Landfill Mining – on the potential and multifaceted challenges of implementation
Landfill Mining – definitions and trends

• No commonly accepted definition – *excavate, process, recycle and treat previously deposited materials*

• Overall research trends
  – From solving local landfill problems to emphasis on resource recovery
  – From simple mobile equipment to more technically advanced solutions
  – An emerging system perspective – societal impacts and synergies

• Characteristics of the knowledge area
  – Research intense
  – Sporadic and isolated real-life projects
Landfill Mining in a circular economy perspective

- A stepping stone for building future capacity for a circular economy
  - In many regions, a large-scale exploitation of landfills could double the available amounts of some secondary resources for decades

- A possible seed-bed for development of new, more resource-effective separation and recycling technologies
Societal perspectives on Landfill Mining

• Collectively, the research display significant resource and climate impacts combined with other potential societal benefits
  – Improved regional material autonomy, e.g. for base metals
  – Reclamation of valuable urban land
  – Reduced long-term pollution concerns related to (old) landfills
  – Employment and strengthened local economies

• In specific landfill mining cases, societal impacts are dependent on a large number of inter-related factors and conditions

• Need for more comprehensive studies addressing impacts on different societal scales and time horizons
Economic principles of resource recovery from landfills

• For municipal landfills, resource recovery alone cannot justify such projects financially yet
  – Economic incentives rely on high alternative costs that could be reduced or postponed by landfill mining

• For more high-grade industrial landfills, the economic conditions for resource recovery look somewhat better...

• A key challenge is that only a small share of all the processed materials (i.e. metals) generate any significant income
Integrated remediation and resource recovery – regulatory and organizational issues

Solely remediation

Incl. landfill tax for re-deposited residues and conventional waste disposal costs

Case A Integrated remediation and resource recovery

1.3

3.2

0.9

Case B Integrated remediation and resource recovery

1.9

2.8

Net cost

Costs

Revenues

Net cost

Net cost

Incl. landfill tax and inclusion of costs and revenues for energy recovery

Legend:
- Land reclamation
- Planning
- Excavation/transport
- Disposal costs
- Energy recovery
- Landfill reconstruction
- Material recovery
- Landfill tax
Marketability of extracted resources – learnings from a recent large-scale pilot study on a Swedish shredder landfill

Too low heating value

Too high moisture content

Too high TOC levels

10 weight%

50 weight%

20 weight%

5 weight%

10 weight%

5 weight%

Too high ash content

Too high levels of heavy metals

Too high Chlorine levels

Too high levels of heavy metals

Too high moisture content
Outlook – What can we learn from primary production?

- Which landfills to mine? Reliable prospecting methods
- How to do it? Long-term learning investments and specialized actors
- Institutional conditions and political decisions determine the playing rules
Landfill Mining policy challenges

• The landfill is stuck in a dump regime – the European policy framework advocates isolation, final closure and post-monitoring

• Uncertainties about how current waste and landfill legislations will be applied on Landfill mining prohibit learning investments

• How to handle inherent conflicts between circular economy, local environmental impacts and other important societal values?
Landfill Mining in Europe

- European Enhanced Landfill Mining Consortium initiated in 2014
- 10-15 ongoing Landfill Mining research projects
- A Landfill Mining Raw Material Commitment, approved in 2015
- Upcoming Landfill Mining seminar with European Parliament