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Essen & online, 22 - 23.09.2021 | Phos4You final conference | Blöhse et al. | Lippeverband

# Objectives pursued in the Phos4You project

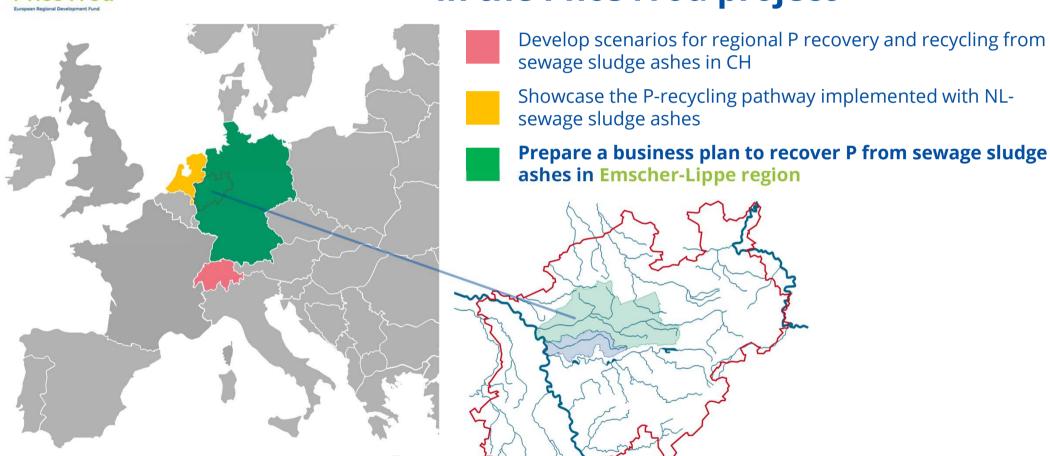




Chart n°3

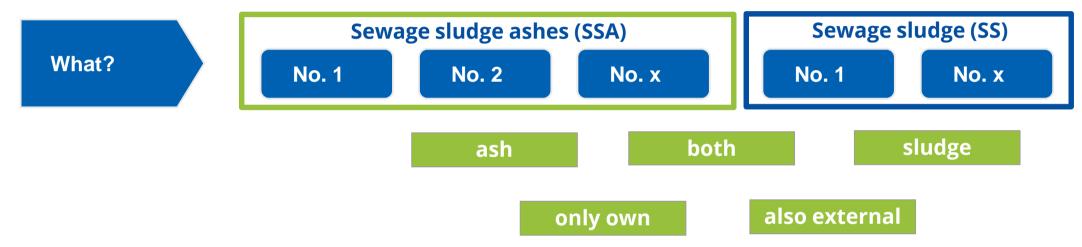


Strategical options

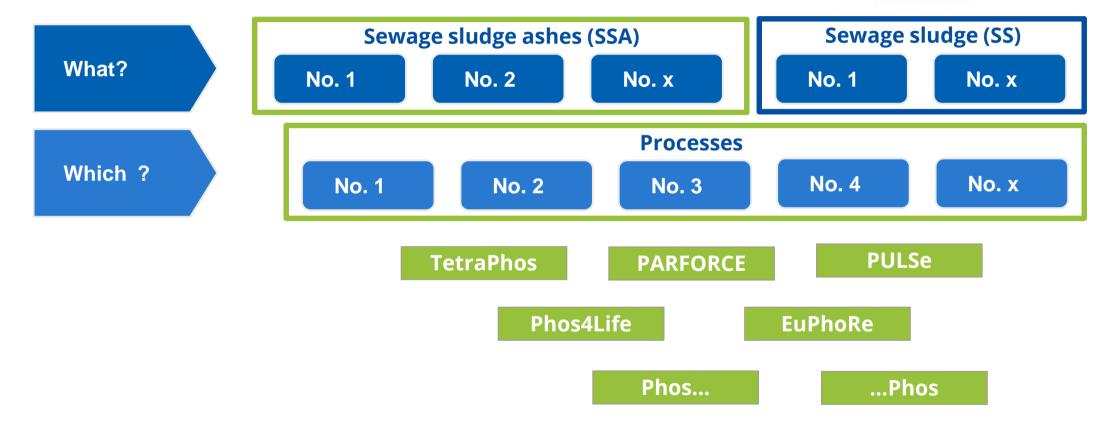
# IT STARTS WITH QUESTIONS





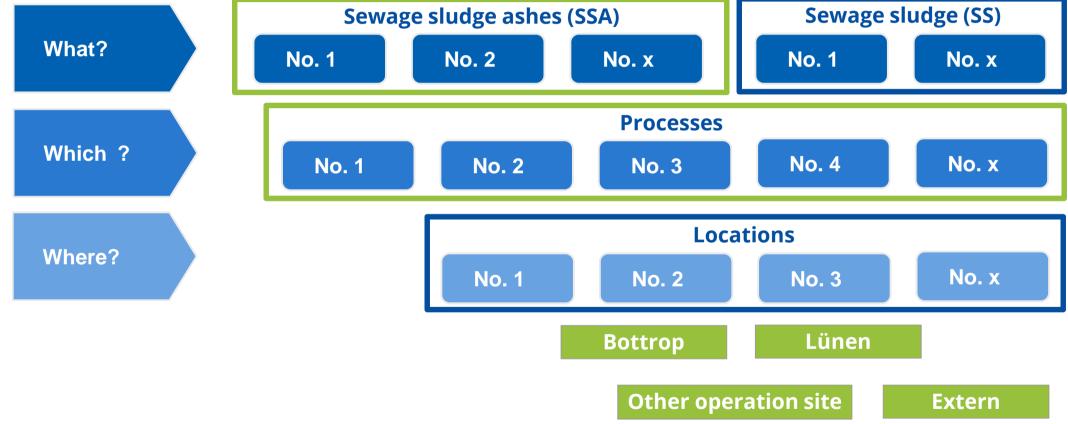




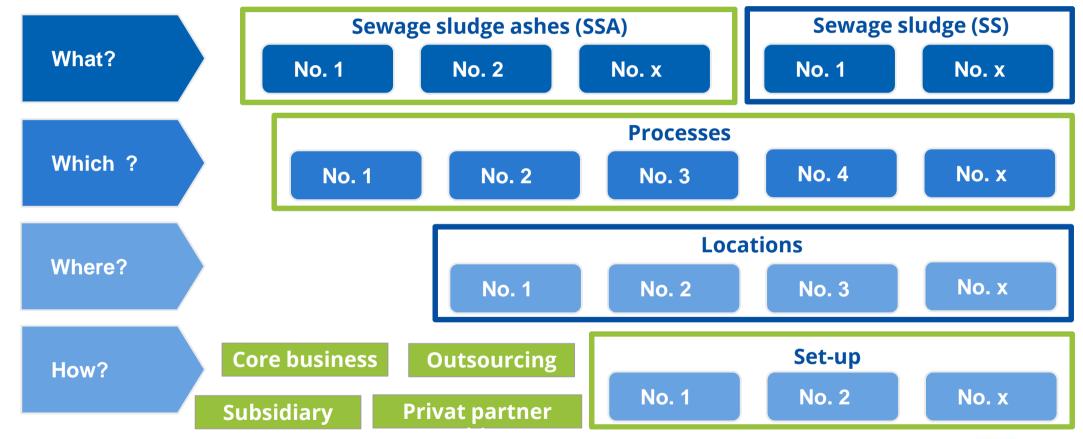






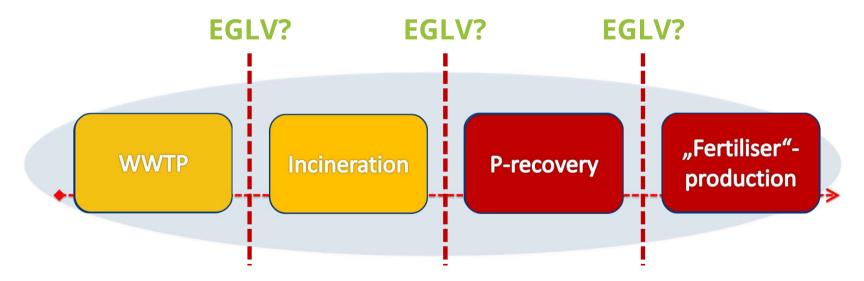








# Which tasks and responsibilities along the recovery and recycling chain should EGLV perform?



What is our business model?

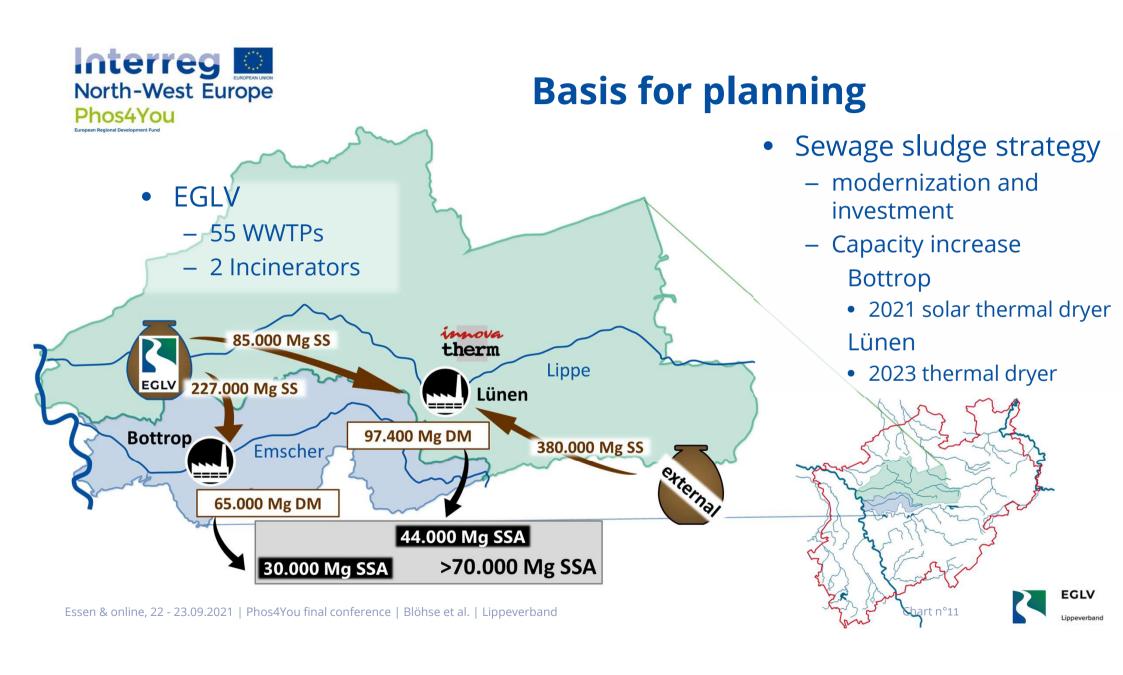




Sewage sludge strategy & Phos4You Project

## LET'S TAKE A LOOK TO THE BASICS







# **Phos4You - Technology Demonstration**



### **Wet-chemical process**









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# **Distribution & marketing (1)**



Phosphoric acid Fertilisers producers with international market main stakeholders that might be outreach implicated in the recycling pathways of phosphoric acid produced P-Fertilisers Nutrient businesses P-recovery plant Phosphoric operator acid **Farmers** Agro-Sewage sludge wholesalers Industrials ashes Sewage sludge Chemicals incinerator plants wholesalers Source: Blöhse *et al.*, 2020 operators Legende Stakeholder Material / Product Delivery Alternatively



## **Distribution & marketing (2)**



EuPhoRe® ashes Existing fertiliser producers with international market main stakeholders that might be outreach implicated in the recycling pathways Innovative fertiliser Solid inorganic Inorganic producers with of SSA fertiliser fertiliser regional outreach (high-end) (high-end) Sewage sludge incinerator Sewage plant operators sludge ashes Agro-Farmers wholesalers Sewage sludge Source: Ploteau *et al.*, 2020, modified Nutrient Fertilising businesses product blend Wastewater treatment (low-end) plants operators Conventional Legende fertiliser blenders (regional)

Delivery



Material / Product



### Value chain conclusion



**Wet-chemical process** 

**Fertiliser industry** 

Thermo-chemical process





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Tetraphos®









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# **Business models - Overview General Options**

# North-West Europe Phos4You

#### 1st Conclusion

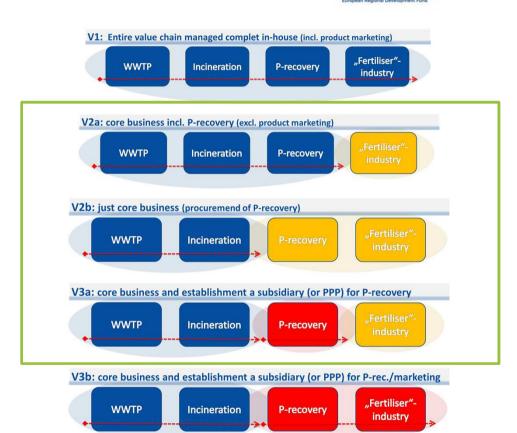
- Production of fertiliser are not our scope (incl. distribution/marketing)
- Just production of "raw-materials"

### **Preferred Options:**

- Core business incl. P-Recovery
  - Performance of the legal obligation for Precovery
- Just core business (outsourcing)
- Subsidiary for P-Recovery

### 2<sup>nd</sup> Conclusion

- integration of private companies tends to be questioned critically, since water management is generally carried out under public law
- Privat Public Partnership (PPP) is a complex construct, which is not easy to implement for a waterboard as EGLV





### Some answers to create concrete scenarios



What?

Because of sewage sludge incineration at EGLV, a SSA related P-recovery is focused on

Which?

Wet-chemical processes to produce P-Acid and usable by-products, but modified incineration processes to produce SSA with fertilising value are also looked at

Where?

Own operating sites are preferred, but suitable external sites are also considered

How?

By our own, possibly as subsidiary, but suitable provider for outsourcing are also considered



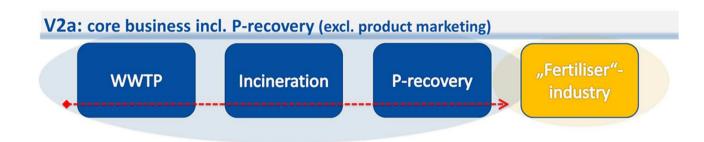


### Strategical options

## **THREE OPTIONS**







1st Option

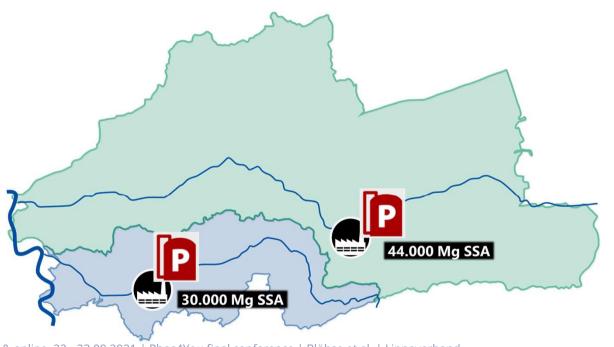
## WE MAKE IT OURSELVES

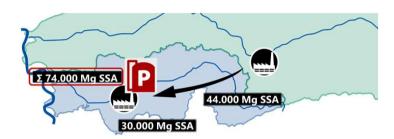


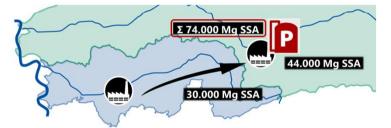


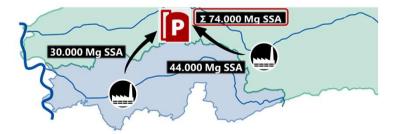
# 1<sup>st</sup> Option – Implement in core business Various locations possible

More than two options for location









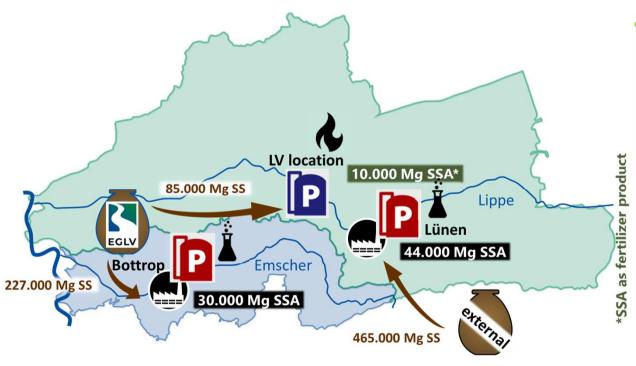




# 1<sup>st</sup> Option – Implement in core business

### **Different technologies**

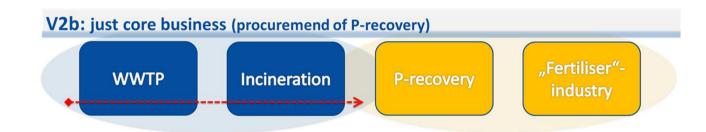
Possible implementation for EuPhoRe®-Technology



 Current modernisation with high investments do condition the conversion to an alternative combustion technology only in the longterm







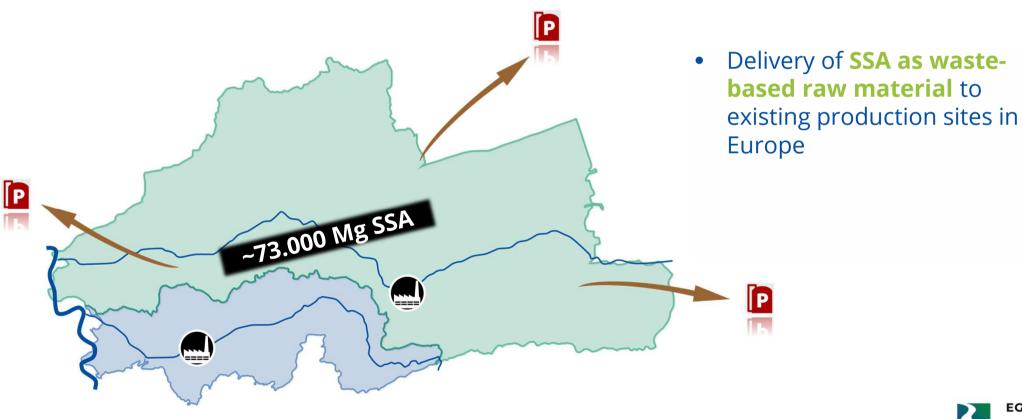
2<sup>nd</sup> Option

## **OUTSOURCING**





# 2<sup>nd</sup> Option - Outsourcing







2<sup>nd</sup> Option – Outsourcing

Use of inland harbour

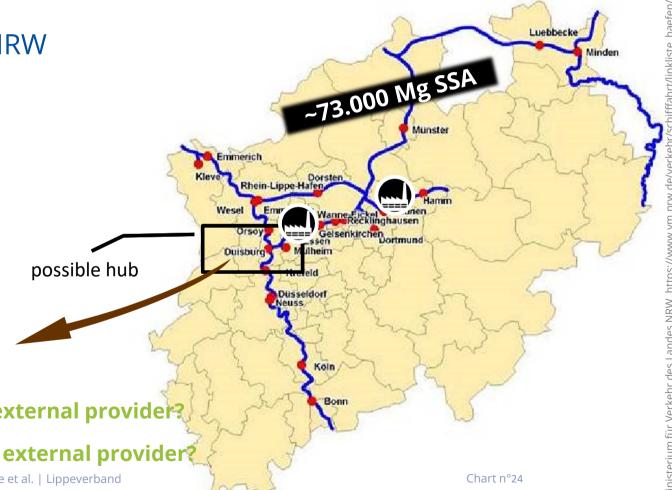
- Infrastructure waterway NRW
- Ship transport
- International stakeholder
  - YARA Norway
  - PRAYON Belgium
  - Elixir Group Serbia
  - ICL Netherlands
  - Fertiberia Spain

# **Transport and storage?**

Conditions at the plant of the external provider?

SSA-requirements of external provider?

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## FAQ - KEYWORDS

- Transport options
  - Truck
  - Train
  - Ship
- Storage/handling warehouse
  - Required investment
  - Available areas
- Notification (hazardous waste)
  - Effort (time/human ressources)
  - Fee
  - surety/liability risks

# **2<sup>nd</sup> Option – Outsourcing Conditions and requirements**

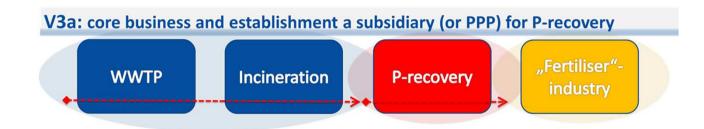
- State of the art
  - Purchase capacity (tonnes SSA)
  - Ecological aspects Disposal of wastewater and ash residues
  - All required permits (acceptance of harzadous waste)
  - Quality of SSA (low P/Impurities)
  - Infrastructure for transport/storage
- Gate fee
  - Stable prices
  - Contract terms



- Certificates
  - Of P recovery: acceptability for e.g. German authority







3<sup>rd</sup> Option

## WE DO IT IN COOPERATION





30.000 Mg SSA

# **3rd Option – Cooperation**

**Concept AMPHORE** 



5 years

regional SSA-based approach / large-scale technology implementation

- 5 waterboards
- 5 incinerators
- approx. 120.000 Mg SSA/a



44.000 Mg SSA







Bundesministerium für Bildung und Forschung

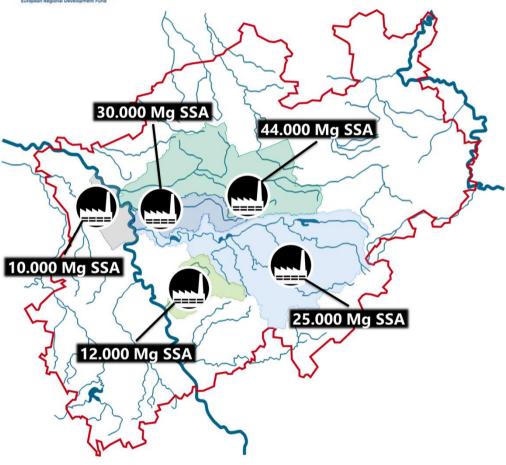
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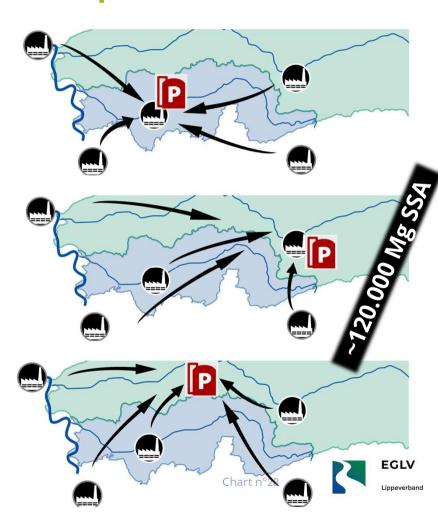


# **3rd Option – Cooperation**

## **Various locations possible**



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# **3rd Option – Cooperation Material flow management**

Challenge of a centralized approach

Goods in transit	Factor per Mg SSA <sup>a</sup>	Capacity of P-recovery plant			
SSA*	1.0	30,000	70,000	120,000	
Chemical-demand	0.5 - 1.5	15,000-45,000	35,000-105,000	60,000-180,000	Mg/a
H <sub>3</sub> PO <sub>4</sub> (75 %)	0.2	6,000	14,000	24,000	
Ca-Byproduct	0.3 - 0.4	9,000-12,000	21,000-28,000	36,000-48,000	
Fe/Al-Byproduct	1.0 - 2.0	30,000-60,000	70,000-140,000	120,000-240,000	
Residues	1.0 - 1.2	30,000-36,000	70,000-84,000	120,000-144,000	
Total (min-max)	2.5 - 3.8	120,000-189,000	280,000-441,000	636,000-756,000	

\*minus the SSA arising at the location of the P-recover plant



# 3<sup>rd</sup> Option – Cooperation Logistic aspects (1)

- Phos4You-logistics study
  - Approach
    - Implementation of alternative transport via ship and/or train
    - Calculation of transport costs and emission
      - Supply, labor, and energy costs
    - Estimation of costs for infra- and superstructure
    - Consideration of different locations
      - Two operation sites of (EG Bottrop/Innovatherm Lünen)
      - Three external (2 different chemical parks, 1 industrial area chemical wholesaler)











# 3<sup>rd</sup> Option – Cooperation Logistic aspects (2)

North-West Europe
Phos4You

- Phos4You-logistics study
  - Results



- Relatively short distance for train and barge
- **Transport costs** are 1.8 to 2.8 (2.0 to 3.1 economically) times **higher for truck** transport than for optimal transport.



- **Emission costs** are 2.6 to 3.9 times **higher for truck** transport than for optimal transport.
  - Transports by rail and inland waterway are cheaper and possible, despite the short distances, with sufficient storage capacity on site.



Investements for infra- and superstructure are estimated between 20 and 30 Mio. €





# **3rd Option – Cooperation Location aspects**

- Phos4You-logistics study
  - Criteria catalogue for assessment of location
    - Land availability
    - Right of approval
    - Modality
    - Investment needs
    - Logistics costs
    - Other location factors
      - Suppliers/customers on site/or not
      - Disposal or utilisation opportunities on site/or not
      - Energy surplus (electricity/heat) on site/or not
  - various advantages and disadvantages all sites can be considered further













### Strategical options

# **SUMMARY**



## **Summary**



- 1st Option In-house
  - Directly implementable, but P recovery is not expected to be costcovering and technology readiness is still "low"
- 2<sup>nd</sup> Option Outsourcing
  - High provider engagement is required and there are a lot of open questions which are investigate
- 3<sup>rd</sup> Option Cooperation
  - Joint cooperation provides many possible synergies, but also challenges. Investigation started with new project AMPHORE





### Conclusion

## P-RECOVERY IN 2029





# **Conclusion** P-recovery 2029

### **Strengths**

- EGLV & subsidiaries are broadly positioned with their activities
- Technical solutions are identified
- Good networking with stakeholders at national and international level

### **Opportunities**

- Potential for process optimization exists
- High willingness from the stakeholders to engage into collaboration





# **Conclusion** P-recovery 2029

#### Weakness

 Suboptimal technology readiness and market availability as well as diversity

#### **Risks**

- Time horizon until 2029
- The presumably high costs have a strong influence on the development of the fees of our citizens/members

### **Further action**

- Continue to track and promote technology development
- Evaluate detailed aspects of implementation (location/logistics/customers/suppliers)
- The strategic options must be regularly reviewed and adjusted in the case of new developments





# Many thanks to all the partners, stakeholders, suppliers & consultants













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





















