mines on a Single Adit:** Around the Ponikowska adit alone, some **300 mines** operated concurrently during the peak of gravity-drainage mining.
- **32.5 Kilometers of Adit Mastery:** A network of 5 grand drainage adits constructed between 1548 and 1621 to beat the water table.
- **2,000 Sunken Shafts:** Geometrically cataloged and marked on Eisler Rensch's mining map of Olkusz, Bolesław, and Starczynów in 1769.
- **12,000 Tonnes of Annual Zinc (1825):** Produced from 18 calamine mines and 26 smelters across the region, igniting the 19th-century global zinc rush.
- **620,000 Meters of Drilling:** A massive post-WWII exploration campaign (1950–1970) involving **3,600 boreholes** that ultimately unlocked the deep, untouched Zn-Pb sulfide deposits

POMORZANY MINE
1974 - 2020

The youngest, largest, and most technologically advanced facility in the Olkusz -Tarnowskie Góry basin, launched in 1974. Pomorzany **hoisted its symbolic "final ton" of ore on December 31, 2020,** bringing to a triumphant close the chapter of primary ore extraction in Poland and strategically launching our circular smelting transition

TRZEBIONKA MINE
1968 - 2013

A pivotal private-sector operation in the neighboring Chrzanów region that demonstrated outstanding commercial viability. Remaining highly functional and profitable until 2013, Trzebionka outlasted many of its state-run counterparts, **serving as a vital bridge between the old industrial economy and new models of sustainable resource management.**

HCM Miasteczko Śląskie

ZGH BOLESŁAW HCM SA
Stalprodukt S.A.

Zinc Smelting in Poland: Global Leadership and the Circular Transformation

MILESTONES OF ZINC SMELTING IN POLAND

- **1834 THE IN** – Launch of the "Wilhelmina" (later HMN Sz… …elters.
- **19** …ed through the strategic …melters, consolidating …kusz region.
- **THE IMPERIAL** …asteczko Śląskie.
- … becomes a strategic …
- **2012** **…KATION** – On December 11, 2012, ZGH… **…dukt S.A. Capital Group**

Did You Know?
The 1909 "Zinkkartell"

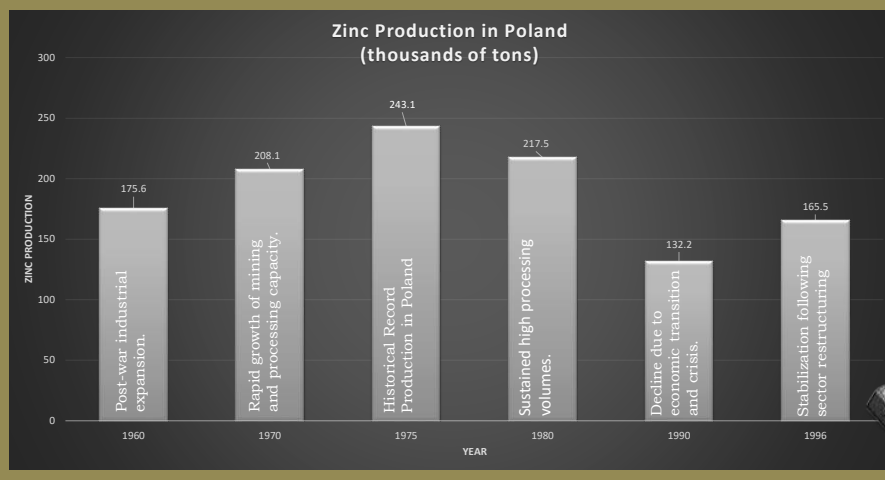
In 1909, the International Zinc Cartel (*Zinkhüttenverband m.b.H.*) was established, immediately monopolising over **75% of European and 50%** of global zinc supply.
Reflecting Silesia's immense industrial power, the syndicate's vast eastern sales were managed directly from its headquarters in **Kattowitz (Katowice).** Orchestrated by three elite German trading houses known in Britain as the **"German Octopus,"** this powerful network dictated European market prices using automated monthly production cuts of **5% to 10%** to defend price thresholds, until its collapse at the outbreak of World War I in 1914

Zinc–lead shaft furnace.
Source: Ullmann's Encyklopedia of Inustrial Chemistry

FACTS AND FIGURES
Poland on the Global Zinc Market - 20th & 21st centuries

- **19th CENTURY HEGEMONY (SILESIAN GIANT):** In 1825, the basin operated 18 calamine mines and 26 smelters, yielding over **12,000 tonnes of zinc metal annually**. In the 1860s, the Silesia-Cracow region was a global colossus, supplying **40% to 50% of the world's total zinc demand**.
- **1975 ALL TIME HIGH**– Poland reaches its peak production 243,100 tons of metallic Zinc.
- **2021 - The Circular Shift** – Completion of primary ore mining and transition to a circular economy model based on **100% recycling**

METALLIC ZINC PRODUCTION DYNAMICS IN POLAND 20th CENTURY



Source: Metallic Zinc Production Dynamics in Poland (Chart Data)
Based on statistical records from the Polish Academy of Sciences (PAN) and GUS

THE EVOLUTION OF POLISH ZINC SMELTING

PRE-WWII ERA
The Age of Global Dominance
1798–1939

- **Wesoła Smelter (Mysłowice)**
- **Wilhelmina (Szopienice) & Karol (Ruda Śląska)**
- **Ksawery Smelter (Dąbrowa Górnicza)**
- **Fryderyk Smelter (Tarnowskie Góry)**

POST-WWII ERA
Modernisation & Integration
1945–2020

- **ZGH "Bolesław" (Bukowno)**
- **HCM Miasteczko Śląskie**
- **HMN "Szopienice"**
- **Katowice-Wełnowiec**

CURRENT ERA
Leaders of the Circular Economy
2021–Present

- **ZGH "Bolesław" S.A.**
- **HCM Miasteczko Śląskie**

Did You Know?
Scale of Industry
By the late 1920s, the Silesia-Cracow region reached its industrial peak with **33** active zinc smelters in operation

ZGH BOLESŁAW GROUP
THE TRANSITION TO 100% SECONDARY FEED

Production relied almost exclusively on primary **sulfide concentrates (ZnS).**

Pre-2008

2008

Launch of the first **Oxide Campaign**, marking the strategic shift toward secondary feedstocks.

Comissioning of the **ZGH Oxide Plant** & Zinc Oxide Dechlorination

2013

2023

Last **sulphide/ concentrates** campaign in HCM

2026

Full transition to **100% secondary/ oxide feed at Miasteczko**

45 % seconary oxide feed at ZGH Boleslaw

Leaders of the Circular Economy

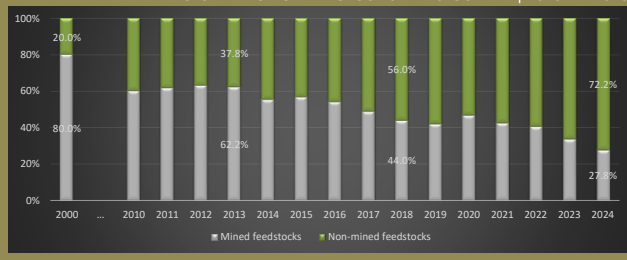
The Future of Polish Zinc: Leading the Circular Economy

ZGH BOLESŁAW GROUP
CURRENT PRODUCTION AND STRATEGIC SCALE

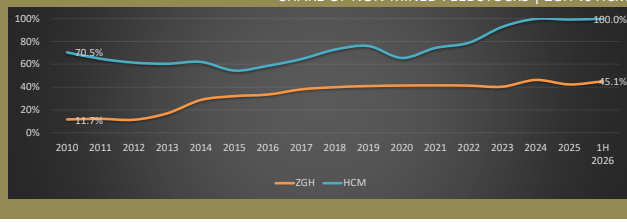
HCM SA
Stalprodukt S.A.

Today

TRANSFORMATION OF THE GROUP'S FEEDSTOCK MIX | 2010–1H 2026



SHARE OF NON-MINED FEEDSTOCKS | ZGH vs HCM



Tommorow

- **Total Annual Output Ambition:** **200 000** metric tons (MT) of metallic zinc.
- **ZGH Bolesław S.A.:** Strategic capacity of **120 000** MT via the electrolytic process.
- **HCM Miasteczko Śląskie:** Operational target of **80 000** MT SHG ZINC (2026 forecast: 70'000 MT of zinc and alloys) + 5'000 MT GOB ZINC

ZGH BOLESŁAW GROUP
TECHNOLOGIES

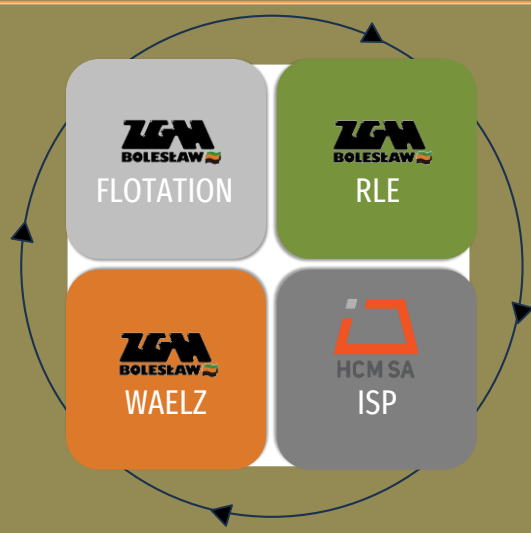
HCM SA
Stalprodukt S.A.

Flotation

Hydrometalurgical enrichment of zinc residues

Waelz

Pyrometalurgical enrichment of zinc residues



Roast Leaching Electrowinning

Hydrometallurgical process of zinc electrolysis

Imperial Smelting Process

Pyrometallurgical process of zinc smelting

ZGH BOLESŁAW GROUP
RECYCLING REVOLUTION IN ACTION

- **150,000 TONS OF EAF DUST:** Annually upcycling hazardous Steel Industry Waste (Electric Arc Furnace Dust containing 13% to 43% Zn) into high-purity zinc oxide.
- **RE-FLOTATION PLANT– WORLD-FIRST INNOVATION:** Operating a globally unique plant since 2017 to recover zinc and lead directly from historic flotation tailings.
- **100% SECONDARY FEED:** Since 2024, our HCM Miasteczko Śląskie smelter operates **entirely on recycled oxide feed**, producing LME-registered Special High Grade (SHG) Zinc.

ZGH Bolesław S.A.

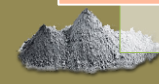
ZGH BOLESŁAW GROUP
SECURING EUROPE'S RESOURCE AUTONOMY

- **UNLOCKING HIGH-VALUE SMELTING:** By processing complex industrial waste, we don't just recover zinc - we act as a vital European supplier of **Critical and Strategic Raw Materials**:
  - ✓ **Germanium (Ge):** Recovered from metallurgical drosses, crucial for global fiber optics and infrared technologies.
  - ✓ **Indium (In):** Essential for touchscreens and advanced LCD displays.
  - ✓ **Bismuth (Bi):** Key for eco-friendly, lead-free alloys and chemical applications.
- **CLOSING CROSS-INDUSTRY LOOPS:** We bridge the gap between the steel, copper, chemical, and technology sectors, proving that circularity is the only way to achieve European raw material independence

A strategic, circular hub for Europe's Critical Raw Materials (CRM).

ZGH BOLESŁAW GROUP PRODUCTION IN 2026

Zinc*	150 000 tons
Lead	8 000 tons
Sulphuric Acid	80 000 tons
Dore Silver	15 tons
Strategic metals	Copper 500 tons Tin 25 tons
Critical metals	Germanium 1 ton Indium 5 tones Bismuth 50 tones



*included: galvanising alloys, die-cast alloys, special alloys (magnesium, nickel, bismuth), zinc anodes

Stalprodukt S.A.

THANK YOU FOR YOUR ATTENTION

Marek Drosik
Member of the Board at ZGH and HCM