



Funding Measure of the German  
Federal Ministry of Education and  
Research (BMBF)

# Regional Phosphorus Recycling

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## Funding Measure of the German Federal Ministry of Education and Research (BMBF)

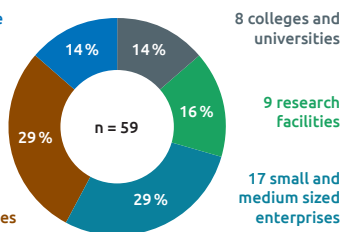
- » Development and implementation of innovative economical solutions for Recycling and sewage sludge utilization
- » Secondary phosphorus for agricultural and industrial use from the circular economy
- » Contribution to the implementation of the amended Sewage Sludge Ordinance (AbfKlärV)
- » Large-scale implementation of various P-recovery technologies

### Key figures of the implementation stage

- » Years of funding: 5–6 years (start: July 1, 2020)
- » Number of joint projects: 7
- » Funded affiliated partners: 59
- » Funding volume: appr. 32 Mio. €

10 large-scale enterprises

15 public institutions and enterprises



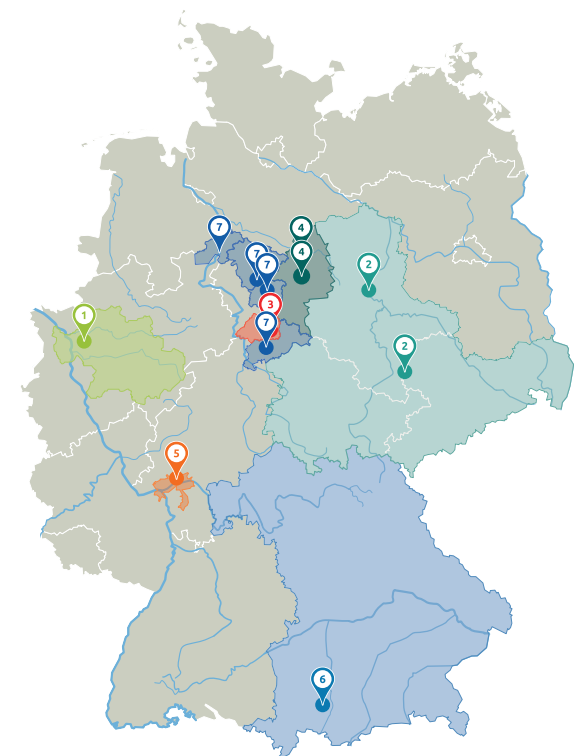
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## TransPhoR – Networking and Transfer Project on Regional Phosphorus Recycling

- » Analysis and synthesis of the results from individual joint projects
- » Press and public relations
- » Coordination of network activities and overarching technical issues, e.g., legal issues and product requirements
- » Further development of standardized test methods and criteria for P-recycles
- » Development of a catalogue of criteria for a comparative assessment of Life Cycle Criteria and economic feasibility
- » Presenting recommendations for action and implementable solutions



# Overview of Joint Projects Study Sites



- 1 **AMPHORE:** Regional sewage sludge and ash management for phosphorus recycling for a conurbation  
Bottrop
- 2 **DreiSATS:** Technology demonstration for the combination of dust firing and acid digestion granulation with integrated heavy metal separation for regional phosphorus recycling in the “Middle German border triangle” of Saxony-Anhalt, Thuringia and Saxony  
Magdeburg, Markranstädt
- 3 **KlimaPhoNds:** Climate-neutral and residue-free sewage sludge utilization with phosphoric acid production in southeast Lower Saxony  
Northeim
- 4 **P-Net:** Establishing a network for resource-efficient phosphorus recycling and management in the region “Harz und Heide” in Northern Germany  
Gifhorn, Braunschweig
- 5 **RePhoRM:** Regional phosphorus recycling in the Rhine-Main area under consideration of industrial and agricultural material cycles  
Frankfurt am Main – Höchst
- 6 **R-Rhenania:** Modified Rhenania phosphate from sewage sludge ash for Bavaria  
Altenstadt
- 7 **SATELLITE:** Process technologies in the main and satellite operation of an inter-communal recycling center to maximize the return of phosphorus to regional agriculture  
Hildesheim, Pattensen, district Nienburg, Göttingen

## 1 AMPHORE



- » Development of a decision basis for a regional concept of sewage sludge disposal with phosphorus recycling
- » Establishment of regional utilization and marketing structures for the phosphorus product as well as other by-products and the use of residues
- » **Technology:** large-scale demonstration of a wet-chemical phosphorus recovery from sewage sludge ashes (PARFORCE process)
- » **Product:** phosphoric acid

## 2 DreiSATS



- » Decentralized thermal sewage sludge utilization by dust firing (by Carbotechnik)
- » Production of fertilizer granulate
- » Development of a GIS-based software tool for the planning of an economical, regional P-recycling-concept
- » **Technology:** Pontes Pabuli process
- » **Product:** Fertilizer

## 3 KlimaPhoNds



- » Technical and economic proof of:
  - P-Recovery in compliance with legal requirements
  - Multiple resource efficiency on the way towards zero emission sewage sludge recycling
- » Compliance with required product qualities for the recycling of phosphoric acid, ammonia water and magnesium chloride
- » **Technology:** bio-P elimination from sludge water
- » **Product:** MAP-fertilizer

## 4 P-Net



- » Process engineering production and use of P recyclates (struvite)
- » Establishment of a regional cluster for P-Recycling
- » Optimization of existing struvite plant
- » **Technology:** biological P remobilization from excess sludge
- » **Product:** MAP-fertilizer

## 5 RePhoRM



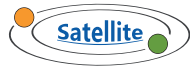
- » Implementation of technological as well as organizational collaborative solution for P-Recycling in the Rhine-Main area
- » Large-scale implementation of the further developed PHOS4green technology
- » Production of fertilizer granulate
- » **Technology:** PHOS4green technology
- » **Product:** Fertilizer

## 6 R-Rhenania



- » Construction and operation of a full-scale demonstration plant for 37,500 t sewage sludge per year
- » Pot and field trials in organic farming to determine the P-fertilization effect
- » **Technology:** thermochemical process
- » **Product:** Fertilizer

## 7 SATELLITE



- » Adjustment of phosphorus recovery processes upstream and downstream of wastewater and sludge treatment in municipal wastewater treatment plants and regional nutrient management
- » Development of software-based tools for strategic investment planning and smart operation to create plant engineering synergies for the whole system
- » Apart from phosphorus, inclusion of nitrogen as a resource in process selection and regional nutrient management concept
- » Process testing and evaluation for individual locations of wastewater treatment plant and a model region (district of Nienburg/Weser), taking into account economic and ecological indicators
- » Technology: intelligent decision support (plant-specific, scenario-based, flexible)
- » Result: Concept of nutrient recycling for strongly agricultural regions and methodological approach and implementation of strategic planning in the network



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