ELFM challenges and opportunities

Yves Tielemans on behalf of EURELCO

CO-ORGANIZED WITH

Agència de Residus de Catalunya

Consell General de Cambres de Catalunya

EUROPEAN ENHANCED LANDFILL MINING CONSORTIUM

ELFM challenges and opportunities

Yves Tielemans on behalf of EURELCO

Barcelona, October 18, 2017

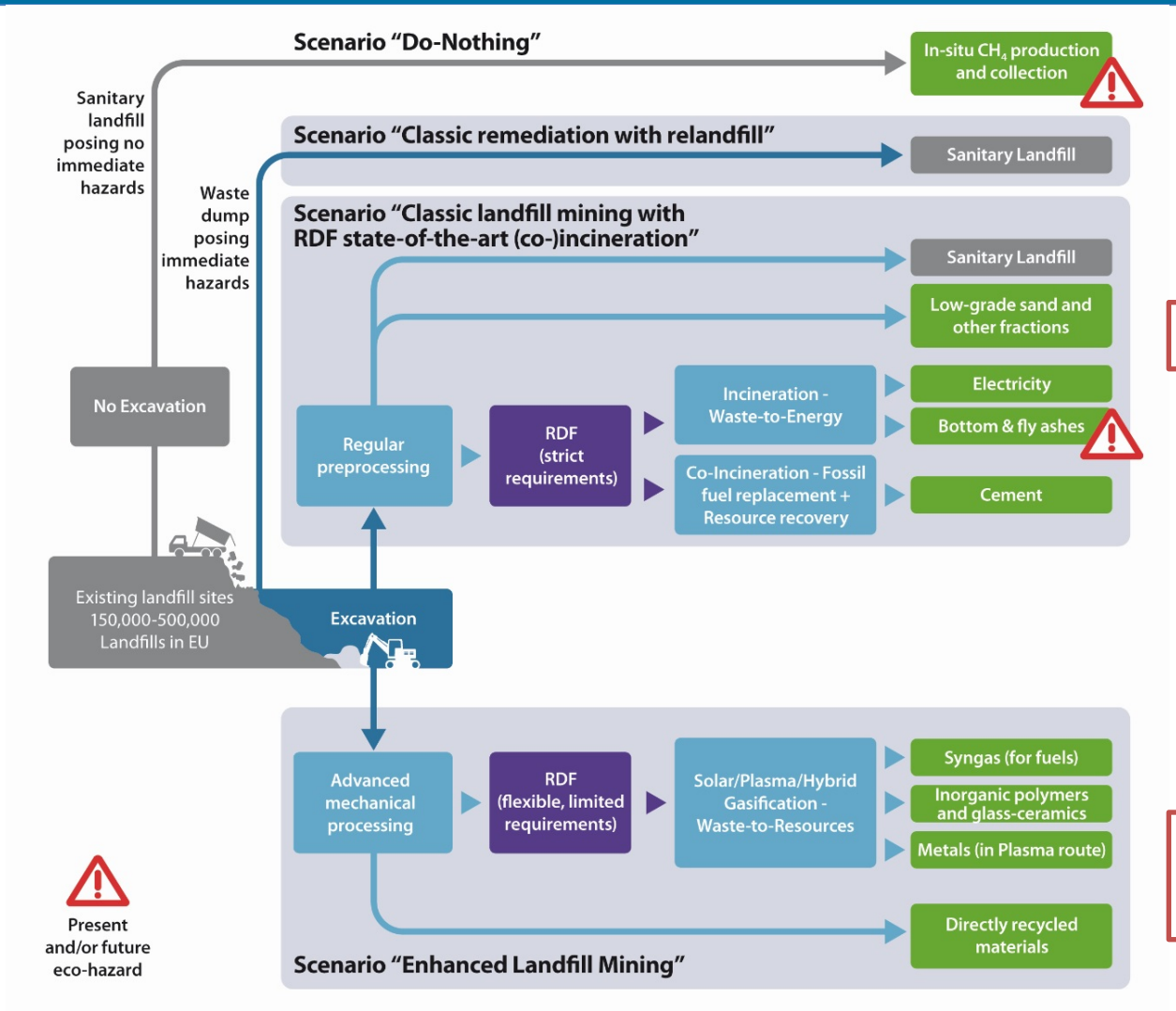
Definition ELFM – Flemish ELFM Consortium

Enhanced Landfill Mining =

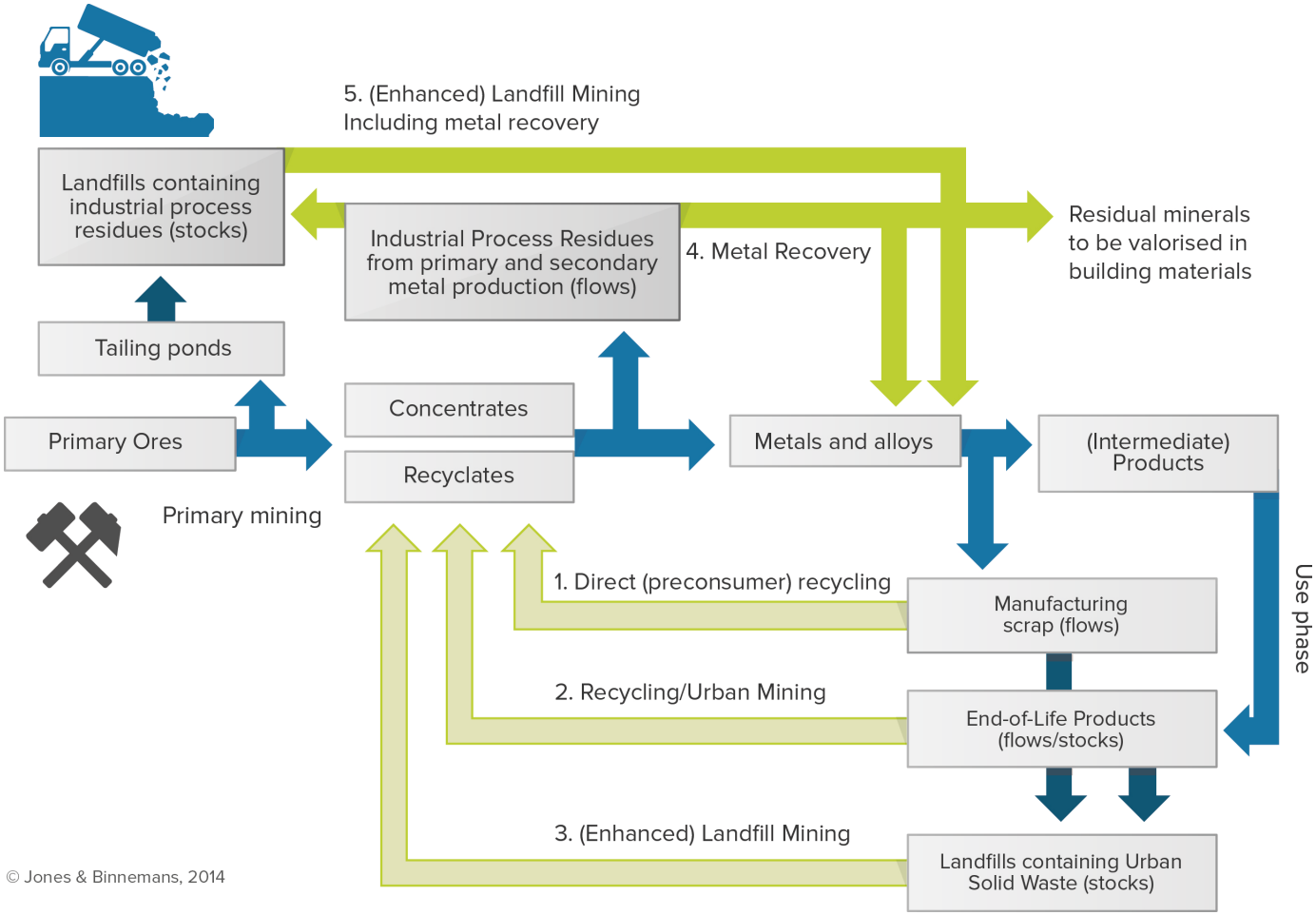
"the safe conditioning, excavation and integrated valorization of (historic and/or future) landfilled waste streams as both materials (Waste-to-Material) and energy (Waste-to-Energy), using innovative transformation technologies and respecting the most stringent social and ecological criteria."

Enhanced Landfill Mining in view of multiple resource recovery: a critical review

ELFM – With respect to other scenarios



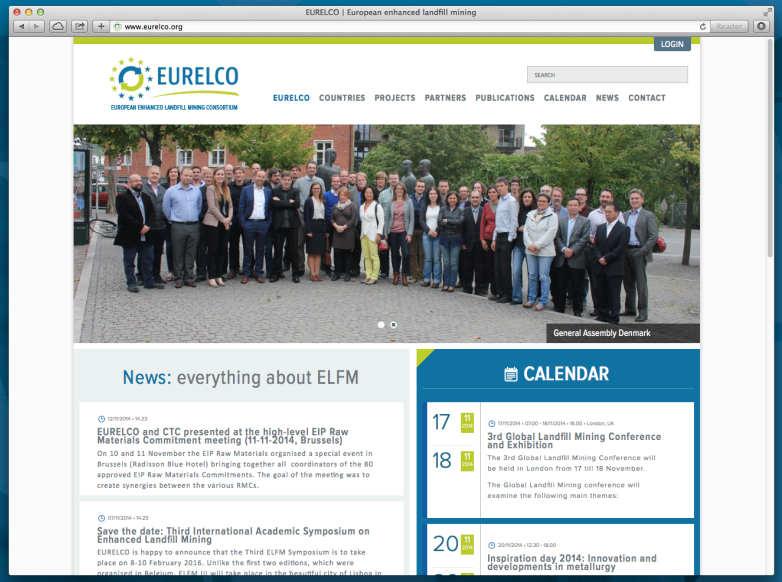
(Enhanced) Landfill Mining within a broader Recycling strategy

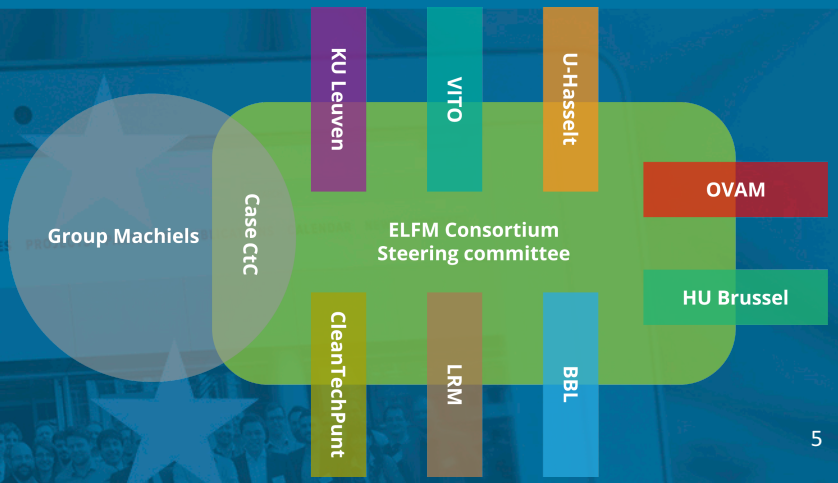


Brief history of EURELCO

Enhanced Landfill Mining (ELFM) has gradually obtained more coverage and credibility in the EU:

- Flanders: Multi-actor research consortium since 2008
- Several national research projects are running in BE, NL, GE, SE, FI, Baltic Region, AU, etc.
- Erection EUROPEAN ENHANCED LANDFILL MINING Consortium in march 2014 www.eurelco.org
- EURELCO received EIP RMC Status
- ELFM to be part of new EIT KIC on Raw Materials





EURELCO Factsheet

EURELCO is an open, quadruple helix network that supports the required (…) innovation with respect to Enhanced Landfill Mining within the context of a transition to a resource efficient, circular, low-carbon economy. www.eurelco.org

Established in 2014, implementing **quadruple helix model**

58 Members (incl. 25 companies, €1000 fee)

5 Working Groups Mapping - S/T - System conditions - Projects - Dissemination

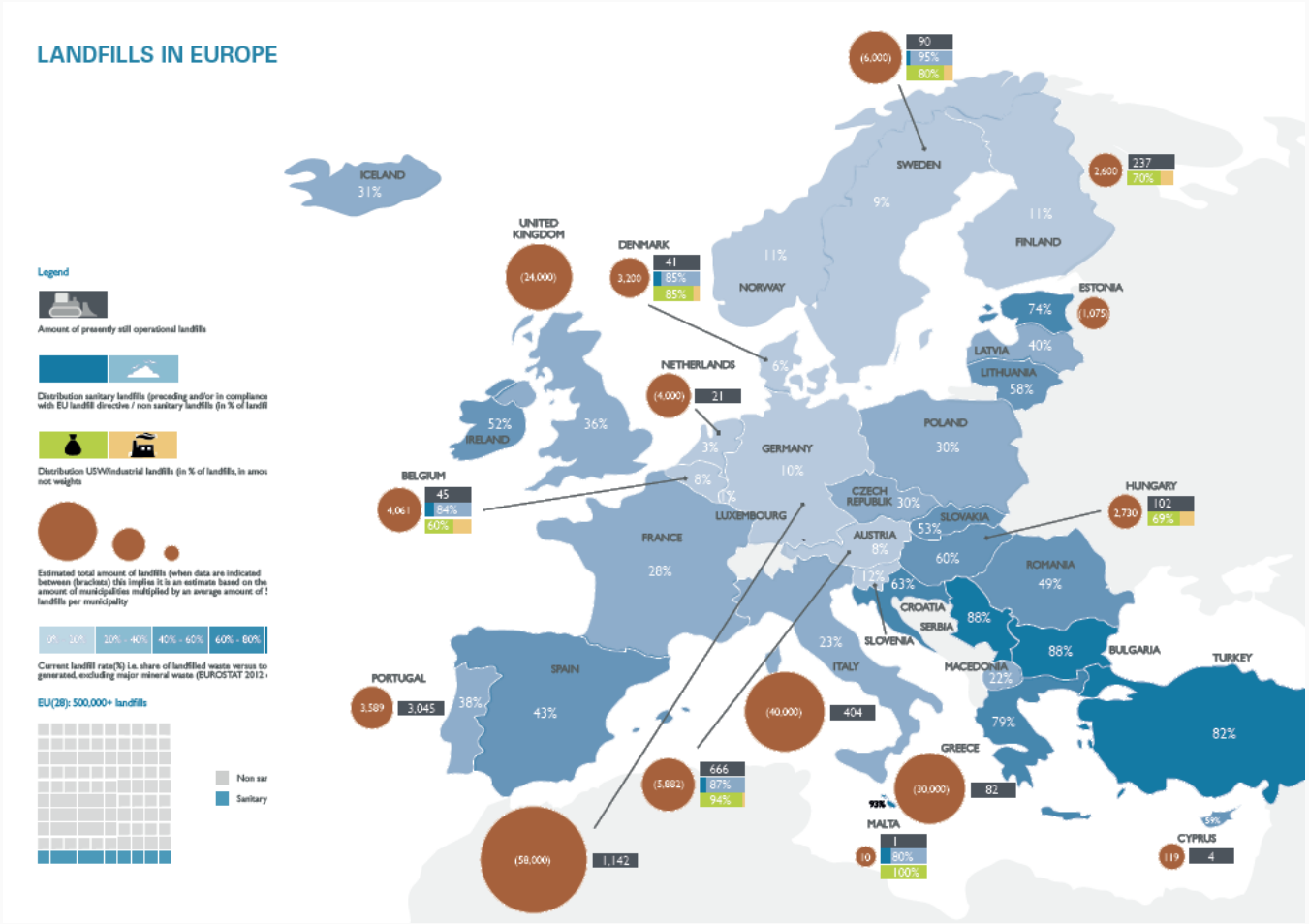
EURELCO Members

EU Member State	Company	Knowledge Institute	Association	Public Body	Total
Austria		Montanuniversität Leoben			1
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, ISSEP, OVAM, Province of Limburg	30
Denmark	Danish Waste Association, Danish Waste Solutions				2
Estonia		Estonian University of Life Sciences			1
Finland		VTT			1
Germany		Aachen University, Fraunhofer ISC			2
Greece	Enveco	National Technical University of Athens			2
Italy		CINIGeo, University of Padova		CNR-ISTEC	3
Portugal		Instituto Superior Técnico, New university of Lisbon, Universidade de Aveiro			3
Sweden	Lundahydro, Scanarc, Stena	KTH, Linköping University, Linnaeus University			6
The Netherlands	OonKAY	Deltares, Wageningen University			3
UK	Axion Consulting, Terra Recovery	Cardiff School of Engineering, Cranfield University			4
Spain				Waste Agency of Catalonia	1
13	26	25	2	6	59

Landfills in EU Infographic EURELCO (20-10-2015)

European Parliament
Enhanced Landfill Mining Seminar
20-10-2015

EUROPEAN ENHANCED LANDFILL MINING



> 500,000 landfills in EU-28

> 90% of them are essentially "**non-sanitary landfills**", preceding the Landfill Directive, requiring remediation

"**Classic remediation**" cost for EU-28 "guestimated" by OVAM to be **0,1 - 1 trillion euro**

Impact of ELFM on a EU-scale (see Jones et al., 2013)

Economic benefits

- Avoidance of landfill remediation costs:
  0,1-1 trillion € (if ELMIRE is used for all EU-landfills)
  - A new resource recovery economy, with significant short, medium and long term potential for EU SMEs in EU-27 and in the rest of the world: CH_4 extraction *(in situ);* Organic based materials (WtM or WtE) *(ex situ);* Metals *(ex situ);* Materials for building and construction *(ex situ)*
- Recovery of valuable land *(in situ* or *ex situ)*

Impact of ELFM on a EU-scale (see Jones et al., 2013)

Strategic benefits

- Improve the EU's *materials autonomy* through resource recovery:
  - Reducing pressure on primary raw materials (fossil fuels and non-energy raw materials)
  - Fostering the use of secondary raw materials:
    - Aggregate figure: **Up to 5% of the current DMC/year** for EU-27, for 25 years
    - Plasmarok slag (a.o. replacement for cement clinker): **250–840 Mtonne** for 25 years
- Improve the EU's *energy autonomy* through resource recovery:
  - Contributing to the EU's renewable energy target through accelerated CH_4 uptake through *in situ* LFM: **7 million TOE ~3% of the EU-27 renewable energy target for 2020**)
  - Contributing to EU's renewable energy target (WtE from SRF (mixed organic) from *ex situ* LFM: **an additional 0,4-1,1 million TOE**)
- Building up on more sustainable production and consumption patterns
- Founding of a world-leading European competence centre on Effective Landfill Mining

Impact of ELFM on a EU-scale (see Jones et al., 2013)

Health and environment

- Lower the EU's carbon footprint (benchmark with direct **EU-27 CO2(eq) emissions:** 4600 Mtonne CO2(eq)/year):
  - Avoided CO2(eq) emissions due to *in situ* CH4 mining of **112 – 139 Mtonne/year**;
  - Avoided CO2(eq) emissions due to net carbon balance, from a full EU-27 ex situ LFM approach (versus in *situ* only approach, for 150.000-500.000 landfills): **extra 15 - 75 Mtonne CO2(eq)/year**
  - With carbon sequestration techniques, this overall CO2(eq.) benefit can be significantly increased.
  - Plasmarok slag replacing cement clinker: **3-11 Mtonne CO2(eq)/year**
  - Use of CO2 in horticulture (not addressed in ELMIRE)
- Carbon Capture and Storage or Enhanced Coal Bed Methane for WtE facility (not ELMIRE's scope)
- Land reclamation (**>2800 - 6000 km²**, available for nature, urban, industrial etc. purposes)
- Avoiding human health and environmental issues in the future due to landfill pollution problems
- Reducing environmental & health impact associated with primary mining of energy and non-energy materials

Impact of ELFM on a EU-scale (see Jones et al., 2013)

Social benefits

- Creation of new jobs associated with the start-up of new, SME-driven markets:
  - Up to 800 FTE new jobs for the Remo landfill site (ex situ mining)
  - Up to 240.000-800.000 new jobs in EU-27 (for full implementation of ELMIRE framework)
- Generation of transition management expertise relevant to other domains as well

Barriers for ELFM – Policy aspects ELFM [credits to Linköping University, Sweden]

The landfill is stuck in a dump regime

- EU Landfill Directive strongly advocates isolation, control, final closure and post-monitoring
- This perception of landfills as hazardous, end stations for obsolete materials displays clear signs of path-dependency and lock-in
- The fact that ELFM is not part of EU policy and regulatory frameworks causes multiple challenges and uncertainties
- Such uncertainties regarding the market rules (e.g. landfill tax for fractions that need to be relandfilled) make it difficult for actors to foresee the outcome of their investments
- Most of the benefits of landfill mining only occur on the societal level = key policy challenge → *coupling ELFM with remediation needs can offer a way forward!*

Landfills in EU-28 - Parliamentary Question H. VAUTMANS (ALDE) & Response K. VELLA (EC) 28-7-2015

Has the Commission performed any calculations on the future remediation costs for the EU-28? NOT YET

Has the Commission performed a mapping of the resource potential of its 150,000 to 500,000 landfills? NOT YET

Does the Commission plan to support R&D and/or pilot activities, as well as demonstration projects, which explicitly address Enhanced Landfill Mining? NOT YET

EUROPEAN PARLIAMENT EN

FORM FOR TABLING A QUESTION FOR WRITTEN ANSWER (Rule 130)

Select only one addressee:

PRESIDENT OF THE EUROPEAN COUNCIL	○	COUNCIL	○
VICE-PRESIDENT / HIGH REPRESENTATIVE	○	COMMISSION	◉

Priority question ☐

AUTHOR(S):	Hilde VAUTMANS
SUBJECT: (please specify)	Stimulating Enhanced Landfill Minning as part of the transition to a circular economy

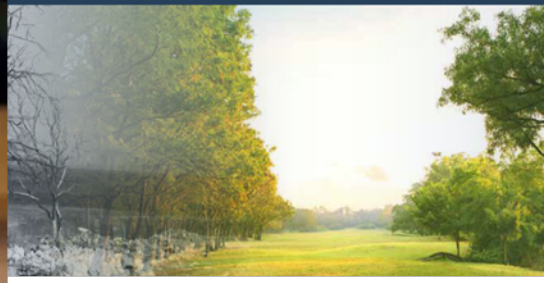
European Parliament

Enhanced Landfill Mining Seminar
20-10-2015

ELFM EP Seminar A milestone

European Parliament

Enhanced Landfill Mining Seminar
20-10-2015



85 Participants, 4 DGs EC, EIP Raw Materials, 2 key MEPs

Landfills in EU Shared conclusions ELFM EP Seminar

Improved inventories of Europe's landfills are required

A vision for Europe's landfills needs to be developed

Remediation to be combined with resource recovery through ELFM

–> Main objective Interreg COCOON project

Major attention should go out to develop and demonstrate a set of innovative technologies that deliver high added-value outputs

–> Main objective EU H2020 MSCA-ETN NEW-MINE project

Anno 2017… Large scale implementation of ELFM still jeopardized by certain barriers

Anno 2017 ELFM is not part of EU policy and regulatory frameworks

This causes multiple challenges and uncertainties for private actors who want to perform ELFM investments and projects

- E.g. Uncertainty with respect to landfill tax for (non-valorisable) residual fractions after completion of ELFM, which need to be landfilled again
- E.g. Uncertainty about potential market outlet for recyclates from ELFM

EURELCO-vision (cf. OVAM): sustainable landfill management

- Landfills as dynamic resource reservoirs in a circular economy-context
- Management of resource stocks through interim land use coupled with a phased mining strategy

NEW-MINE & COCOON will provide new insights and should improve the political-societal carrying capacity for ELFM projects and programmes


4th International Symposium on
Enhanced Landfill Mining
5 - 6 February 2018
Belgium
H2