The Urban Mining Potential of Zinc

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Content

- Introduction
- Method
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Global trends, Swiss zinc flows

1. INTRODUCTION
Prices and ore grades over the last century...

Sources: Metals Week and Metal statistics and [1-3]
Contemporary Swiss zinc flows

Zinc stocks and flows 2010

Flows in kg Zn/cap/a
Stocks in kg Zn/cap

Sources: [4-7]
Research gap relevant for policy making

- Studies on the zinc cycle focus on material flows
  - Material potentials for better resource management
  - Highly useful discussion base
- But complementary information is needed for policy, e.g.,
  - Economic barriers or environmental issues limiting material potentials
  - Available governance tools
  - Foreseeable technological developments
- Urban mining potential analysis to inform Canton of Zurich for strategic planning in resource and waste management
2. METHOD
Method for urban mining potential

1 Material potentials
- The global situation
- Material flow analysis
- Primary and secondary resources

2 Five domains
- Ecological
- Technological
- Economic
- Social
- Governance

3 Urban mining potential

Adapted from [8]
Material potentials, five domains, Urban Mining Potential

3. RESULTS
Material potentials: main elements of zinc management in Switzerland

- 2 steel works
  - Electric-arc furnace as zinc-rich by-product of steel making
  - 1 kg Zn/cap/a

- 10 out of 30 municipal solid waste incinerators
  - Filter dust further processed to hydroxid sludge through acid washing (FLUWA)
  - 0.09 kg Zn/cap/a

- In future: zinc recovery in centralized plant in Switzerland (SwissZinc) instead of foreign Waelz kilns
Ecological domain

a) Relative environmental impacts of life cycle stages of primary production [9]

b) Life cycle assessment of hydroxide sludge disposal in Waelz kilns (blue, no pattern) and with the SwissZinc process (red, pattern) (b) [10]
Technological domain

Zinc ore (3-7%) ➔ Concentration ➔ Concentrate (55-65%)

Pyrometallurgy
Distillation

Hydrometallurgy
Roasting ➔ Leaching ➔ Liquor purification ➔ Electrolysis

Special high-grade zinc (SHG, purity >99.995%)

Recycling
Steel works ➔ Filter dust ➔ Filter dust ➔ Waelz oxides
MSW ➔ Fly ash ➔ FLUWA ➔ Hydroxide sludge ➔ SHG zinc >99.995%
MSW ➔ Fly ash ➔ FLUWA ➔ Hydroxide sludge (SwissZinc) ➔ SHG zinc >99.995%
MSW ➔ Fly ash ➔ FLUWA / FLUREC

Sources: [11-14]
Economic domain

Total imports
21 000 t / 63 M CHF

- Ore, slag: 0.12%
- Unwrought zinc: 48%
- Chemicals: 6%
- Wire, sheets, etc.: 46%
- Scrap: 0.0061%
- Others: 54%

Total exports
16 000 t / 24 M CHF

- Unwrought zinc: 4%
- Ore, slag: 10%
- Chemicals: 1%
- Wire, sheets, etc.: 69%
- Goods: 85%
- Scrap: 15%

Sources: [15]
Social domain

- Zinc recycling is not an important economic sector
- At the social level, primary (foreign) and secondary (Swiss) production are not comparable

<table>
<thead>
<tr>
<th>Social impacts of a mine opening (South Africa)</th>
<th>Social impacts of a mine closure (Australia)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macroeconomics (incl. jobs)</td>
<td>Economic progress (incl. jobs)</td>
</tr>
<tr>
<td>Social aspects and health</td>
<td>Preservation of indigenous culture and traditions</td>
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<tr>
<td>Visual landscapes</td>
<td>Conservation of landscape and environment</td>
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<tr>
<td>Traffic</td>
<td>Social progress and stronger communities</td>
</tr>
<tr>
<td>Cultural heritage, archeology, and paleontology</td>
<td>Fulfillment of agreement between indigenous population and other stakeholders</td>
</tr>
</tbody>
</table>

- Exporting acid-washing technology should be scrutinized

Sources: [16,17]
Governance domain

- Private sector initiatives
  - “Öko-Stahl” campaign provides environmental impacts of recycling steel to promote its use
  - Zinc is not (yet) included in environmental impact assessment

- Public sector
  - New (2016) waste regulation prescribes metal recovery from MSWI fly ash
  - Mineral zinc in bottom us remains to be tackled!
Urban Mining Potential

- Current evaluation
- Field of action

3: high
2: average
1: low

Environment
Resource management
Technology
Society
Economy
4. CONCLUSIONS & OUTLOOK
Conclusions & Outlook
Thanks for your attention
References

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References


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