



GROUP
MACHIELS

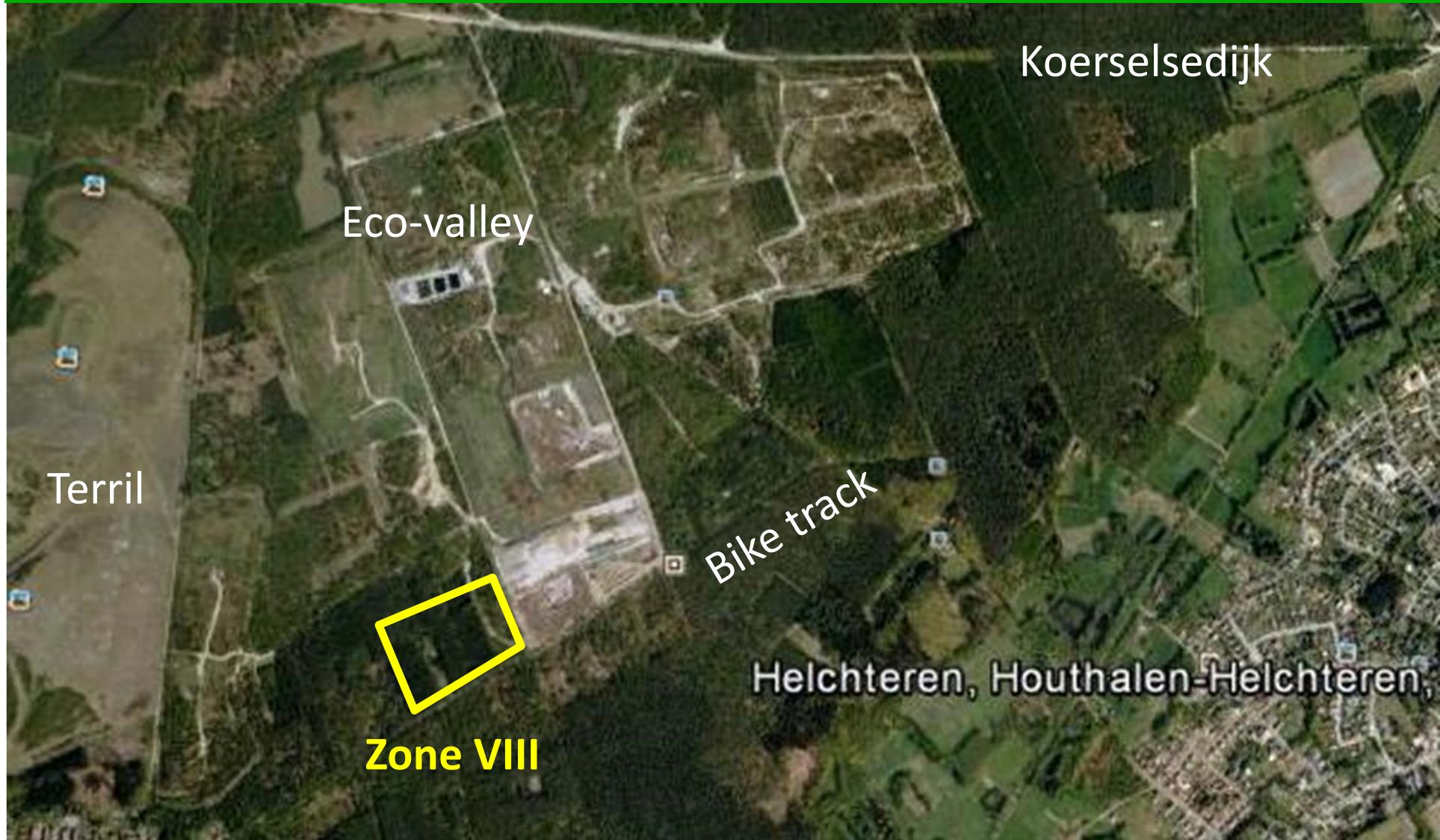
www.machiels.com

**Remo Milieubeheer &
Closing the Circle (E.L.F.M.)**

**Postgestion des CET - ISSeP
Mai 23 2017
Liège**



Temporary Storage



Temporary storage

Remo milieubeheer



Location

Remo site, 3530 Houthalen-Helchteren

Part of Group Machiels

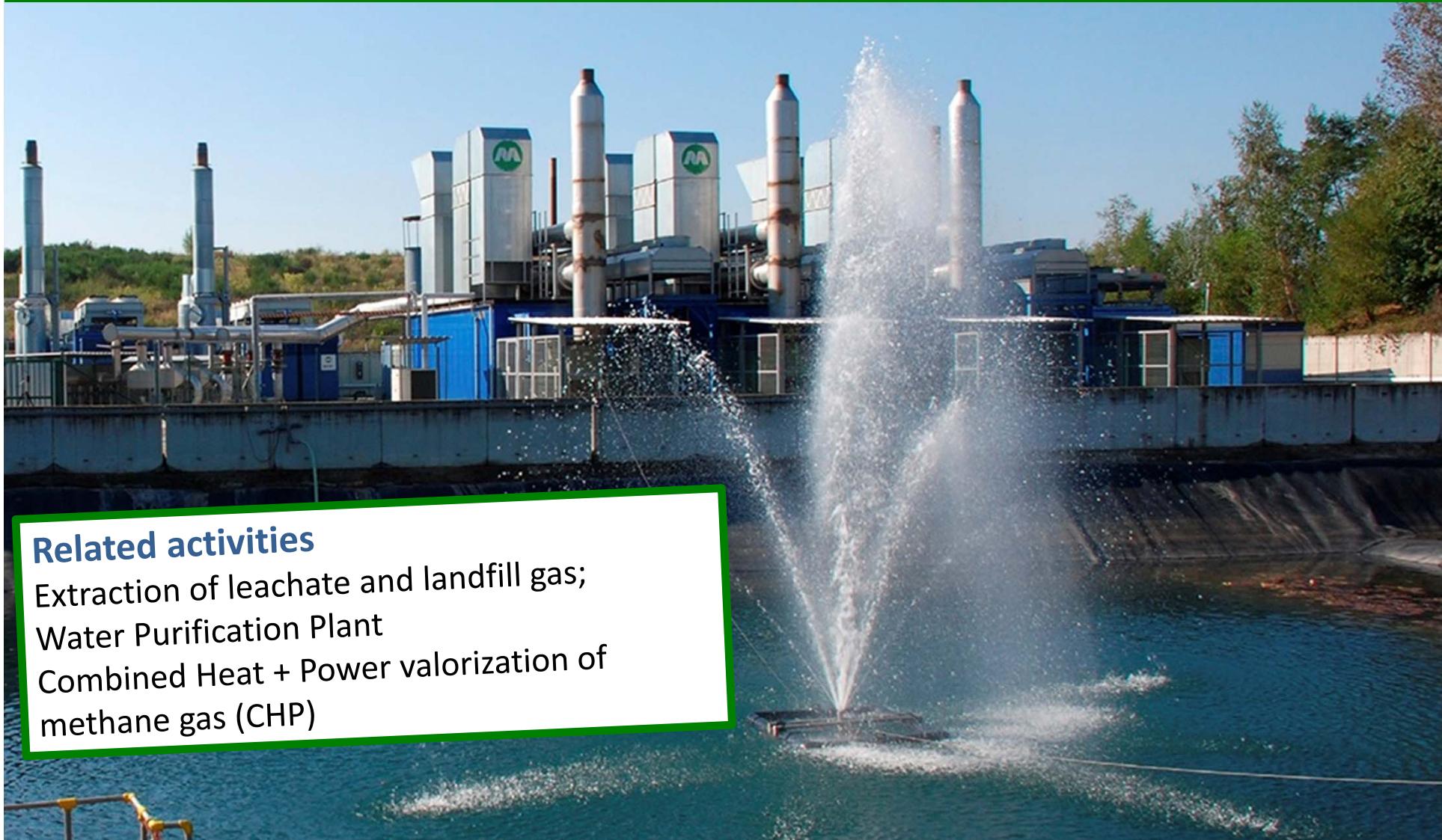
Activities of Remo as of today

State-of-the-art Temporary Storage for Industrial waste.

Transition towards Closing the Circle

Landfill represents a reserve of materials and energy





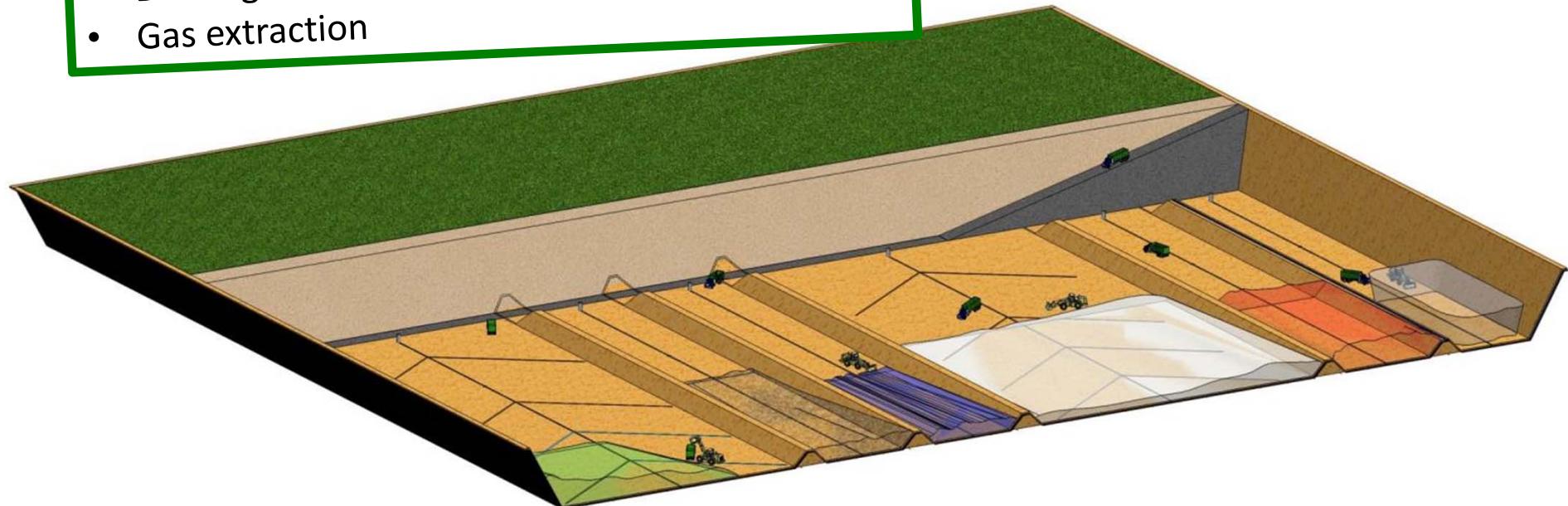
Related activities

Extraction of leachate and landfill gas;
Water Purification Plant
Combined Heat + Power valorization of
methane gas (CHP)

Temporary storage design



- Compartments for different types of waste
- Leak detection
- Drainage + pumping of leachate water
- Gas extraction



International waste management best practises: Chile

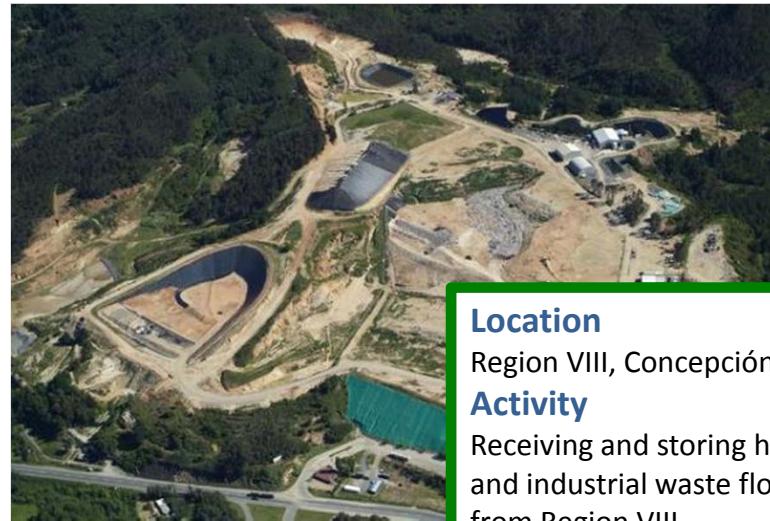


Location

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.

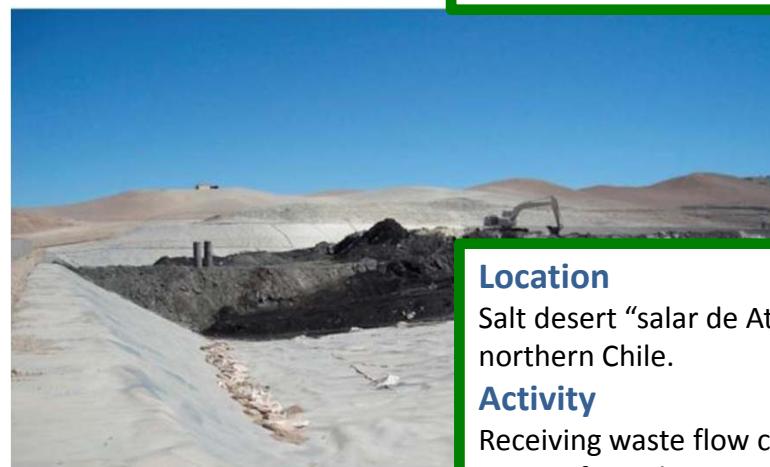


Location

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.

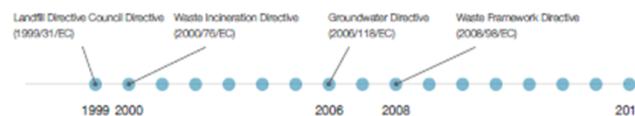
Assessment EU landfill's

150.000 – 500.000 landfills in EU-27
 2.800 – 6.000 km² occupied by landfills
 5.000 million tons of waste



EUROPEAN ENHANCED LANDFILL MINING CONSORTIUM

Timeline of waste related directives in Europe



Legend



Amount of presently still operational landfills



Distribution sanitary landfills (preceding and/or in compliance with EU landfill directive / non sanitary landfills (in % of landfills)



Distribution USW/industrial landfills (in % of landfills, in amounts not weights)

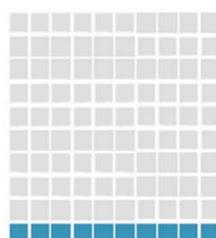


Estimated total amount of landfills (when data are indicated between (brackets) this implies it is an estimate based on the amount of municipalities multiplied by an average amount of 5 landfills per municipality)

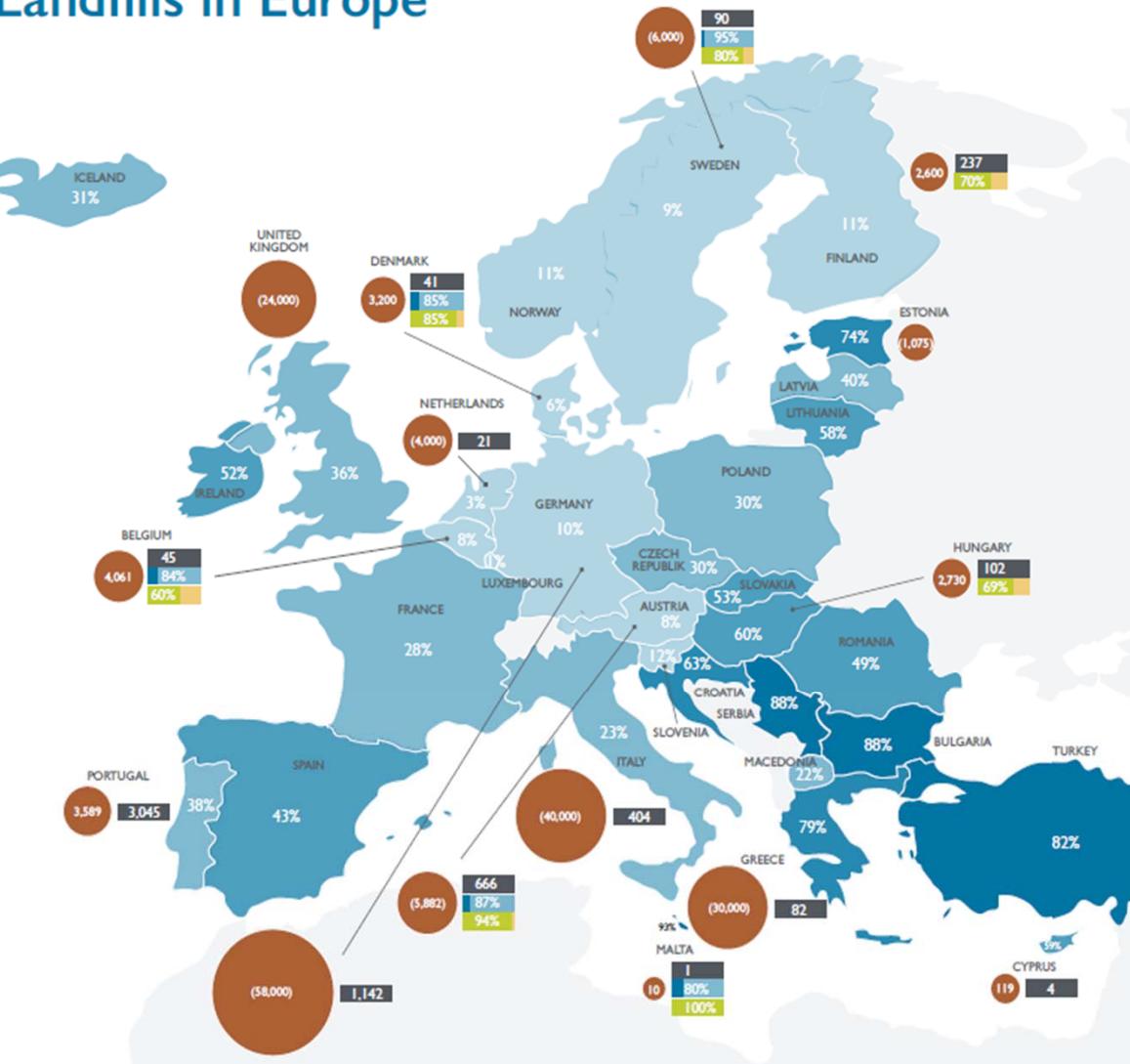


Current landfill rate(%) i.e. share of landfilled waste versus total waste generated, excluding major mineral waste (EUROSTAT 2012 data)

EU(28): 500.000 landfills



Landfills in Europe



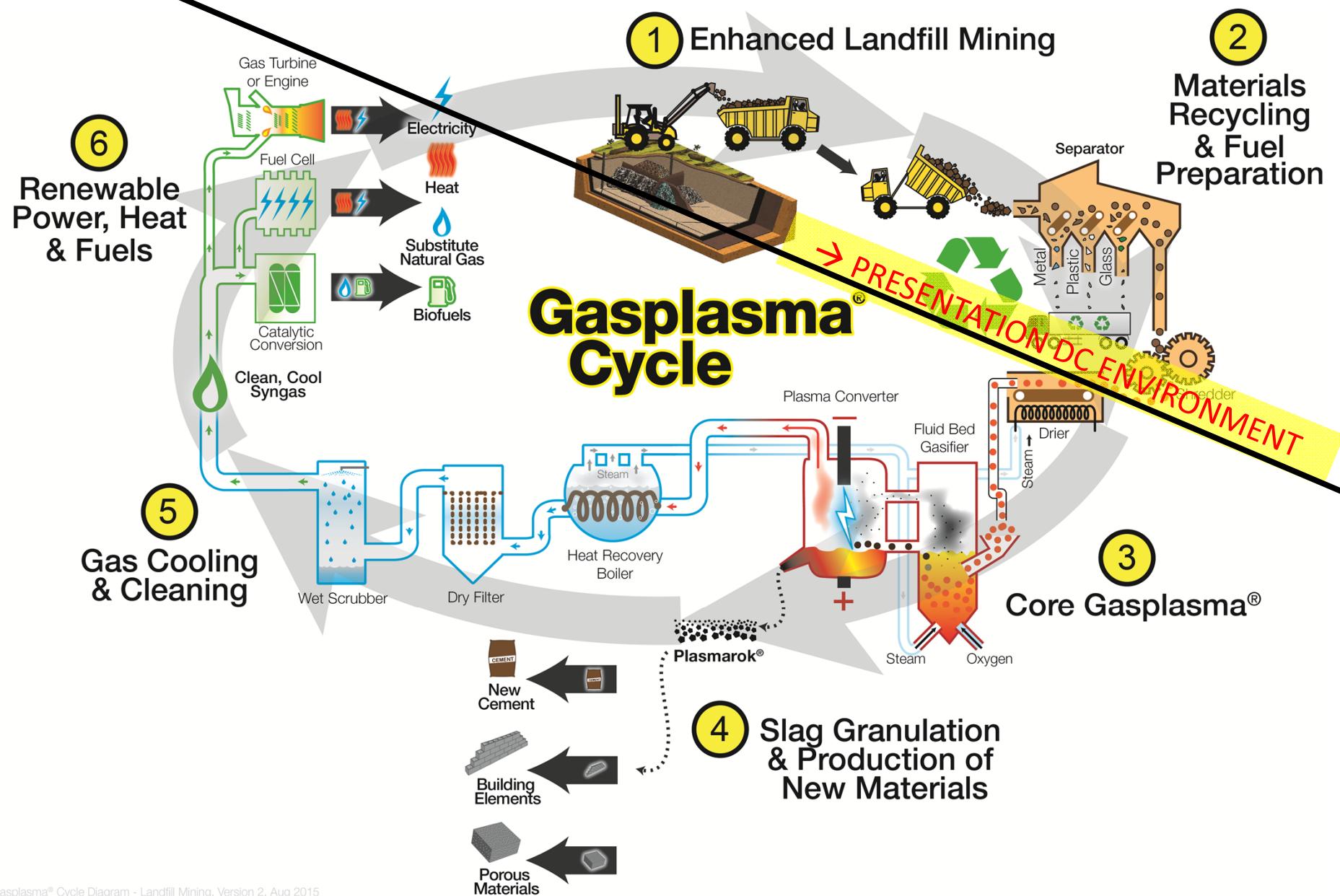
Classic Landfill Mining vs Enhanced Landfill Mining

- Most appropriate landfill mining solution for urban solid waste (USW) landfills depends 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 30 years (**TAILORED** solution)
 - Equipment: Mainly stationary installations
 - Ambition level of resource recuperation: primary focus

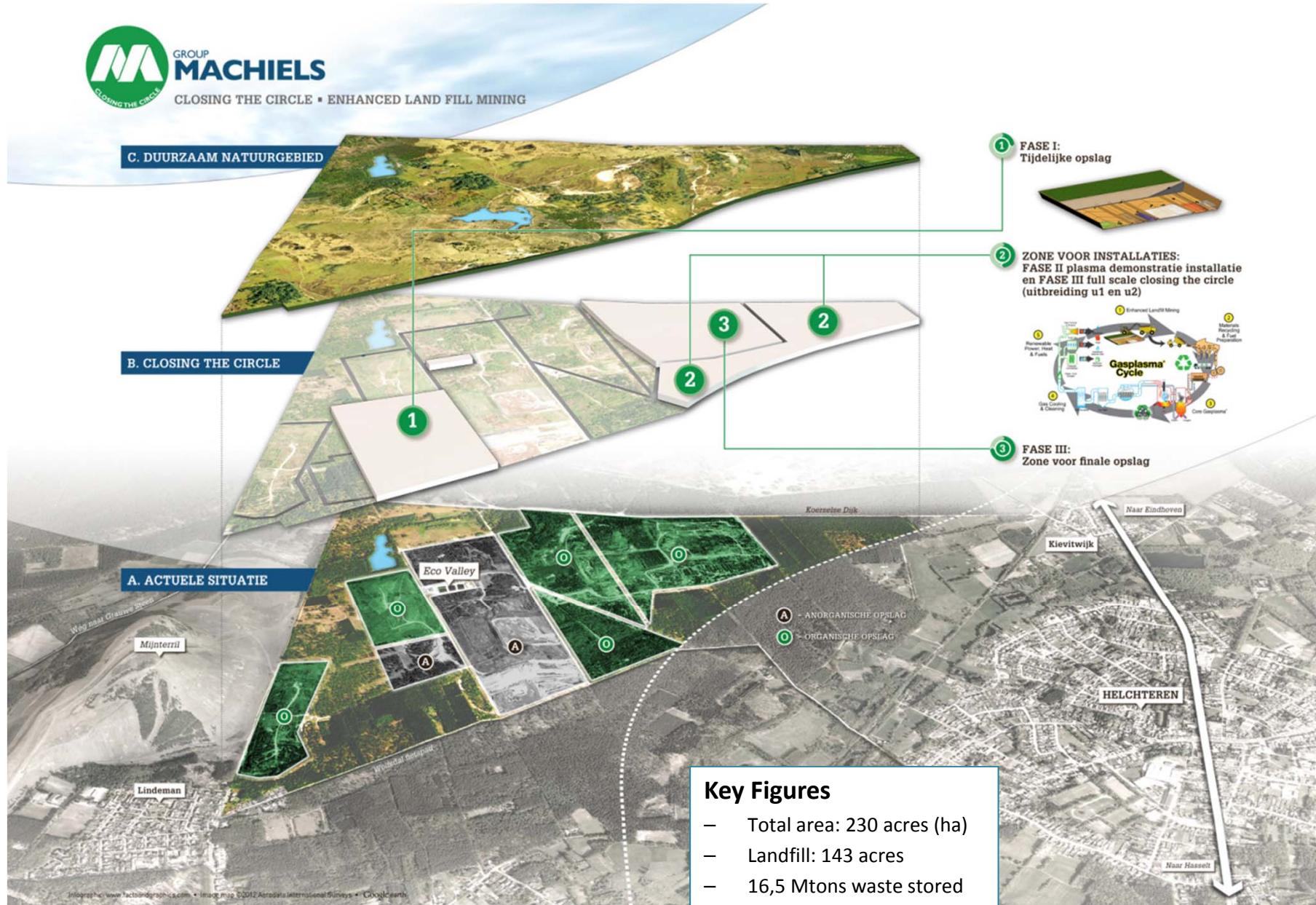
Classic Landfill Mining



ELFM: Plasma Gasification Technology



Closing the Circle masterplan

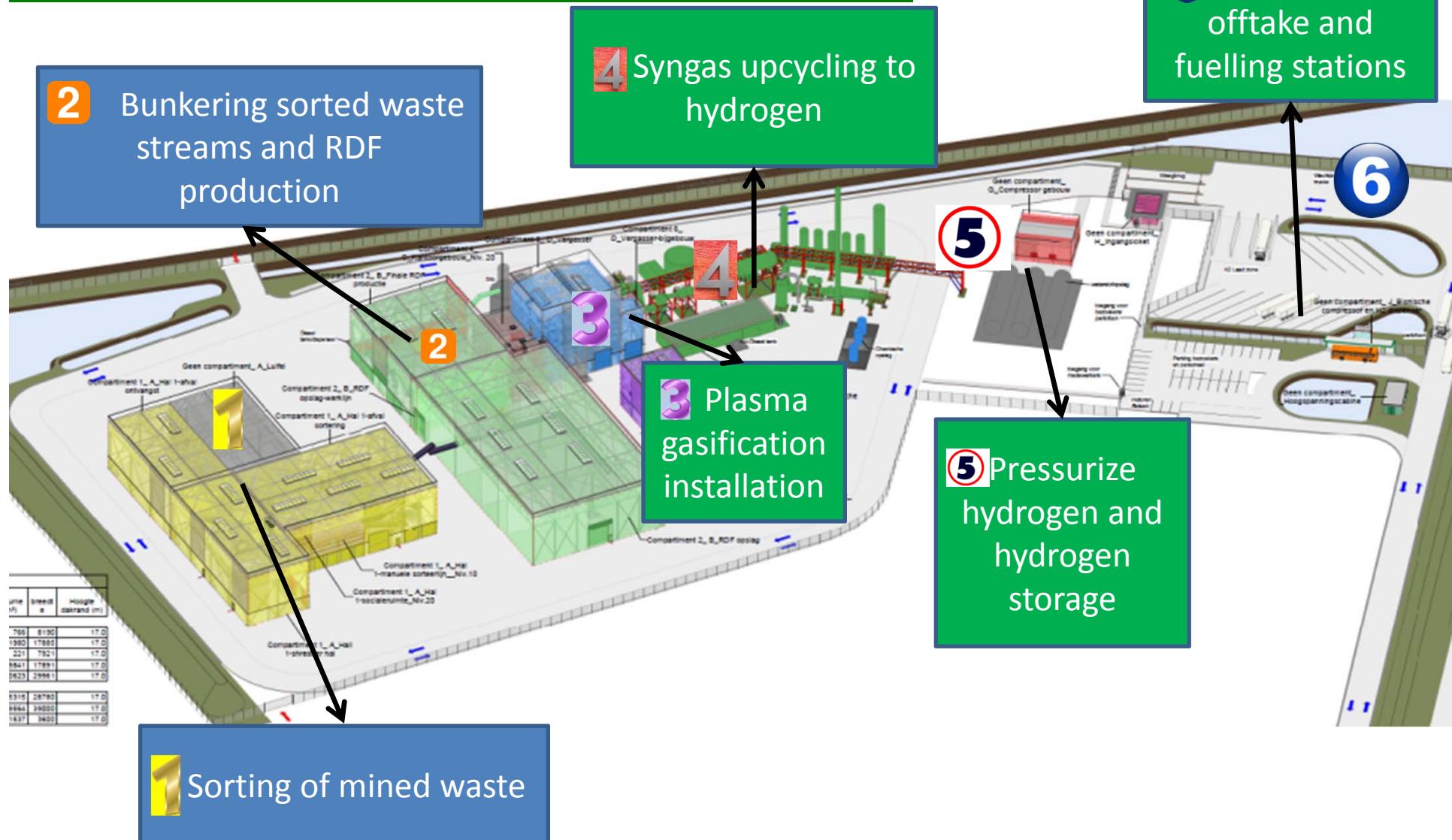


Closing the Circle

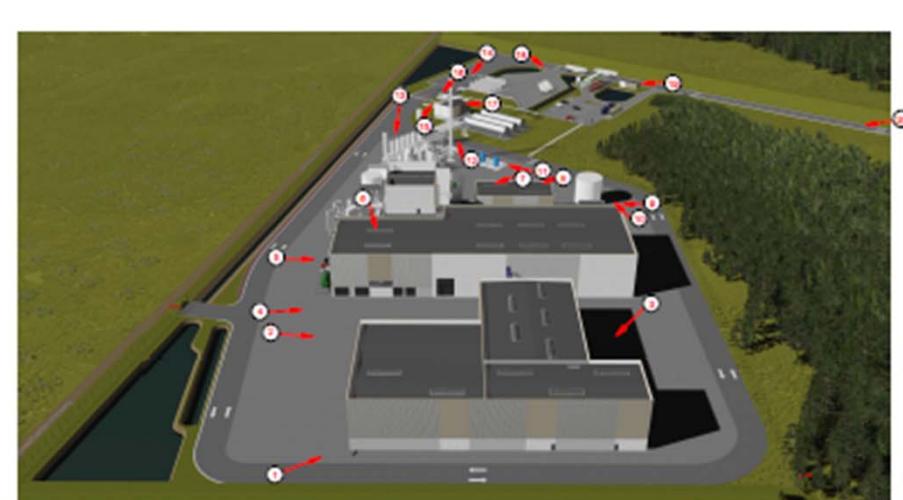
Test: excavation of municipal waste



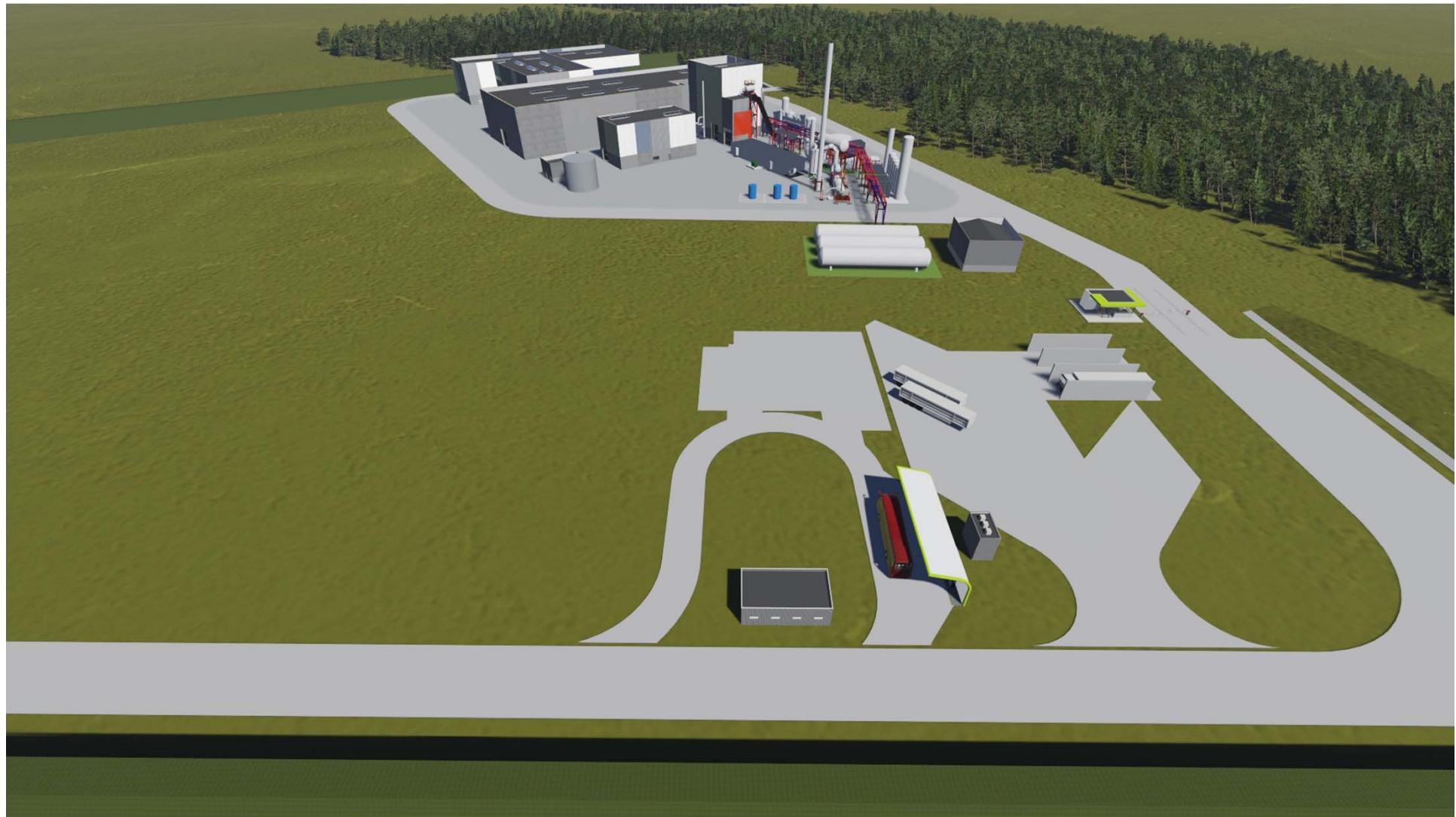
CtC Demonstration Plant



CtC Demonstration Plant



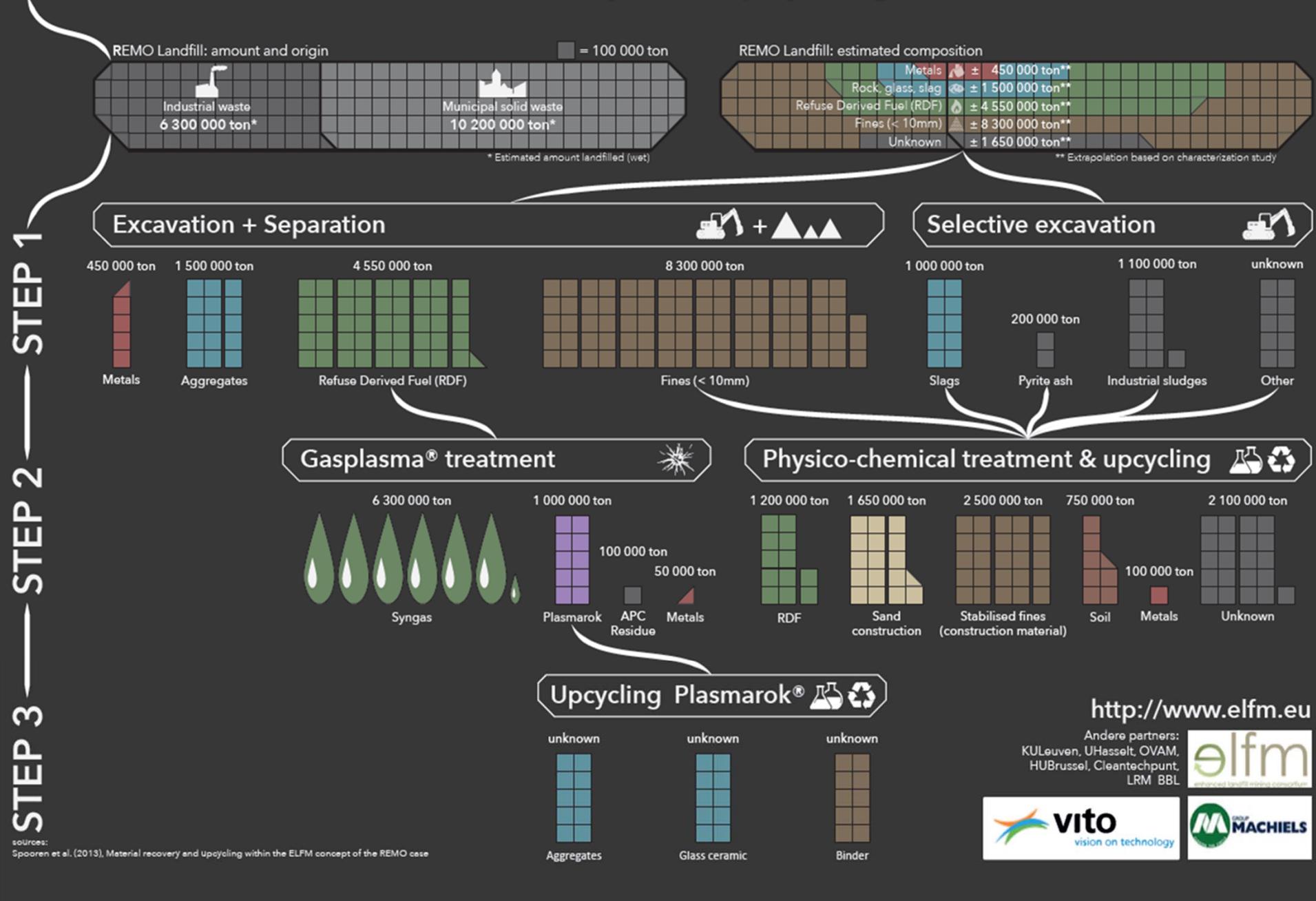
CtC Demonstration Plant



Existing hydrogen applications



REMO Landfill: Material recovery and upcycling within the REMO case



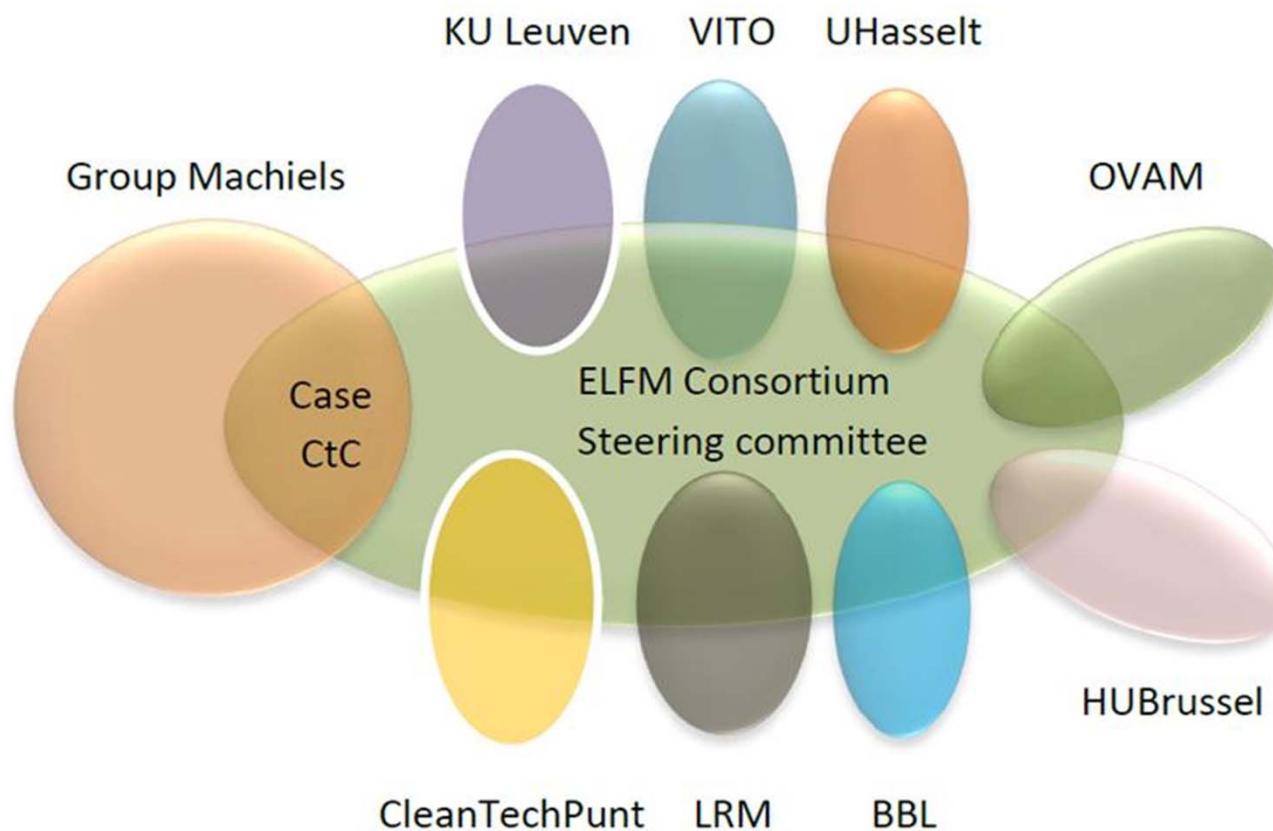
ELFM timeline

- Phase I: demonstration
 - Demonstration plant 30.000 ton RDF(*) / year
 - Total hydrogen production: 0.3 - 1.0 ton/hour
 - Operational: expected 2019, for period of 28 years
- Phase II: extension 1
 - Second plant 130.000 ton RDF/year
 - Total hydrogen production (2 plants): 1.3 - 2.0 ton/hour
 - Operational 2022-2023 voor for period of 24 years
- Phase III: extension 2 → full scale capacity:
 - Third plant 230.000 ton RDF/year
 - Total hydrogen production (3 plants): 2.3 - 3.0 ton/hour
 - Operational 2025-2026 for period of 21 years
- TOTAL CAPEX = € 250 million TOTAL EMPLOYEES = 250 - 300 FTE's

(* RDF = refuse derived fuel)

ELFM Consortium Flanders

- Started in 2008, creation of a basis for development



ELFM: Europe → EURELCO

- EU ELFM Consortium, www.eurelco.org
- Quadruple helix R&D Consortium to facilitate ELFM breakthrough on EU level, full support in Flanders achieved
- Established March 2014, 58 members, 13 EU member states

EU Member State	Company	Knowledge Institute	Association	Public Body
Austria		Montanuniversität Leoben		
Belgium	Aertsen, Arche, Ballast Nedam, Bioterra, DEC/DEME, Ecorem, Envisan, GreenVille, InsPyro, JM Recycling NV, Point Consulting Group, Shanks, Spaque, Tauw, Witteveen & Bos, Tractebel, ERM	Antwerp University, Ghent University, Hasselt University, KU Leuven, University of Liège, VITO, CTP	CleanTechPunt, i-Cleantech Vlaanderen,	ANB, OVAM, Province of Limburg
Denmark	Danish Waste Association, Danish Waste Solutions			
Estonia		Estonian University of Life Sciences		
Finland		VTT		
Germany		Aachen University, Fraunhofer ISC		
Greece	Enveco	National Technical University of Athens		
Italy		CINI Geo, University of Padova		CNR-ISTEC
Portugal		Instituto Superior Técnico, New university of Lisbon, Universidade de Aveiro		
Sweden	Lundahydro, Scanarc, Stena	KTH, Linköping University, Linnaeus University		
The Netherlands	OonKAY	Deltares, Wageningen University		
UK	Axion Consulting, Terra Recovery	Cardiff School of Engineering, Cranfield University		
Spain				Waste Agency of Catalonia
	13	26	25	2
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END

Lode Willems

Business Development Manager

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