



Technische  
Universität  
Braunschweig



# LANDFILL MINING – A CONTRIBUTION TO CONSERVATION OF NATURAL RESOURCES?

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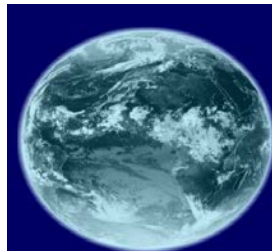
# Motivation - Landfill Mining



**Protection  
of waters**



**Climate  
protection**



**Lifetime  
extension  
of landfill**



**Recycling  
of land area**



**Resource  
extraction**



# Motivation - Landfill Mining

## Amount of recyclable fractions provided by MSW landfills

### Germany:

since 1975: approx. 2,5 billion t MSW with demolition and commercial waste<sup>1)</sup>

### World wide:

since 1975: approx.  
60 billion t<sup>2)</sup>

Sources:

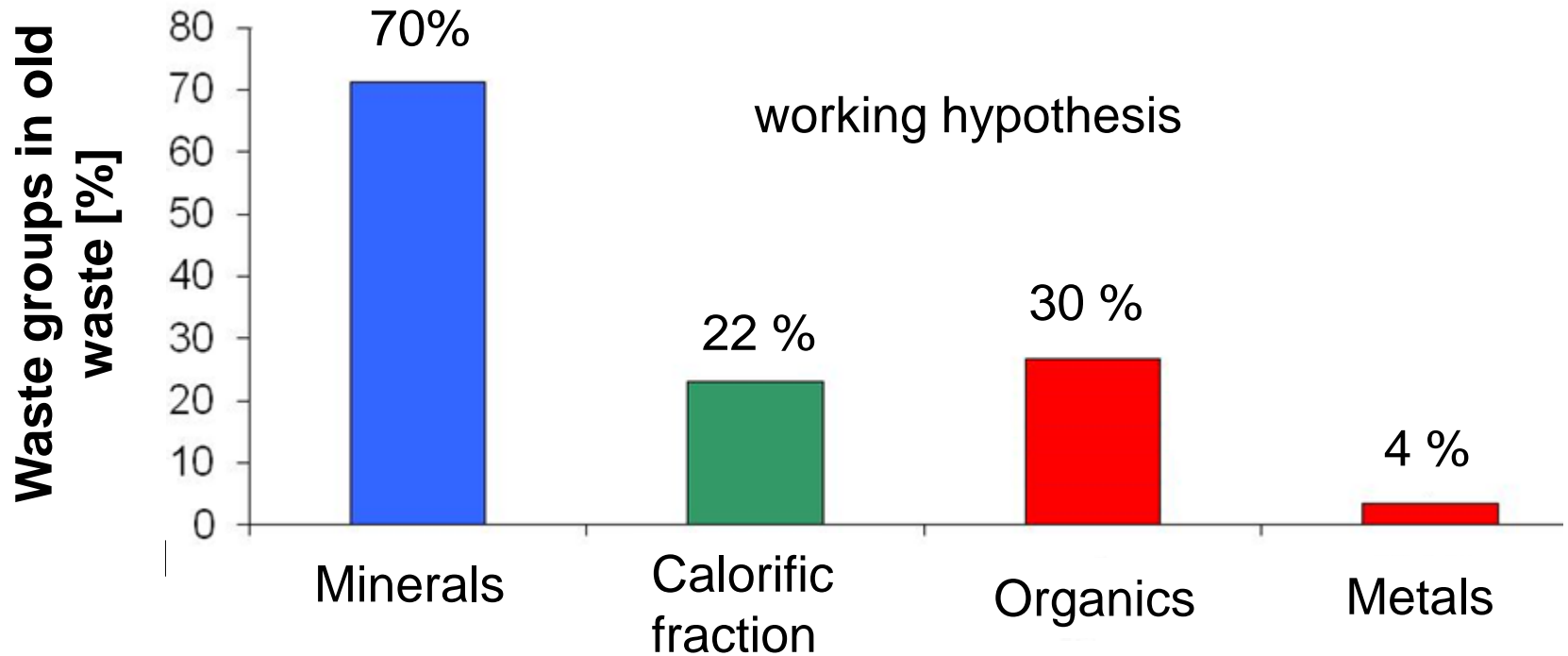
1) Bilitewski 2000, Görner et al. 2002, UBA 2006

2) MSW UNEP = 0,28 Mg /cap./a)



# Motivation - Landfill Mining

## Composition of Landfill Waste by Waste Groups



# Motivation - Landfill Mining

## Resource Potential in Landfills – Germany

Landfilled waste since 1975:

- 250 Mio. t calorific fraction on basis of coal<sub>equ.</sub> resp. Oil<sub>equ.</sub>
- 1,20 Mio. t copper scrap
- 0,50 Mio. t aluminium scrap

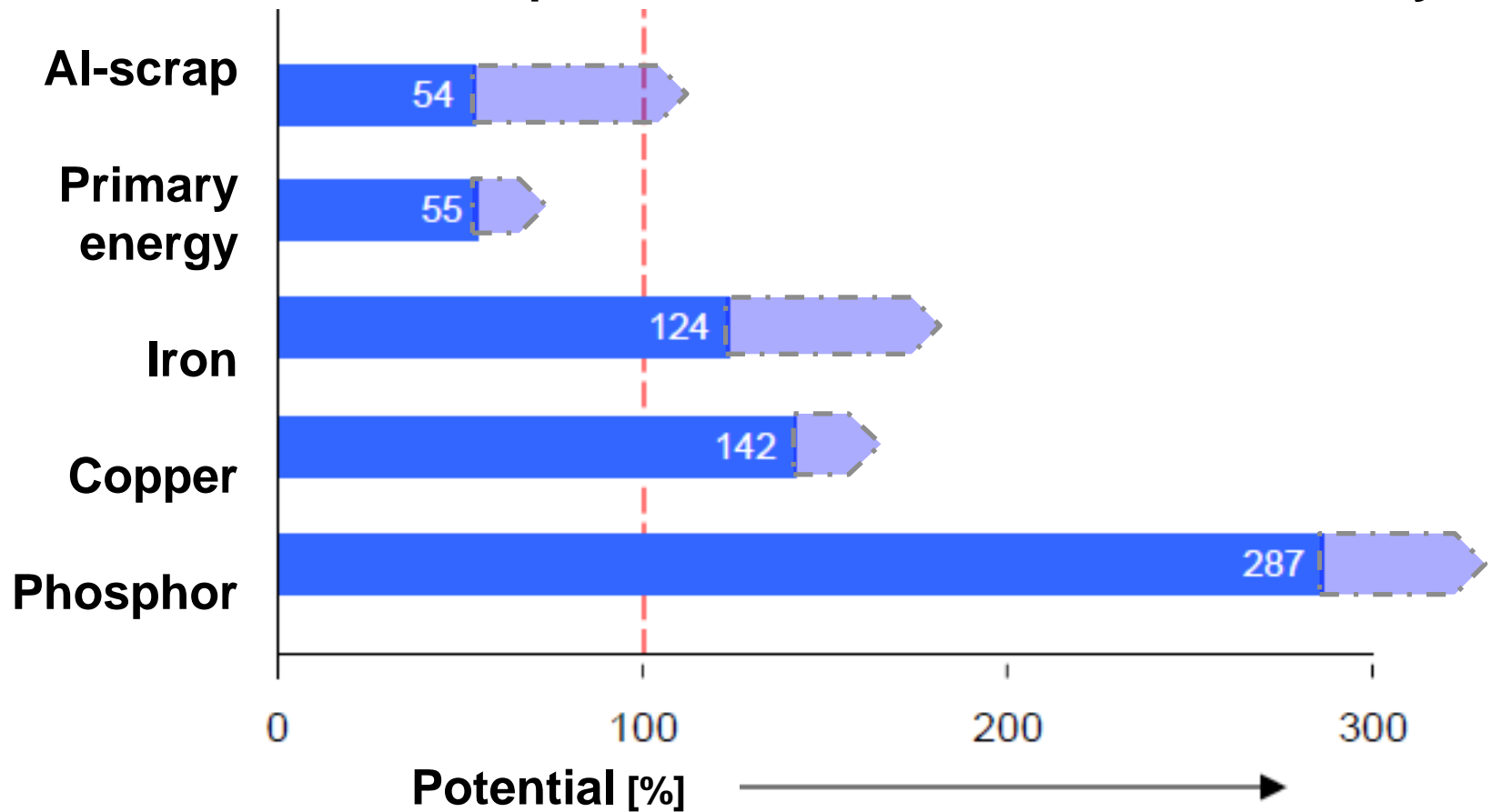
Focus

Fine fraction (< 20mm, represents with 50 – 70% b.w. the largest fraction)

- potentially organic components which can substitute natural resources, e.g. Biogas
- preparation of minerals for the use as construction material
- phosphate as fertilizer
- metals

# Motivation - Landfill Mining

## Resource Potential Compared to „One“ Annual Need - Germany



# Motivation - Landfill Mining

## Plastics



## Wood



## Metal scrap



## Refuse derived fuel



## Biogas



## construction material



# The r<sup>3</sup> Joint – Research Project „TÖNSLM“

Aided by:

- Federal Ministry of Education and Research



Runtime: 2012 - 2015

Companies:

- Tönsmeier Dienstleistung GmbH & Co. KG
- AML (Kreis Minden-Lübbecke)
- IFEU / Öko Institut



Universitys

- Technische Universität Braunschweig
- Technische Universität Clausthal
- RWTH Aachen



Leichtweiß-Institut für Wasserbau  
Abt. Abfall- und Ressourcenwirtschaft

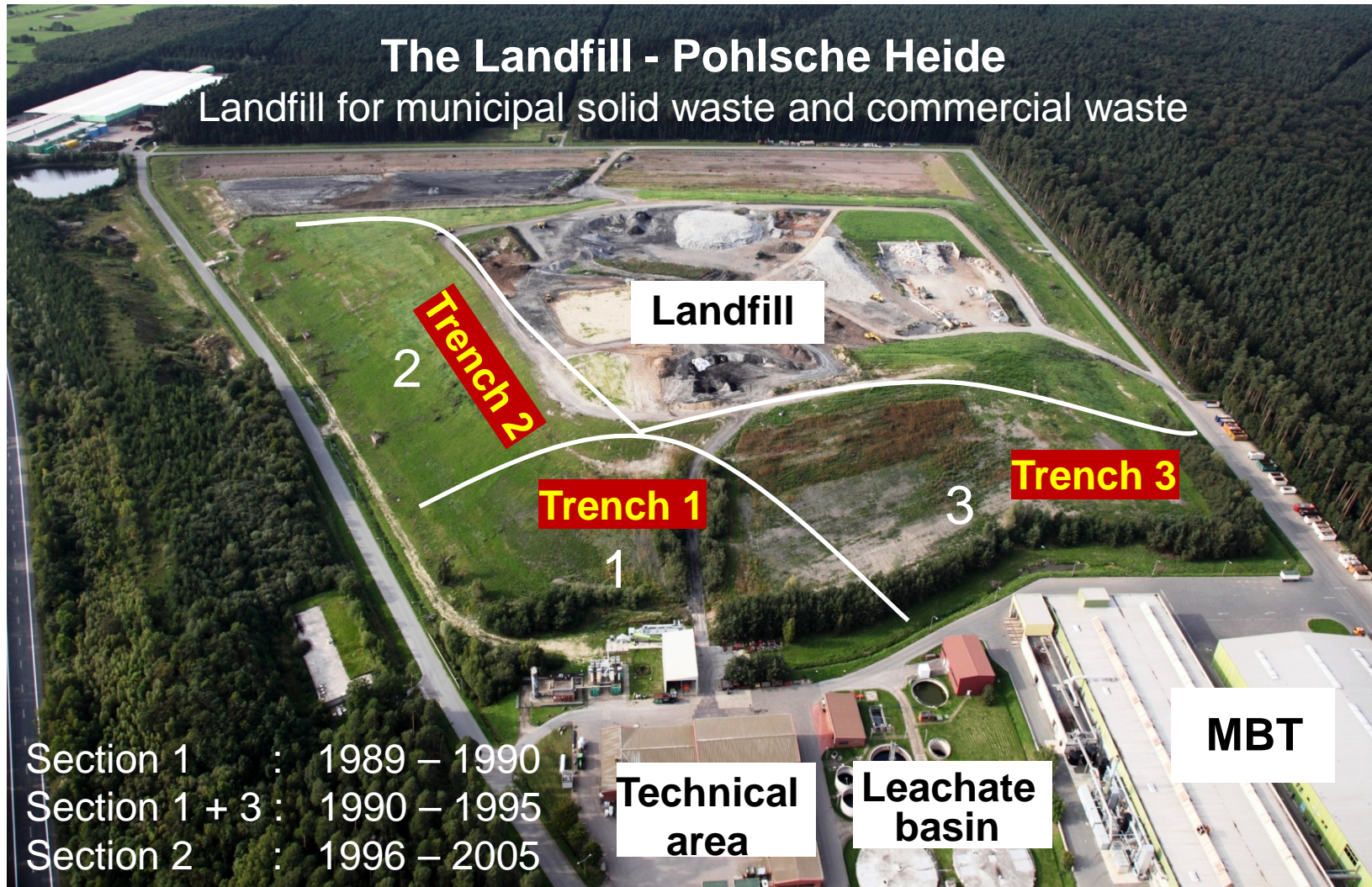


# The r<sup>3</sup> Joint – Research Project „TÖNSLM“

## Topics of Investigation

- Potentials (resources, raw materials)
- Development of technical concepts for excavation and classification
- Development of products generated from LM
- Economical and ecological aspects
- Legal requirements
- Acceptance
- Measures for work safety

# The r<sup>3</sup> Joint – Research Project „TÖNSLM“



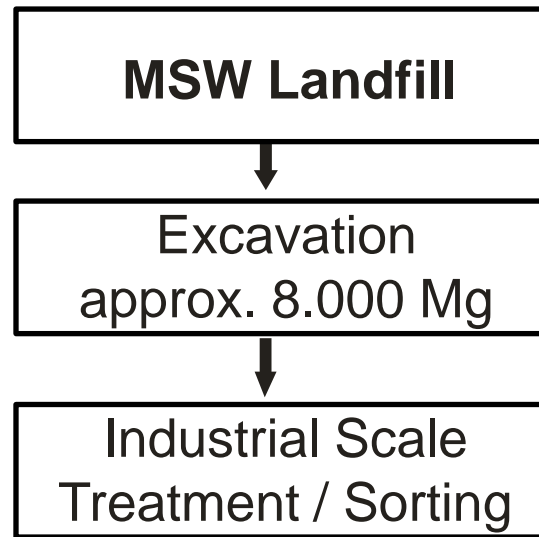
# The r<sup>3</sup> Joint – Research Project „TÖNSLM“

## Process Steps of Landfill Mining (LFM)

- 1. Test drillings** → waste composition, leachate situation, aeration
- 2. Excavation** → 3 Campaigns, each with about 2.600 m<sup>3</sup>/trench
- 3. Separation** → size reducing, screening, ballistic separator
- 4. Treatment** → **minerals, metals, organics, plastics**  
lab. Scale / industrial scale
- 5. Disposal/ re-disposal of the remainder**

# The r<sup>3</sup> Joint – Research Project „TÖNSLM“

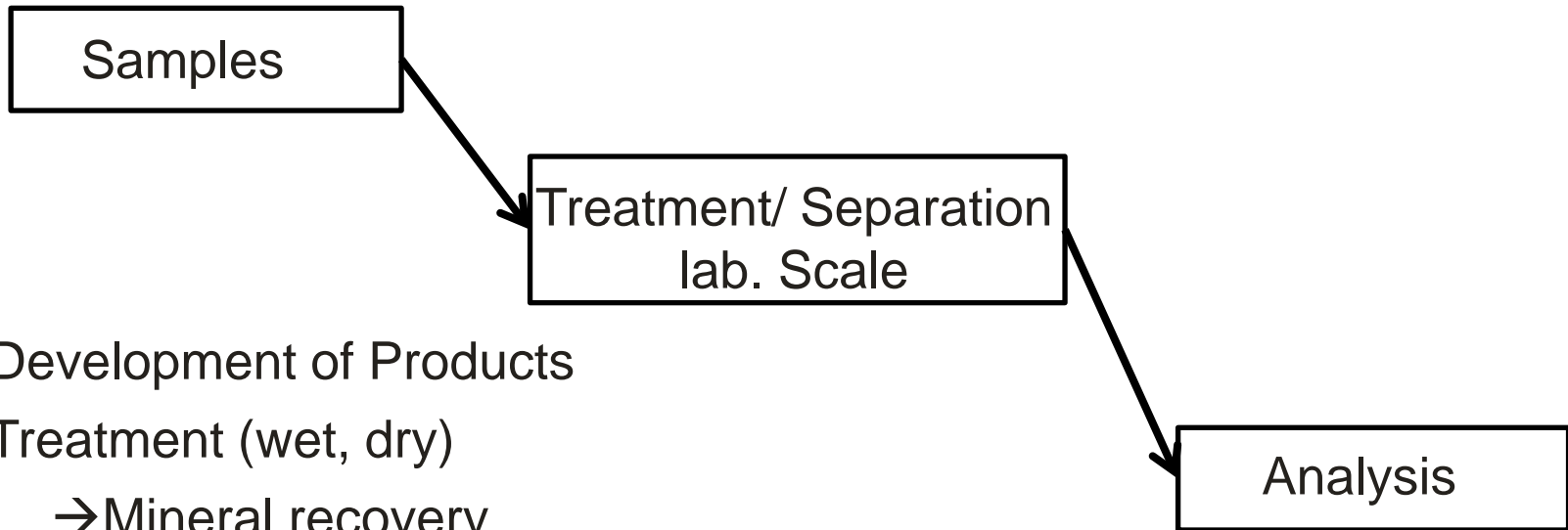
## Treatment (industrial scale)



- Thermal treatment (heating power plant Minden)
- Mechanical biological treatment (Waste Management Center Minden)
- Sorting, wet (MBT Göttingen)
- Sorting, dry (Mechanical Sorting Plant for lightweight Packaging, Porta Westfalica)

# The r<sup>3</sup> Joint – Research Project „TÖNSLM“

## Treatment (laboratory scale)



- Development of Products
- Treatment (wet, dry)
  - Mineral recovery
  - Energy recovery
- Pyrolysis
- Purification
- Evaluation of different technologies for incineration

# Ecological and economical evaluation of landfill mining projects

## Evaluation by UMBERTO

→ new tools have to be developed to describe all processes and interactions

To develop the model, data *from literature and own data from the Oeko-Institut data are used.*

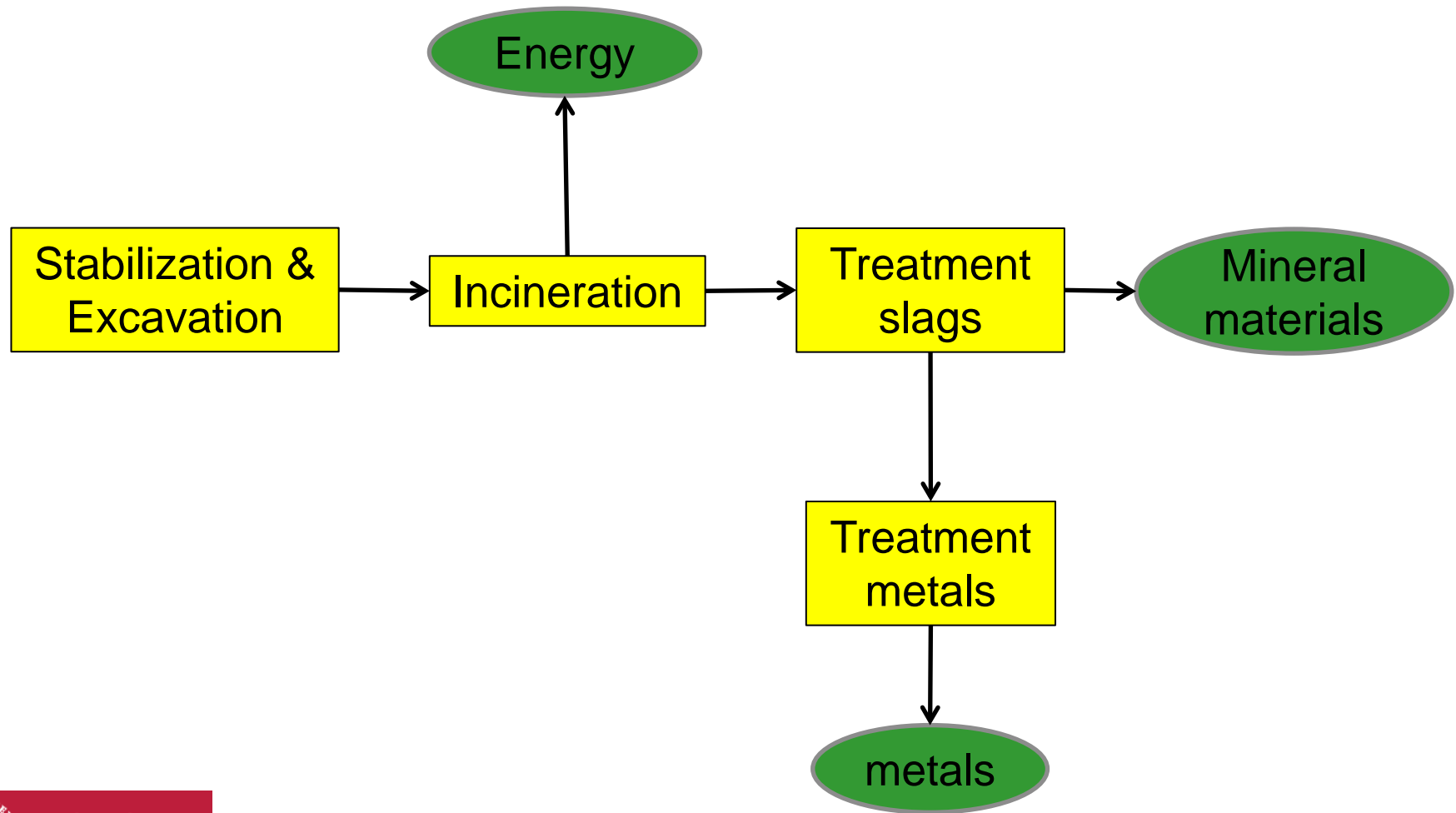
*To refine the model, data from literature and own data will be replaced by data from the landfill “Pohlsche Heide”.*

Reference scenario:

The waste from the landfill is not excavated. LFG and leachate are collected and treated.

# Ecological and economical evaluation of landfill mining projects

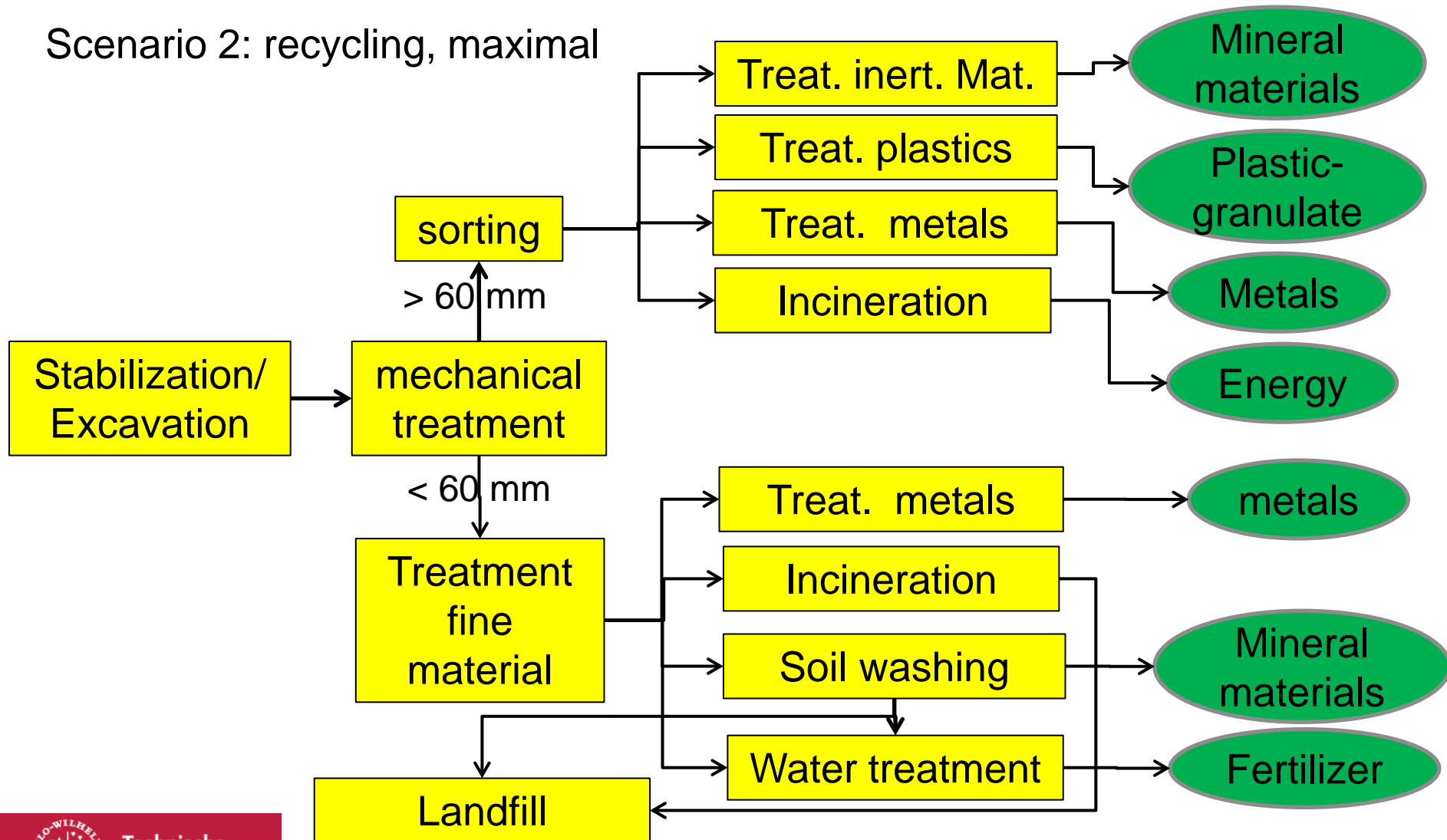
## Scenario 1: Incineration, complete



Sources: Treatment processes and material flow in the TÖNSLM project  
(Theis and Knappe, 2013)

# Ecological and economical evaluation of landfill mining projects

Scenario 2: recycling, maximal

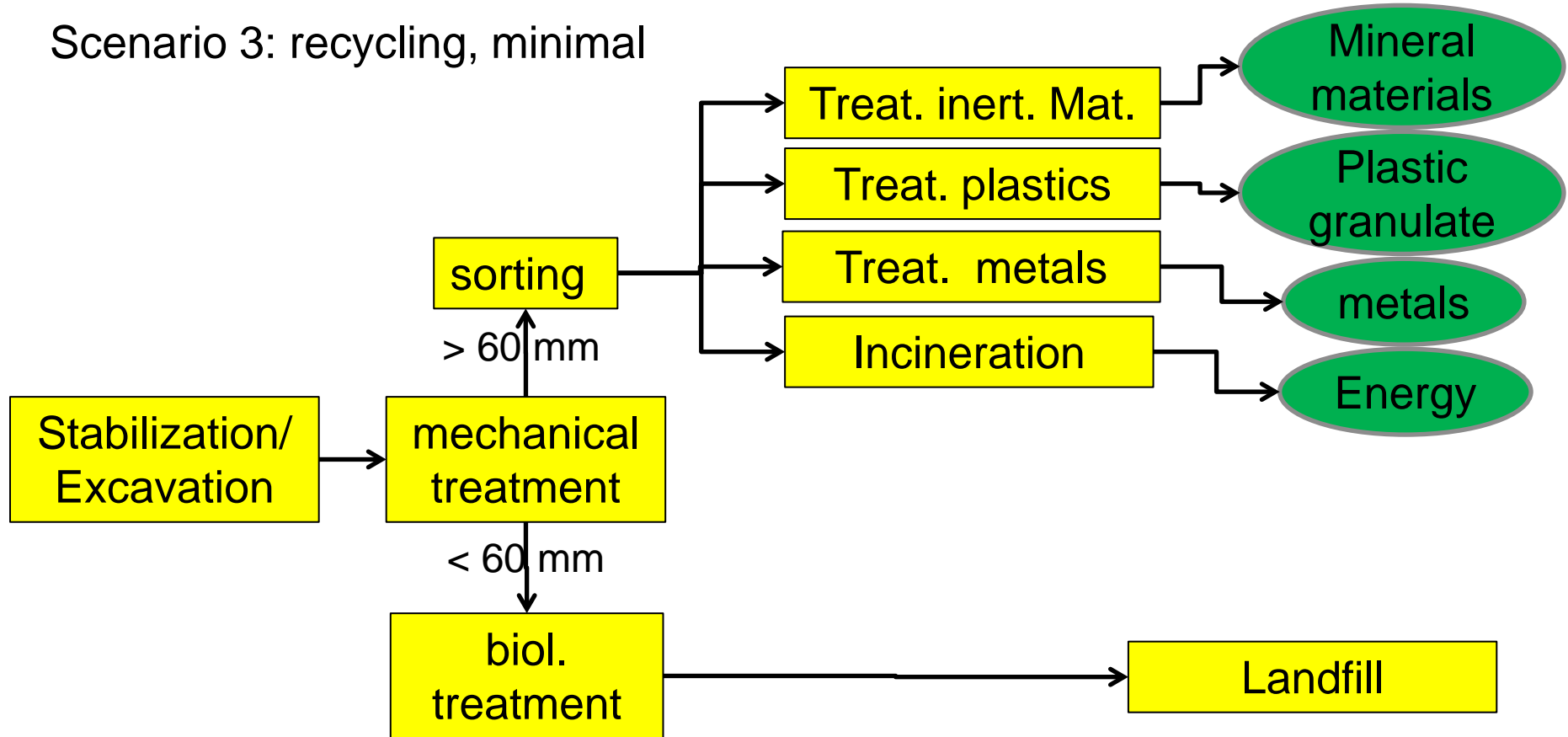


Sources: Treatment processes and material flow in the TÖNSLM project  
(Theis and Knappe, 2013)

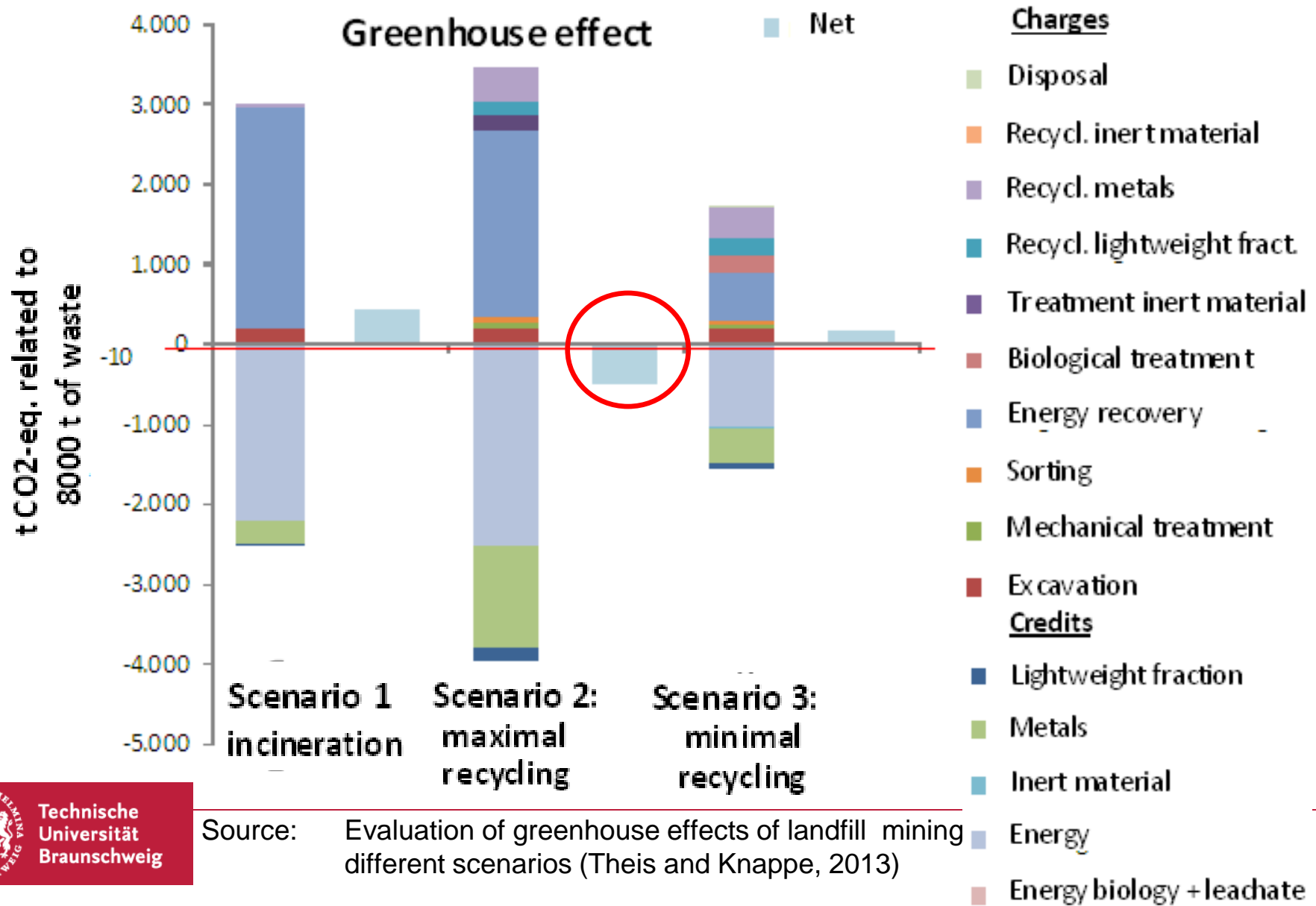


# Ecological and economical evaluation of landfill mining projects

Scenario 3: recycling, minimal



# Ecological and economical evaluation of landfill mining projects



Source: Evaluation of greenhouse effects of landfill mining different scenarios (Theis and Knappe, 2013)

# Conclusions

- Under only ecological aspects landfill mining with the aim to bring as much as possible waste material back into material cycle is certainly discussed controversially.
- At the moment only economical aspects cannot be the main motivation for landfill mining, but the revenues will reduce the total costs for landfill mining considerably.
- Although recycling measures and landfill mining alone can of course not prevent the shortage of resources on the long-term, they form an important module for the future supply of resources.
- The aim of the project is to generate a universally valid guideline for such projects.

**it is not the question of whether....**

**..... it's the question of when**

