



NEW-MINE – EU Training Network for Resource Recovery Through Enhanced Landfill Mining

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WO AUS FORSCHUNG ZUKUNFT WIRD

Lehrstuhl für Abfallverwertungstechnik und Abfallwirtschaft



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1. Vorbemerkungen

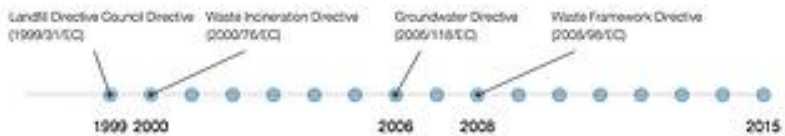
Ich bin nicht naiv !

Eine Deponie ist eine Deponie und
hat daher besonders hohe ENTROPIE

Nur wegen „Rohstoffen“ wird kein LFM gemacht werden.
Haben diese Sekundärrohstoffe Qualität und Markt?

Ich habe eine leicht kritische Haltung zu EU Projekten

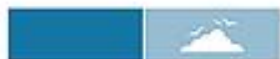
Timeline of waste related directives in Europe



Legend



Amount of presently still operational landfills



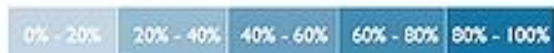
Distribution sanitary landfills (preceding and/or in compliance with EU landfill directive / non sanitary landfills (in % of landfills)



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

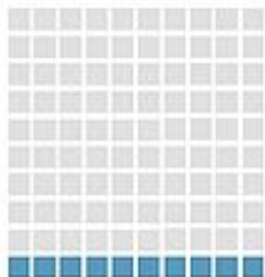


Estimated total amount of landfills (when data are indicated between brackets this implies it is an estimate based on the amount of municipalities multiplied by an average amount of 5 landfills per municipality)



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

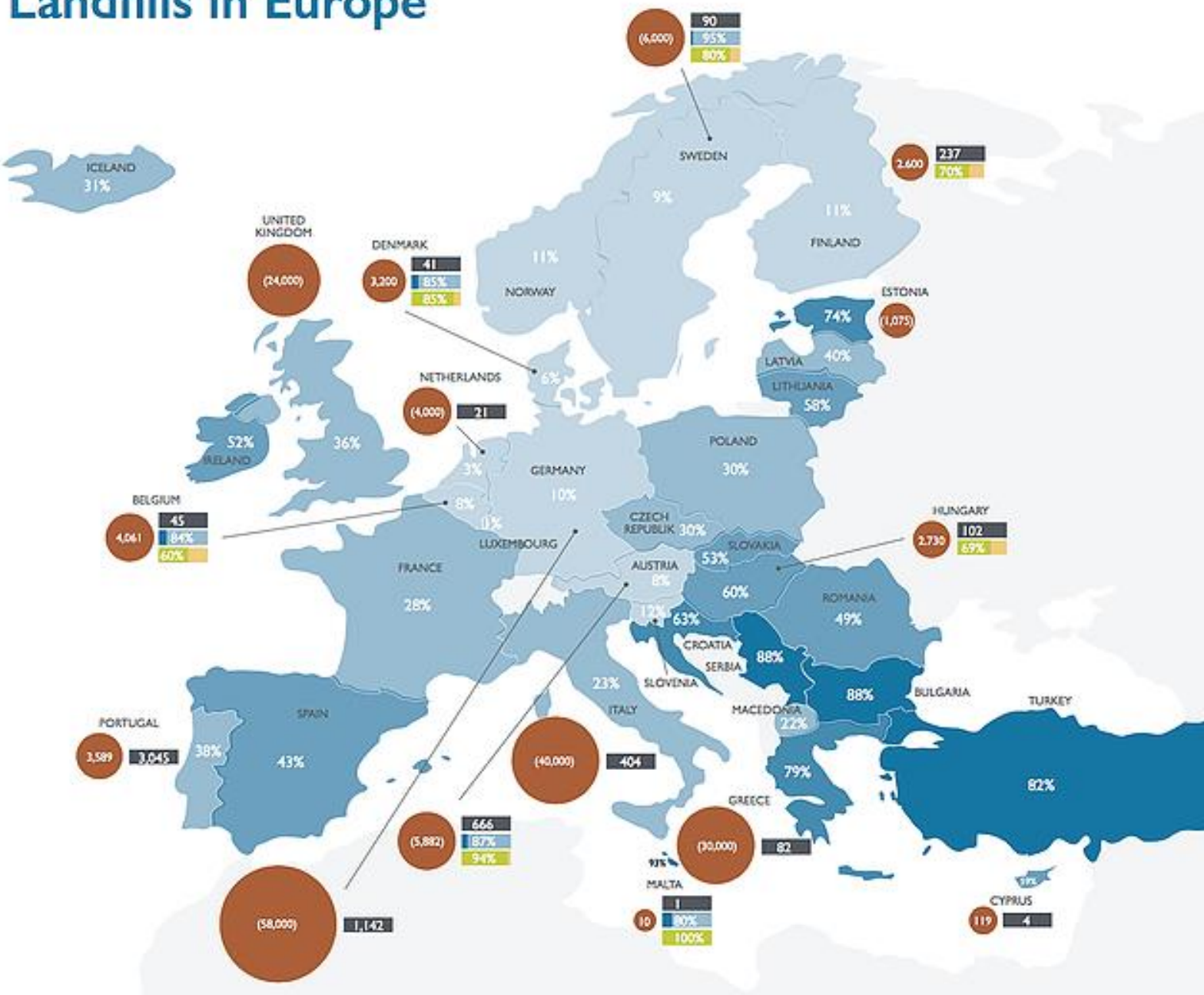
EU(28): 500,000+ landfills



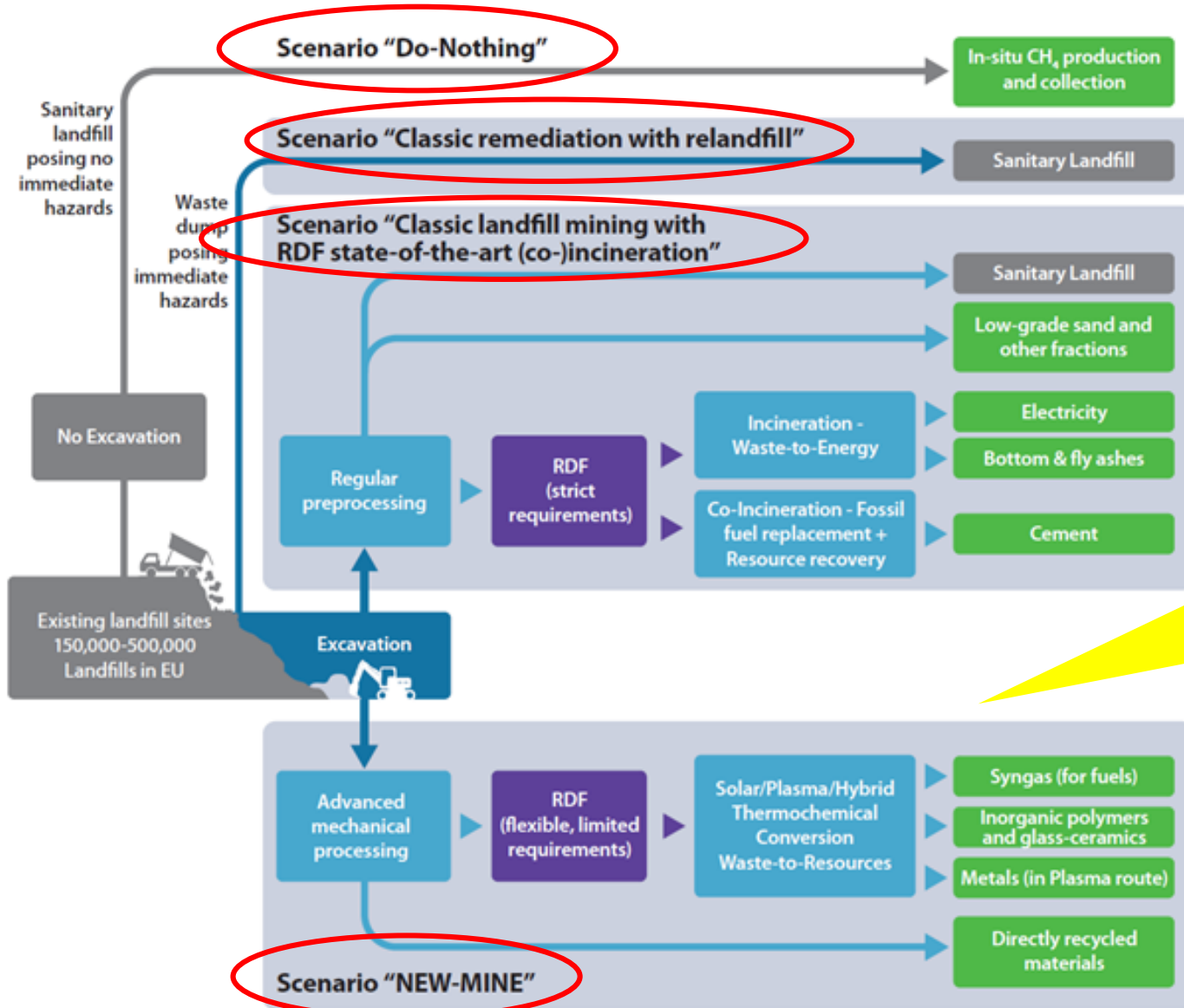
Non sanitary landfills

Sanitary landfills

Landfills in Europe



1. Ausgangslage



Enhanced Landfill Mining (ELFM)

versucht durch neue Technologien und komplexe Prozessketten größtmöglichen Nutzen und neue Produkte zu erzielen.

2. Das MSCA Programm der EU





Welcome to EURELCO
 EURELCO is an open, strategic beta network that supports the required technological, legal, social, economic, environmental and organisational innovation with respect to Enhanced Landfill Mining within the context of a transition to a resource efficient, circular, low-carbon economy.

NEWS: everything about ELM

Public acceptance of mining and recycling in Europe: six recommendations
 Jan 16, 2019
 Public acceptance or the 'Social License to Operate' is widely acknowledged as the biggest financial risk for the mining sector. Six different participations and recommendations coming from six different sectors were obtained during a seminar event of the EU Raw Materials Forum (22 Nov. 2018).

Open Position for a Professor in Mining Engineering
 Nov 16, 2017

Open Position for a Professor in Mining Engineering
 Nov 16, 2017



First ever ELM Seminar in the European Parliament
 The seminar, which was organized by two Finnish MPs (Oksanen & Demanter) and EURELCO, featured speakers from DG of the European Commission (DG ENER, DG ENV and DG) along with leading actors representing industry, academia and public bodies. The seminar was attended by almost 100 people who actively debated the landfill mining situation in Europe. It was agreed that the EU is urgently requiring thorough inventories of its landfills, and needs to develop a clear vision with respect to the management and mining of its landfills.



Search

What is EURELCO
 EURELCO is an open, strategic beta network that supports the required technological, legal, social, economic, environmental and organisational innovation with respect to the development and implementation of a Dynamic Landfill Management (DLM) framework. The DLM framework includes resource recovery-driven Enhanced Landfill Mining (ELM) as one of its most advanced components, thereby supporting the transition to a resource efficient, circular, low-carbon economy. Are you a relevant actor working on DLM or ELM?



Survey
 Questionnaire on landfill, landfill management and ELM in the EU
 EURELCO aims to further develop the knowledge on landfills in Europe and wants to improve the current infographic. The aim of this questionnaire is to collect EU-wide information about landfills, landfill management and LFM activities and policy issues. This is useful to better understand potential drivers, barriers and enablers for LFM implementation, and how such challenges could vary among regions. Please contact the leaders of ELM mapping and system conditions for more info.



New civil engineering materials based on bottom ash valorization
 Partners: New University of Lisbon, RWTH Aachen University, IIR, Suberchke Bachy, Schreyer, Fomac, Inerac, Inovative Osborn Polymer Concrete. News: also that University of Lisbon Faculdade de Ciências e Tecnologia Departamento de Ciências e Tecnologia de Biomateriais Ed.



DATA LAUNCHED ON THE LANDFILL SITUATION IN THE EU-28
 EURELCO, in collaboration with 12 research partners, has formally published an infographic containing new data on the landfill situation in the EU-28. Based on a bottom-up approach, data were collected from several public bodies in Europe. The headlines messages from...



Can industrial waste be mined and recycled?
 European Future has released a new video on the topic of Enhanced Landfill Mining. What is suitable for most people's needs is used as a measure to assess the scientific and waste strategies.



5th International Symposium on Enhanced Landfill Mining
 From Dynamic Landfill Management to Enhanced Landfill Mining
 6 February 2020
 Leuven, Belgium

FIRST SEMINAR ABOUT ENHANCED LANDFILL MINING
 20 OCTOBER 2015
 EUROPEAN PARLIAMENT



61 Mitglieder aus 15 EU-Ländern

<https://eurelco.org/>

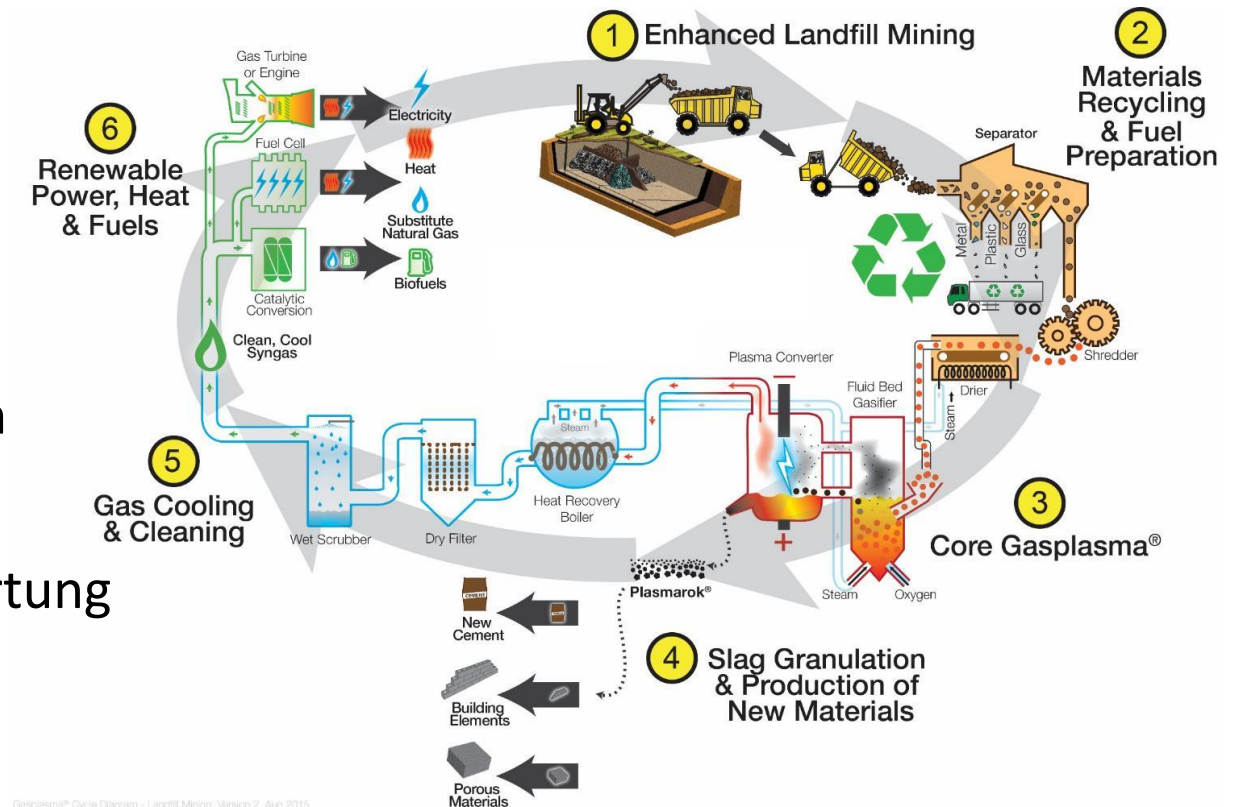
3. Das Projekt



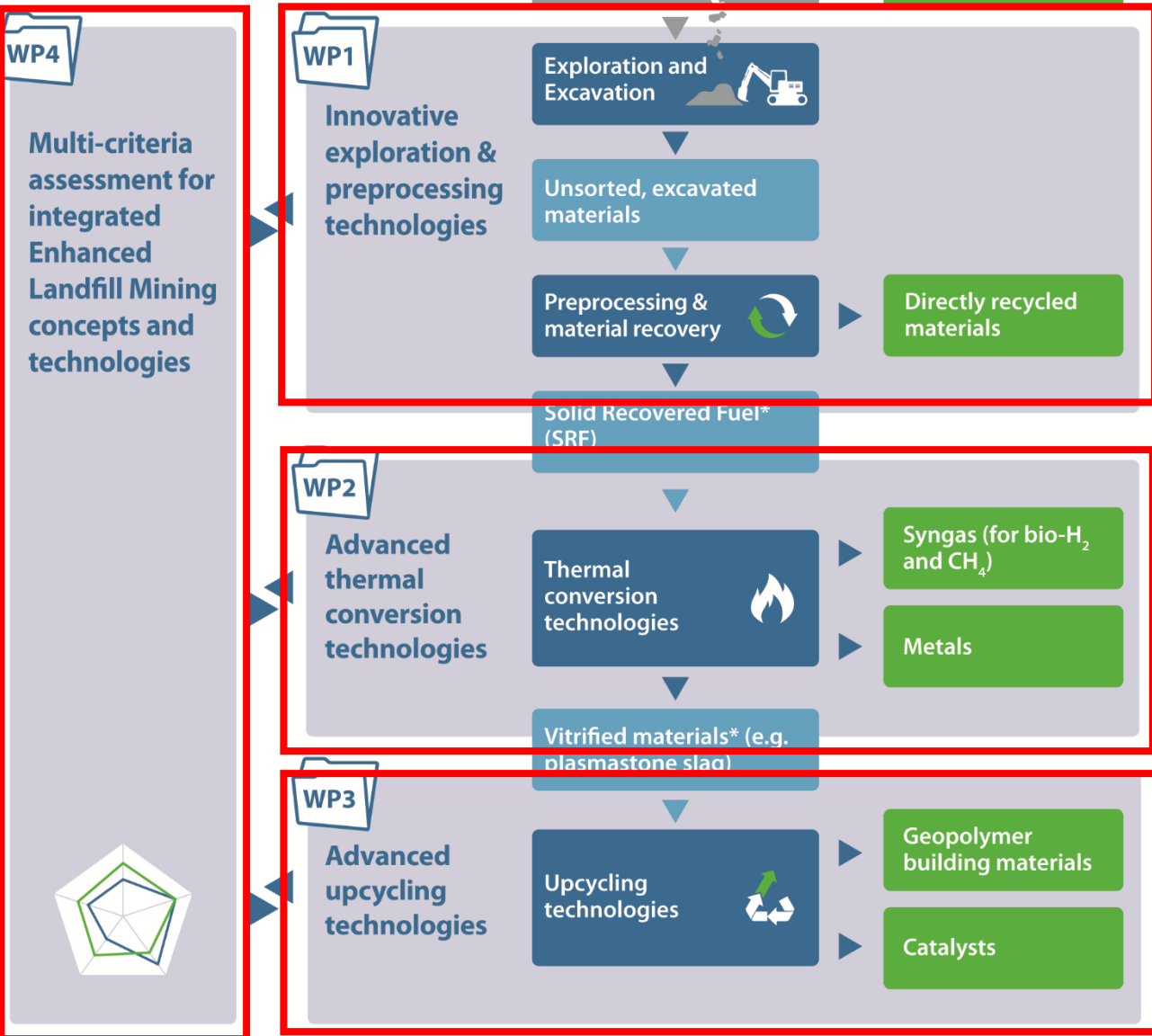
**EU Training Network for Resource Recovery
Through Enhanced Landfill Mining**

Grundgedanke NEW-MINE

- 15 Doktoranden verteilt in EU
 - Fokus auf Wissensaustausch
 - Fachgebietsübergreifende Kooperation
- Themengebiete
 - Deponieerkundung & **Mechanische Aufbereitung**
 - Thermische Behandlung / Plasmaverfahren
 - Asche-/Schlacke-Weiterverarbeitung zu Bauprodukten
 - (Sozio-) ökonomische & ökologische Bewertung
- Ziel: mehr&hochwertigere Produktfraktionen



NEW-MINE S/T WPs



* **NEW-MINE access to landfill and intermediate research materials:**

- ▶ 5 landfill case-studies: Remo landfill (BE, owned by JMR), Mont-Saint-Guibert landfill (BE, owned by Shanks), Allerheiligen landfill (AT), Leppe landfill (DE, owned by BAV), Gärstad landfill (SE).
- ▶ SRF from WP1 and on-going landfill mining R&D projects: CTC/PLASMAT (Remo, JMR), MINERVE (Mont-Saint-Guibert, Shanks), LAMIS (Allerheiligen, ASA)
- ▶ Vitrified materials from WP2 and on-going landfill mining R&D projects: CTC/PLASMAT (Remo, JMR), LAMIS (Allerheiligen, ASA)

4. Die Forschungsschwerpunkte



Brennbares aus der Deponie (RDF)

Plasma Vergasungs Verfahren

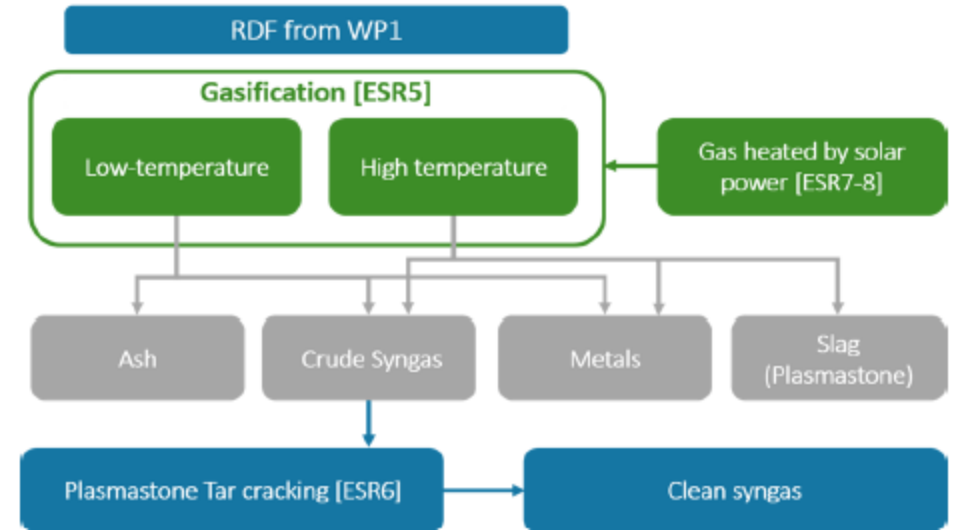
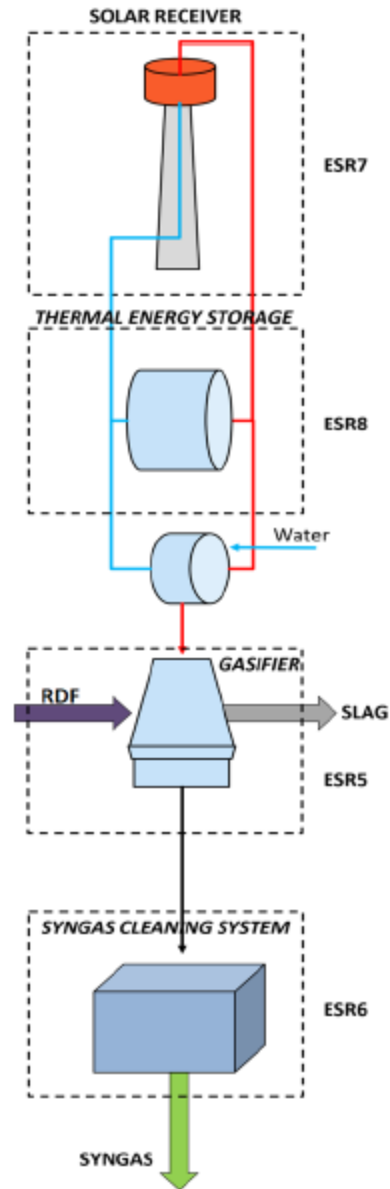
Syngas Reinigung

Kombination mit Solar Energie

Themen tw. ziemlich weit weg vom LFM

Solar and Plasma thermochemical conversion

Work Package 2



Zaini Ilman Nuran (ESR5)

- Optimizes the RDF conversion into energy forms by reducing gas emissions and minimizing solid waste.



Yamid Gomez Rueda (ESR6)

- Uses hybrid reactors to diminish tars concentration in the syngas.



ESR7

- She/he will focus on fundamental and applied aspects of solar-driven thermochemical conversion of RDF.

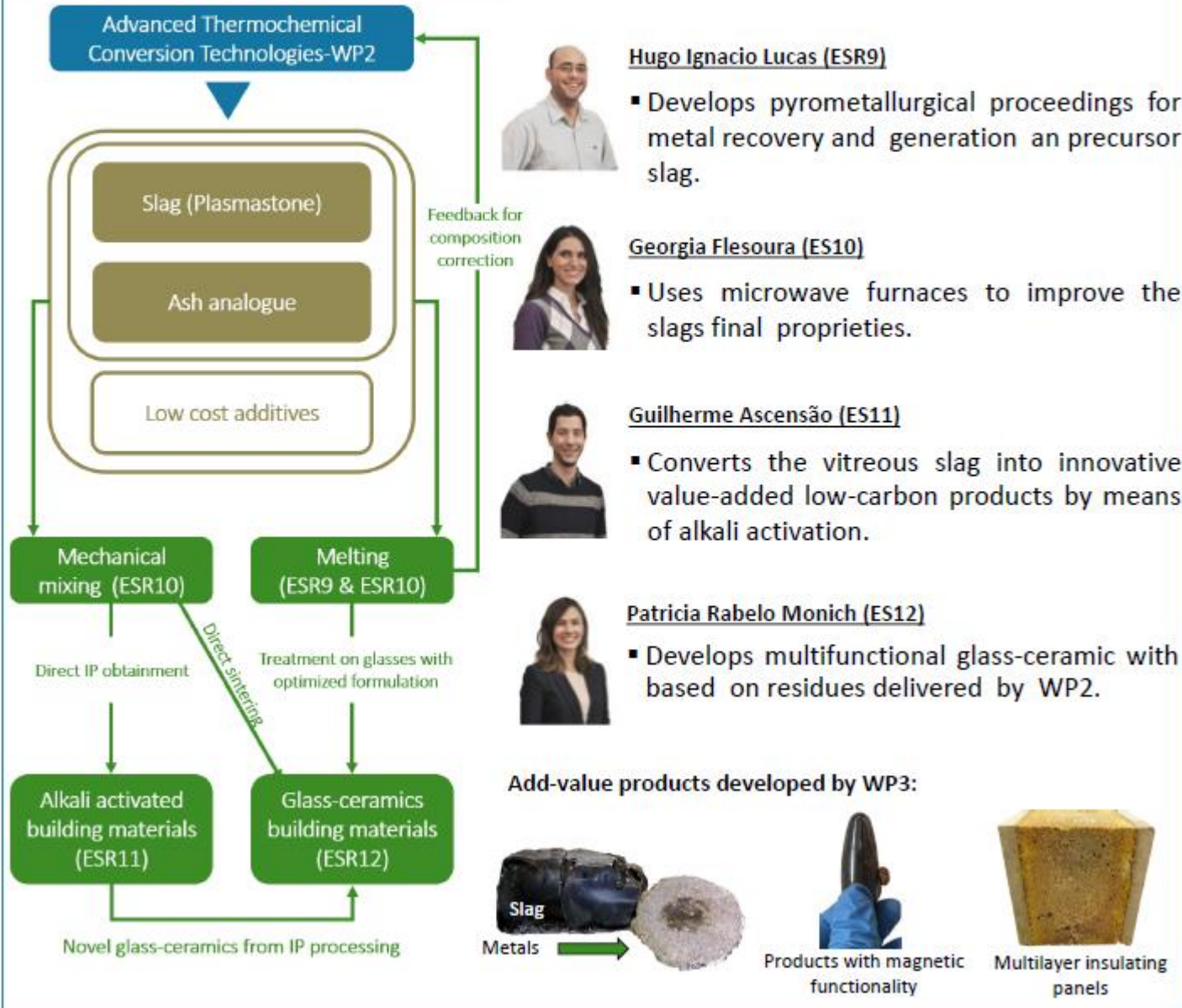


Marco Gigantino (ESR8)

- Pre-heats the gasifying fluid (air/steam) with solar thermal energy from concentrated solar systems.

Work Package 3

Advanced upcycling of ELFM by-products

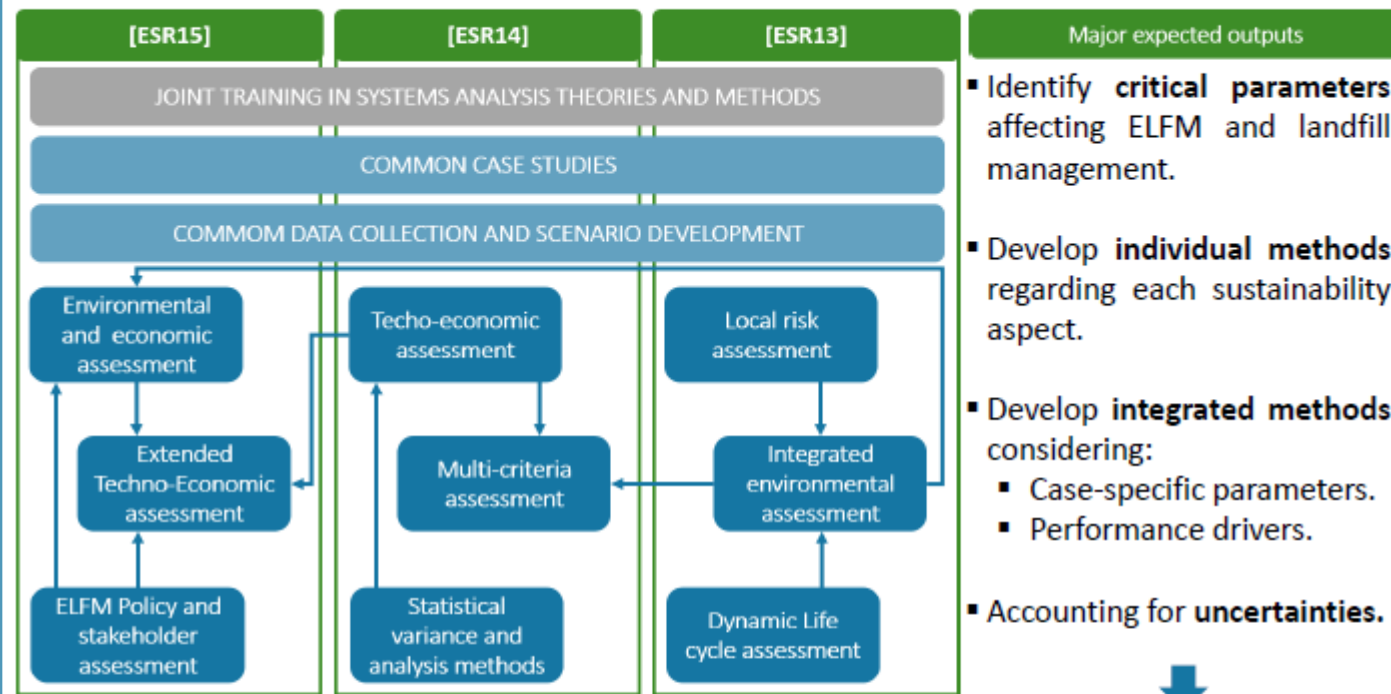


„upcycling“ von Rückständen aus dem Plasma Prozess

Synthese von anorganischen Polymeren

Entwicklung und Prüfung neuer Bindemittel / Keramik

Multi criteria assessment
 Technisch-ökonomische
 Analysen
 Szenarien Vergleiche



Giovanna Sauve (ESR13)

- Uses integrated LCA and RA methodology for environmental assessment of ELFM.



John Laurence Esguerra (ES14)

- Performs techno-economic and Multi-Criteria Assessments of ELFM concepts and technologies.



Paul Einhüpl (ES15)

- Analyses policy and market interventions for facilitating ELFM implementation.

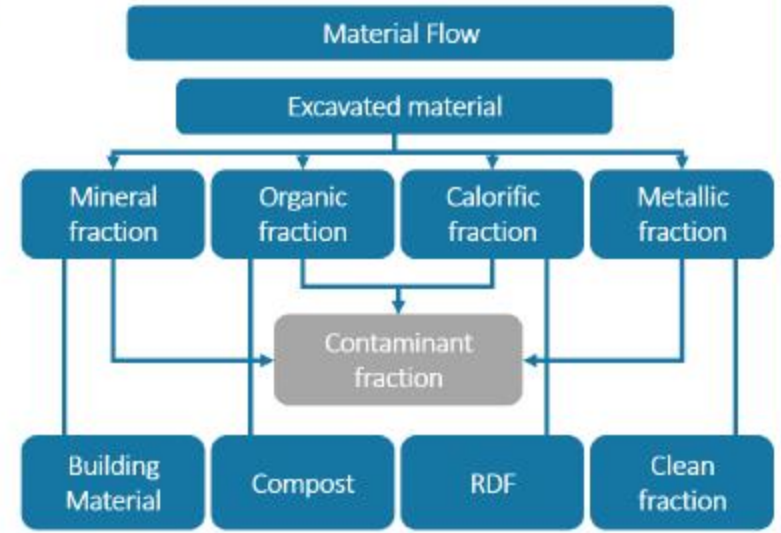


5. Unsere Forschungsaktivitäten



Work Package 1

Landfill Exploration, Excavation and Processing



Christin Bobe (ESR1)
▪ Uses electric, magnetic and electromagnetic techniques to develop geophysical models.



Cristina García López (ESR2)
▪ Validates and expand the geophysical model by mechanical processing.



Bastian Küppers (ESR3)
▪ Models and validates sensor-based technologies .



Juan Carlos Hernandez (ESR4)
▪ Recovers calorific and mineral fractions from the fine fractions.

2 Schwerpunkte

1. Geophysikalische Erkundung
2. Charakterisierung und Aufbereitung

Für MUL und RWTH

Charakterisierung

Einfache und leistungsfähige
Volumstromtrennung

Feinkorn Aufbereitung

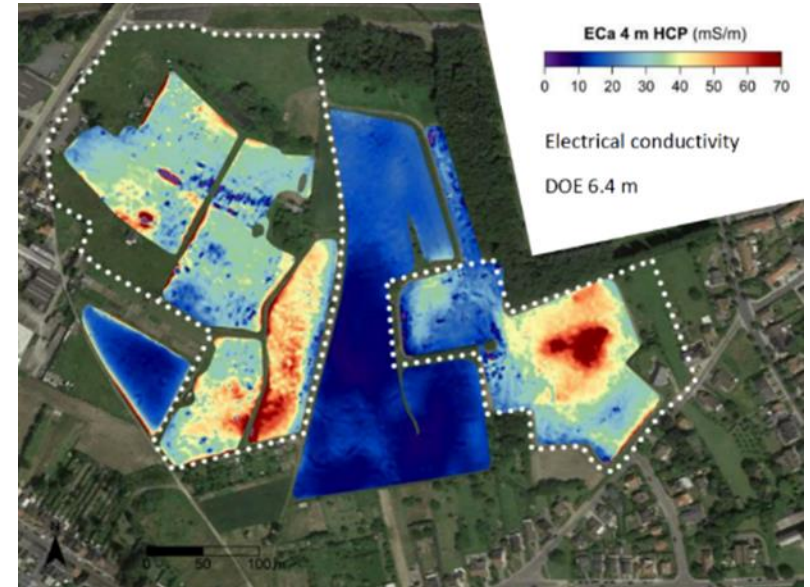
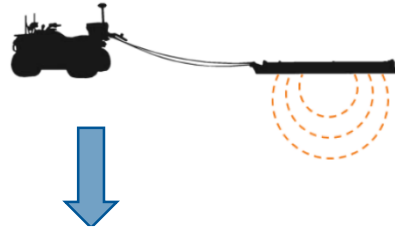
Einsatzmöglichkeiten für SBS

Einfluss von Verschmutzungen auf
die Erkennbarkeit im SBS

Geophysikalische Erkundung

Case Study - Deponie Mont Saint Guibert (BEL)

- Mächtigkeit der Deckschicht bestimmen
- Deponieaufbau erkunden (Schichten erkennen)
- Materialspezifische Zusammensetzung bestimmen



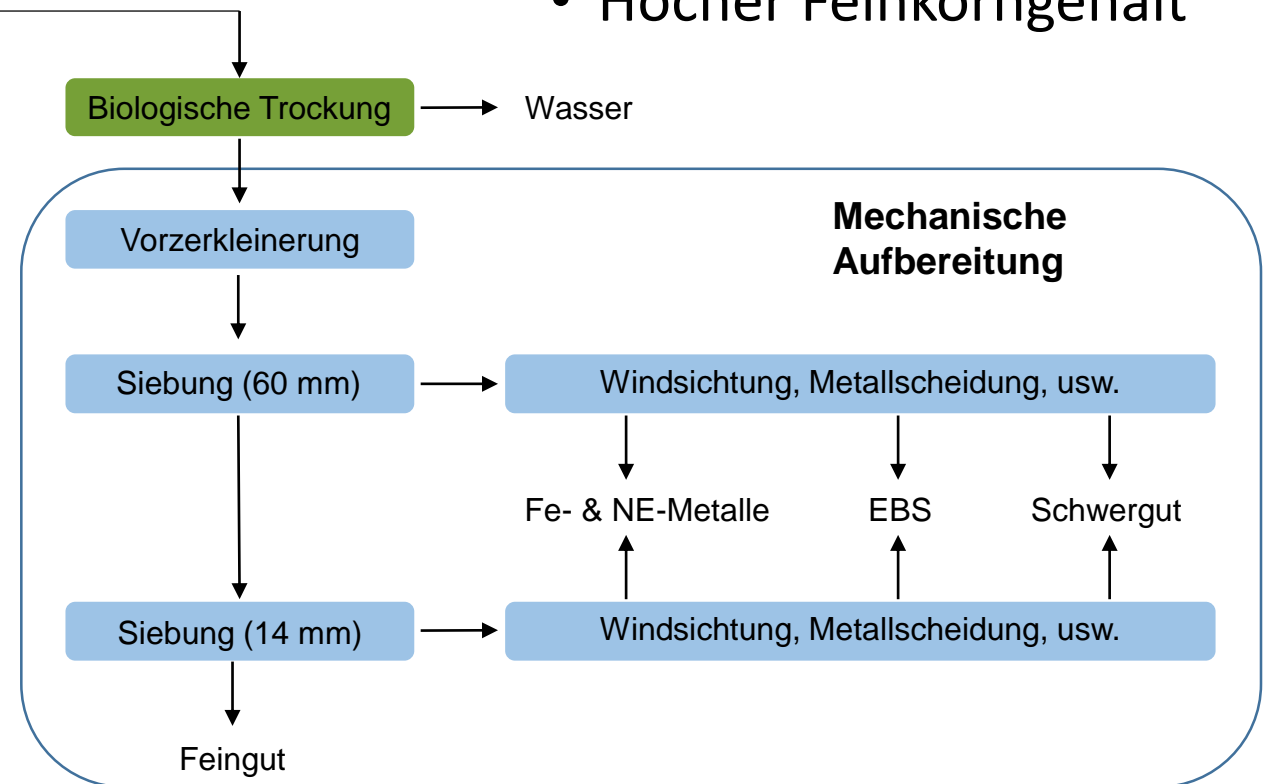
Problematik der mechanischen Aufbereitung

Case Study: Halbenrain (A)



- Herausforderungen:
 - Heterogenität
 - Feuchtigkeit
 - Hoher Feinkorngehalt

- Aufbereitung in bestehender MBA
 - Stillstände
- Verwertbare Outputmenge zu gering
 - **Feinkorn muss verwertbar werden**



Mechanische Aufbereitung

Ballistikseparator als Volumenstromtrenner

Aufbereitung von Deponat in Mont-Saint-Guibert

- Input:
 - Deponat: Restmüll & Baurestmassen
- Einsatz Ballistikseparator
 - Zweistufig
 - Trennschnitte: 200 mm & 90 mm
- Outputströme:
 - > 200 mm – 2D & 3D
 - 90 – 200 mm – 2D & 3D
 - < 90 mm
- Durchsatz: ~ 120 t/h



Mechanische Aufbereitung – Ballistikseparator als Volumenstromtrenner



3D



2D

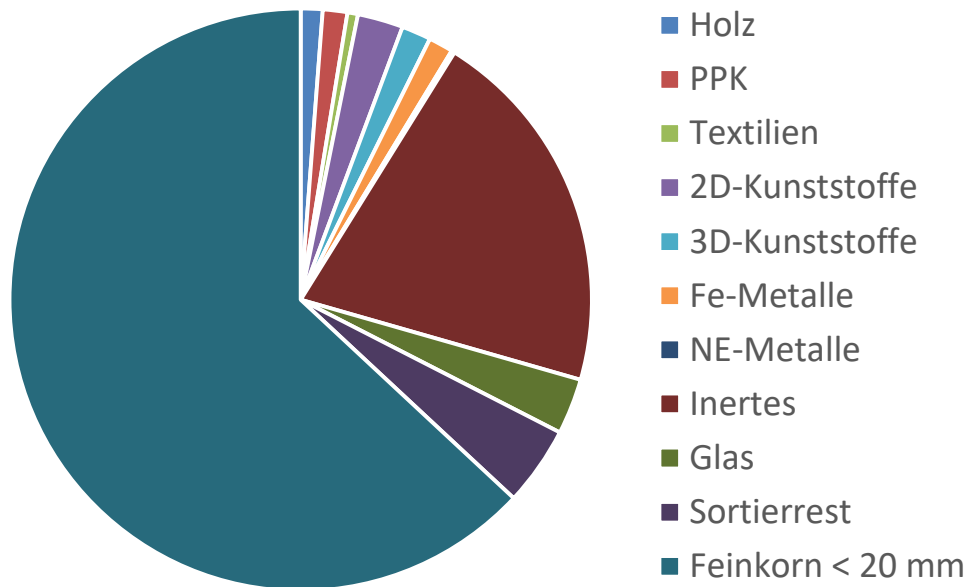


Fines < 90 mm

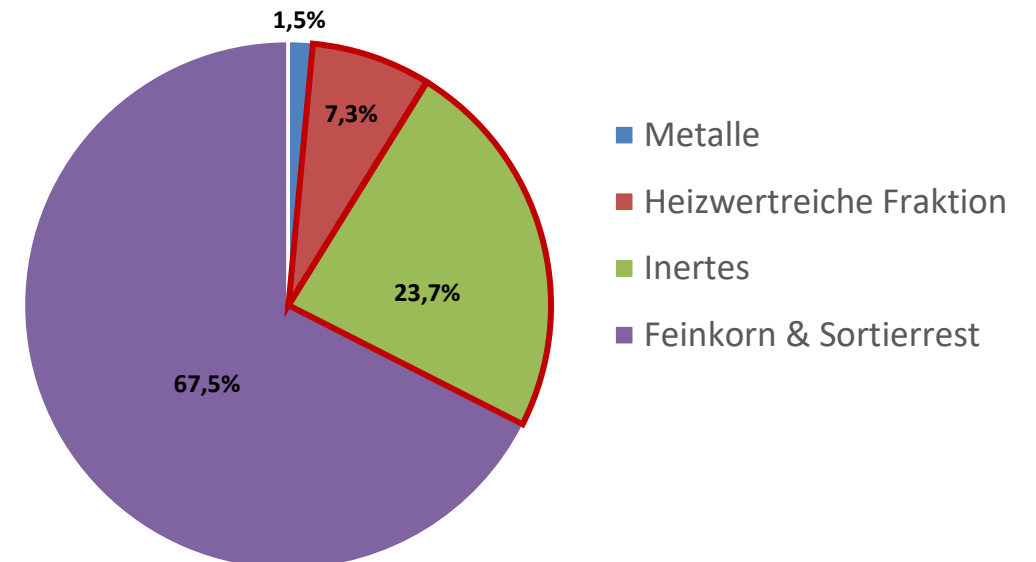


Potenzial der sensorgestützten Sortierung im ELFM

Deponiezusammensetzung



Potenzial für sensorgestützte Sortierung

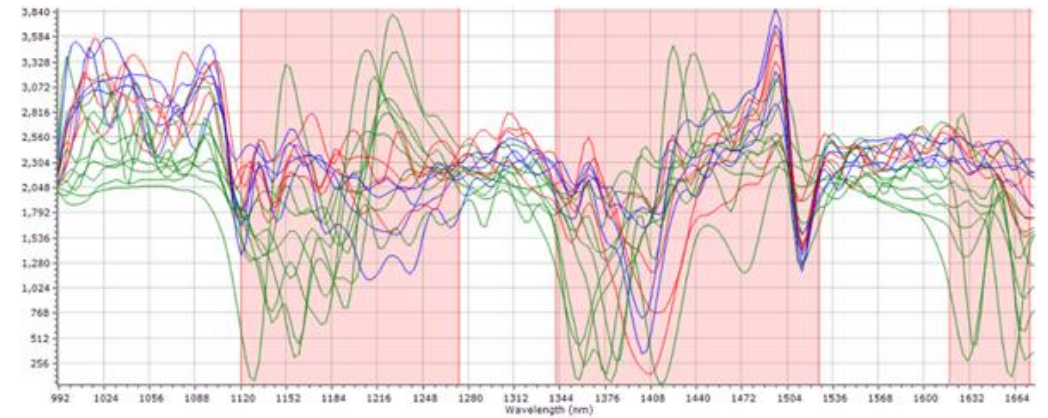
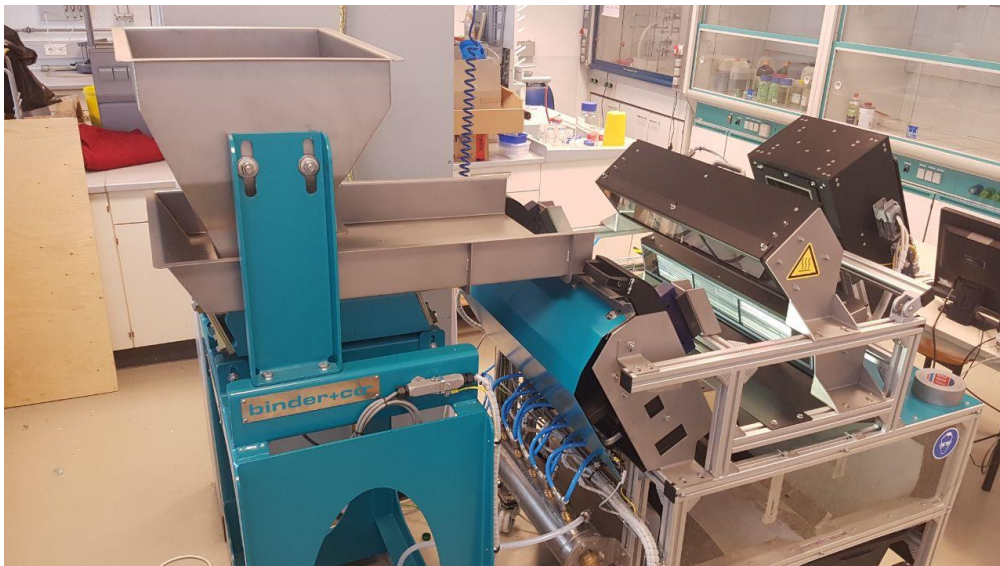


→ Untersuchungen zur technischen Umsetzbarkeit der sensorgestützten Sortierung

Prinzip Sensorgestützte Sortierung

Sensorgestützte Sortierung

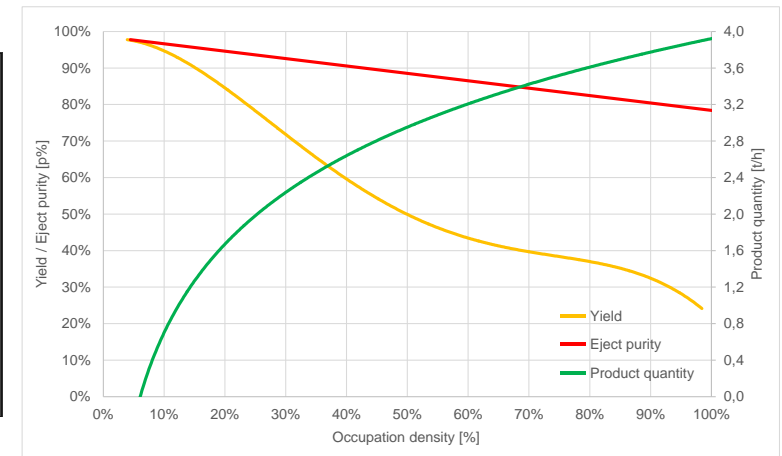
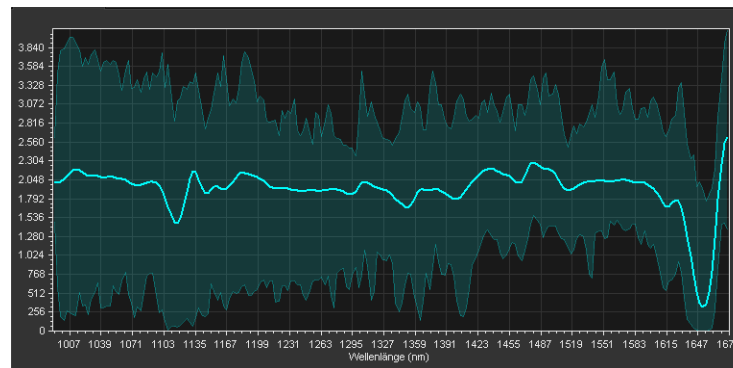
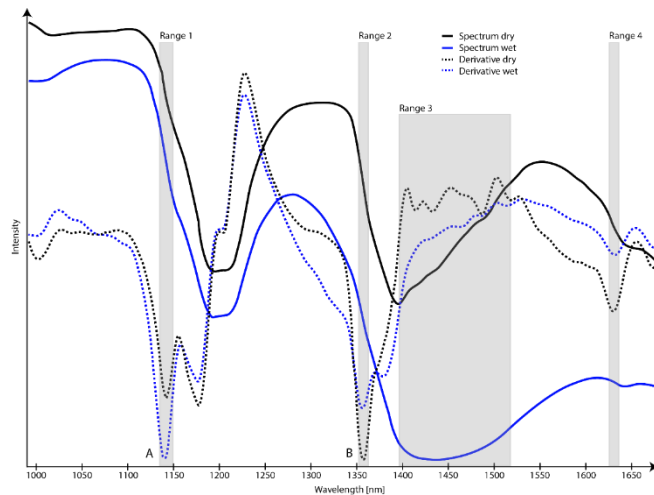
- Nahinfrarot-Technologie – NIR
- Farbsignal – VIS
- Metallerkennung – Induktion



Potenzial der sensorgestützten Sortierung im ELFM

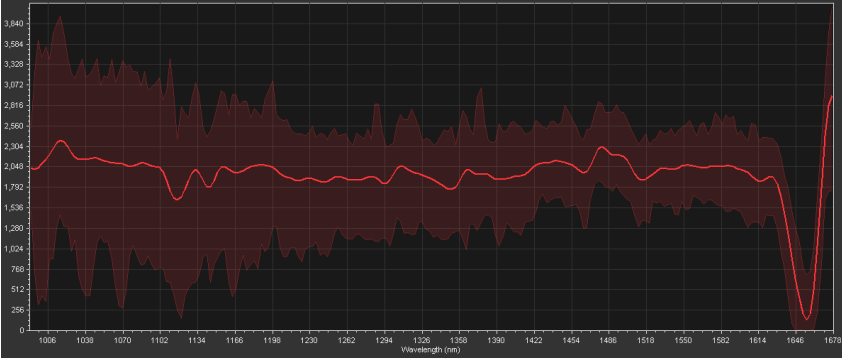
- Untersuchung von Einflussfaktoren auf SGS: Verschmutzungen
 - Feuchtigkeit (durch Wasser in Deponiekörper)
 - Oberflächenrauheit (durch mechanische Behandlung und Alterung)
 - Störstoffgehalt in Fraktion für SGS

Systematiken wurden untersucht:

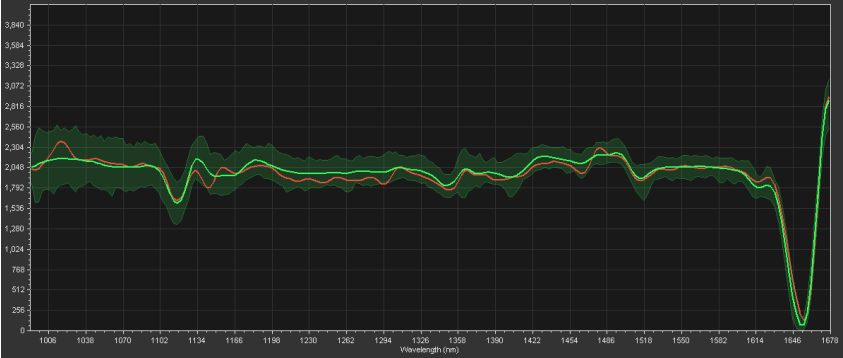


Einflussfaktoren für NIR-Sortierung

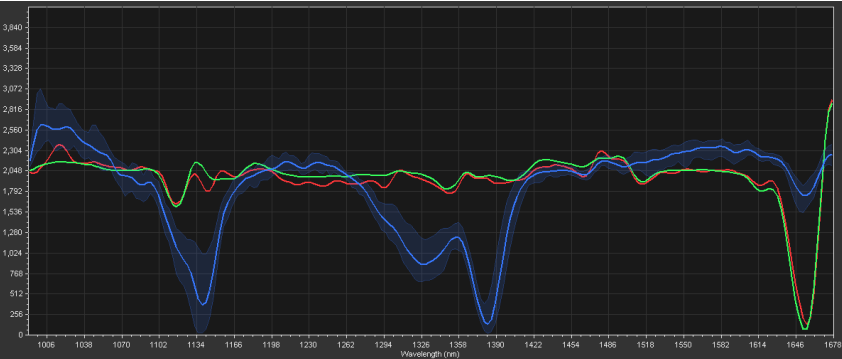
Glatte Oberfläche



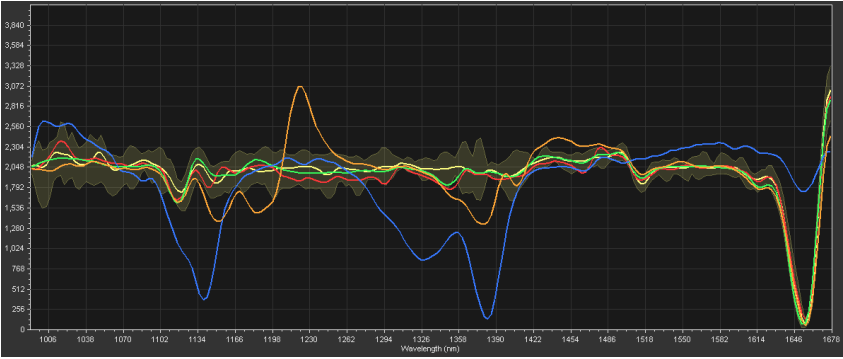
Raue/kalkhaltige Oberfläche



Wasser auf Oberfläche

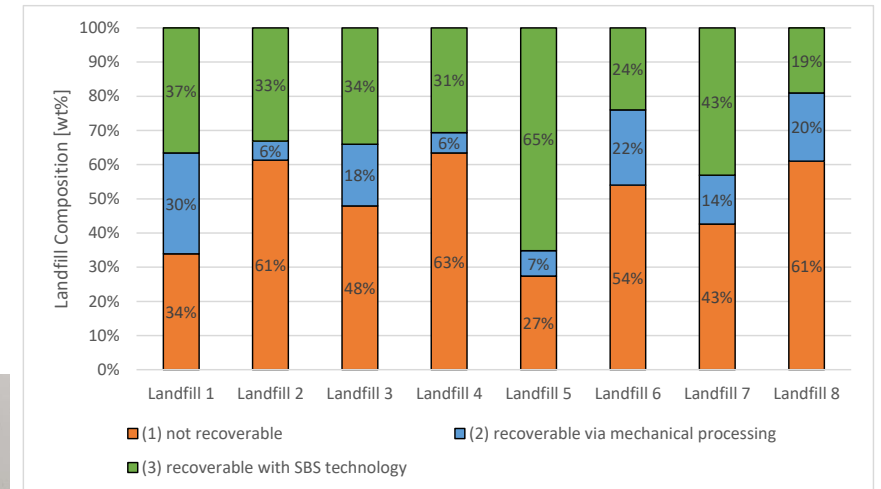
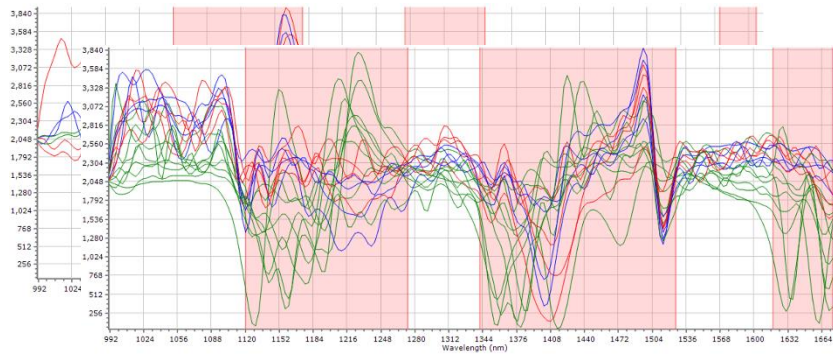


Öl auf Oberfläche



Potenzial der sensorgestützten Sortierung im ELFM

- Unter Einbeziehung der Verschmutzungen wurden Versuche mit ELFM Material gefahren
- Verwendete Technologie: Hyper-Spectral-Imaging NIR Sensorik



15% 50%



6. Ein kritischer Blick

Stärken und Schwächen von NEW MINE

- + Grundlagenforschung – Themen die die Wirtschaft nicht finanzieren würden
- + Ergebnisoffen – Gut für die Wissenschaft
- + Viele wissenschaftliche Publikationen
- + Internationale Kooperation – Unis und einige Unternehmen
- + Thema wird positioniert
 - Umsetzbarkeit ?
 - Wirtschaftlichkeit ist kein Thema
 - Jeder Partner tut was er will
 - Hat das immer mit dem Ziel zu tun ?
 - Aufwand der Kommunikation

Bewertung für meinen Bereich

- Tolle Zusammenarbeit mit RWTH Aachen
- Wir konnten machen was Sinn macht
- Ergebnisse in der SGS – allgemein umsetzbar
- Viele Publikationen in internationalen Journals
- wissenschaftliche Sichtbarkeit
- Gutes internationales Netzwerk



Bisher 13 peer reviewte Beiträge in MSCI Journals

- Garcia López, Cristina; Kueppers, Bastian; Clausen, Adele; Pretz, Thomas, LANDFILL MINING: A CASE STUDY REGARDING SAMPLING, PROCESSING AND CHARACTERIZATION OF EXCAVATED WASTE, *Detritus Journal*, Volume 02 / June 2018 , 2018, 29-45, DOI:10.31025/2611-4135 /2018.13664, [download](#)
- J.C. Hernandez Parrodi, D. Hoellen and R. Pomberger, Characterization of fine fractions from landfill mining: A review of previous investigations, *Detritus - Multidisciplinary Journal for Waste Resources & Residues*, 2018, 46-72, DOI:10.31025/2611-4135/2018.13663, [download](#)
- J.C. Hernandez Parrodi, D. Hoellen and R. Pomberger, Potential and main technological challenges for material and energy recovery from fine fractions of landfill mining: A critical review, *Detritus - Multidisciplinary Journal for Waste Resources & Residues*, 2018, 19-29, DOI:10.31025/2611-4135/2018.13689, [download](#)
- Garcia López, B. Küppers, T. Pretz, LANDFILL MINING: A CASE STUDY REGARDING SAMPLING, PROCESSING AND CHARACTERIZATION OF EXCAVATED WASTE, *detritus*, 2018, DOI:10.31025/2611-4135 /2018.13664
- B. Küppers, C. Lopez, D. Höllen, R. Pomberger, A. Clausen, T. Pretz, EU Training Network for Resource Recovery through Enhanced Landfill Mining (NEW-MINE), *agungsband zum 7. DGAW-Wissenschaftskongress 2017*, 2017
- B. Küppers, S. Mallnitz, Versuchsstand für sensorgestützte Erkennung und Sortierung, *Tagungsband zum 8. DGAW-Wissenschaftskongress 2018*, 2018
- C. Garcia Lopez, A. Ni, J. C. Hernandez Parrodi, B. Köppers, K. Raulf, T. Pretz, CHARACTERIZATION OF LANDFILL MINING MATERIAL AFTER BALLISTIC SEPARATION TO EVALUATE MATERIAL AND ENERGY RECOVERY POTENTIAL, *Detritus Journal*, 2019, DOI:10.31025/2611-4135 /2019.13780
- Köppers B, Schloegl S, Oreski G, Pomberger R, Vollprecht D., Influence of surface roughness and surface moisture of plastics on sensor-based sorting in the near infrared range, *Waste Management & Research*, 2019, DOI:10.1177/0734242X19855433
- Bastian Köppers, Xiaozheng Chen, Irina Seidler, Karl Friedrich, Karoline Raulf, Thomas Pretz, Alexander Feil, Roland Pomberger, Daniel Vollprecht, INFLUENCES AND CONSEQUENCES OF MECHANICAL DELABELLING ON PET RECYCLING, *detritus*, 2019, DOI:10.31025/2611-4135/2019.13816
- J.C. Hernandez Parrodi, C. Garcia Lopez, B. Kueppers, K. Raulf, D. Vollprecht, T. Pretz and R. Pomberger, Case study on enhanced landfill mining at Mont-Saint-Guibert landfill in Belgium: Characterization and potential of fine fractions, *Detritus - Multidisciplinary Journal for Waste Resources & Residues*, 2019, 47-61, DOI:10.31025/2611-4135 /2019.13877
- J.C. Hernandez Parrodi, K. Raulf, D. Vollprecht, T. Pretz and R. Pomberger, Case study on enhanced landfill mining at Mont-Saint-Guibert
- J.C. Hernandez Parrodi, K. Raulf, D. Vollprecht, T. Pretz and R. Pomberger, Case study on enhanced landfill mining at Mont-Saint-Guibert landfill in Belgium: Mechanical processing of fine fractions for material and energy recovery, *Detritus - Multidisciplinary Journal for Waste Resources & Residues*, 2019, 62-78, DOI:10.31025/2611-4135/2019.13878
- J.C. Hernandez Parrodi, H. Lucas, M. Gigantino, G. Sauve, J.L. Esguerra, P. Einhaeupl, D. Vollprecht, R. Pomberger, B. Friedrich, K. Van Acker, J. Krook, N. Svensson and S. Van Passel, Integration of resource recovery into current waste management through (enhanced) landfill mining, *Detritus - Multidisciplinary Journal for Waste Resources & Residues*, 2019, 141-156, DOI:10.31025/2611-4135/2019.13884

Recy &

DepoTech

2020

18.-20.11.2020 in Leoben (Österreich)



Conference „Recy & DepoTech 2020“ / November 18th-20th, 2020 / Leoben

Organiser: Chair of Waste Processing Technology & Waste Management

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