Scenarios for implementation of phosphorus recovery in Switzerland
Using data from pilot and production plants
Phos4You final conference, Essen & online, 22-23 September 2021
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Outline

1. Swiss context
2. How were the scenarios developed?
3. Pros and cons of the scenarios
4. Conclusion
Phosphorus in Switzerland

Updated from: Nättorp, Jutz, ESPC3 2018
Swiss context

Legislation
• VVEA- recovery from sludge and meat and bone meal
• Implementation aid 50% recovery until 2026
• (validated) Vision SwissPhospor 75% until 2036
• Minrec- fertilizer limits, stricter than EU/DE

Infrastructure
• 180’000 t sludge DM (municipal and industrial)
• Sludge incinerated, 63% in SIP
• Hardly any fertilizer production
Northwestern Switzerland

- Northwestern Switzerland
  - 7% of Swiss area
  - 17% of Swiss population
  - 24% of Swiss sludge production
  - 38% of Swiss sludge disposal

Legislation and infrastructure similar
Scenarios applicable to Switzerland
Scenario development

• Collect base data
  – Inventory of SIP of Switzerland
  – Inventory of sludge drying and cement works of Switzerland
  – Sludge balance NWCH
  – Suitable technologies

• Develop scenarios
  – Draft scenarios and target criteria with stakeholders
  – Validation workshop
  – Evaluation
  – Validation workshop for finished scenarios
Sludge balance

- 180% capacity
- Replacement SIP next ~15y

⇒ Flexibility recovery: technology & site
Technologies

• Technology selected and described for ministry of Northrhine-Westfalia MUNLV
  – TRL
  – Technology provider
  – European experience  ➔ publication pending

• Swiss context
  – Swiss target criteria
  – Cost updated
    • Bigmac-Index
    • Swiss disposal
  – Technologies
    • Less because of contaminants limits and yield requirement
    • New Swiss experiences

1 EcoPhos®
2 EuPhoRe®
3 PARFORCE
4 Phos4Life
5 PhosForce
6 Pyrophos
7 REALphos
8 Stuttgarter
9 ZAB/PHOS4green
Scenarios for recovery and disposal

Process step 1

1. Mineralization Status Quo
2a. Mineralization SIP
2b. Red.-Oxidizing- Mineralization
3a. Reducing-Oxidizing Mineralization
3b. Mineralization SIP
4. Extraction from sludge

Process step 2

Extraction
Extraction abroad
Extraction
Acidification
Cement works/MSWI
## Scenario Evaluation - high influence of technology choice

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<th>Economic efficiency</th>
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<th>T3</th>
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Mineralization status quo and recovery open until 2026

- Less cost with later implementation
- More technology experience on market
- Combine with disposal renewal
- Less partners for cooperation
Mineralization in SIP
Extraction of P from the ash

- High removal of pollutants
- High recovery rate and plant availability
- Closure of P cycle in Switzerland and in agriculture
- Complex processes with likely difficulties for first movers
- Limited Swiss experience
Mineralization in SIP extraction of P from the ash

...extraction abroad

• Requires stable cooperation partners
• Comparable cost
• German market w. additional potentially better options in SIP in Red.-Oxidizing mineralization
• Today less experience and thus more risk than with SPI.
• No known advantages in cost or environmental impact.
Reducing-oxidizing mineralization or acidification to increase of plant availability

- Relatively simple processes
- Rather positive warming potential
- Little landfilling
- High recovery rate
- Closing of P cycle difficult in Switzerland because of diluted fertilizer product
- Challenge: low contaminant input mix (e.g. MBM) to fulfill Swiss contaminant limits.
Extraction from sludge
Mineralization in cement plant or MSWI (or SIP)

- High removal of pollutants
- No landfill needed if combined with cement works
- Low recovery rate
- Low output revenue
- No (positive) Swiss experience
Conclusion

• Recent, reliable data with all relevant process types
• NWCH disposal renewal gives large flexibility for disposal- recovery combinations
• No obvious best choice, stakeholder weighting of criteria decisive
• Scenario choice has considerable impact, e.g. 22 MEUR OPEX/a, 700 t P/a
The circular phosphorus future is wide open, stakeholder initiative is key