



P-REX

Fostering phosphorus recovery and recycling from sewage sludge

- Opportunities for Europe -

Dr. Christian Kabbe

*EC DG R&I / ESPP/ P-REX workshop on
„Circular approaches to phosphorus: from research to deployment“*

PHOSPHORUS RECYCLING
FROM PROTOTYPE TO MARKET



KOMPETENZZENTRUM
WasserBerlin

www.p-rex.eu

**Knowing is not enough, we must apply!
Willing is not enough, we must do!**

Johann Wolfgang von Goethe

FACTSHEET

Instrument:

FP7, Collaborative Project

Total Cost: 4,359,684 €

EC Contribution: 2,888,560 €

Duration: 36 months

Start Date: 1/9/2012

Consortium:

15 partners from 7 countries

Project Coordinator:

Dr. Christian Kabbe

Kompetenzzentrum Wasser Berlin
gGmbH (Germany)


Project Web Site:


www.p-rex.eu

PROJECT PARTNERS

Kompetenzzentrum Wasser Berlin gGmbH	DE
Fachhochschule Nordwestschweiz	CH
BAM – Bundesanstalt für Materialforschung und -prüfung	DE
IASP – Institut für Agrar- und Stadtökologische Projekte an der Humboldt Universität zu Berlin	DE
Veolia Eau	FR
Outotec (Finland) Oy	FI
Agro Plus Handelsunternehmen eU	AT
BSH Umweltservice AG	CH
Ingitec GmbH	DE
LimCo International GmbH	DE
Proman Management GmbH	AT
ASIO, spol.s r.o.	CZ
Solintel M&P, S.L.	ES
P.C.S. Pollution Control Service GmbH	DE
PFI Planungsgemeinschaft GbR	DE

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Invited additional technology providers ...

- **Demonstration** and systematic validation of technical processes
 - Systematic **assessment** and validation of the quality of recovered materials with regards to plant availability of phosphorus and ecotoxicity
 - Analysis of **market barriers** and **market potential** for novel recycling technology and recycling products
 - Development of strategies and recommendations for efficient and **wide-spread phosphorus recovery** and market penetration from the wastewater stream with regards to specific regional conditions -> **policy brief, guidance document**
- 
- **EU-wide implementation of P recovery/recycling from wastewater stream with respect to regional conditions and demands**

Sludge/
Sludge water

Full-scale

Full-scale
(planned)

Pilot (planned)

PEARL
Struvite



NuReSys
Struvite



Crystallization
Struvite



AirPrex
Struvite



LYSOGEST
Struvite

Struvite



PHOSPAQ
Struvite

Struvite

Struvite

FIX-PHOS
CaP/Ca

Struvite

ANPHOS
Struvite

Struvite

Struvite



Stuttgart
Struvite



Struvite

Sludge

Thermal

LEACHPHOS
P-mineral



Fertilizer Industry
Mineral fertilizer

P-bac (INOCRE)
Bio-P

ECOPHOS
DCP



TetraPhos
H₃PO₄

RECOPHOS DE
MCP

MEPHREC
P-slag



AshDec (Outotec)
P-mineral



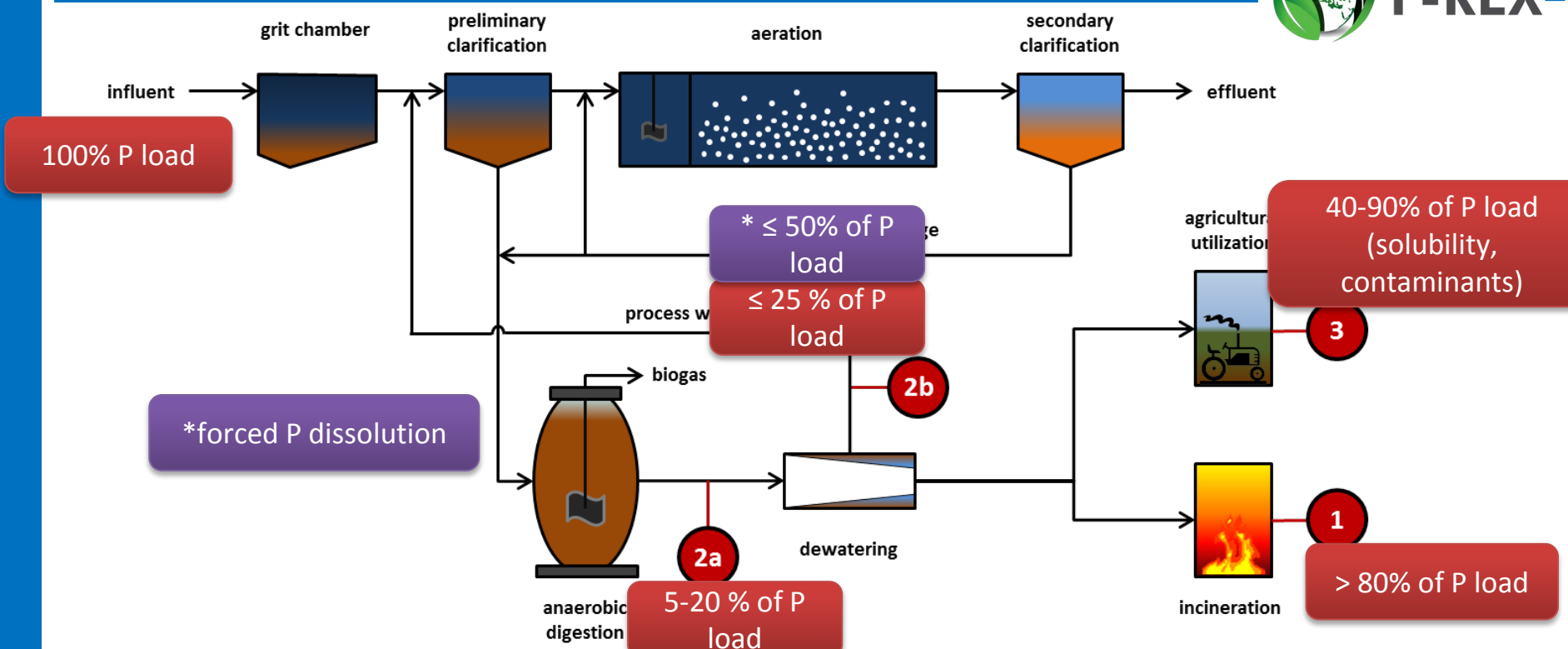
THERMPHOS
P₄

RECOPHOS FP7
H₃PO₄

KUBOTA
P-slag

It's not the number and variety of technologies that counts! It's their applicability!

Hot spots for P recovery from municipal wastewater



- 1 ash after incineration
- 2a undrained sludge after anaerobic digestion
- 2b sludge liquor after dewatering
- 3 direct agricultural utilisation of dewatered sludge

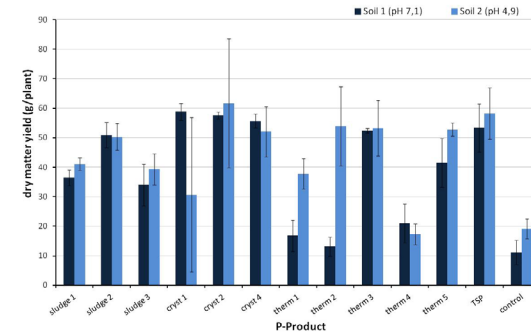
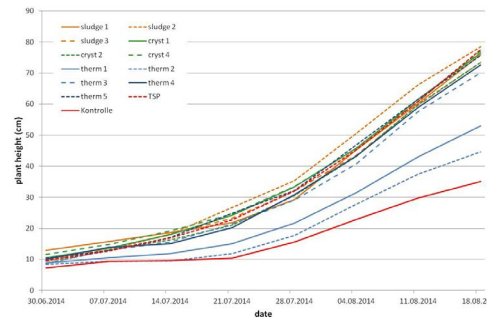
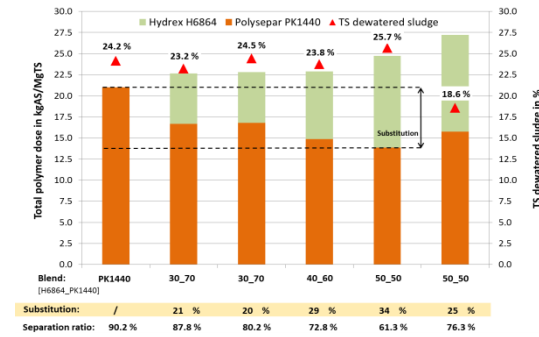
Note:
Difference between precipitation/crystallization and actual separation/harvest

- Assessments based on first-hand technology data with high reliability and plausibility (Ds 1.1-5.1) + process factsheets
 - Quantitative risk assessment for product application (D9.1), LCA (D9.2), LCC (D10.1)

- Sludge safety -> less harmful chemicals for treatment (details D 6.1)

- “Product” quality analysed within project (D8.1)
 - Fertilizing efficiency (pot and field tests)
 - Chemical analyses (heavy metals and organic pollutants)
 - Eco-toxicity tests

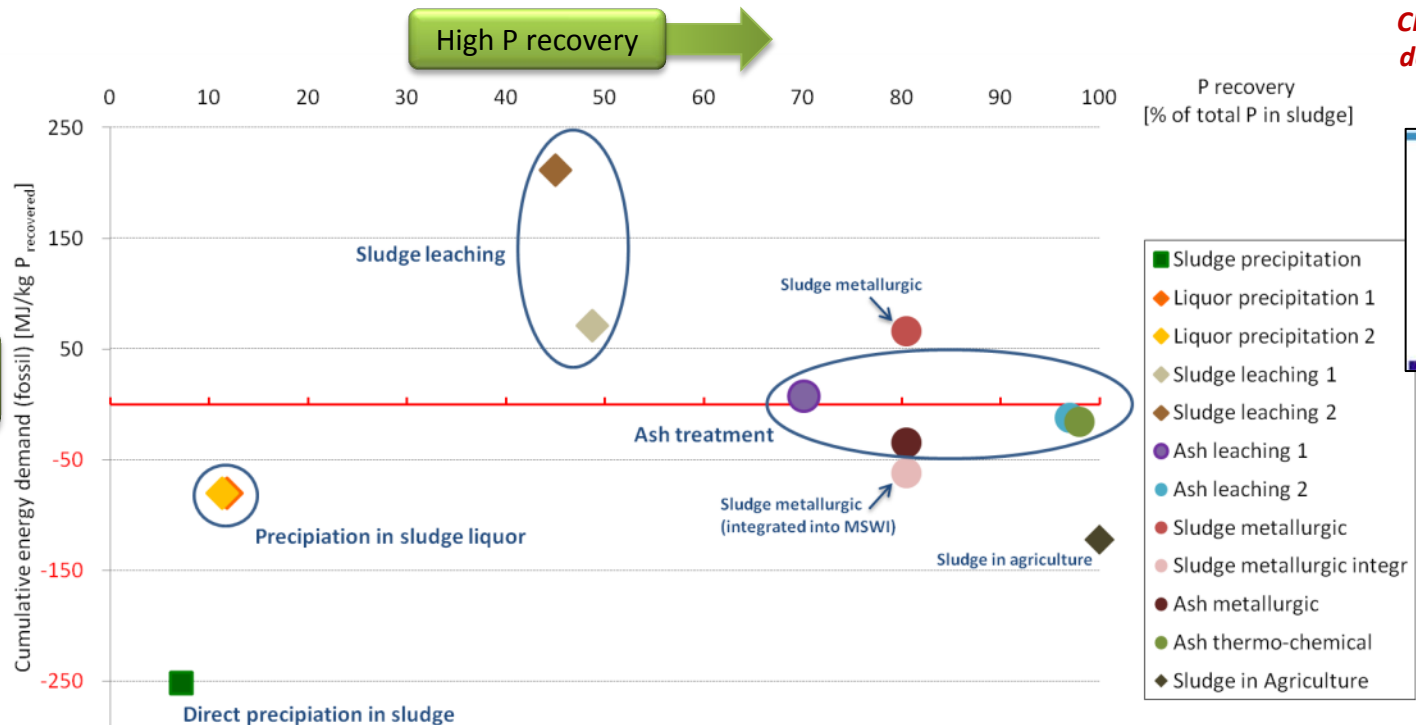
- Guidance document for safe sludge monitoring (D7.1)



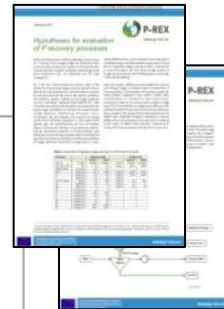
Environmental assessment of P recovery processes with Life Cycle Assessment



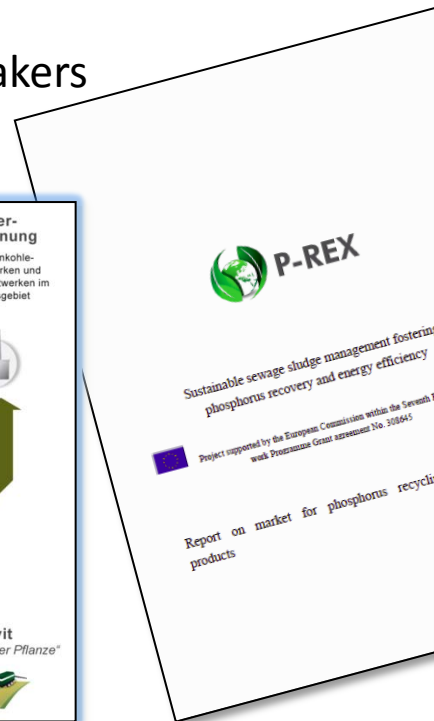
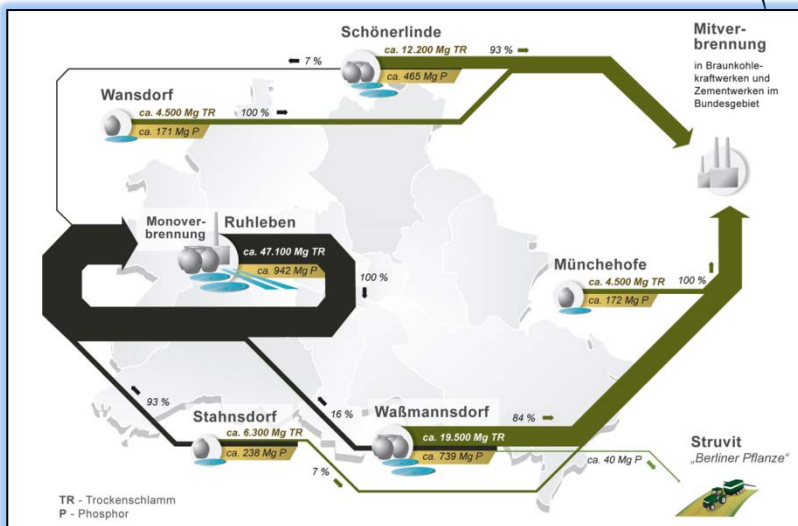
- Full LCA (ISO 14040/44) of all P recovery processes assessed in P-REX
- Input data transferred to reference model (1 Mio pe WWTP sludge line + mono-inc)
- Evaluation with selected environmental indicators (energy demand, global warming, eutrophication, resource depletion, human/ecotoxicity)



Check ref model + data in the P-REX fact sheets!



- P fertilizer market structures and potentials (D11.1)
- Legal framework affecting P recovery and recycling on EU and selected regional level (D11.2)
- Regional scenarios for tailor made implementation (existing infrastructure and P quantities in wastewater /sludge/ash), disposal and valorization cost
- Recommendations for decision makers (D11.3 and D12.1)



PHOSPHORUS RECYCLING - NOW!

Building on full-scale practical experiences to tap the potential in European municipal wastewater

EXECUTIVE SUMMARY

Phosphorus is a non-substitutable raw material whose availability has been identified as a globally relevant bottleneck for fertiliser and food supply. Europe has an import dependency above 90% with regards to mineral phosphorus. As a consequence, phosphate rock was declared a critical raw material by the European commission in 2014. At the same time, a quantity equalling 15% of Europe's mineral phosphorus demand is being wasted as disposed sewage sludge and its ashes. Technologies enabling phosphorus recovery from the wastewater stream have developed tremendously in the past few years and are able to overcome limitations to direct sewage sludge application on arable land. Several technologies are already proven in industrial scale recovering plant available phosphorus. Still, extensive phosphorus recovery, enabling efficient recycling of the valuable resource on European scale is yet to be established.

Legal, societal and market barriers stand against the environmental and supply security reason. The pre-defined responsibility for wastewater treatment is nutrient removal, and not their recovery and recycling. Therefore investments for phosphorus recovery are hampered. The scope of the current legal framework of the European Union fits focuses on traditional mineral and organic, rather than recovered mineral, nutrient sources. Contradictory interpretations of European legislation by member states cause confusion, hampering the recycling of phosphorus-containing materials. A harmonised and reliable European quality control framework is needed to increase stakeholder and consumer confidence in materials containing recycled phosphorus.

Phosphorus is already recycled in organic form at regional level, through application of high quality sludge (conventional recycling). This is complemented by mineral phosphorus from fossil (primary) sources, mostly non-European. This fossil phosphorus must be complemented by recovered (secondary) sources. Technical recovery and recycling from the wastewater stream can:

- triple the European mineral phosphorus supply from 8% to 23%.
- provide phosphorus in marketable quality
- convert the nutrient in stable, transportable and storable form and so enable distribution and storage to match the regional and seasonal demand of agriculture
- safeguard the soils against pollution and pathogens
- recycle phosphorus with an annual cost of less than 5€ per capita (i.e. less than 5% of wastewater treatment cost)

Mineral phosphorus recycling not only saves jobs in Europe, it creates additional green jobs and industries with high export potential.

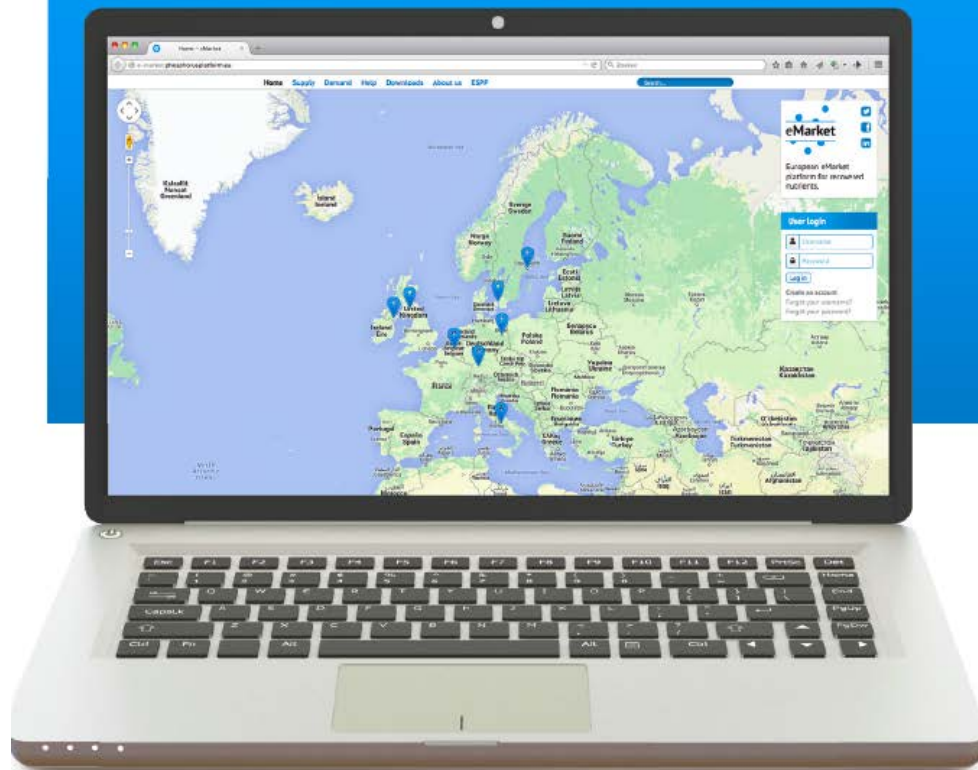
P-REX Policy Brief
"Phosphorus recycling - Now!" represents the views of the 15 partners in the practice-driven P-REX consortium. The policy brief was edited by Sirja Huuani (PHNW), Anders Håltorp (PHNW) and Christian Kahlbe (KWB). The company-related information has been validated by the company representatives and the content reviewed by the expert advisory board of the P-REX project, including representatives of the European Sustainable Phosphorus Platform (ESPP).

P-REX

- Match making between Supply und Demand -> Bridging the gap!

eMarket Marketplace for recovered nutrients

Think forward, act circular



e-market.phosphorusplatform.eu

- EU FP7 project Sep 2012 – Aug 2015

CZ: <http://vimeo.com/84936506>

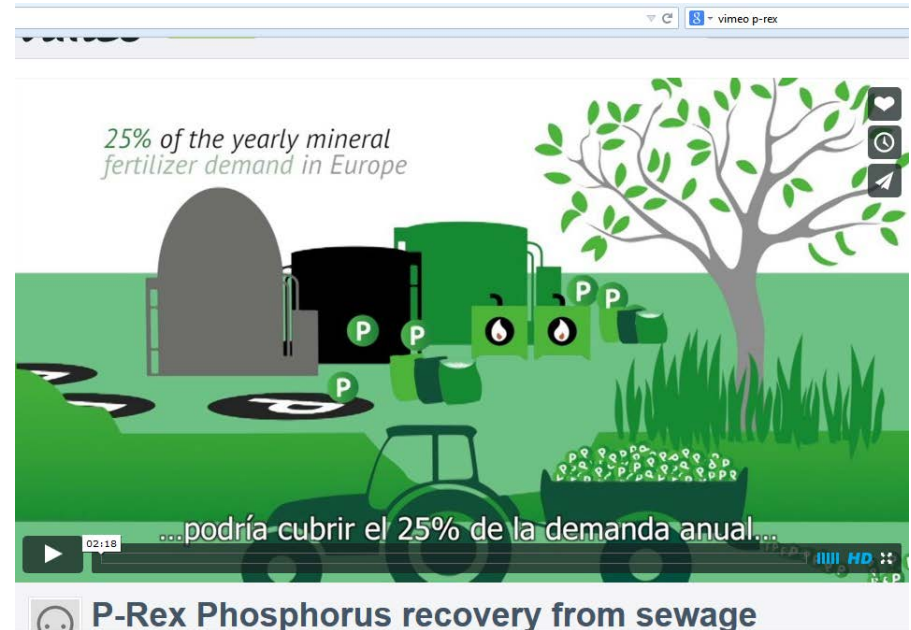
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SE: <http://vimeo.com/84936512>



Overview: <http://vimeo.com/user22393541/videos>



P-REX

**Want more ...
... details, results, inspiration?**

Join us at the
P-REX final workshop

**11 June 2015
in Amsterdam**

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