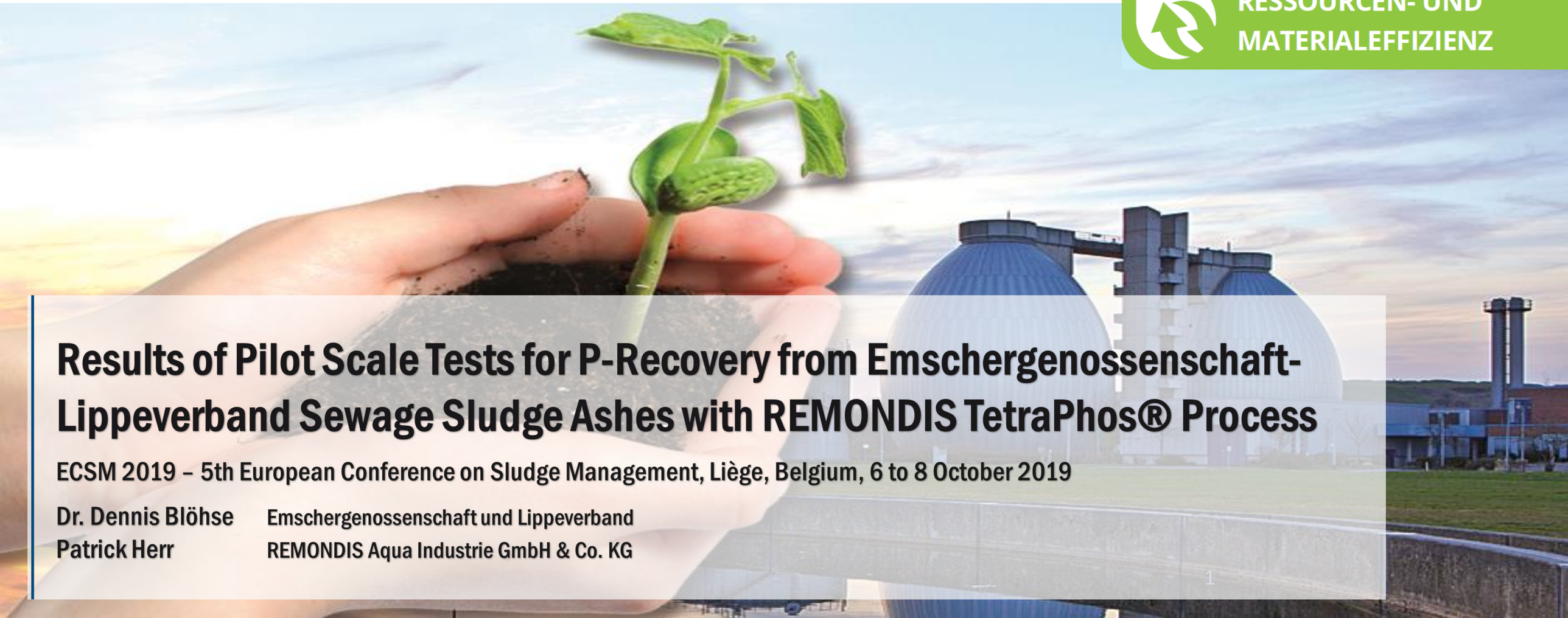
Interreg North-West Europe
Phos4You
European Regional Development Fund

RESSOURCEN- UND MATERIALEFFIZIENZ



Results of Pilot Scale Tests for P-Recovery from Emschergenossenschaft-Lippeverband Sewage Sludge Ashes with REMONDIS TetraPhos® Process

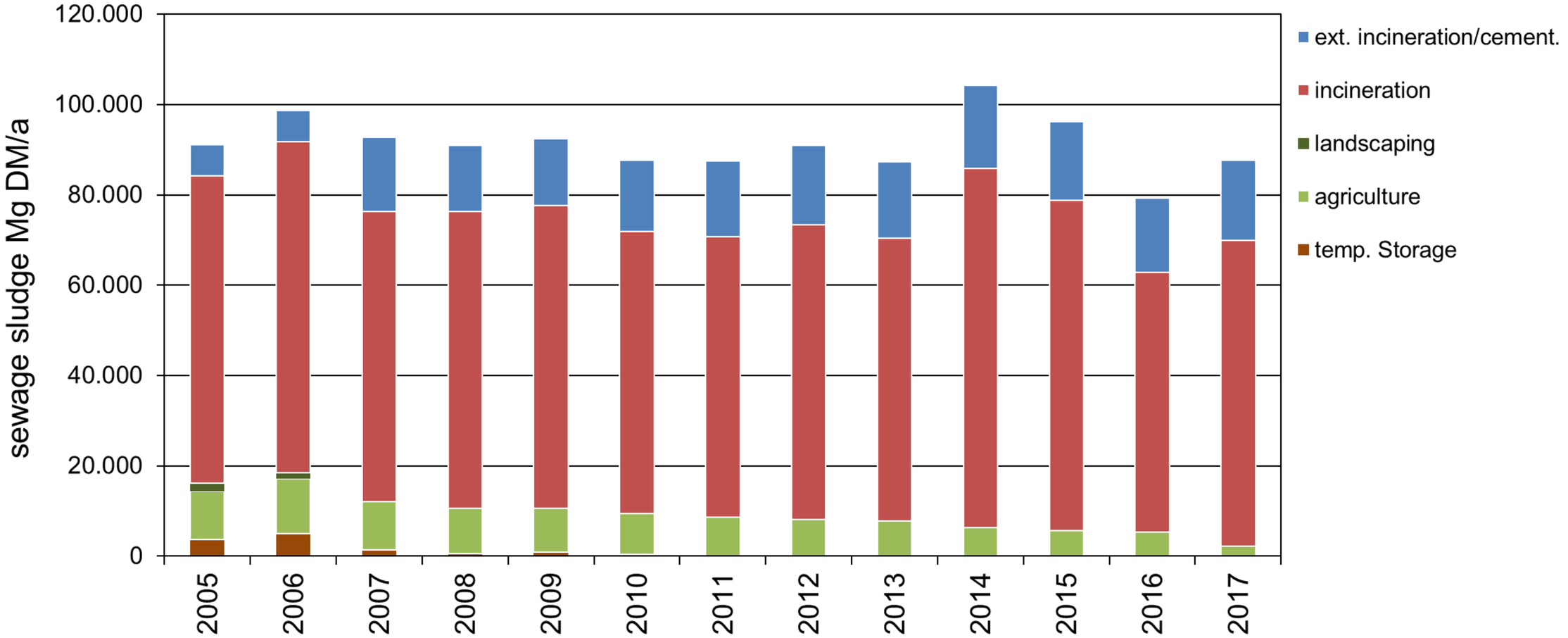
ECSM 2019 – 5th European Conference on Sludge Management, Liège, Belgium, 6 to 8 October 2019

Dr. Dennis Blöhse — Emschergenossenschaft und Lippeverband
Patrick Herr — REMONDIS Aqua Industrie GmbH & Co. KG

Agenda

- Background
- First Resuls
- Further Action
- Outlook

Sludge disposal routes of EGLV

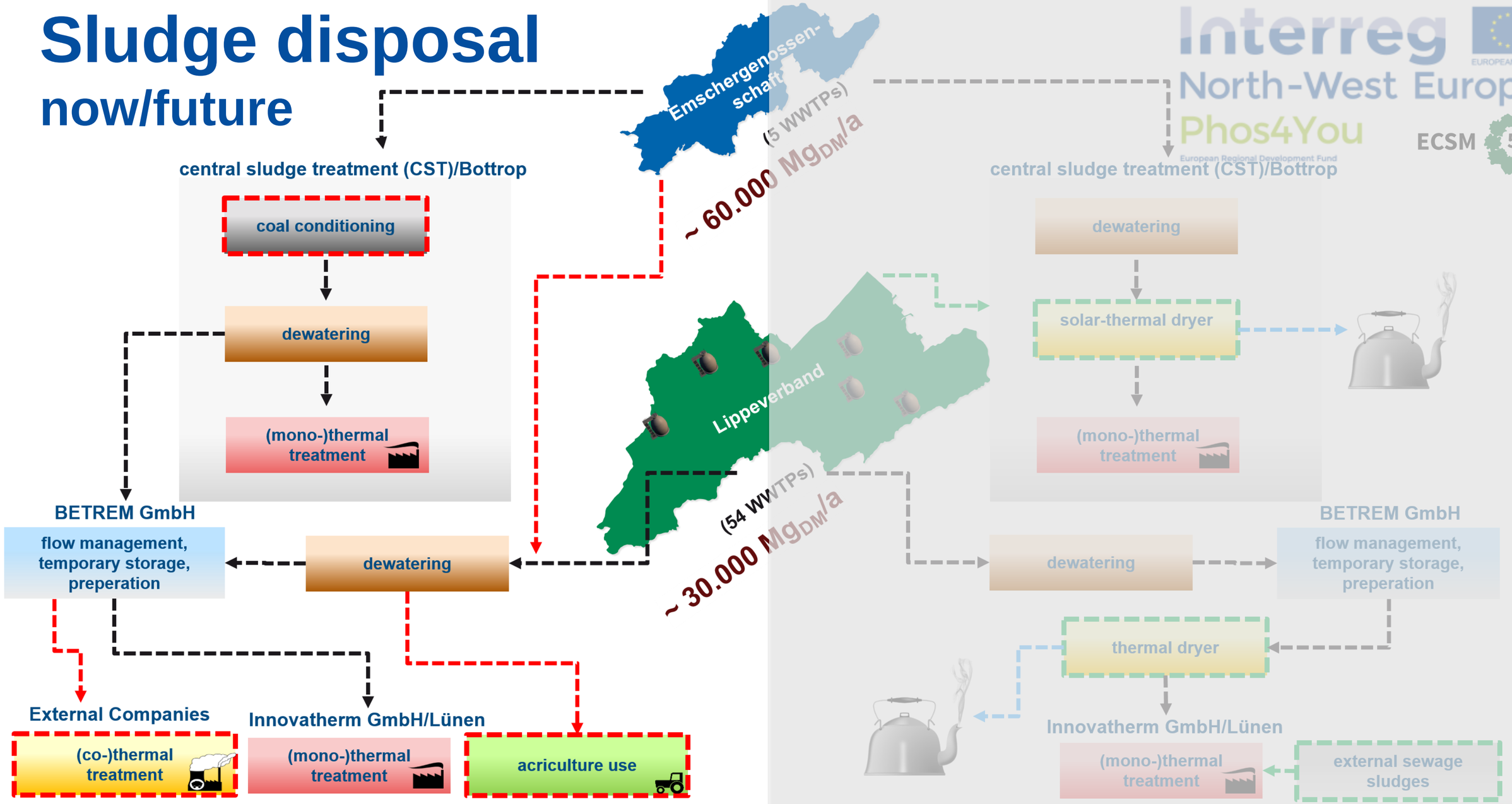


Our facilities for thermal treatment

EMSCHERGENOSSENSCHAFT – Bottrop	INNOVATHERM GmbH – Lünen
Sewage sludge from municipal waste water with influences of industrial sewage	Sewage sludge from several municipal and industrial sources
Capacity: 44.000 Mg DM/a	Capacity: 95.000 Mg DM/a
Ashes*: 15.000 Mg/a	Ashes*: 45.000 Mg/a
P-Content*: 5 %	P-Content*: 3 %

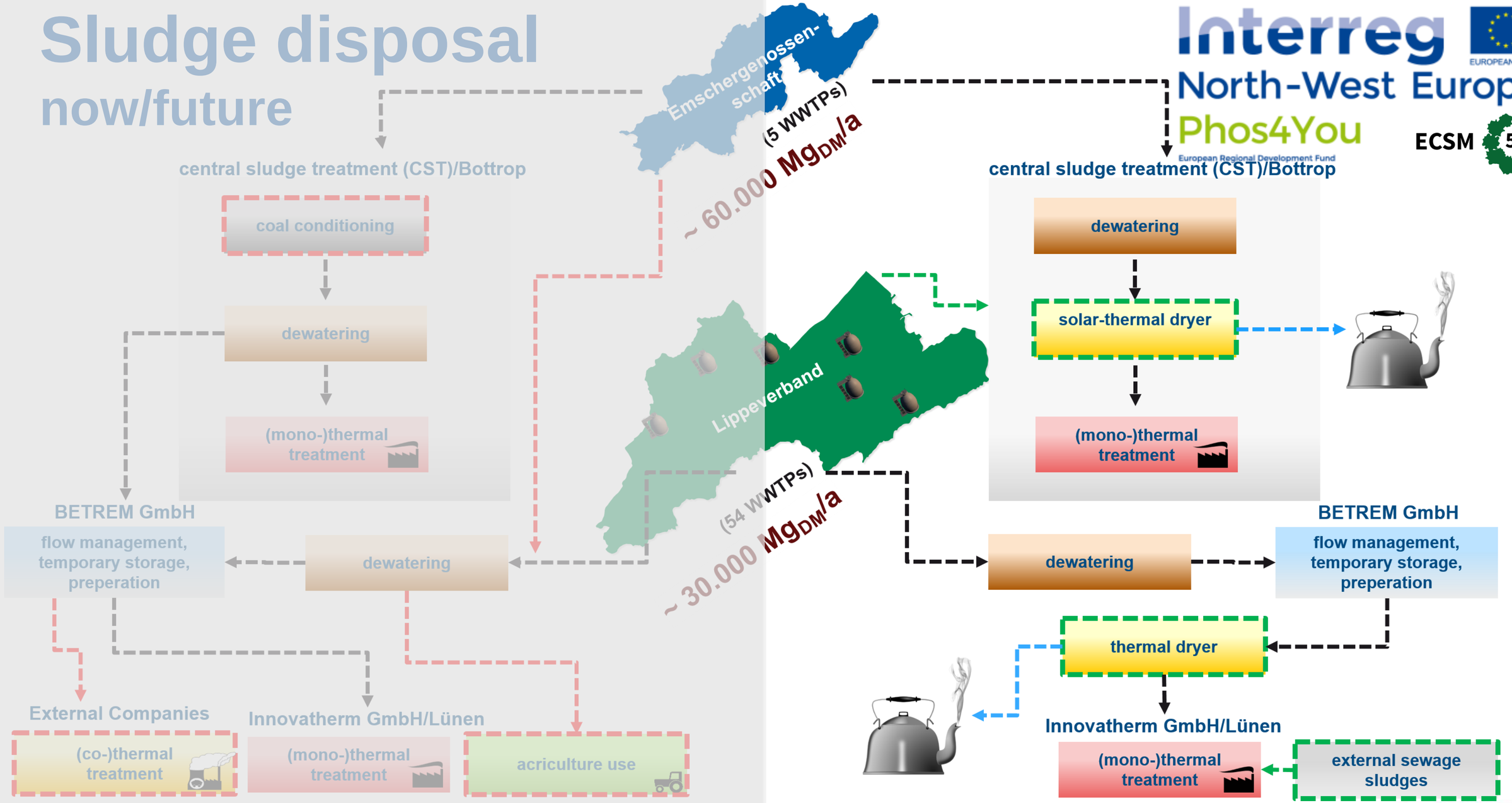
*average of Data from 2015 to 2017

Sludge disposal
now/future



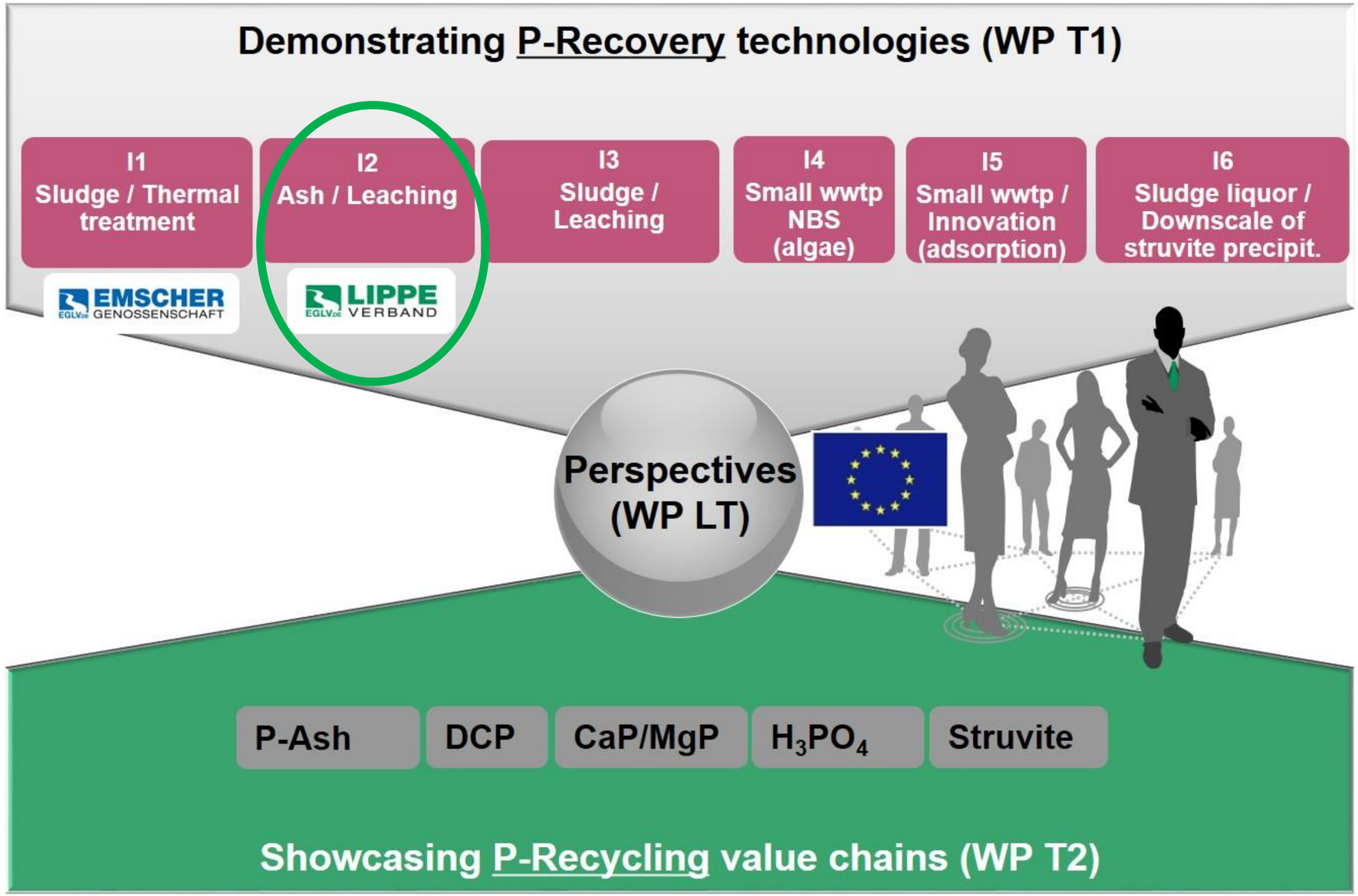
Source: Pfeiffer et al., 2019

Sludge disposal
now/future



Source: Pfeiffer et al., 2019

Scope of „Phos4You“



P:Phosphor WP: Work Package A: Activity I: Investment NBS: Nature Based Solutions

Possible routes at EGLV

© Emschergenossenschaft

Sewage Sludge Ashes

Mono-Incineration

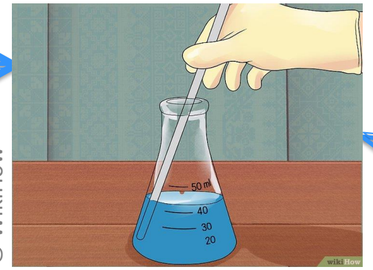
© Emschergenossenschaft

Sewage Sludge

Integration of additional processes

Co-Incineration

(Cement Plant, Coal-Fired Power Plant)



© WikiHow

Phosphoric Acid

© EuPhoRe

Phosphate Rich Ashes

Phosphate Salt (DCP/Struvit)

Industrial Application

© Lippeverband

Fertilizer Industry

Source: Ploteau et al. 2018

Pre-industrial Demonstration

REMONDIS TetraPhos®

©Remondis Aqua

Location: Elverlingsen/Werdohl

Operation: completed

Input:

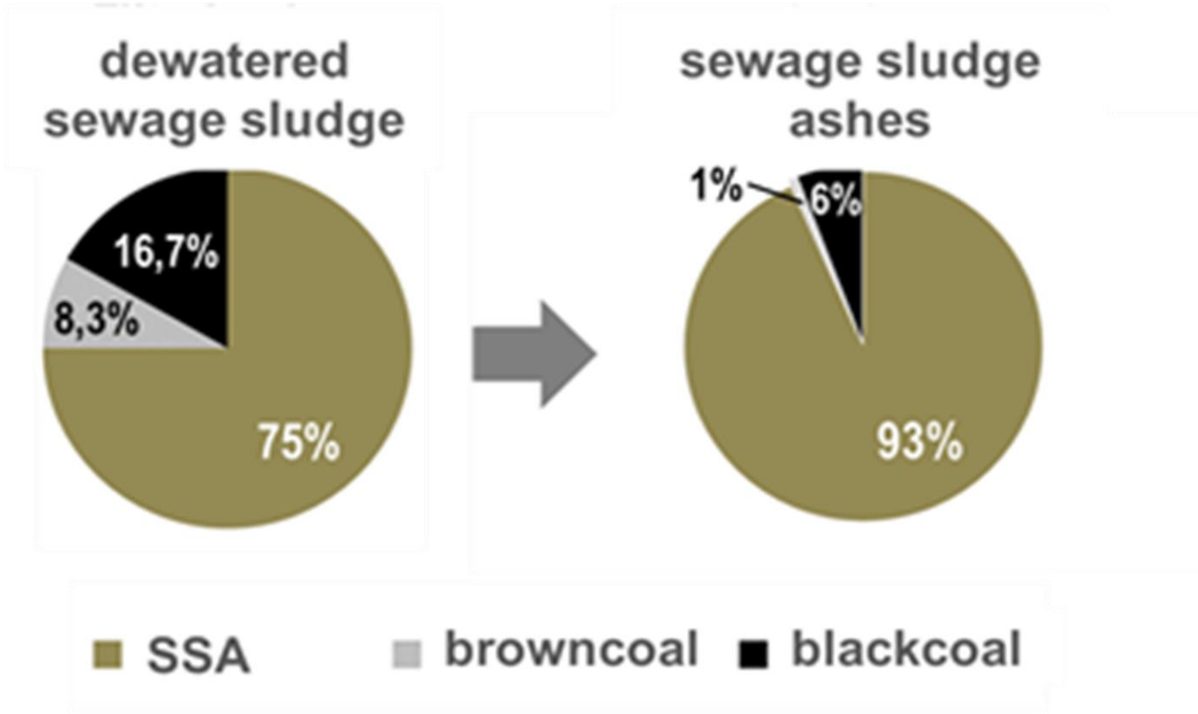
Sewage sludge ashes (SSA) from the incineration plants in Bottrop and Lünen

Capacity: 50 kg/h

Product: H_3PO_4

Results REMONDIS TetraPhos®
Influence of coal-conditioning in sludge treatment

- Coal-conditioning approx. 25%
  (regarding dewatered sewage sludge)
- 7% of the SSA are ashes from coal
  - ➢ Effect of dilution
    → decrease of P
    (absolut 0,6%, relative 11%)
  - ➢ But also increase of S and Al
    → coal ash composition



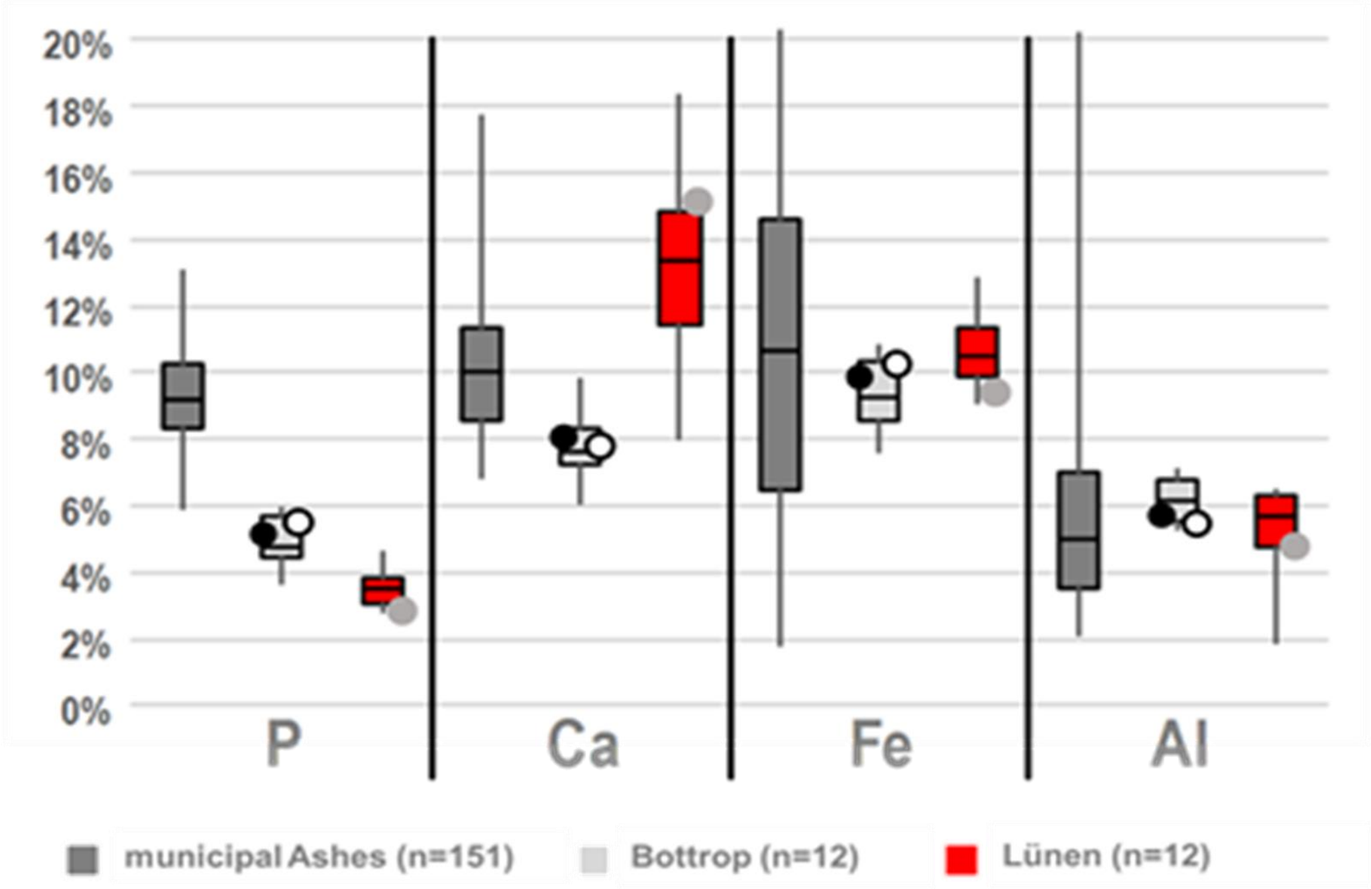
✓ Coal-conditioning has no effect on P-recovery via REMONDIS TetraPhos®

Results REMONDIS TetraPhos®
Compositions of the used ashes

Used ash samples:

- Bot 1 – Bottrop with coal
- Bot 2 – Bottrop without coal
- Lün 1 – Lünen

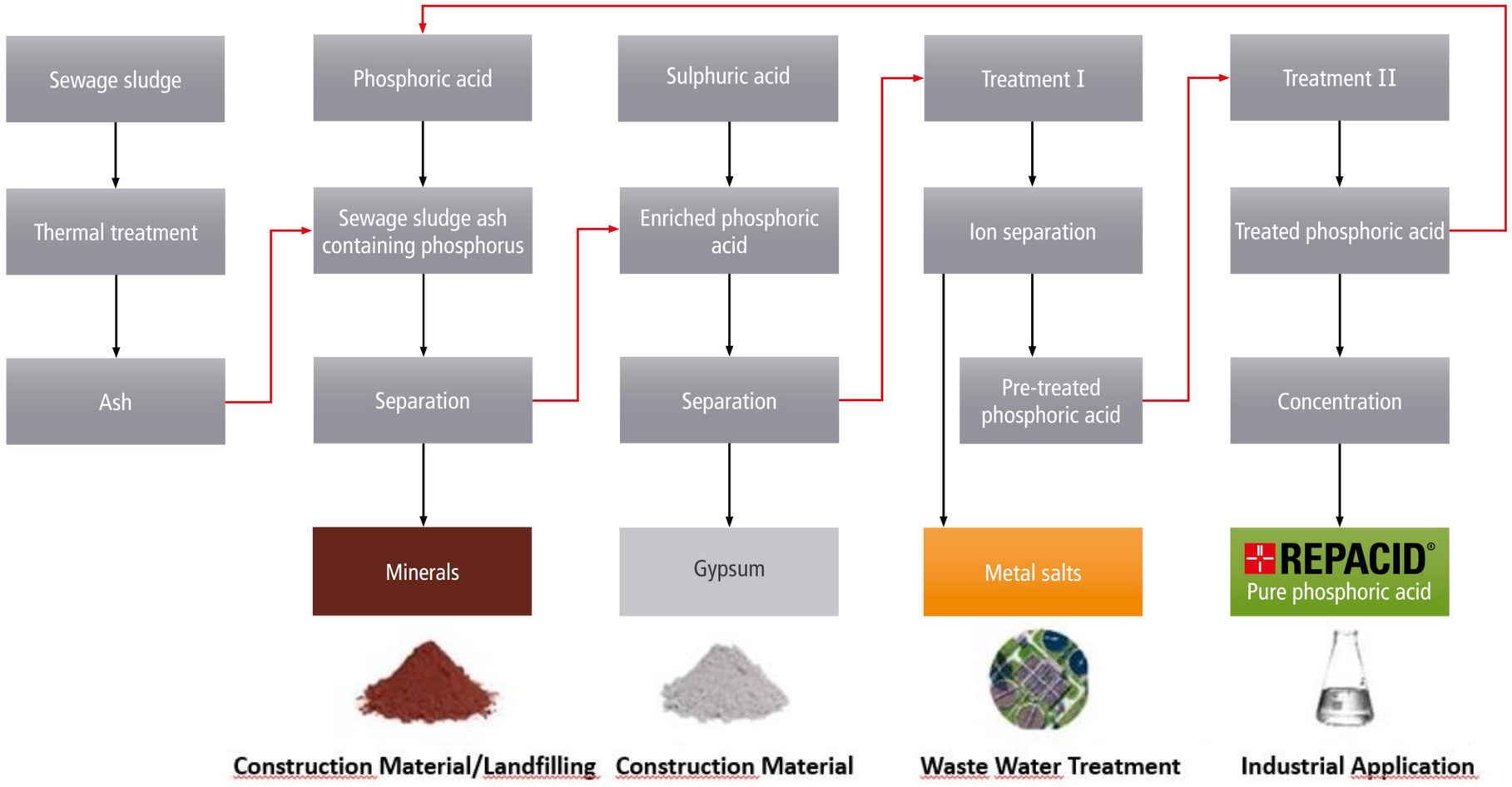
✓ Samples are representative for the respective incineration plant



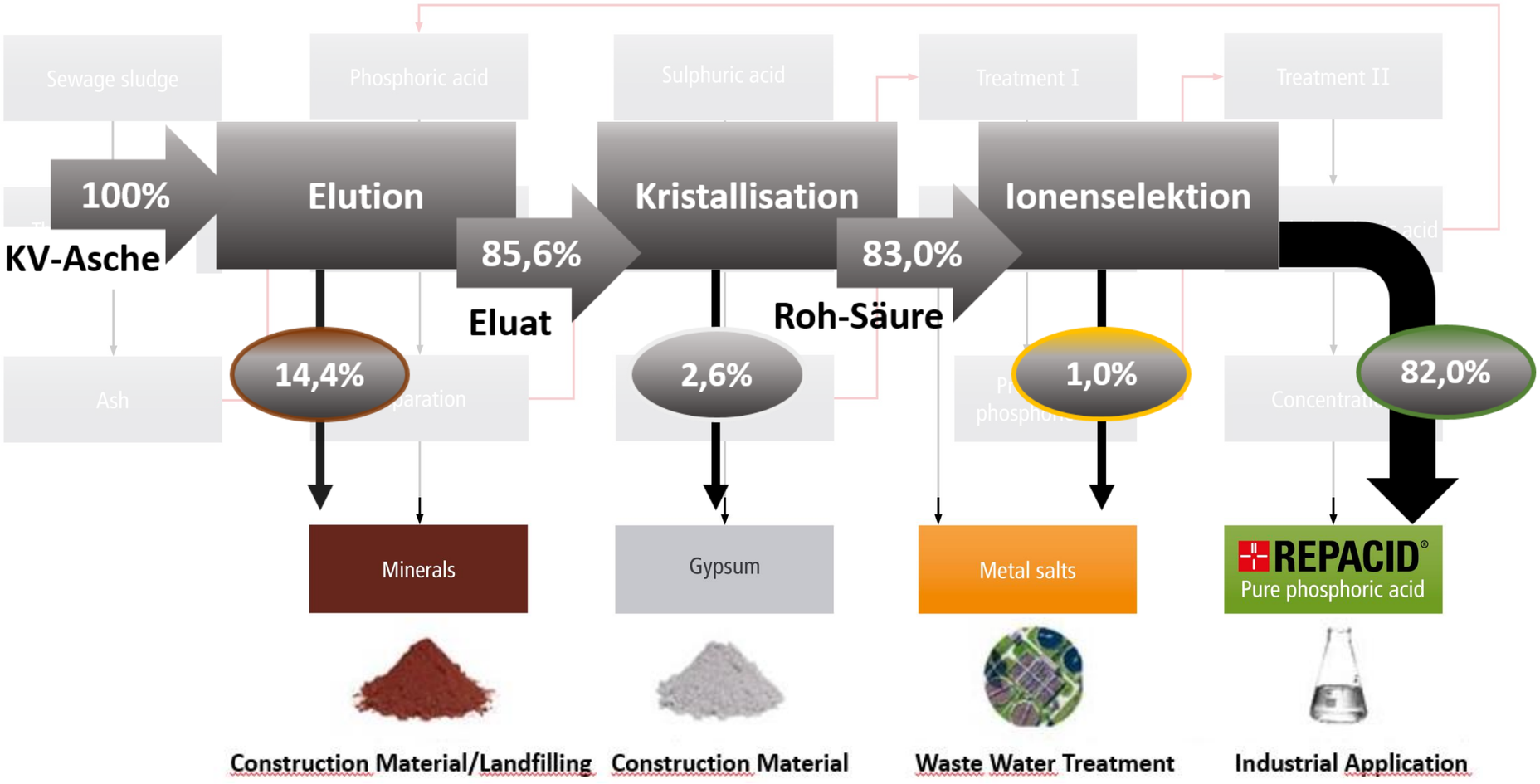
Source: Krüger & Adam, 2014 (Data: Ashe-Monitoring)

Results REMONDIS TetraPhos®

Process steps



Results REMONDIS TetraPhos®
Phosphorus balance



Results REMONDIS TetraPhos®
Summary (1)

two key aspects were demonstrated:

- An effective phosphorus recovery process with a P-recovery rate of >80%, in accordance with future legal requirements.
- A stable operational cycle that produces recycled phosphoric acid (REPACID®) that complies with all product specifications.

…furthermore:

- The produced by-products – gypsum and metal salts – are of high quality with very low levels of contaminants, which makes recycling possible.
- The ash residue from Bottrop shows a better landfill class than the raw ash, which could reduce disposal costs.

Results REMONDIS TetraPhos®
Summary (2)

- A concept for industrial implementation of the REMONDIS TetraPhos® process on the central sludge treatment (CST) Bottrop was established.
- The economic efficiency - amongs others - dependent on…
  - P-content of the ashes
  - As well as from the global marked prices for P-acid.
- EGLV ashes are currently low in phosphorus (<6%) and does not yet reach the (threshold of economic viability) break even.
- In the long term, EGLV is expected to increase the phosphorus content in the sewage sludge of its WWTP and thus in the SSA.
- Phos4You will develop options to increase P levels in SSA to improve the economics of the operation.

Further Action
consolidation– analyze - evaluate

- Update/consolidation the current inventory
  - Discuss future operational changes
  - Recording fluctuations in seizure/ quality
  - Detect possible operational influence/“margins“

- Evaluat optimisation approaches
  - Goal: Increase of P-content in sludges and ashes

- Ecological and economic evaluation
  - variant analysis
  - sensitivity analysis
  - scenarios process

Further Action
possible scenarios

Key question „Location“

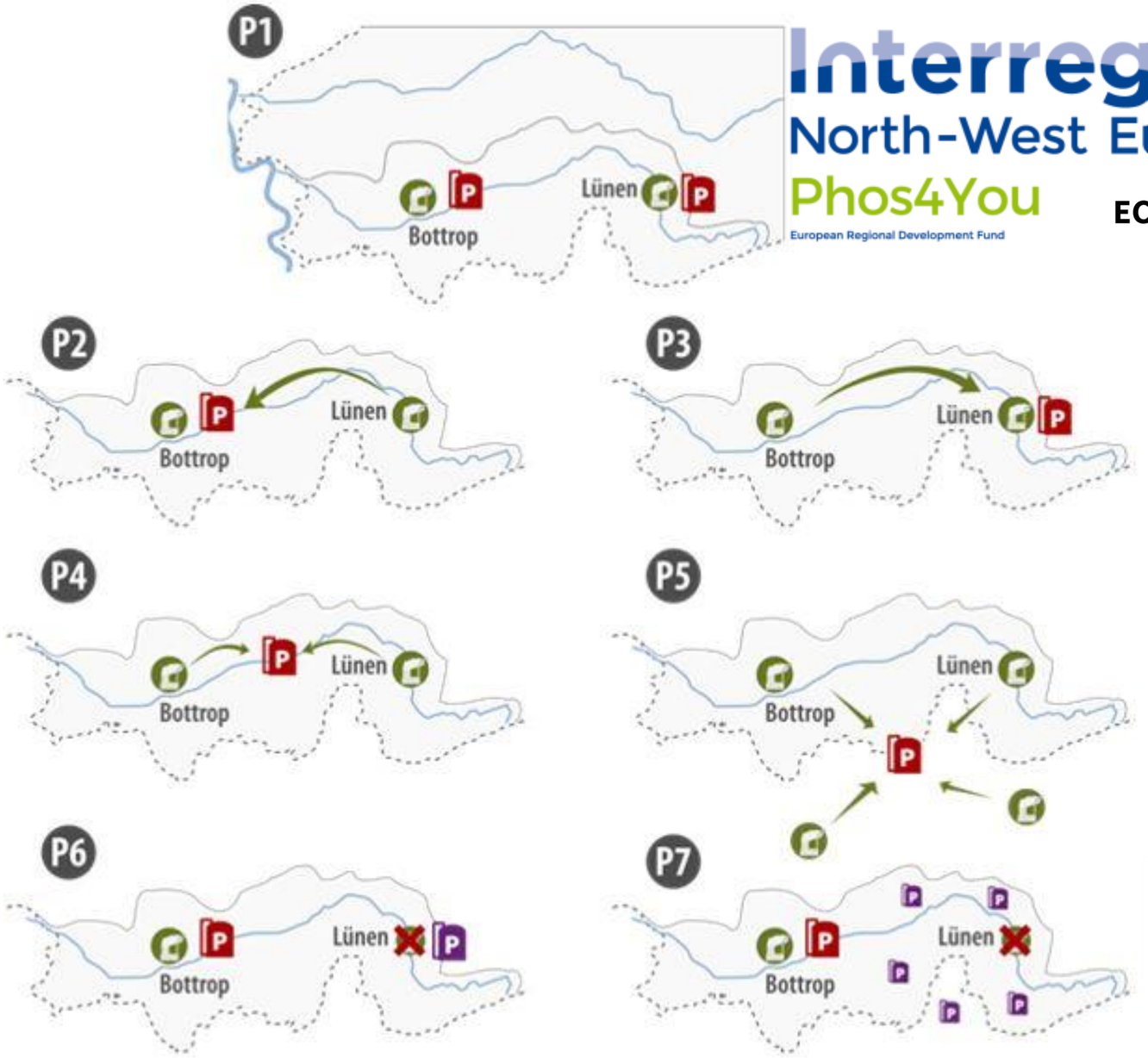
- One or two locations
- External Location

Hybrid solution

- Involvment of processes to recover P from sewage sludge directly on the WWTP (e.g. rural area)

Extension

- Consider regional cooperation



Source: Thiriet and Bioteau, 2019

Follow-up (1)

Regional sludge-ash-management and P-recycling in urban area (AMPHORE)

Funding programm of the Federal Ministry of Education and Research

„Regional Phosphor-Recycling“ (RePhoR)

- ✓ Location and organisational form is defined
- ✓ Process containment is set
- ✓ **Concept is compiled and submitted**

Projektinitiierung und -leitung: Ruhrverband

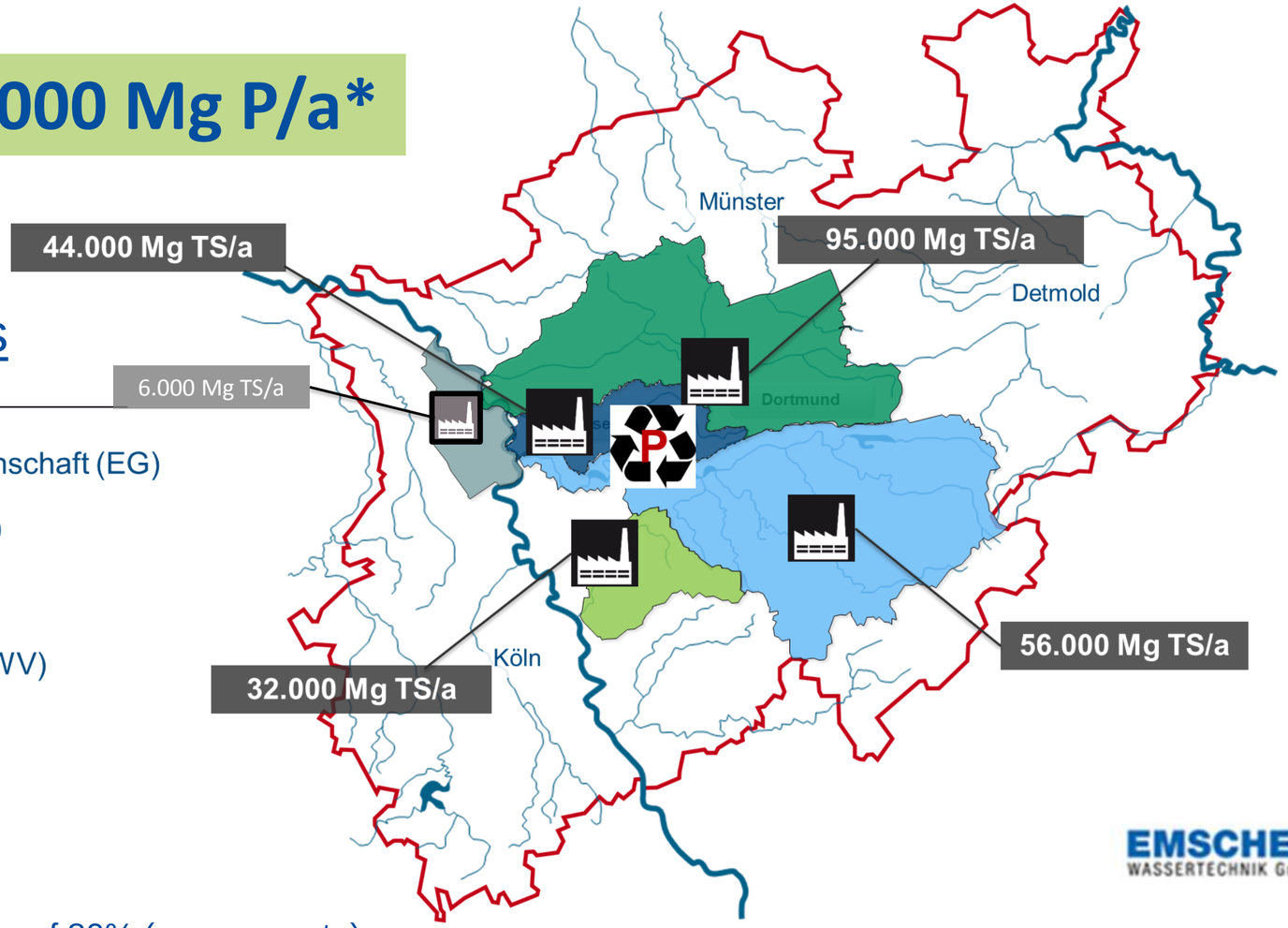
Follow-up (2)

Interreg North-West Europe
Phos4You
European Regional Development Fund
ECSM 5th

>4.000 Mg P/a*

5 Waterboards

- Emschergenossenschaft (EG)
- Lippeverband (LV)
- Ruhrverband (RV)
- Wupperverband (WV)
- Lineg (Lg)



& Partner

Fraunhofer ISI
ISA Institut für Siedlungswasserwirtschaft
RWTH AACHEN UNIVERSITY
ifeu Institut für Energie- und Umweltforschung Heidelberg
WiW Wupperverbandsgesellschaft für integrale Wasserwirtschaft mbH
EMSCHER WASSERTECHNIK GmbH
LIPPE WASSERTECHNIK GmbH

*Potential after recovery of 80% (recovery rate)

LIPPE VERBAND

www.nweurope.eu/phos4you

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Thank you!

University of Applied Sciences and Arts Northwestern Switzerland
School of Life Sciences

Source references

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