NEW-MINE

EU TRAINING NETWORK FOR RESOURCE RECOVERY THROUGH ENHANCED LANDFILL MINING

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Multi criteria assessment of resource recovery through enhanced landfill mining (ELFM)

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WP4 in the NEW MINE project

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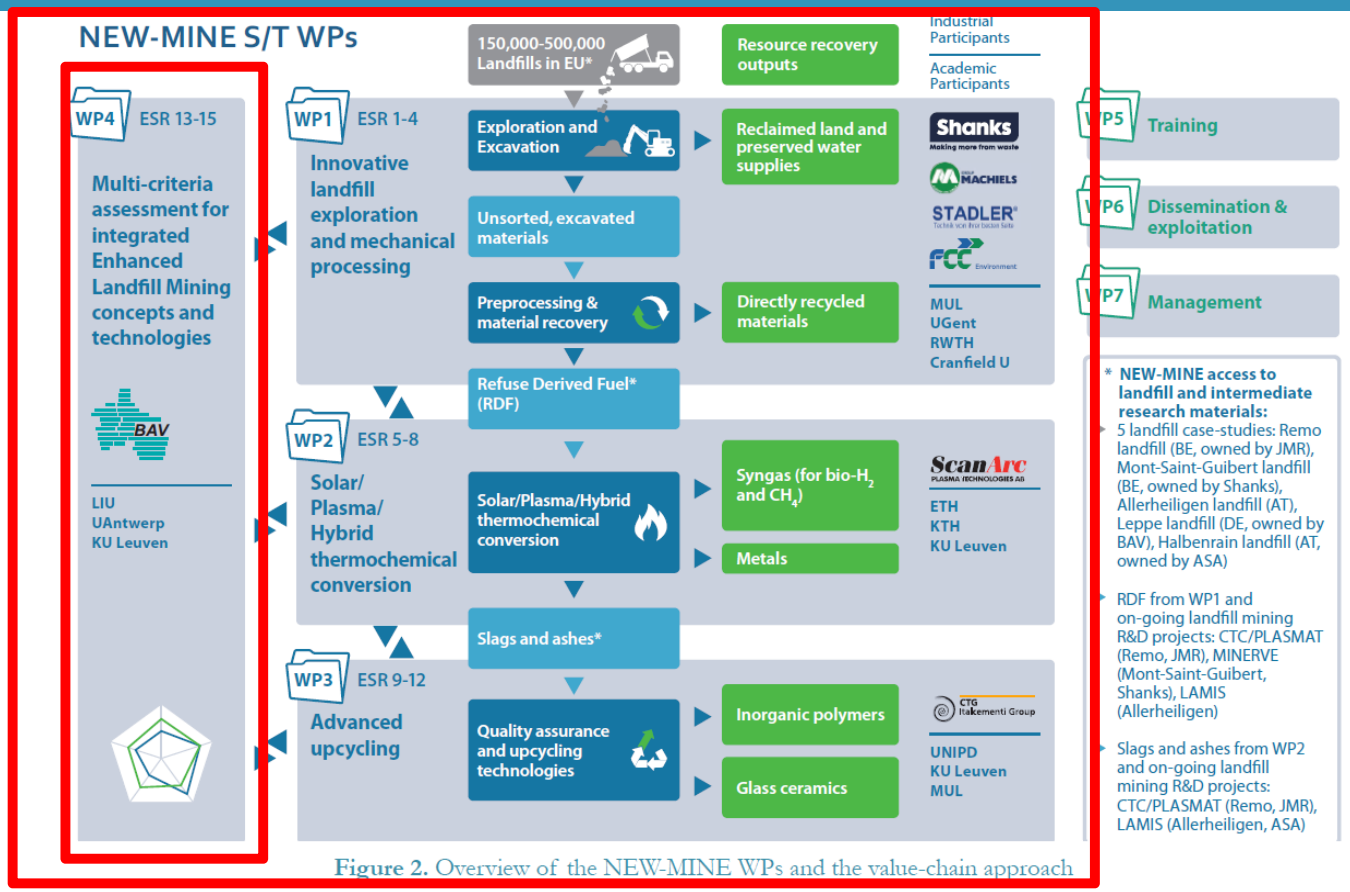

Figure 2. Overview of the NEW-MINE WPs and the value-chain approach

Goal of the presentation

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- Enhanced landfill mining (ELFM)
- The role of Multi Criteria Assessment (MCA) in decision making:
  1. Which landfills can be mined?
  2. How to set up ELFM projects?
  3. What is the role of market and policy interventions?

From landfill remediation to ELFM

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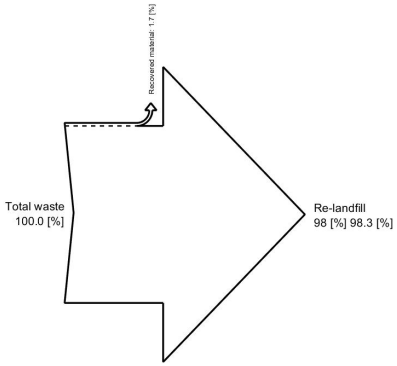
Landfill remediation

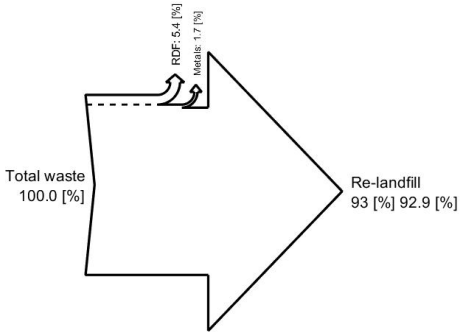
Land reclamation



Landfill mining (LFM)

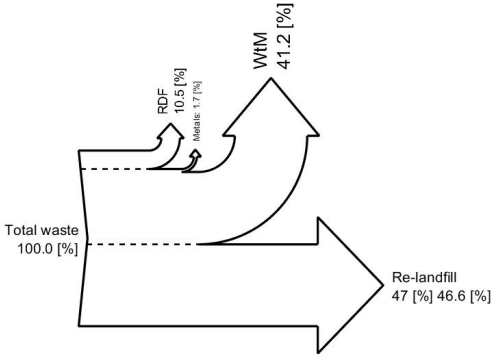
Metals

Energy

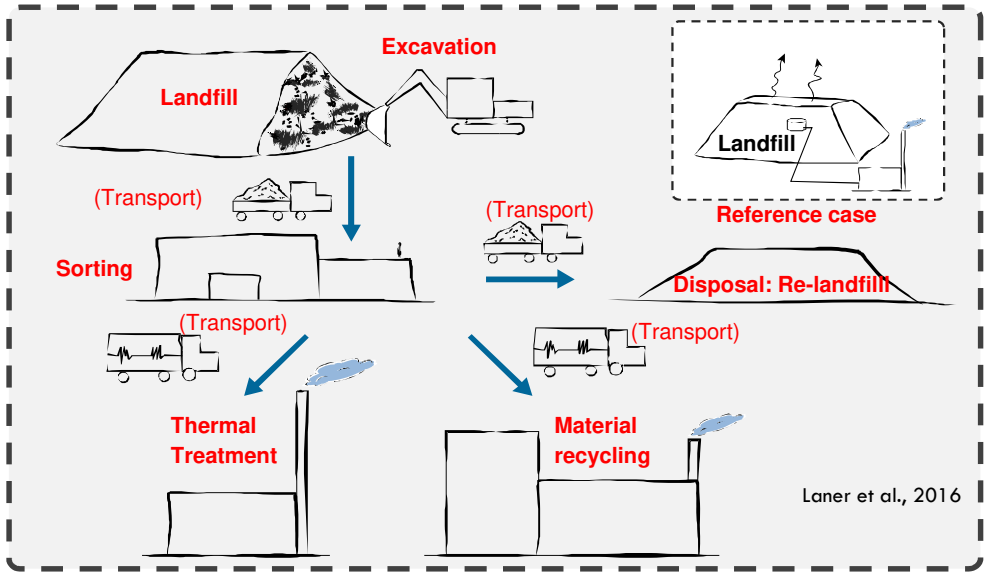


Enhanced landfill mining (ELFM)

Aggregates & construction materials



Enhanced Landfill Mining



"the safe conditioning, excavation and **integrated valorisation** of landfilled waste streams as both **materials (Waste-to-Material, WtM) and energy (Waste-to-Energy, WtE)**, using **innovative transformation technologies** and respecting the most stringent **social and ecological criteria"** (Jones et al., 2013)

Drivers for ELFM

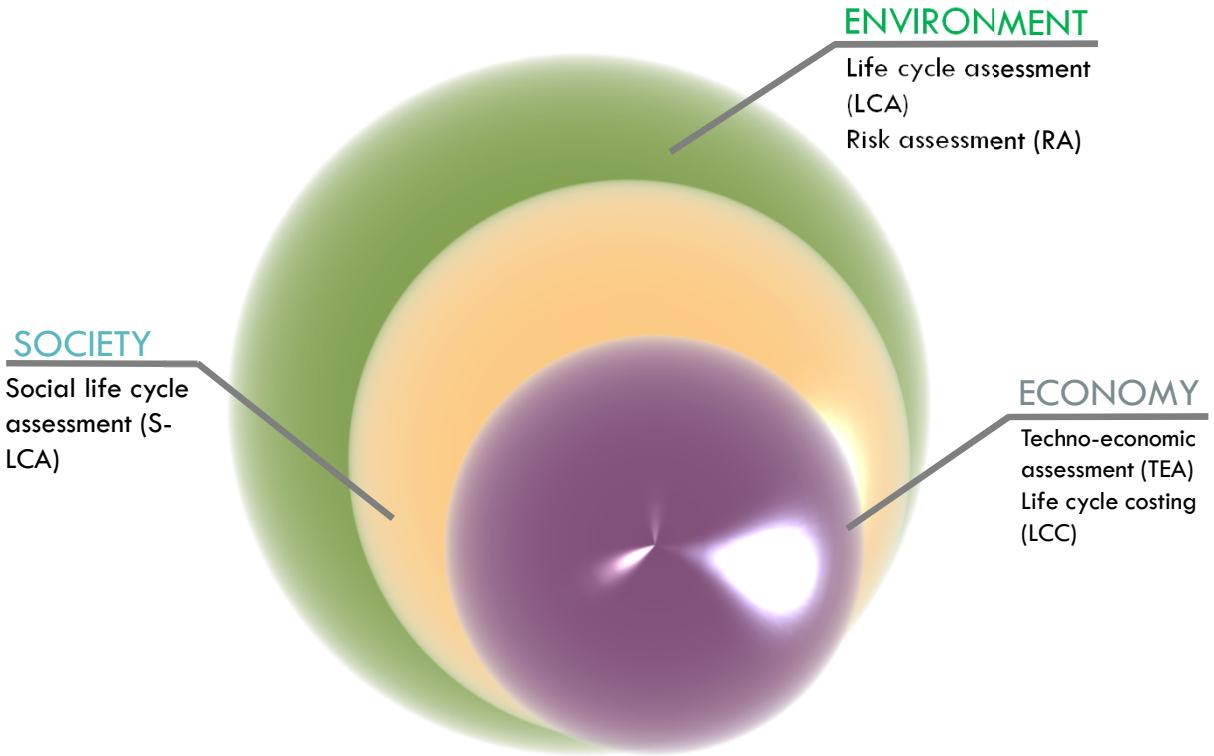
Environmental protection

Recovery of resources and land

Societal benefits

Mont Saint Guibert landfill (2017)

The Multi Criteria Assessment



The Multi Criteria Assessment - Objectives

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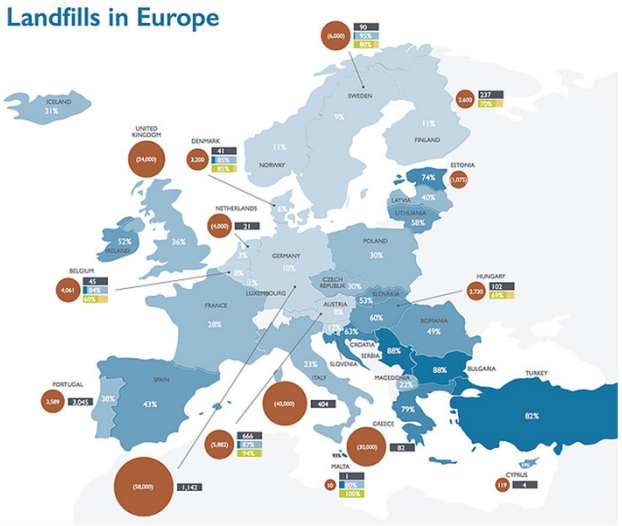
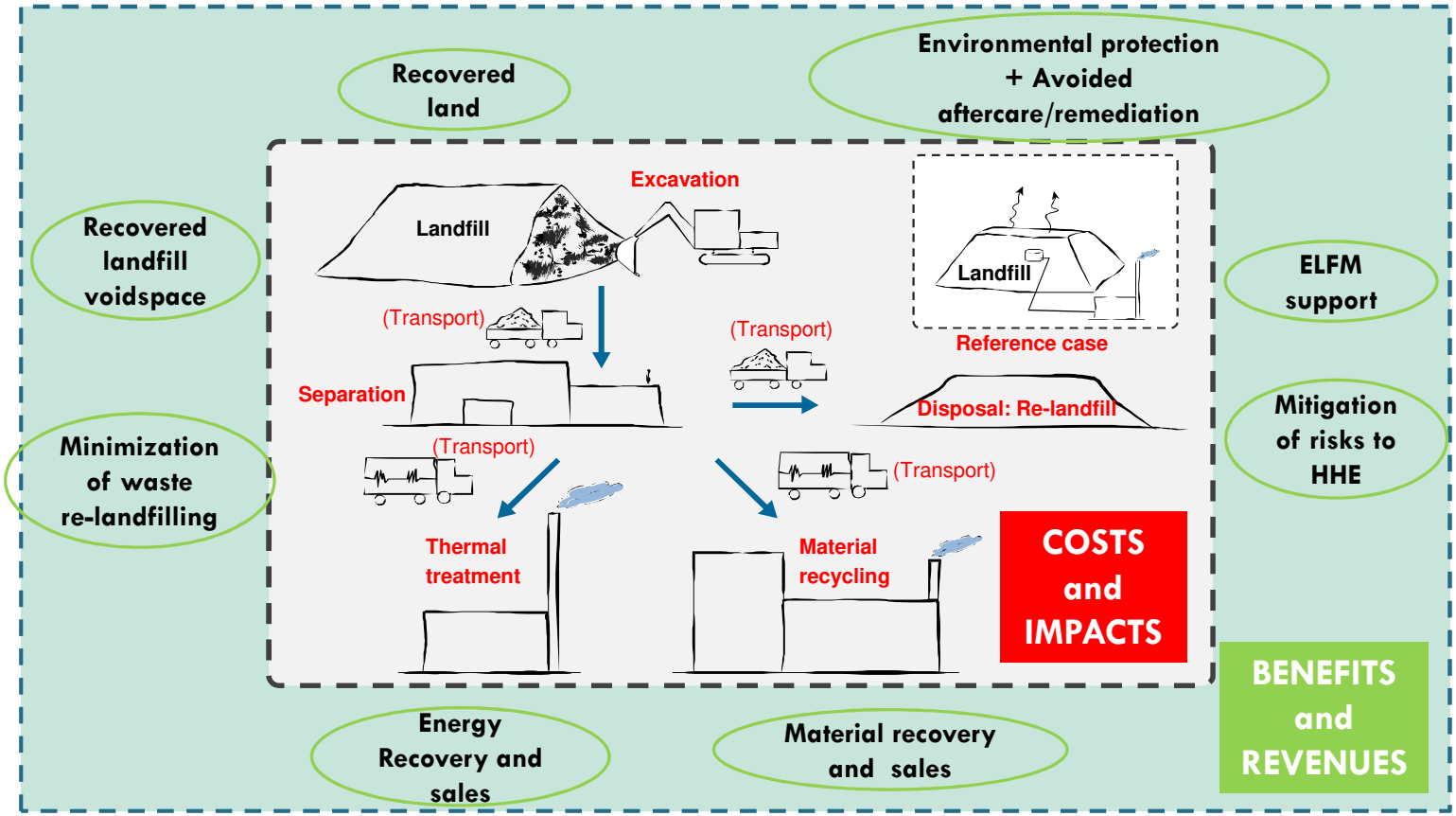


Overview of an ELFM project



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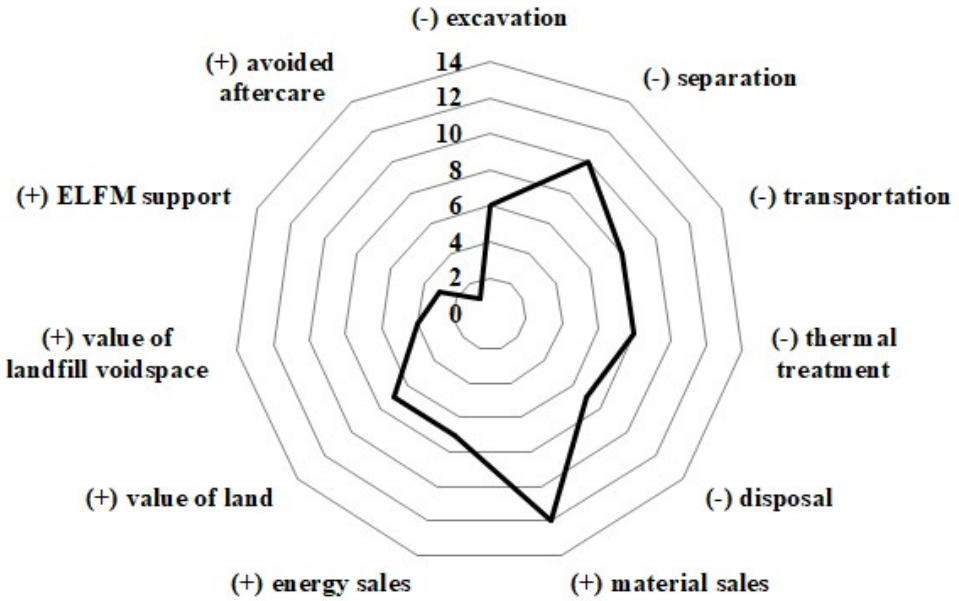
The technical and organizational aspects of ELFM



System-level conditions drive the main costs and revenues:

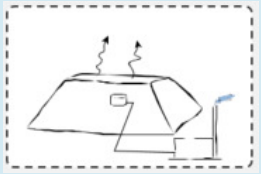
- NPV <0 (80% cases)
- Main costs
  - Treatment and disposal of secondary materials
- Main revenues
  - Avoided landfill management costs
  - Material and land/landfill void space recovery

Dia 10

A1 I suggest to delete this. The content will be added to slide 20, so all the econ results are there.

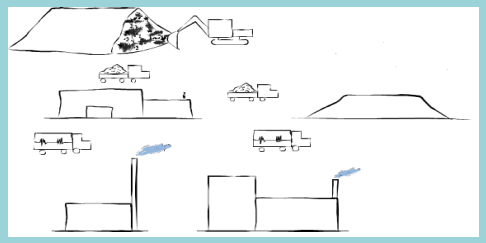
Also, i think it is better to introduce the concept of site, project, and system-level factors--as in the next slide.
Author; 5/02/2020

Critical factors



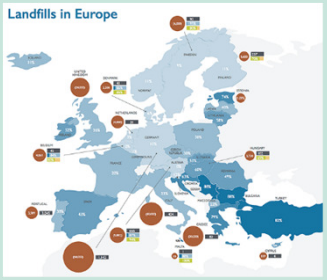
- **Waste composition**
- Landfill location
- **Landfill reference case**
- Quality standards
- Safety regulations

SITE-LEVEL



- **Technology**
- **Quality**
- **Market-acceptance**
- Logistics
- Costs: energy, processing, investment, O&M, etc.,
- Land recovery
- Avoided impacts
- Stakeholder involvement
- Investment incentives

PROJECT-LEVEL



- **Background systems**
- **Transportation**
- Financial effects
- **Materials and energy prices**
- **Legal, institutional, organizational, and societal structures**
- **Public acceptance**

SYSTEM-LEVEL

Summary of the critical factors

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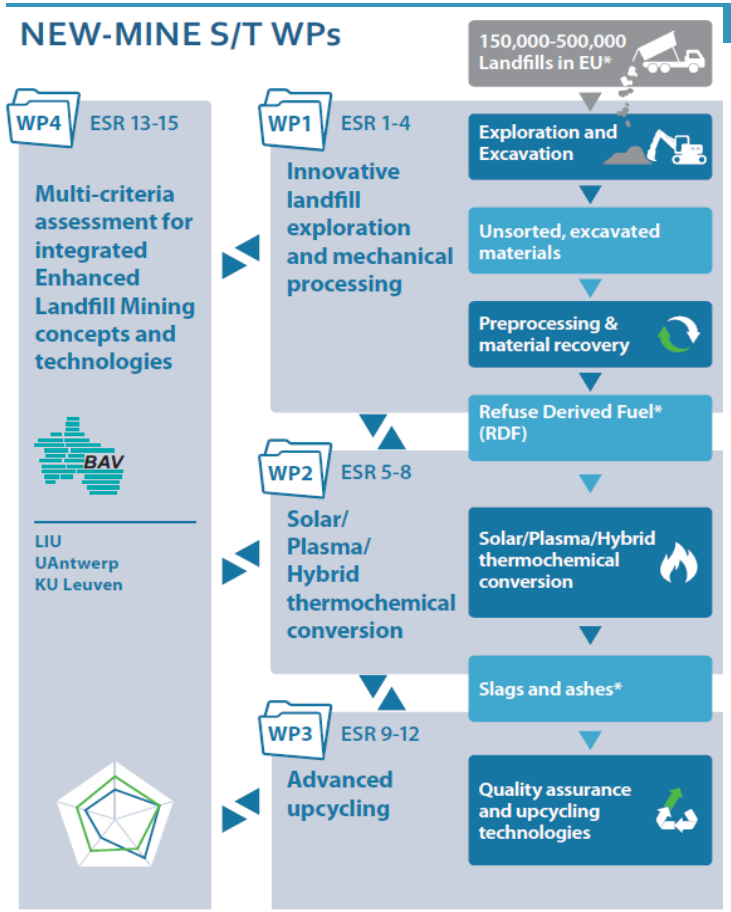
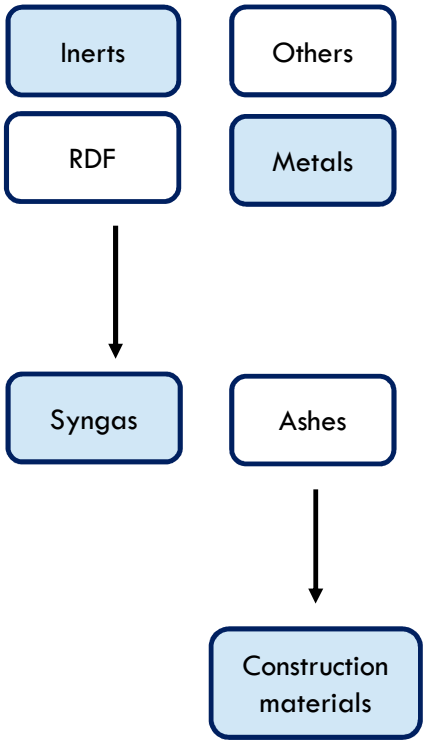
- Waste and landfill types
- Technology availability and choice
- Project acceptance
- Landfill aftercare and remediation
- Markets
- Regulations

How to account for factor variability in the feasibility assessment of ELFM projects?

Critical performance factors in the NEW MINE project





- Humidity
- Waste composition
- Particle size distribution
- Throughput
- Quality

- RDF composition
- Gasifying agent
- Technology

- Ash composition
- Quantity
- Quality

Multiple scenario analysis for the integrated assessment of ELFM

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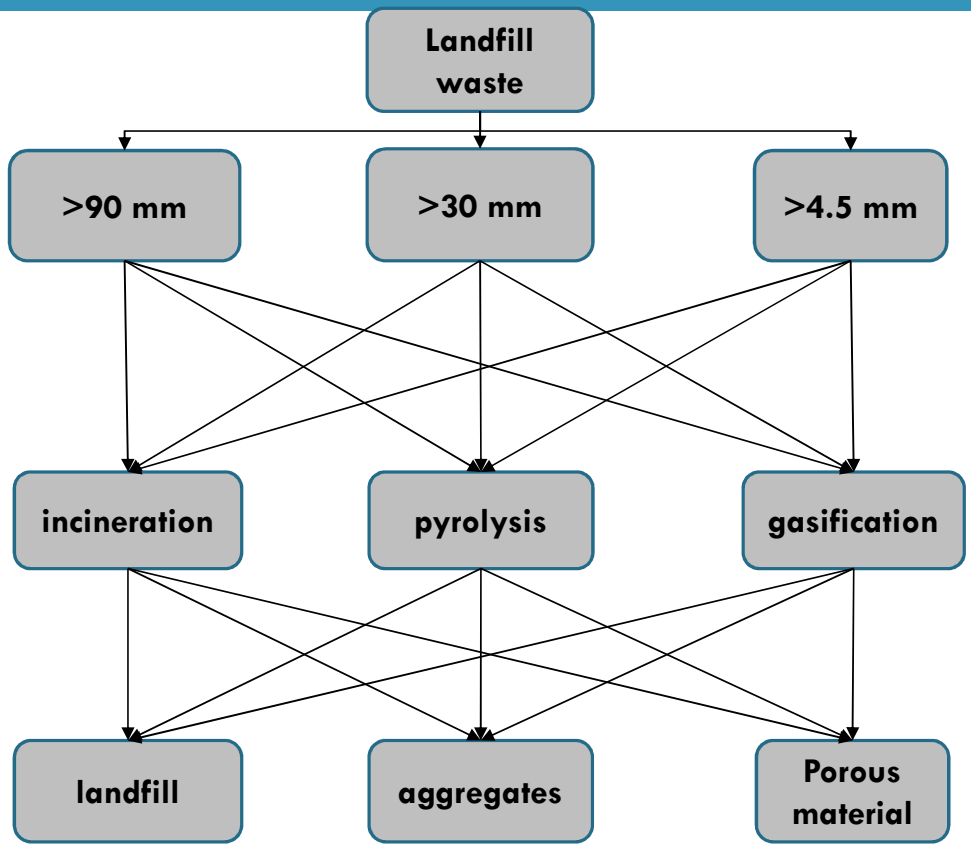
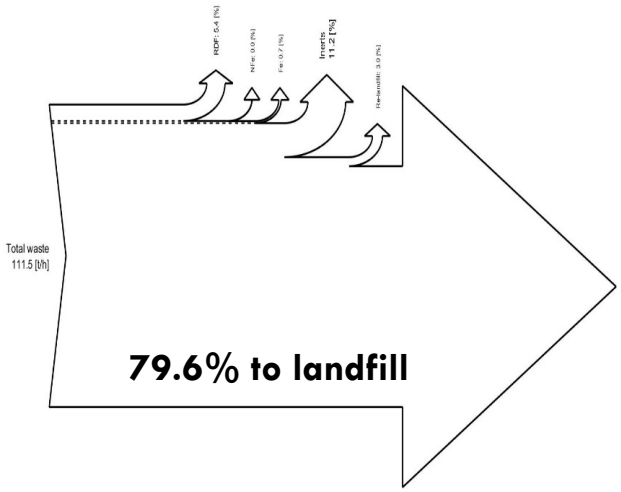


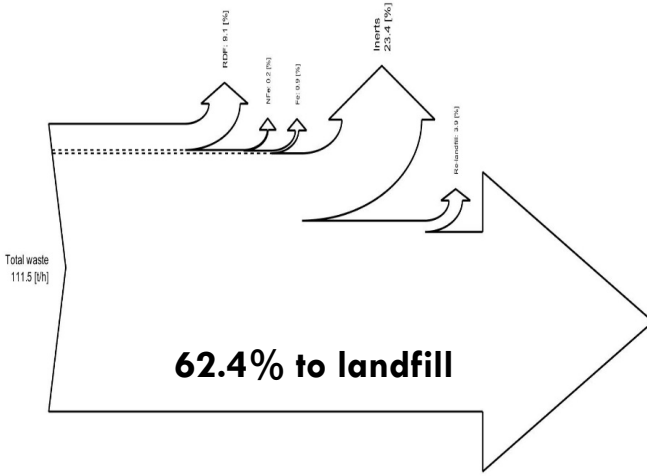
Technology choices and resource recovery potential

Extent of separation and sorting process:

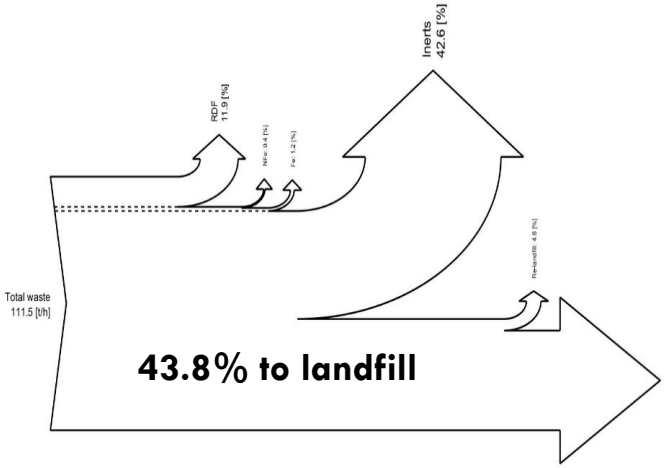
>90 mm



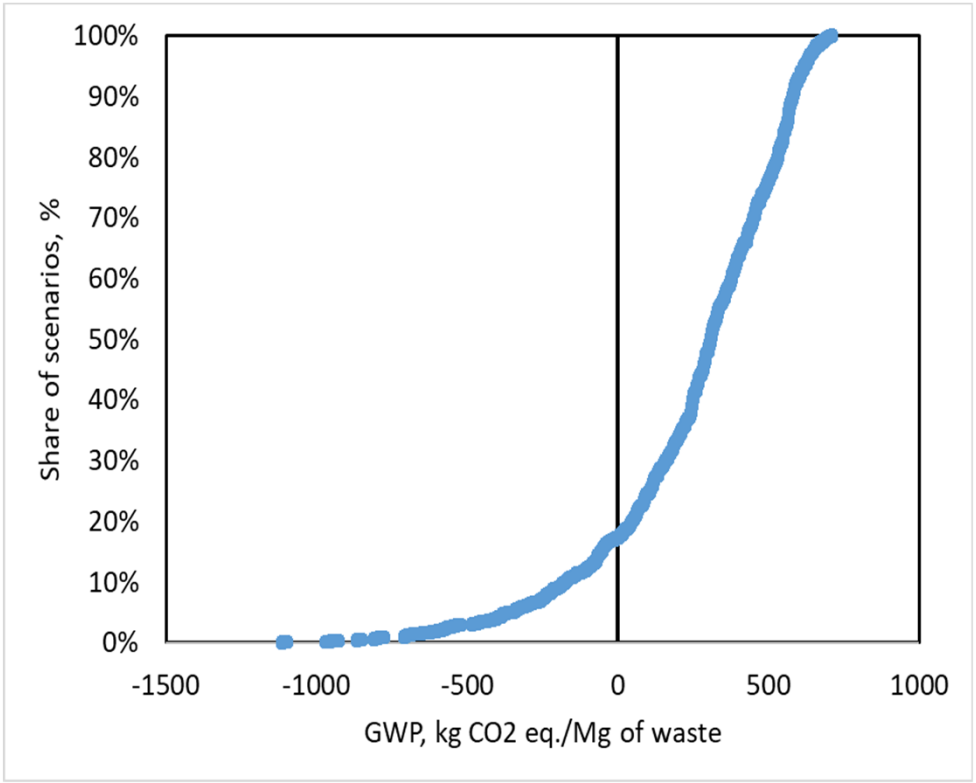
>30 mm

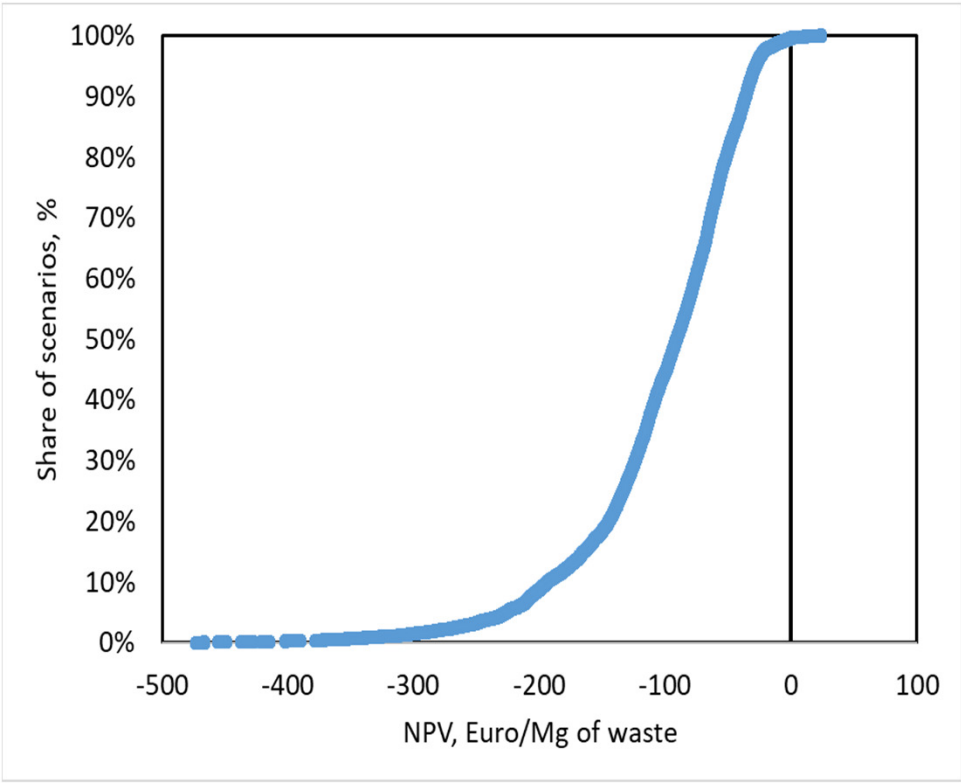


>4.5 mm



Environmental and economic results





Resource recovery through enhanced landfill mining: results of an economic assessment

System-level factors are generically critical for LFM economics.
Hence, it should primarily guide site prioritization and project design.

- Main costs: Waste treatment and disposal
- Main revenues (indirect): Avoided costs for aftercare and remediation

High income and advanced waste management systems

- Maximization of material valorization. ✗

BUT motivated to decrease re-landfilling

- Small landfills (low mass/area) are preferred ✓

Low income and lenient waste management standards

- Maximization of material valorization. BECAUSE treatment & disposal costs are already low ✓
- Landfills with high recoverable materials ✓

A2

Policy interventions required

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- Lower re-deposition costs and taxes
- Intensification of aftercare and remediation requirements.
- Break up current market structures
- Economic instruments aiming to internalize other benefits into the project economy, if motivated from a societal perspective.

Dia 19

A2 Can come after slide 20. OR slide 20 and 21 be combined?

Author; 5/02/2020

Possible interventions and policy measures

- Lower re-deposition costs
- Intensification of aftercare and remediation requirements.
- Subsidizing ELFM directly or indirect (e.g. secondary raw materials, green energy, etc.)
- Break up current market structures
- Private-public partnerships (PPPs)
- Bans, caps, standards and norms, and quotas

The role of policy and market interventions

- Institutional and governmental actors want to avoid to subsidize ELFM
- Industrial actors have a need for investment support

Potential miss out of societal benefits or unforeseen societal costs

Subjectivity

Integration through mixed (qualitative and quantitative) approach and the development of stakeholder archetypes

Goal is **not** to find a "best" solution but rather to present **comprehensive information** for stakeholders in the results of the societal assessment.

Socio-economic and socio-environmental **externalities** have to be **internalized** into **ELFM processes and business models.**

Conclusions

Which landfills to address?

- High costs of aftercare and remediation
- High fraction of recoverable and biodegradable
- High value of land and landfill void space
- Coal-based energy mix

How to select processing and sorting technologies?

- Waste characterization
- Technology choices and efficiencies for excavated waste
- Technology readiness level (TRL)

Role of market and policy interventions?

- Lower disposal costs and taxes
- Market structure and prices

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Thank you very much for your attention!