



**P-REX**

# **General P recovery and recycling implementation aspects**

**Policy briefing, pre-normative matrix and eMarket**

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**Amsterdam, 11 June 2015**

**PHOSPHORUS RECYCLING**  
FROM PROTOTYPE TO MARKET



**n | w**

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[www.p-rex.eu](http://www.p-rex.eu)



## Context:

# What would change if... phosphorus from wastewater stream was recovered?

**Today**

- 5-7 large industrial phosphorus fertiliser producers control the market
- > 50'000 tP/a
- identical starting materials (P-rock)
- dependent on import (92%)
- starting and end – materials are products



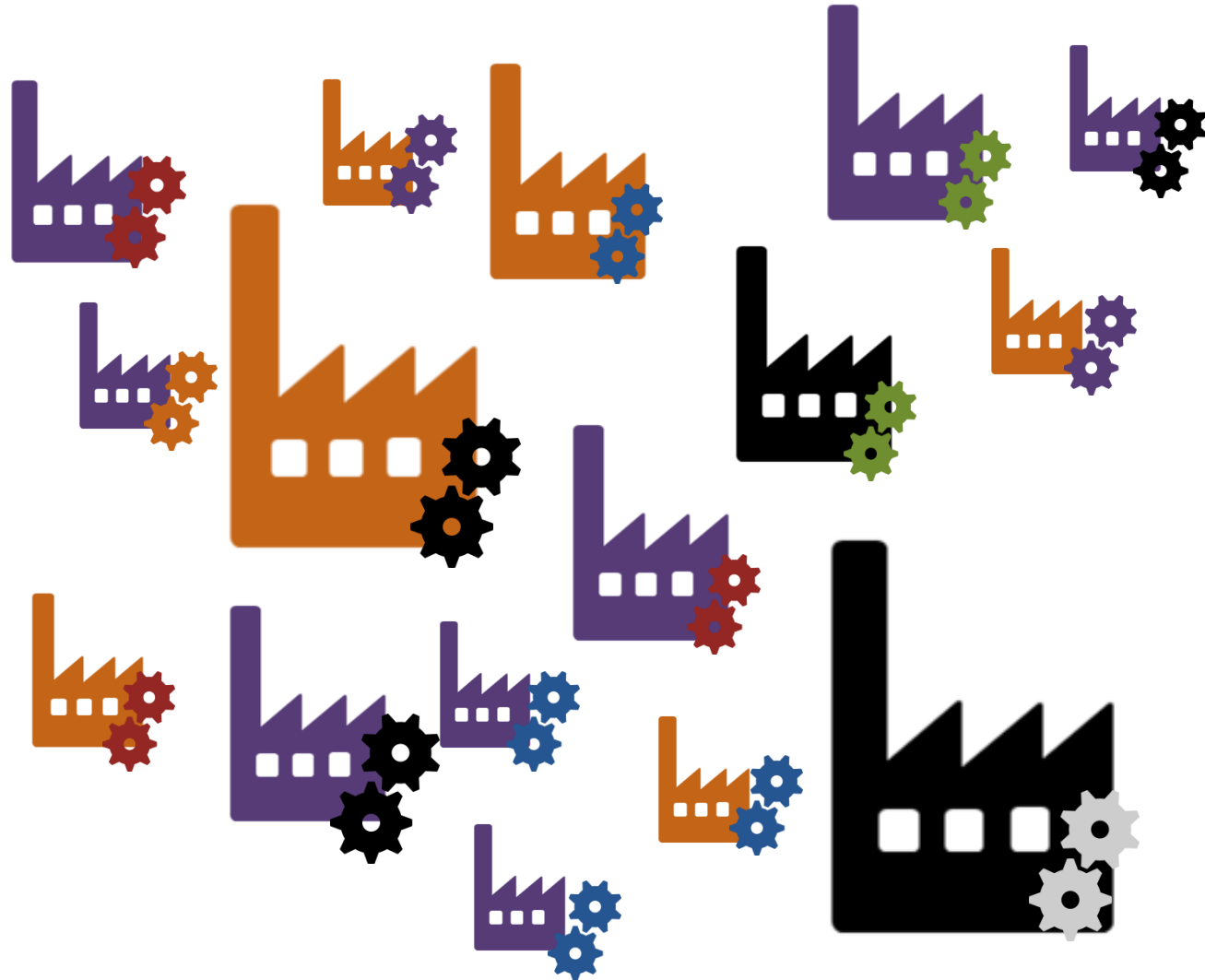


## Context:

# What would change if... phosphorus from wastewater stream was recovered?

### Tomorrow

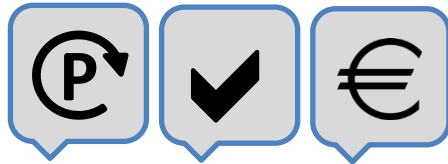
- hundreds of small production plants
- 50 - 5'000 tP/a
- WWTP, technology start-ups, fertiliser industry
- Different starting materials (sludge, ash, other)
- several different processes
- starting (and end) materials with waste status





# Content:

## What can we do to facilitate the change?



### 1. Pre-normative matrix

- How to identify suitable product quality categories for a recovered P market?



### 2. eMarket

- How to match the supply and demand of recovered P?

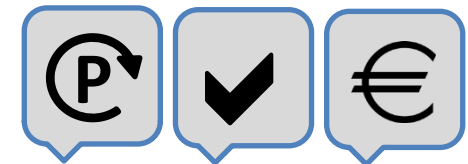


### 3. Policy brief

- How to lower the current market and legal barriers for P recovery?

## Pre-normative matrix

- **Quality** and **price** of recovered materials were compared with the requirements of the
  - fertilizer, feed and technical markets
- **Aims**
  - first step towards identifying suitable categories for recovered phosphorus
  - communicating quality-price relationships to the buyers and sellers of recovered materials
    - **facilitate production and use of secondary phosphorus**



# Pre-normative matrix: Evaluation

## Recovered / recycled materials

Sewage sludge

Sludge ash

Struvite

Treated  
sewage sludge  
ash

Reference market segments

**Feed**

(2003/100/EC)  
(W. Schipper 2013)

**Other non-  
food uses**

(W. Schipper 2013)

**Fertiliser**

(German f  
regul

**No EU  
criteria!**

<b>Quality:</b> heavy metal and organic contaminant limit values	++ All requirements met - All but one requirement met -- Several requirements not met
<b>Quality:</b> nutrient concentration	Measured <b>concentrations</b> for several macro and micro nutrients in comparison to TSP
<b>Quality:</b> Plant availability in comparison to TSP	+ (good) ≥ 80 % 0 (limited) 50-80 % - (poor) 0-50% P-solubility in NAC and H2O or RFE in comparison to TSP
(disposal) Price	€/t P



**Market segments**

Fert.	Feed	Non-food	Sewage sludge		Sludge ash		Struvite		Treated sewage sludge ash		
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Limits (mg/kg)		min	max	min	max	min	max	A	B	C
<b>Feed</b>	As < 10; F < 2000 and other limits	--		--		--		--	--	--
<b>Non-food</b>	Fe, Mg, Ca, Al: 10 to 300	--		--		--		--	--	--
<b>Fertiliser</b>	As < 40; Pb < 150; Cd < 50 (mg/kg P <sub>2</sub> O <sub>5</sub> );	- <sup>7</sup>		- <sup>7</sup>	++ <sup>7</sup>	++	++	++	++ <sup>7</sup>	++ <sup>7</sup>
Inorganic contaminants	Cr(VI) < 2; Ni < 80; Hg < 1; TI < 1									
Organic contaminants	Perfluorinated tensides < 1; I-TE dioxins and dl-PCB < 20 ng-WHO TEQ	++		- <sup>8</sup>	- <sup>8</sup>	++	++	9	9	9

Nutrients (%)		TSP									
P (phosphorus)	23	3	4	10	10	14	12	6	4		
K (potassium)	1	0	0	1	0	2	0	1	1		
N (nitrogen)	0	6	0	0	5	5	0	0	0		
Mg (magnesium)	1	0	1	2	8	11	1	1	2		
Ca (calcium)	19	3	5	24	0	1	22	10	24		
S (sulphur)	1	2	0	2	0	1	7	1	0		

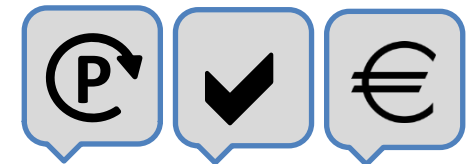
P Plant availability										
P plant availability in pot tests (1 yr)	+	0	+	-	0	+	+	+	-	
Solubility in Water	+	-	-	-	-	-	-	-	-	
Solubility in neutral Ammoniumcitrate	+	+	+	-	+	+	+	+	-	

Price range (Euro/to P; delivered)										
Market price range	Rock (14% P) 400 -1500 (500) TSP (20% P) 800 - 2100	DCP (25% P) 2000 <sup>11</sup>	H <sub>3</sub> PO <sub>4</sub> (8% P) 2000 - 3000 <sup>12</sup>	-2000 to -9000 <sup>13</sup>	-1000 <sup>14</sup>	300 - 1000 (Niches up to 6000) <sup>15</sup>	"Rock" (14% P) 850 - 1100 DSP (16% P) 1200 - 1600 <sup>16</sup>	not known	700 - 1700 <sup>17</sup>	



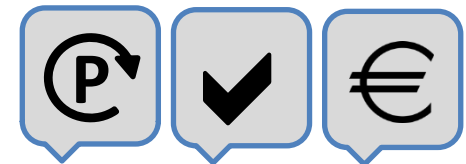
# Pre-normative matrix - Conclusions

- **Quality**
  - recycled materials comply with the current legal requirements for fertilizers in Germany
  - all but one can be evaluated as plant available
  - the phosphorus concentrations are in the range of phosphorus rock or sewage sludge ash, somewhat lower than conventional fertilizers
- **Price**
  - The offered and projected price ranges for recycled mineral phosphorus-containing materials are largely in line with those in the fertilizer market and dependent on grade and plant availability
  - Higher prices could be obtained for phosphorus for feed and other non-food uses, but most recycled materials do not fulfill the more stringent technical and legal requirements for these markets.



## Pre-Normative Matrix - Conclusions

- The matrix can be further detailed and updated
  - to serve as an orientation on price-quality relationships for recyclers and customers.
  - to direct process development and sourcing of recovered phosphorus
- For legislation on quality categories much more detailed discussions of are necessary. These are under way in the frame of the fertilizer regulation recast.



# Content:

## What can we do to facilitate the change?



### 1. Pre-normative matrix

- How to identify suitable product quality categories for a recovered P market?



### 2. eMarket

- How to match the supply and demand of recovered P?



### 3. Policy brief

- How to lower the current market and legal barriers for P recovery?

## eMarket

- “Matching platform” between supply and demand of recycled P
- Aim: to facilitate the market development for recovered nutrients
- non-commercial platform
- Use and participation are free of charge with information/content given on voluntarily base
- incorporated to the website of the European Sustainable Phosphorus Platform (ESPP)



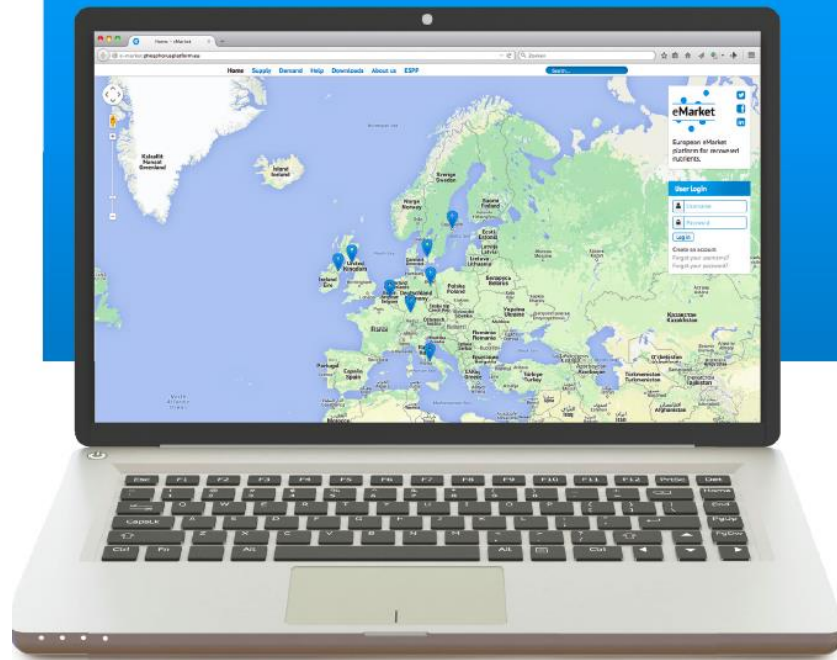


# eMarket

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

eMarket Marketplace for recovered nutrients

## Think forward, act circular



e-market.phosphorusplatform.eu

<https://vimeo.com/121140168>



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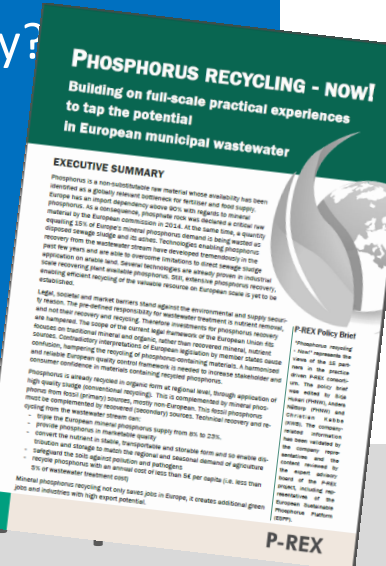
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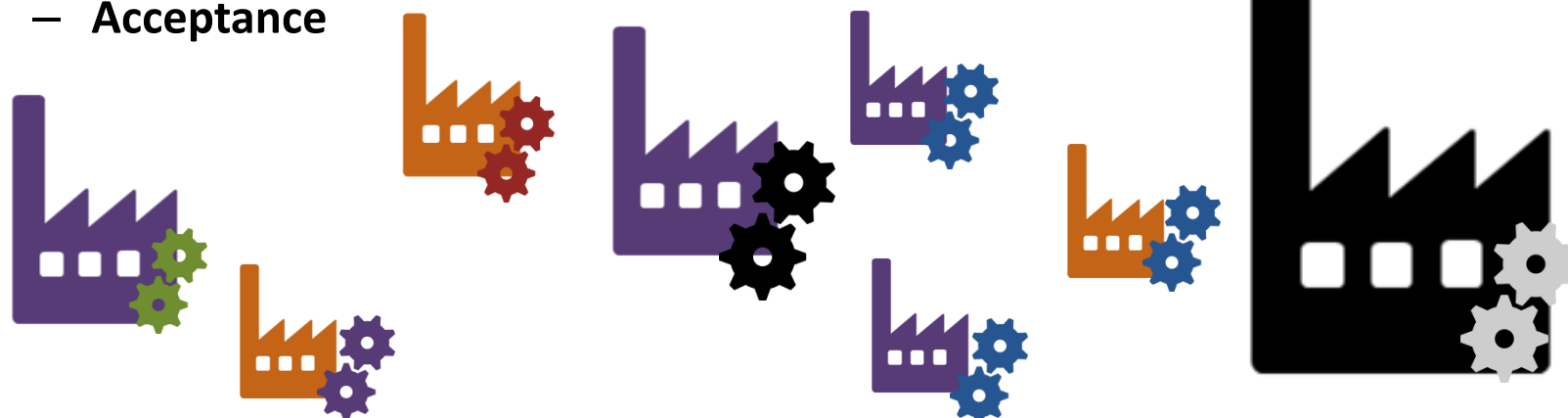
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## Policy brief: Starting point

- Several technologies for P-recovery are already ready for implementation
- **But challenges remain:**
  - **Market access**, if fertilisers not key business
  - **Legal obligations** extensive (Waste Framework directive, REACH, Fertilisers Regulation), but interpretation varies!
  - Narrow definitions for fertilisers
  - **Economies of scale**
  - **Acceptance**



## Why?

### Long-term advantages of recycling efforts:

- supply security
- internalized environmental costs
  - not accounted for in market-based decision-making

### Needed:

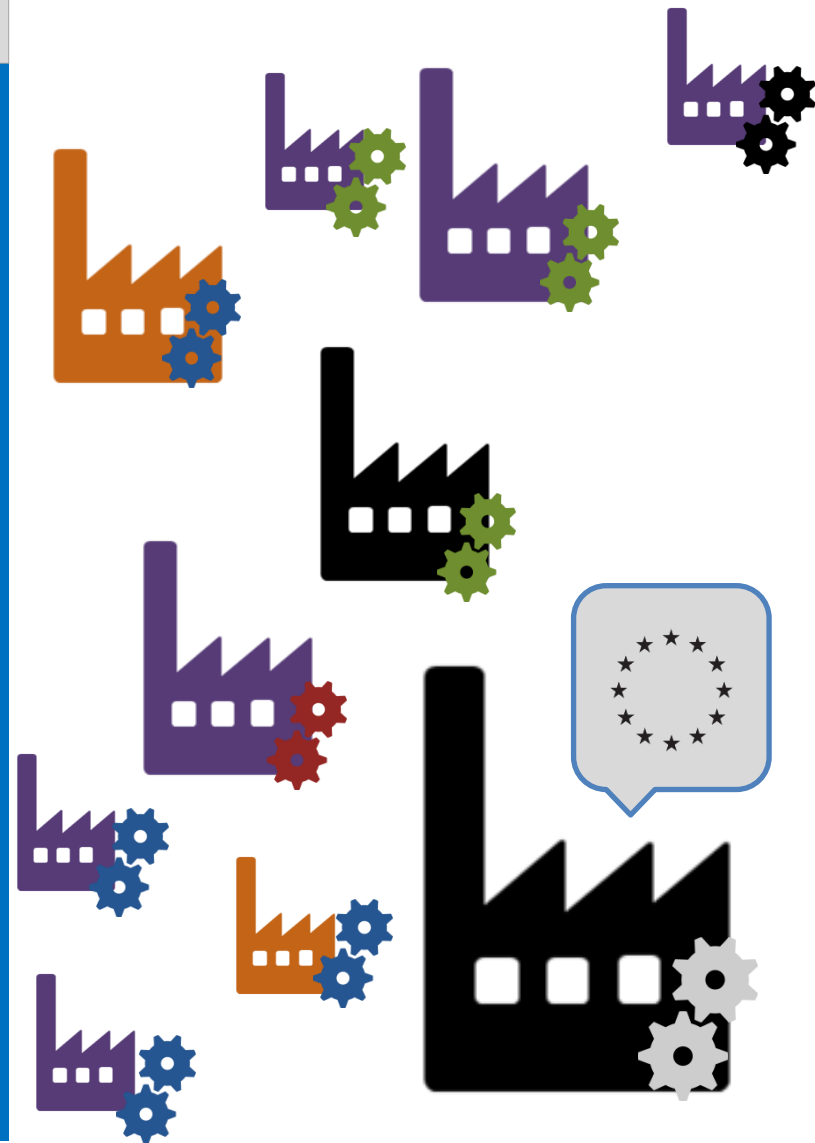
- Market drivers, long-term stability of the legal environment
- Systemic change from exclusive use of fossil P to a mix of fossil & recovered P

→ **New market players and investments**

## Policy Message 1

**Realistic and reliable European phosphorus recovery target, especially from wastewater.**

It should be combined with a **European overall road map** and defining Best Available Technologies for phosphorus recovery and recycling.



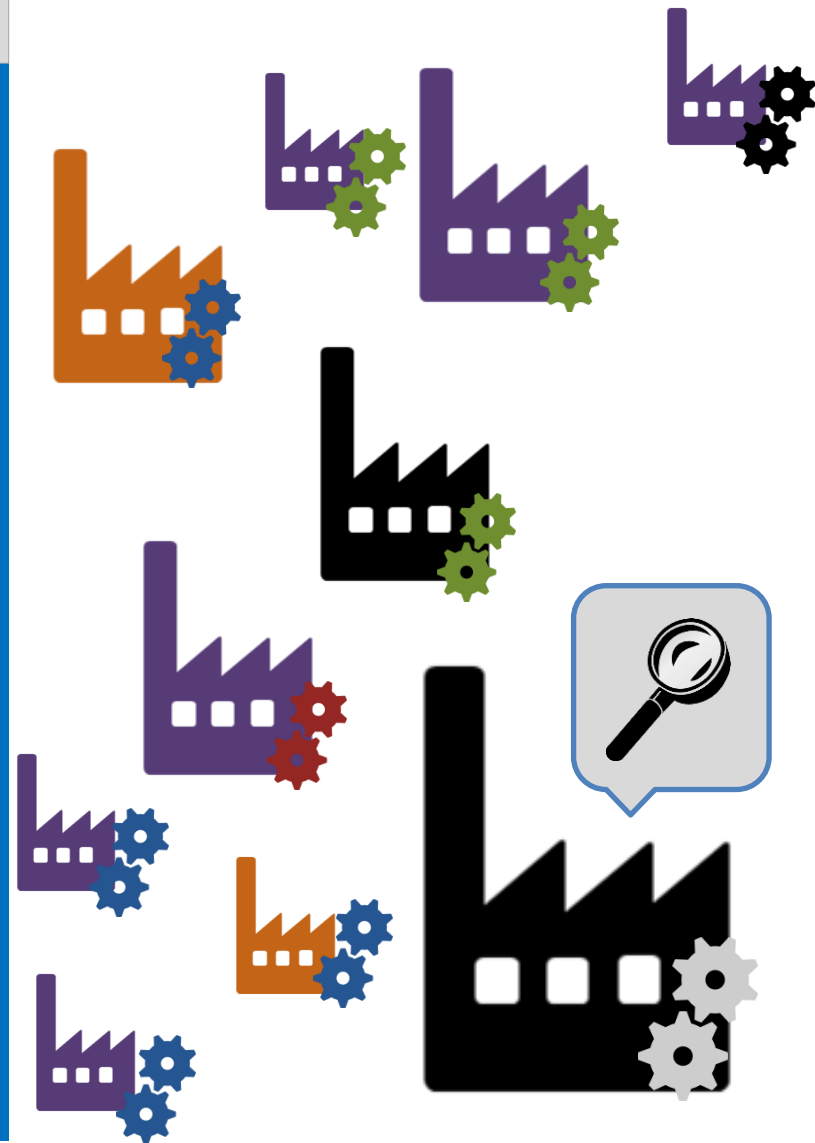


## Why?

- Infrastructure, logistic, demand differences
- National coordination for efficiency
  - Synergies with existing EPBR or mono-incineration
  - Sludge management (raw material supply) optimisation
- Treatment train steps beneficial for recovery have additional cost but can be overcome by value chains

## Policy Message 2

**Obligation for national or regional action plans** for phosphorus recovery, in line with the European goals, implementing technical recovery of phosphorus and/or agricultural valorisation of high quality sludge.



# How to grant market access over Europe and increase acceptance?

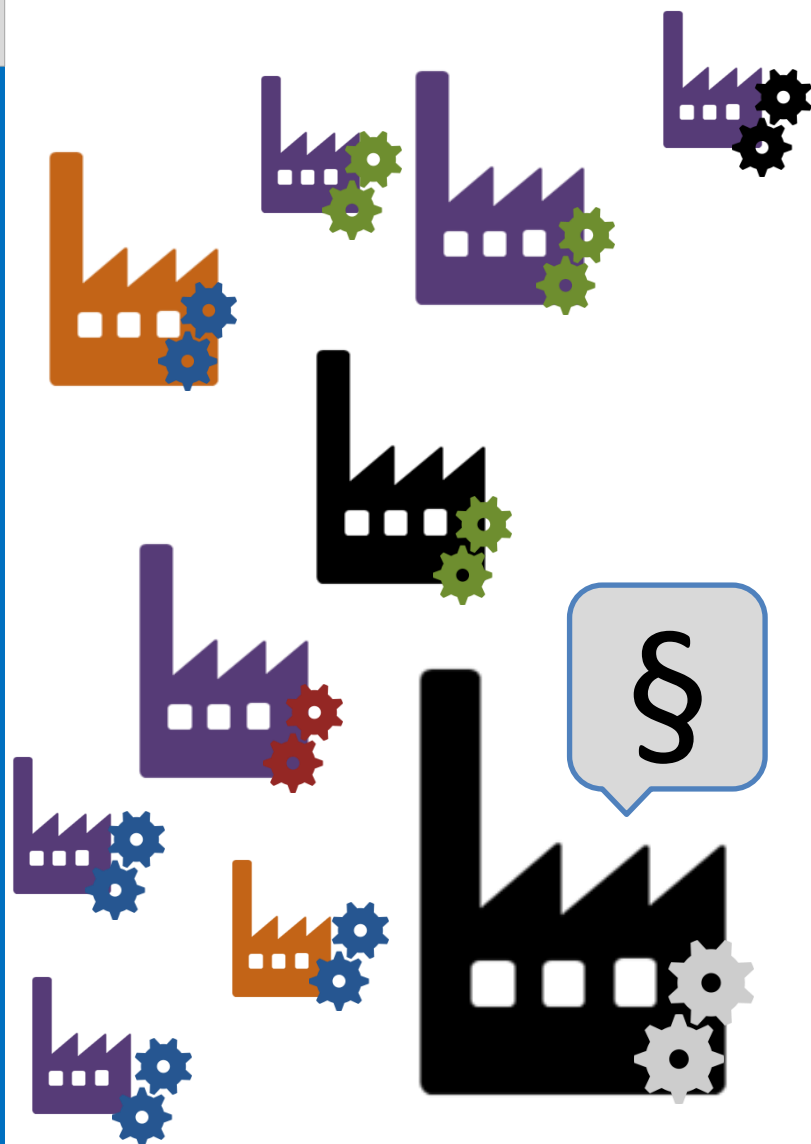
## Why?

- Contradictory interpretation of legislation in member states
- Quality standards are lacking
- Fertiliser Regulation focuses on conventional sources and limits the number of start materials

## Policy Message 3

**Clear guidelines stopping contradictory national interpretation of the current European legislation** around recycling of phosphorus from waste, especially into fertilisers.

Better integration of secondary raw materials and introduction of quality standards including end-of-waste criteria to the European Fertiliser Regulation.



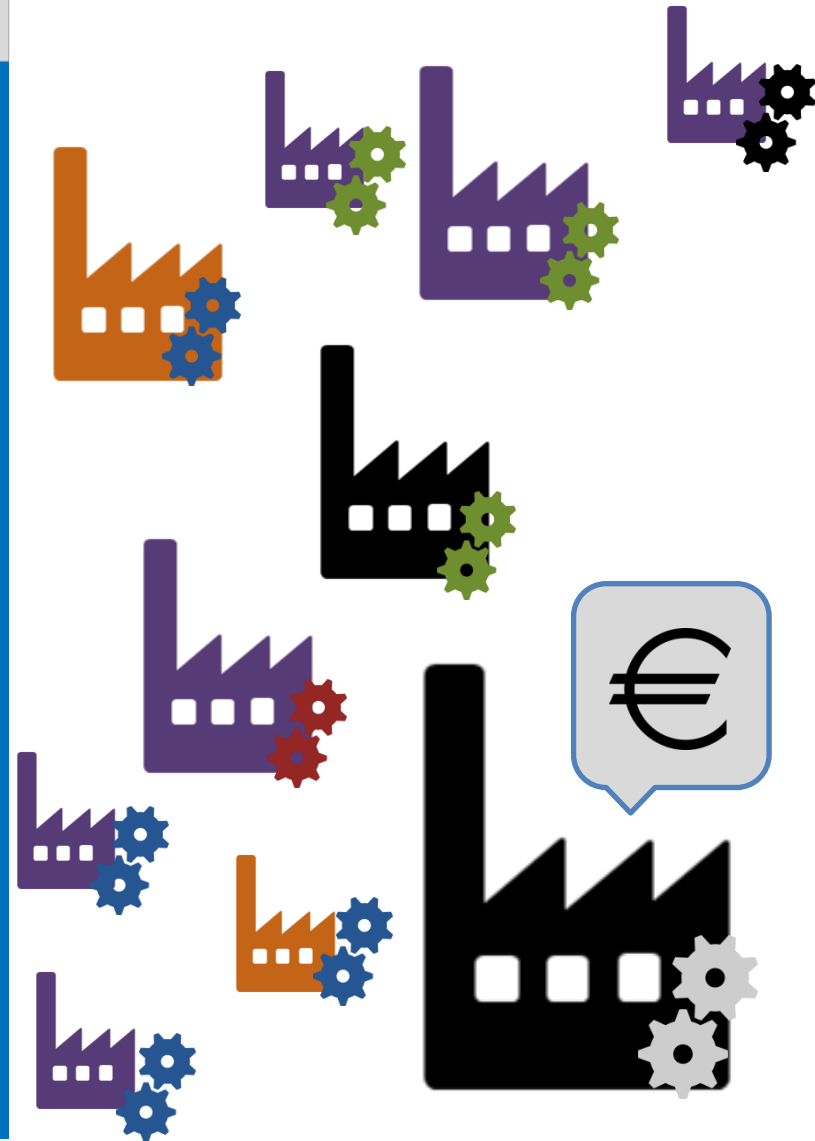
## Why?

- Phosphorus recovery benefits society as a whole and comes with a cost
- First Movers Risk
  - large investment
  - a competitor implements a second generation technology and profits from changes made

## Policy Message 4

**National mechanisms for fair distribution of the cost** of phosphorus recovery (e.g. fertilizer mixing quota, recovery obligations).

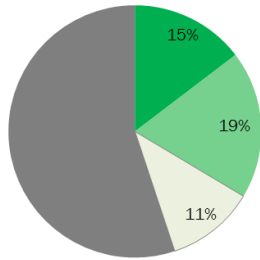
**Financing of demonstration projects**, since references are obligatory for market penetration of innovative technologies and products.



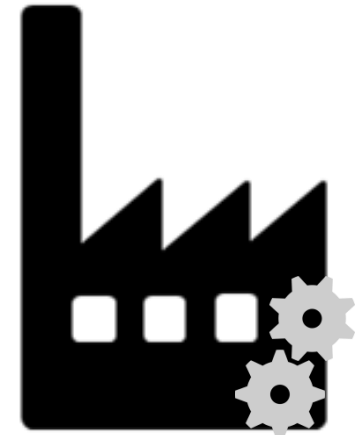
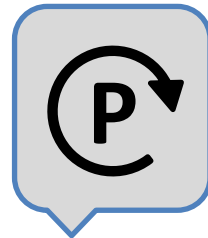


# In summary:

Recovery potential



- Municipal sewage sludge
- Slaughterhouse waste
- Food-waste (household and retail)
- Demand uncovered



Be a part of the solution!

«Think forward, act circular»



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**Thank you for your attention!**

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Download at [www.p-rex.eu](http://www.p-rex.eu) :

P-REX Deliverable D11.2 - Pre-Normative-Matrix, Fertilisation Schemes and  
Legal Framework for Phosphorus Recovery and Recycling

Policy brief and regional studies (D, CH, ES, CZ)

<http://e-market.phosphorusplatform.eu/>



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