Strategy and Concept-Approach for the Recovery of Phosphorus at One of the Largest Sewage Sludge Producers in Germany

D. Blöhse, D. Bogaczyk
Lippeverband/Emschergenossenschaft, Kronprinzenstraße 24, D-45128 Essen
E-Mails: bloehse.dennis@eglv.de / bogaczyk.dirk@eglv.de

The 5th European Conference on Sludge Management, ECSM'2019, in Liège, Belgium, 6 to 8 of October 2019

1. Current Situation at EGLV

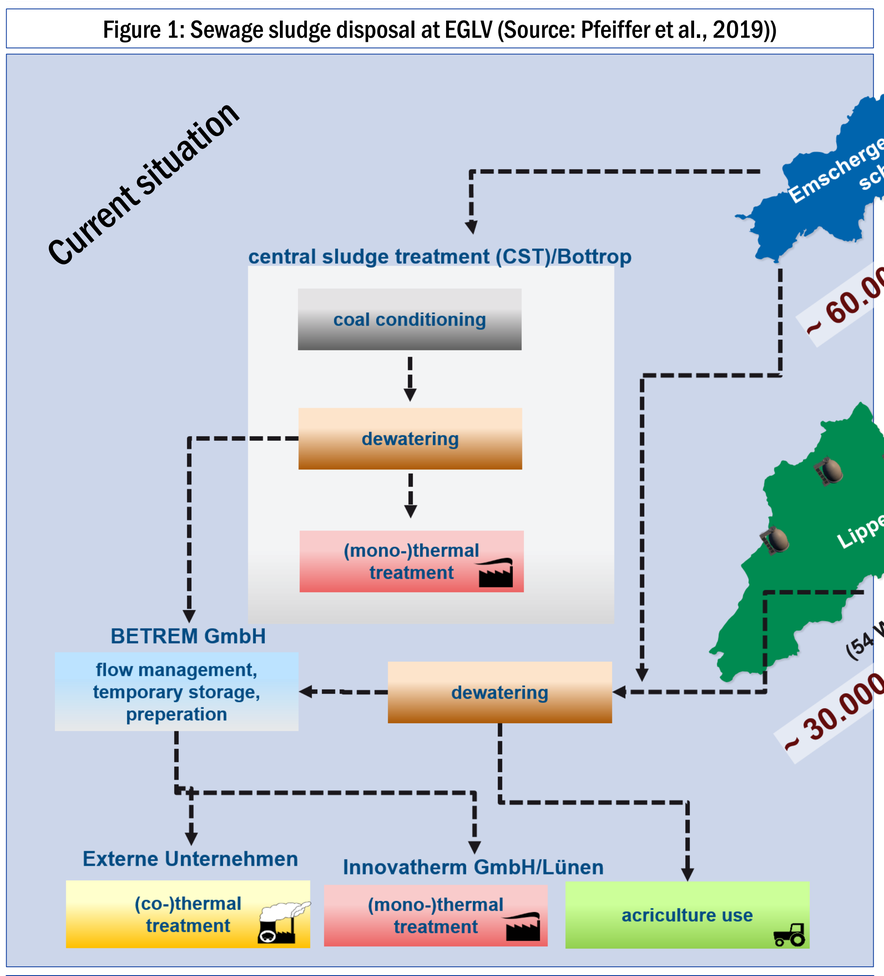
The Emschergenossenschaft (EG) and Lippeverband (LV) together, are one of the largest sewage sludge producer in Germany operating 59 wastewater treatment plants (WWTPs).

Currently:

- 77% of EGLV sludge is thermally disposed of in the associated Bottrop and Lünen incineration facilities.
- 20% is disposed of through external contracts, for instance at cement works or coal power plants (co-incineration).
- 2-3% is used in agriculture, due to new regulations will have no relevance in the future.

In Germany P-recovery from sewage sludge is mandatory from 2029.

Figure 1: Sewage sludge disposal at EGLV (Source: Pfeiffer et al., 2019))



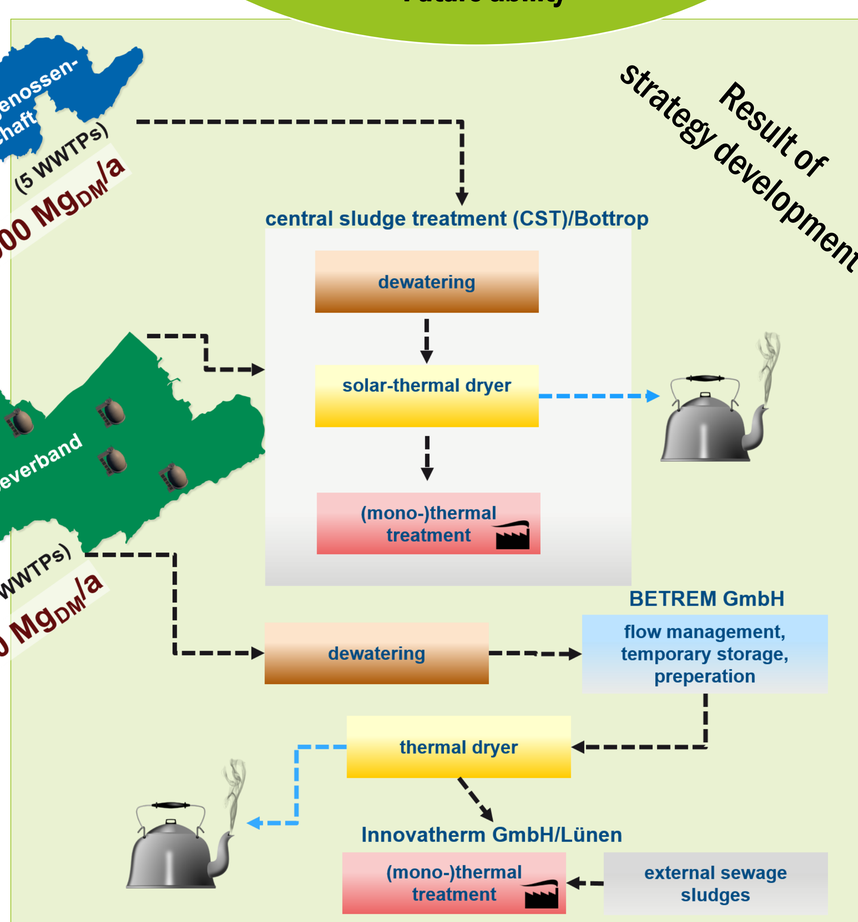
2. Sewage Sludge Strategy

Fertilizer Ordinance | Sludge Ordinance | Market Situation

Development of a strategic approach

TARGET CRITERIA:

- Disposal Security
- Economic Viability
- Environmental Sustainability
- Future ability



3. R&D as a Tools

Under the leadership of LV, the INTERREG VB Northwest Europe "Phos4You" demonstrated innovative technologies towards recovering phosphorus from wastewater. The essential project working objectives are:

- Demonstrate P-recovery technologies from wastewater, sewage sludge, and sewage sludge ash under real conditions.
- Showcase of new fertilizer products using P recovered from waste water.
- Develop a proposal for a EU-wide and standardized quality assessment of the new fertilizers.
- Develop model-like approaches for phosphorus recycling in rural and urban regions.

A regional scenario is currently considered in a complementary project: Five waterboards in North Rhine-Westfalia (NRW) develop a concept for regional sludge-ash-management and phosphorus recycling.

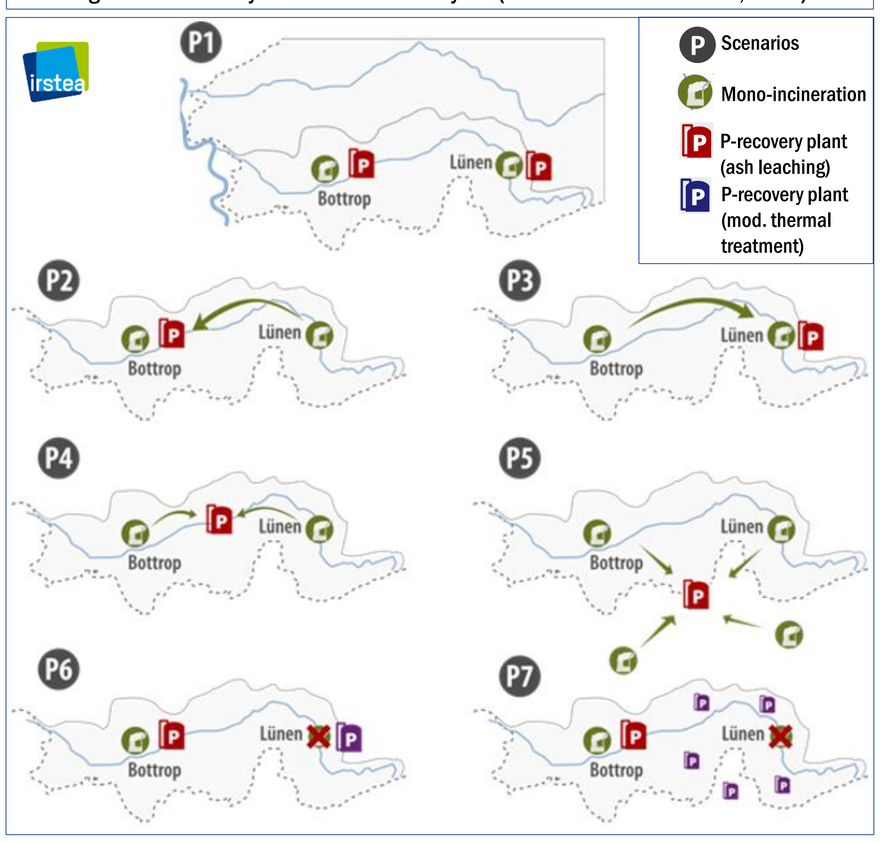
The **essential aspects**, for develop of P-recovery are:

- **site selection**
(area availability, approval capability, infrastructure)
- **process selection**
(method, product, byproduct, residue)
- **organizational structure**
(especially if several parties are involved)

4. Scenario Choice

- Based on the sewage sludge strategy, as well as possible routes of P-recovery (Figure 2), a first approach for different scenarios (Figure 3) was drawn up.
- The sludge scenarios take into account the initial sludge quantities from 2021 to 2029. Sludge quantities could be changed after 2029 based on results of a strategy check in 2025.
- First approaches of the scenarios will be further analyzed, fleshed out, and evaluated according to the already listed criteria (cf. chapter 2).

Figure 3: P-recovery scenarios to be analyzed (Source: Thiriet & Bioteau, 2019)



5. Strategic Procedure and Approach

In 2023, the german sludge producers need to submit a mandatory concept and in 2029 they should adopt P-recovery completely.

The timeline is ambitious, and for this reason, EGLV has worked intensively on the way for P-recycling.

This includes following steps:

- Definition of framework and options (cf. Figure 4)
- Observation of market and process development
- Plant design up to the point of viability
- Analysis of variants for strategic options
- Risk assesment and sensitivity analyses
- Establishing of decision roadmap

Figure 4: Example of possible approaches (Blöhse et al., 2019)

On the basis of the technology demonstrations tested under real conditions, EGLV tracked three routes, which are presented in Figure 2.

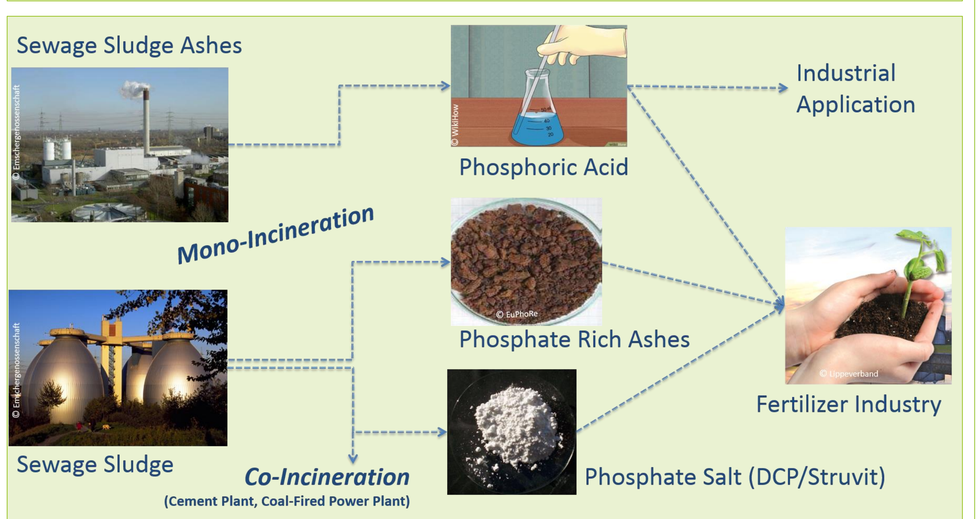
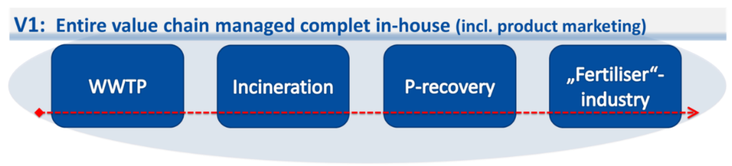
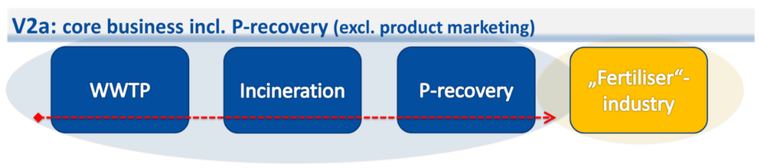
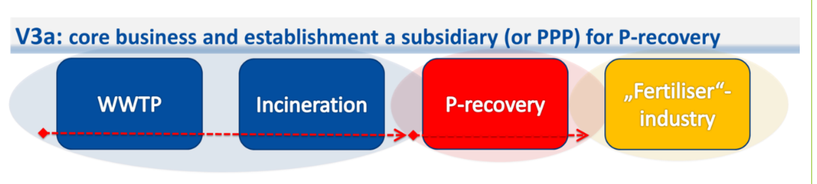
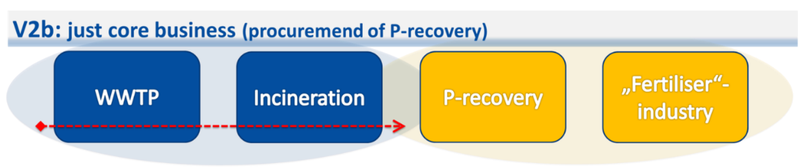


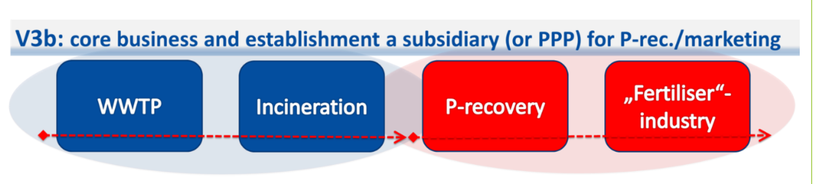
Figure 2: EGLV looks at 3 pathways to recovery P (Source: Ploteau et al. 2018)











References

- E. Pfeiffer, D. Bogaczyk, M. Kuhmann, D. Dörtelmann and F. Lehrmann. Strategische Aufstellung eines großen Wasserwirtschaftsverbandes zur Erfüllung der Klärschlammverordnung. 52. Essener Tagung für Wasserwirtschaft. Aachen 2019
- P. Thiriet, T. Bioteau. IRSTEA-Decision Support Tool – Emschergenossenschaft and Lippeverband case study. Rennes, France 2019 (unpublished)
- D. Blöhse, M.-E. Ploteau, K.-G. Schmelz and I. Nafo. Konzepte eines großen Klärschlammerzeugers aus NRW zur Phosphorrückgewinnung: Erste Erkenntnisse aus dem INTERREG Verbundprojekt Phos4You. In O. Holm, E. Thomé-Kozmiensky, P. Quicker, and S. Kopp-Assenmacher, Verwertung von Klärschlamm. Thomé-Kozmiensky Verlag GmbH, 2018.
- M.-E. Ploteau, I. Nafo, K.-G. Schmelz. Waterboards on the way to recycle phosphorus. Environ2018, 28.03.2018. Cork, Ireland