



GROUP  
**MACHIELS**

[www.machiels.com](http://www.machiels.com)

## Landfill mining: horses for courses

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@tielemay

@GroupMachiels

# Group Machiels' Remo landfill

**Location:** Houthalen, east of Belgium

## Activities of Remo as of today

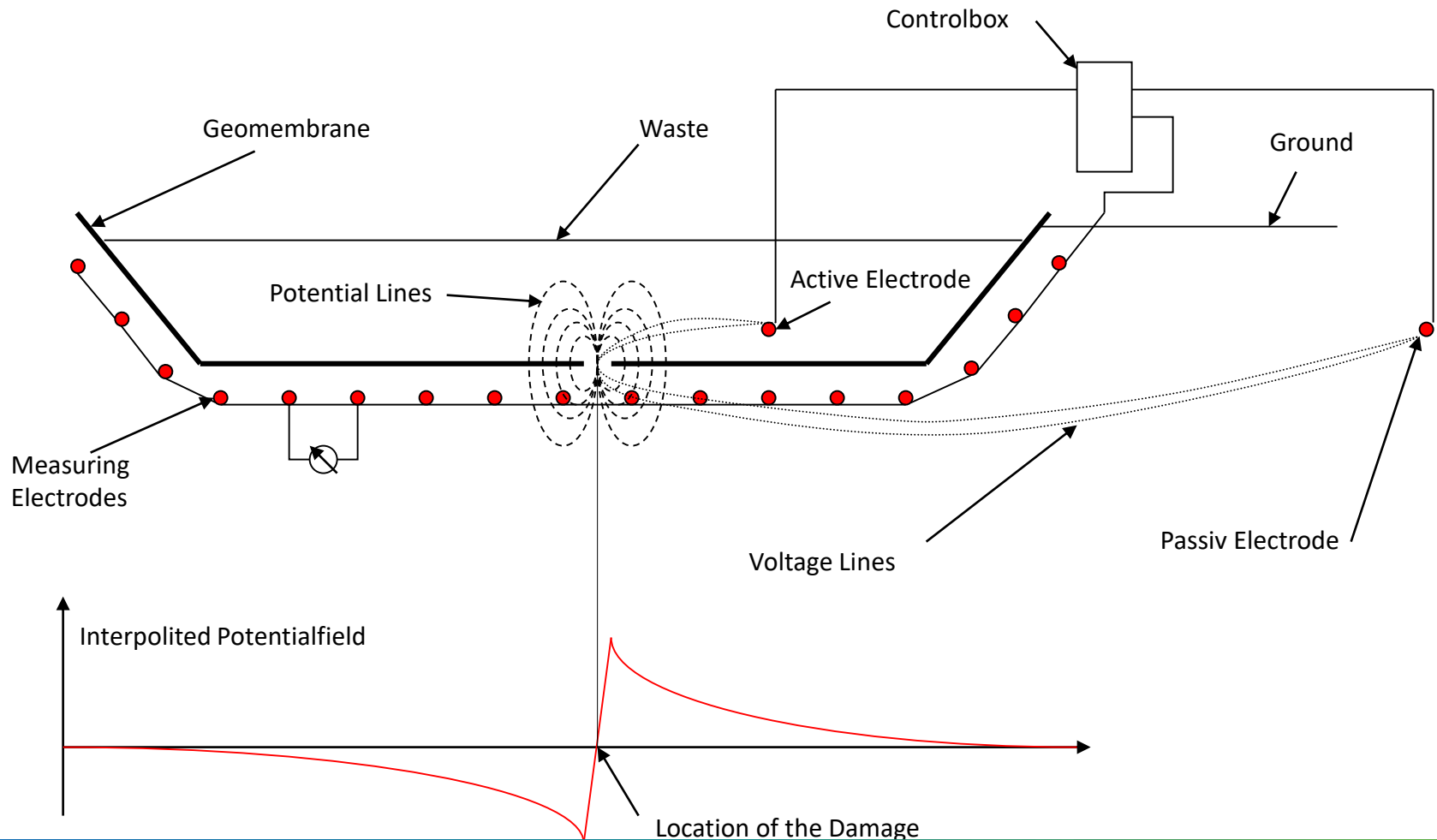
Landfill for industrial waste ( $\pm 300$  kton/annum) incl leachate purification and landfill gas extraction and valorisation (CHP).

## Transition towards Closing the Circle

Landfill represents a reserve of materials and energy, reclaimed land can be redeveloped into an integrated nature park after mining of the landfill.



# State of the art sanitary landfills, Including a leak detection system





# Implementation of landfill





# International waste management best practises



## **Location**

Santiago de Chile

## **Activity**

Receiving, processing, recycling and storing industrial waste flows.



## **Location**

Region VIII, Concepción

## **Activity**

Receiving and storing household and industrial waste flows coming from Region VIII.



## **Location**

El Teniente – Codelco –  
Andes mountains Rancagua.

## **Activity**

Receiving of slags from melting ovens in the copper mine. Treating it and storing it for future re-use in the copper production process.



## **Location**

Salt desert “salar de Atacama” in  
northern Chile.

## **Activity**

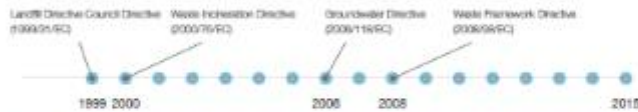
Receiving waste flow containing arsenic from the copper mines in northern Chile. Neutralizing, stabilizing and storing of waste materials.

# Assessment EU landfills



EUROPEAN ENHANCED LANDFILL MINING CONSORTIUM

Timeline of waste related directives in Europe

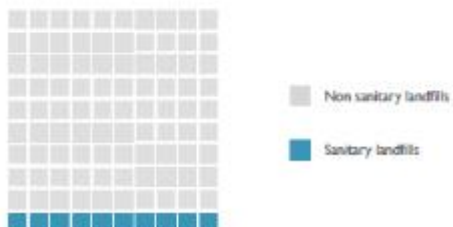


Legend

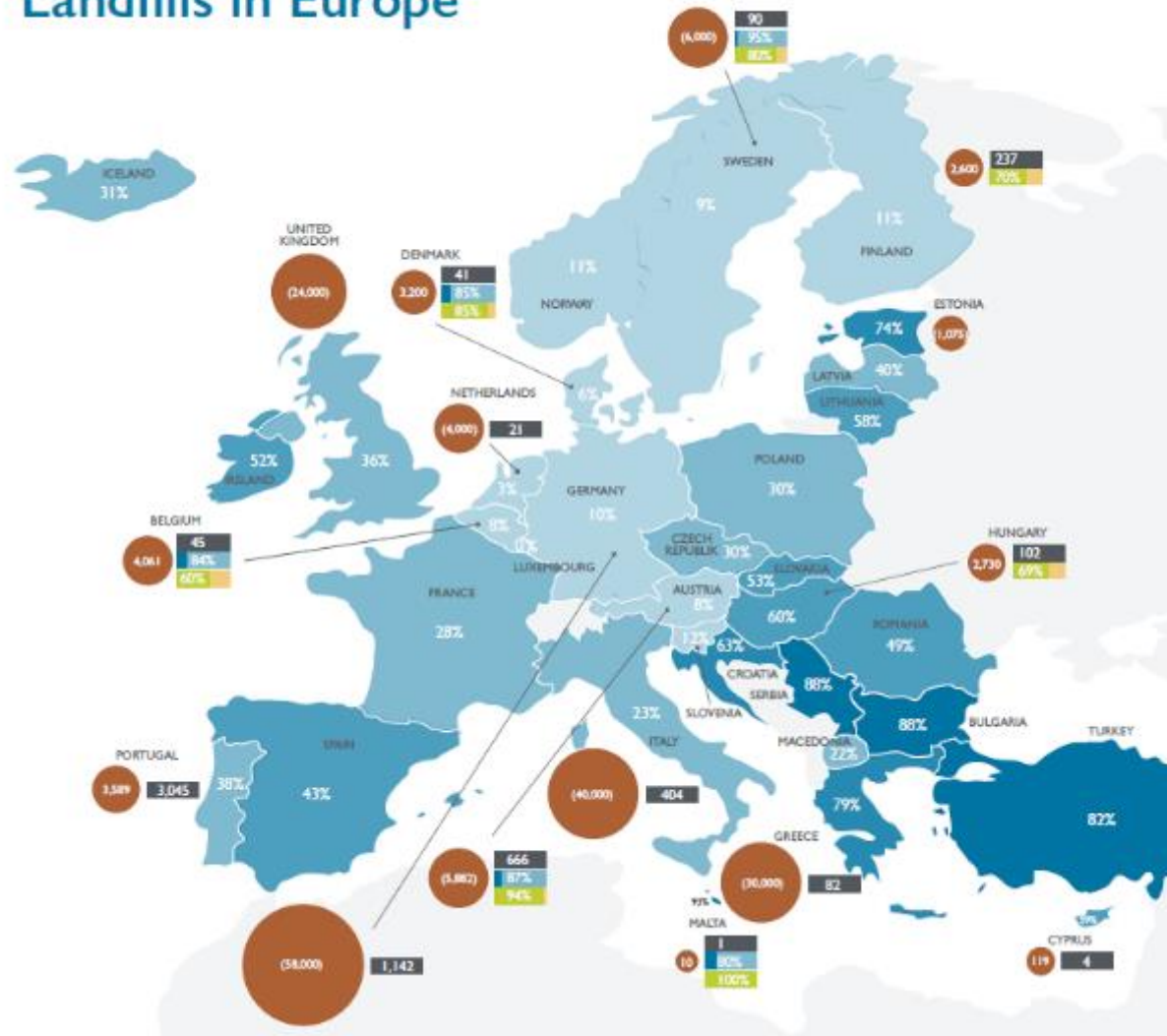


Current landfill rate(%) i.e. share of landfilled waste versus total waste generated, excluding major mineral waste (EUROSTAT 2012 data)

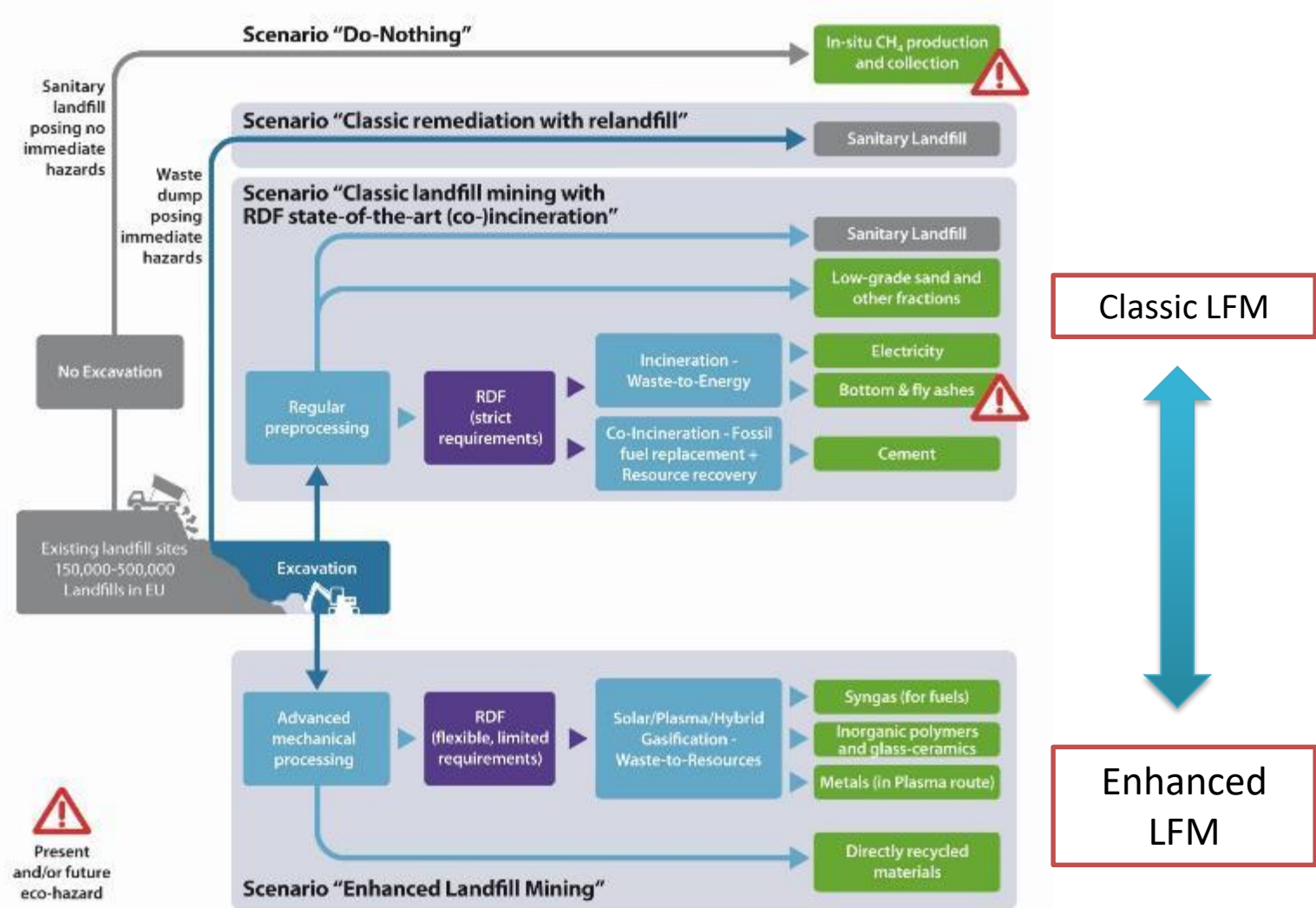
EU(28): 500,000 landfills



## Landfills in Europe



# LFM vs ELFM





- Urban Solid Waste (USW) == Municipal Solid Waste (or equal) and/or Mixed Industrial Waste
- Most appropriate landfill mining solution for USW landfills to be tailored based on project driver(s) and objectives
- Option A: **“Classic” Landfill Mining (LFM)**
  - Drive: Resolve environmental problem and/or reclaim land for redevelopment
  - Duration: Few months to 2 years (**FAST** solution)
  - Equipment: Mainly mobile installations
  - Ambition level of resource recuperation: secondary focus
- Option B: **“Enhanced” Landfill Mining (ELFM)**
  - Drive: Maximize potential of materials, energy and land recuperation
  - Duration: 10 to 25 years (**TAILORED** solution)
  - Equipment: Mainly stationary installations
  - Ambition level of resource recuperation: primary focus

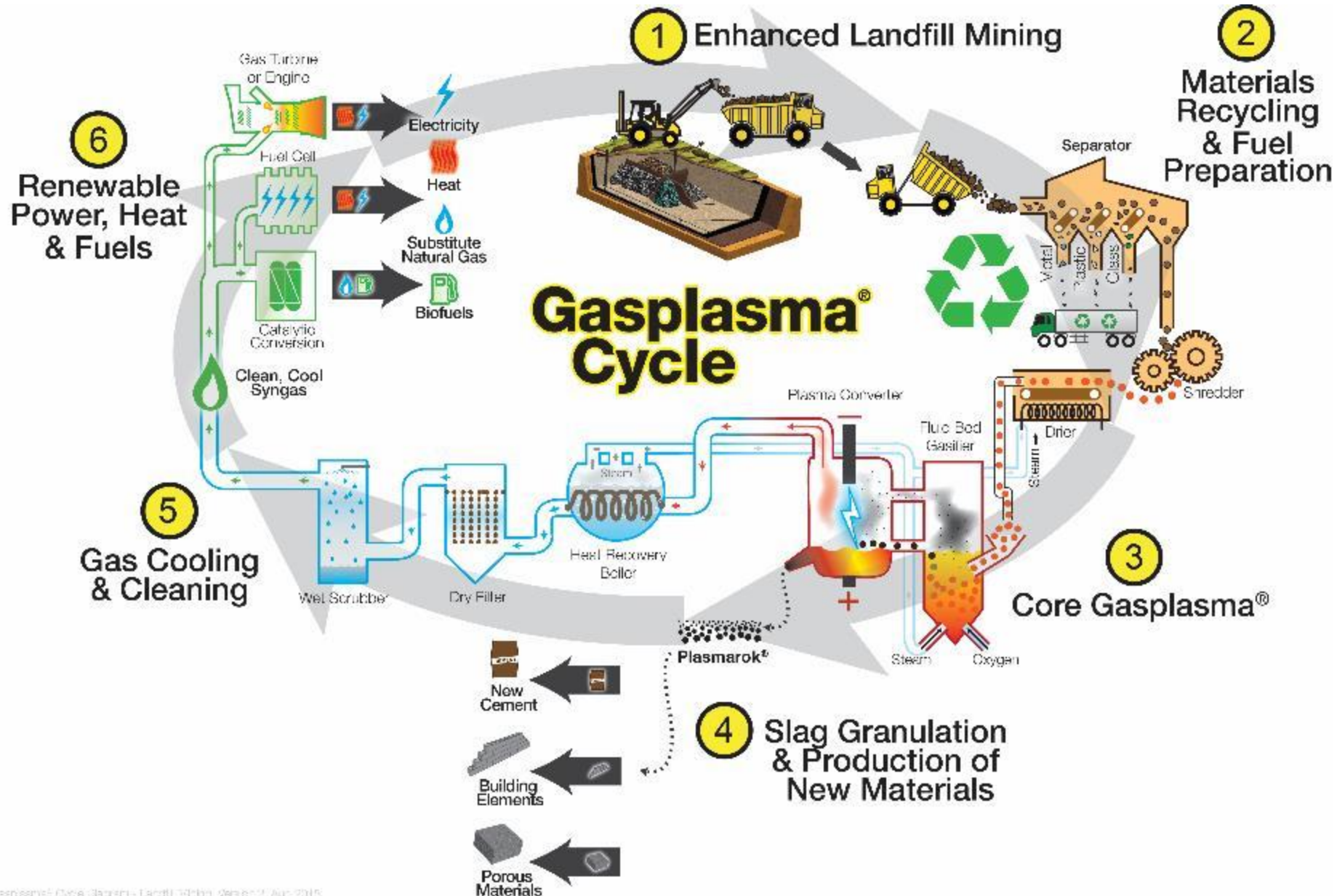


# Classic Landfill Mining (LFM)





# ELFM – Innovative upcycling technologies and products



# The Closing the Circle (CtC) masterplan



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CLOSING THE CIRCLE • ENHANCED LAND FILL MINING

C. DUURZAAM NATUURGEBIED

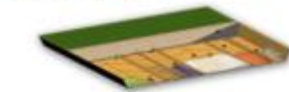
B. CLOSING THE CIRCLE

A. ACTUELE SITUATIE

1 FASE I:  
Tijdelijke opslag

2 ZONE VOOR INSTALLATIES:  
FASE II plasma demonstratie installatie  
en FASE III full scale closing the circle  
(uitbreiding u1 en u2)

3 FASE III:  
Zone voor finale opslag



## Key Figures

- Total area: 230 ha
- 151 ha landfill
- 18+ Mtons waste stored



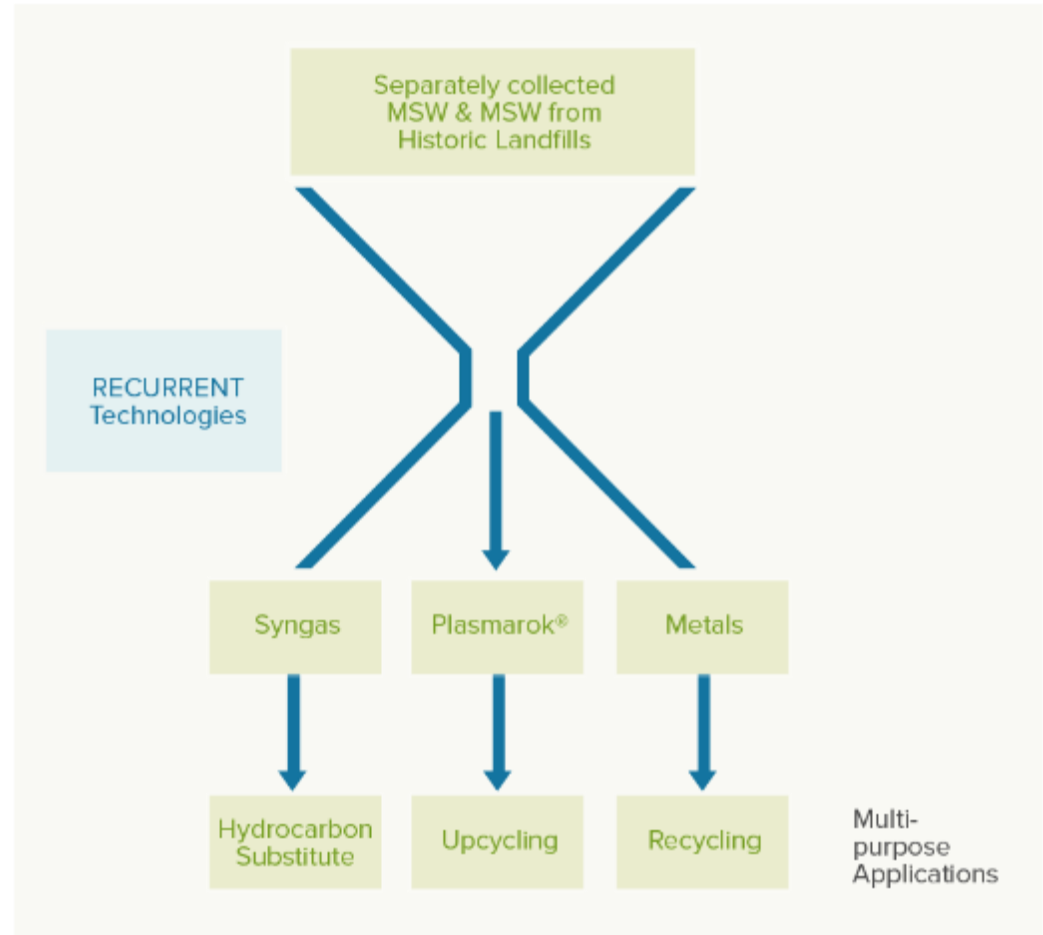
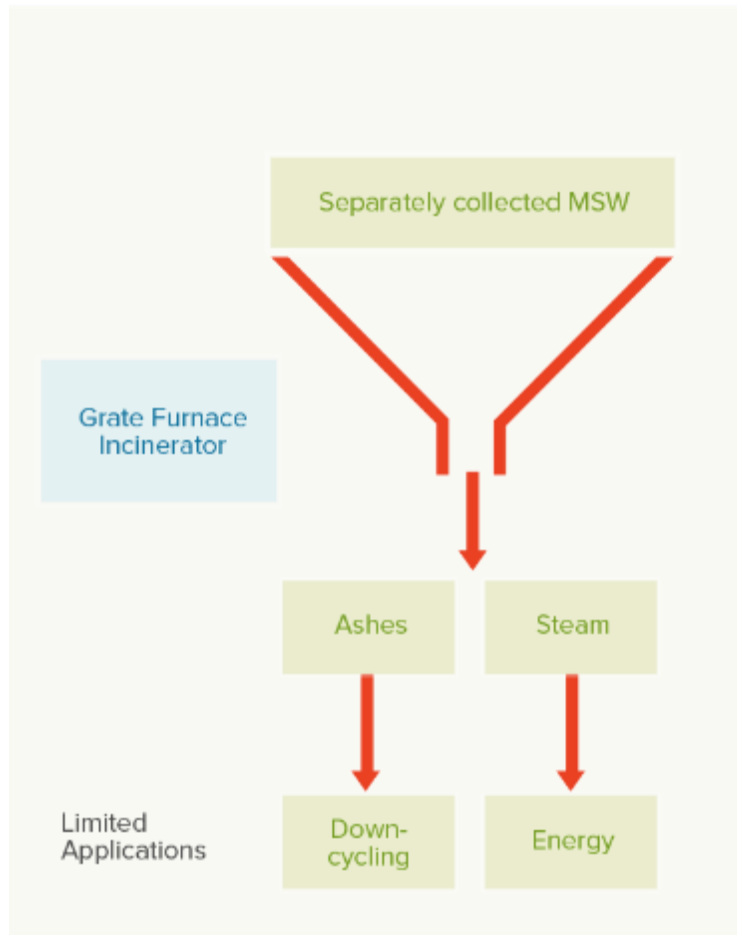


# Existing hydrogen applications

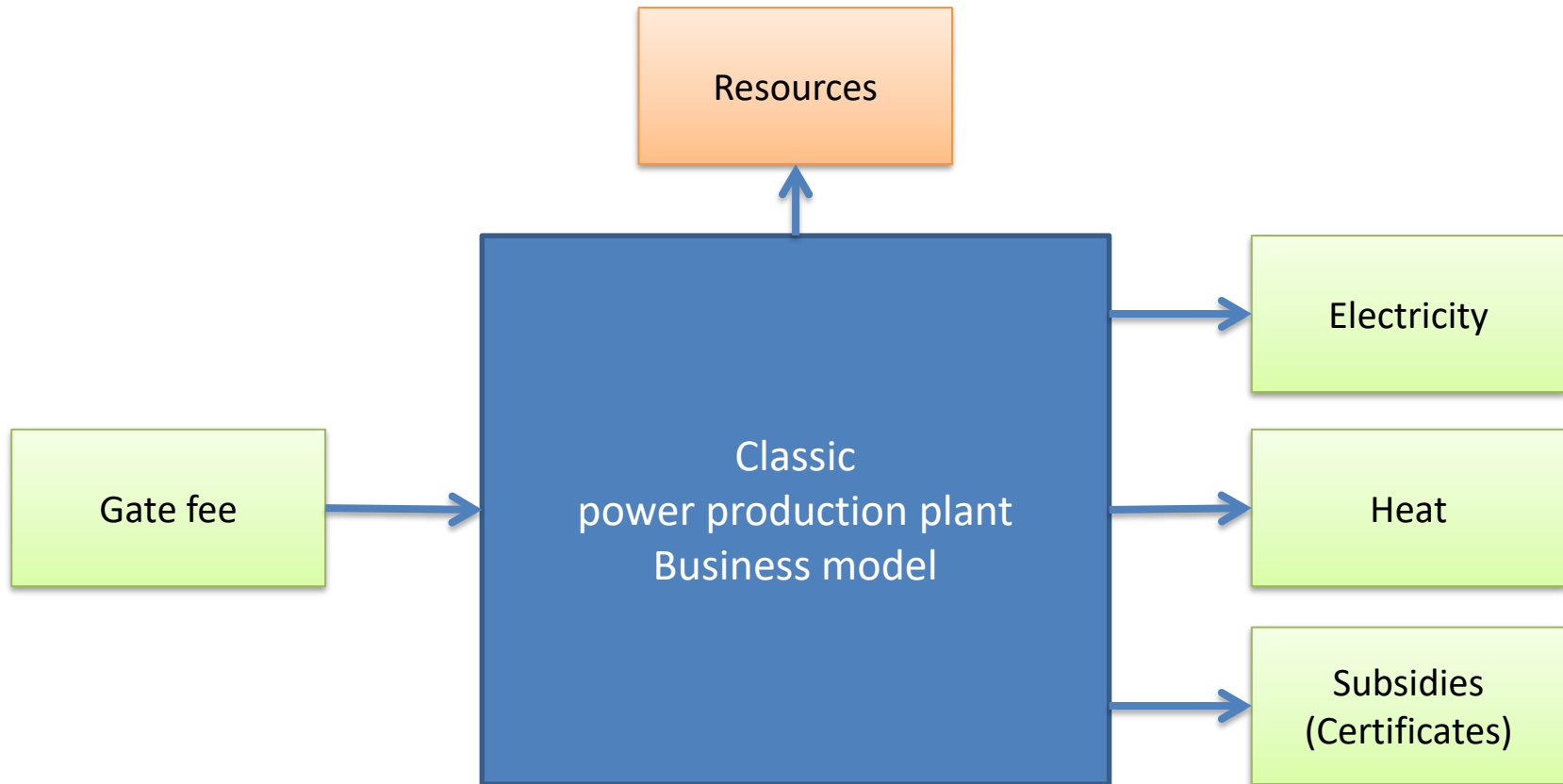


# Towards a sustainable economical model for ELFM projects

Funnel and hourglass sand model



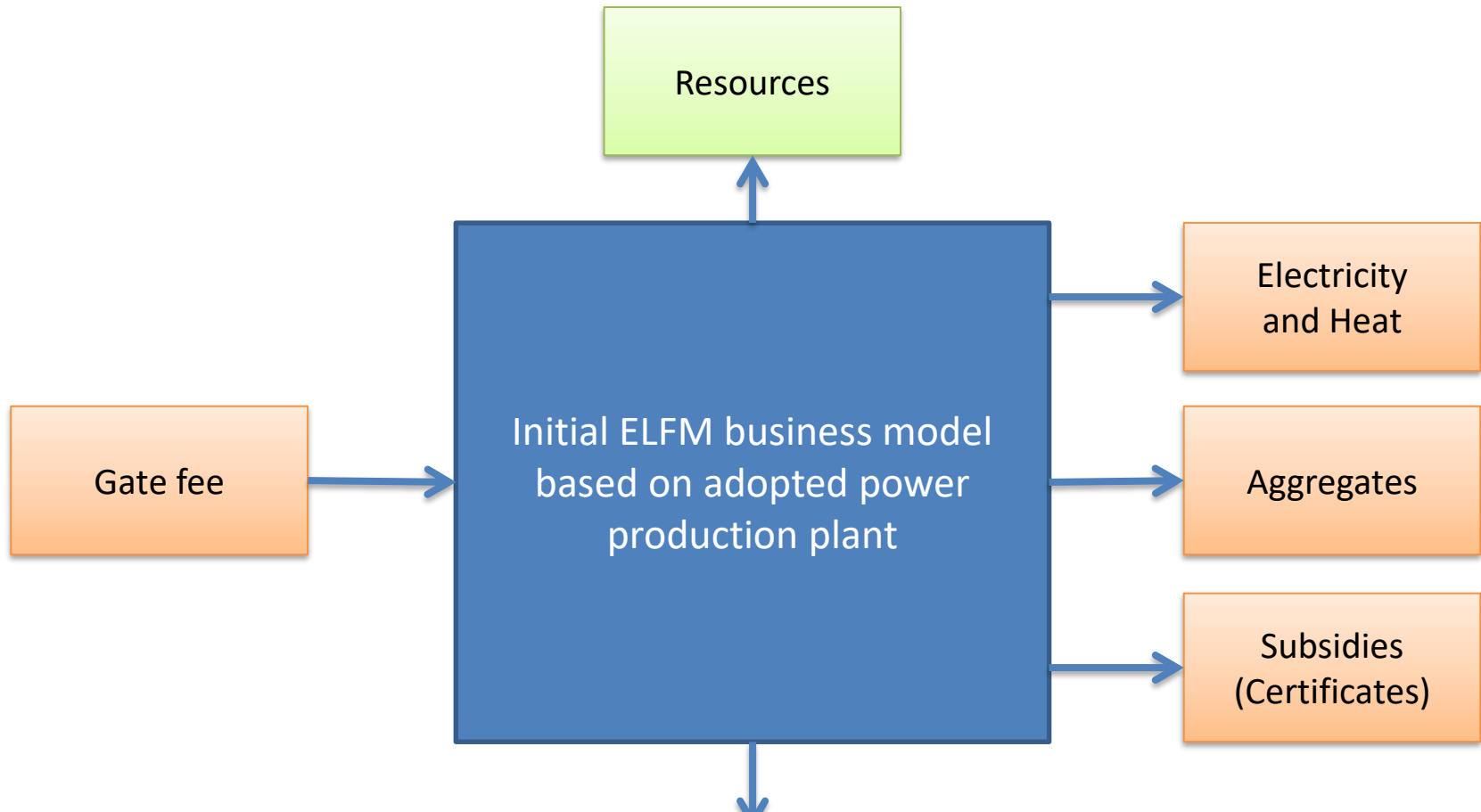
# Towards a sustainable economical model for ELFM projects



**Classic configuration heavily depends on revenues from gate fee, grey and green electricity**

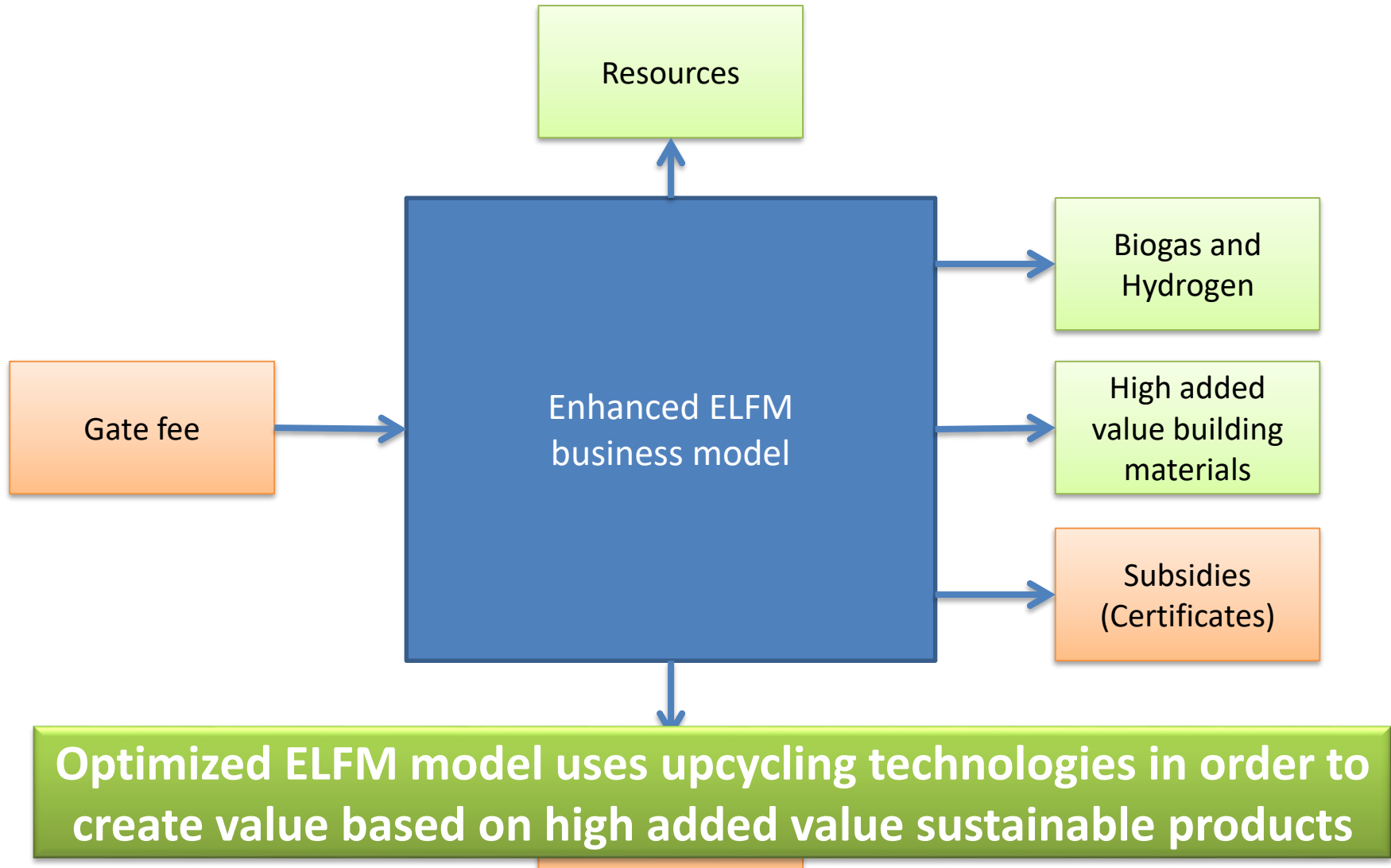


# Towards a sustainable economical model for ELFM projects



**ELFM can't rely on same level of revenues from gate fee, grey and green electricity**

# A sustainable economical model for ELFM projects



# Status realization CtC project

## ■ Science & Technology (R&D):

- R&D subsidy programmes are readily available: EFRO, VLAIO R&D and MIP ICON projects have generated required technical solutions, as a results first installations are permitted and ready-to-be-built

## ■ Awareness & buy-in:

- Quadruple helix model deployed since 2009: growing awareness and buy-in on all levels (local <-> super local, Belgium <-> Europe), but unfortunately appeals from isolated individuals pose a real threat

## ■ Planning & permitting:

- Long, complex and expensive set of procedures have led to all required permits, which will most likely be destroyed by higher court due to appeals from these isolated individuals

## ■ Legal appeals:

- Higher court assesses permits and all included decisions from a content point of view, going much further than securing that no procedural errors are made
- Hard protection of nature is at this moment only parameter being considered in this assessment
- Temporary local removal of nature in order to create a higher total nature value is not allowed
- Upsides like creation of nature park, recovery of resources & energy and employment are not being considered

## ■ Financing:

- Lack of ELFM legislation jeopardizes financial close of project as framework for ELFM is not available

## ■ Legislation:

- EC poses that ELFM can be performed as long as relevant EU (landfill) directives articles are being adhered to
- Much better would be to have an unambiguous definition and framework included in EU directives



# Opportunities towards a sustainable implementation

- Best possible short term interim use will be explored as soon as final judgments are known
- Continuity of Remo landfill operation is imperative to be able to continue the development of CtC



# Wright brothers, 1903

