

# Fosforscheerste: ONZIN!

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# Phosphate situation

*Preliminary definition :*

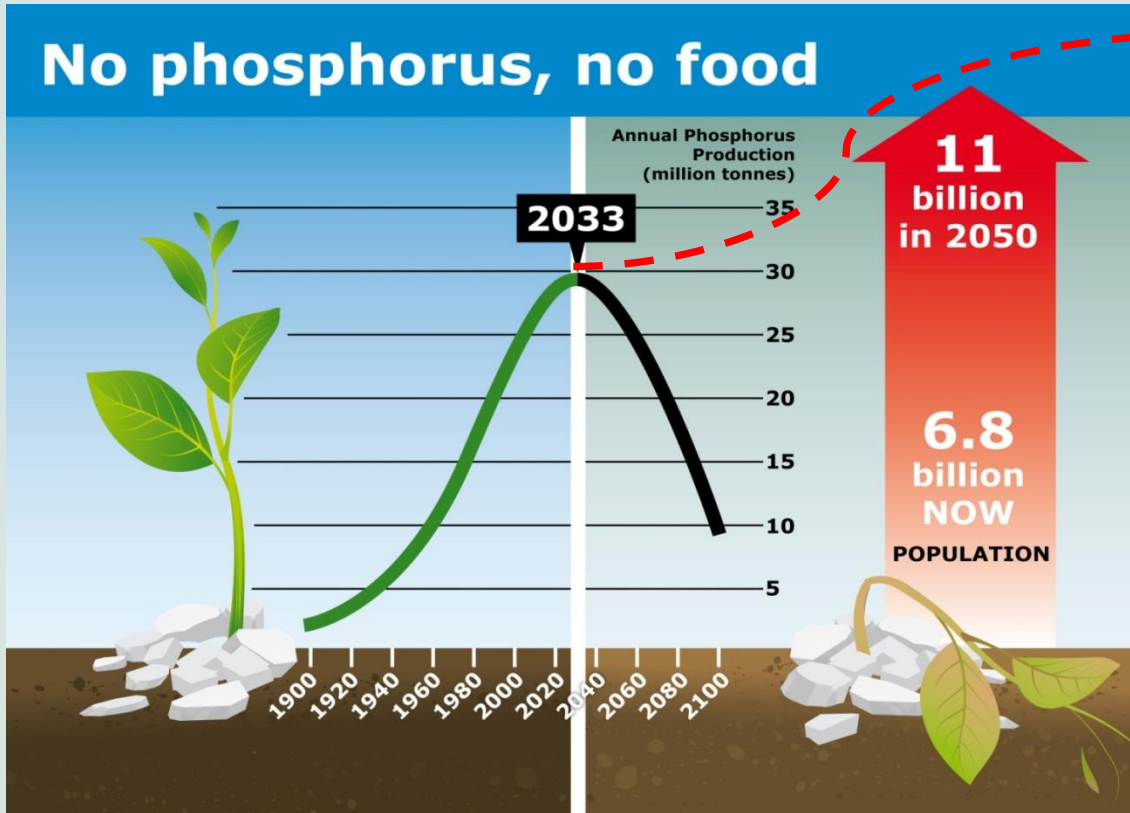
**High Grade rock phosphate** = rock phosphate with low content of impurities (Al, Fe, Mg, Heavy metal) and high content of  $P_2O_5$  → classical process

**Low grade rock phosphate** = All other sources of phosphate containing too much impurities to be used by the conventional process

(rock phosphate with high Mg, Fe, Al content, Ashes from sewage sludge,...)

# PEAK of High Grade Phosphate

No phosphorus, no food



## Ecophos Process

Ecophos process allows to use alternative sources of phosphate in order to produce fertilizer, feed or high grade phosphate !

### Ex of alternative source :

- **Low grade rock phosphate** (high content of impurities (Al, Fe, Cd, Mg,...))
- **Ashes** from sewage sludge incinerator
- ...

It is an essential element  
There is no alternative

ecophos





## 1/ P-recovery → Strategic for Europe

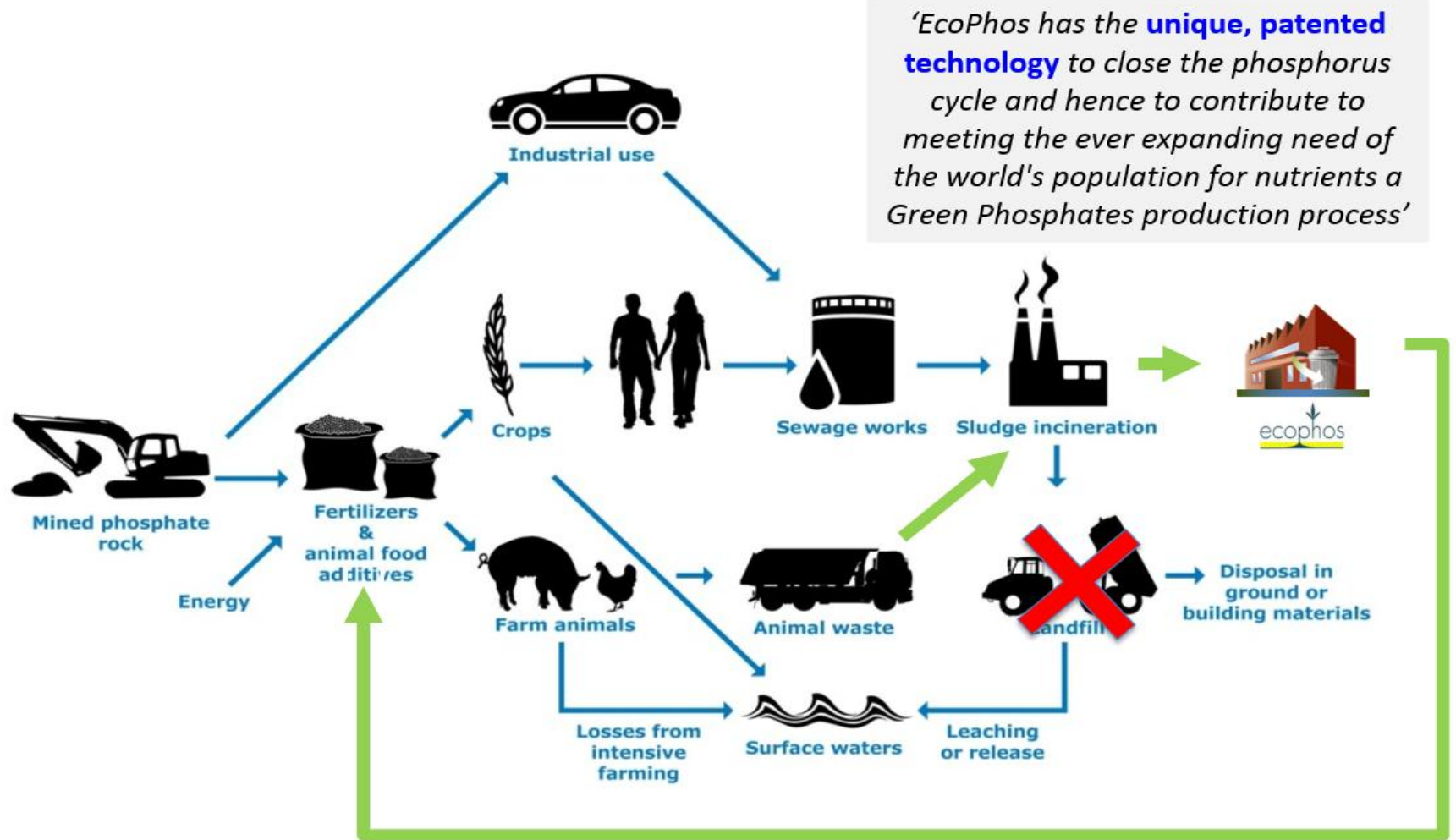
“The complete replacement of phosphate mined in the EU by recycled phosphorus is neither feasible nor necessary in the foreseeable future. However, greater recycling and use of organic phosphorus where it is needed could stabilize the amounts of mined phosphate required and mitigate the soil contamination and water pollution issues. This will be put on track to close the phosphorus cycle in the long term, when the physical limitations of the resource will become increasingly important”

→ URBAN Mines ←

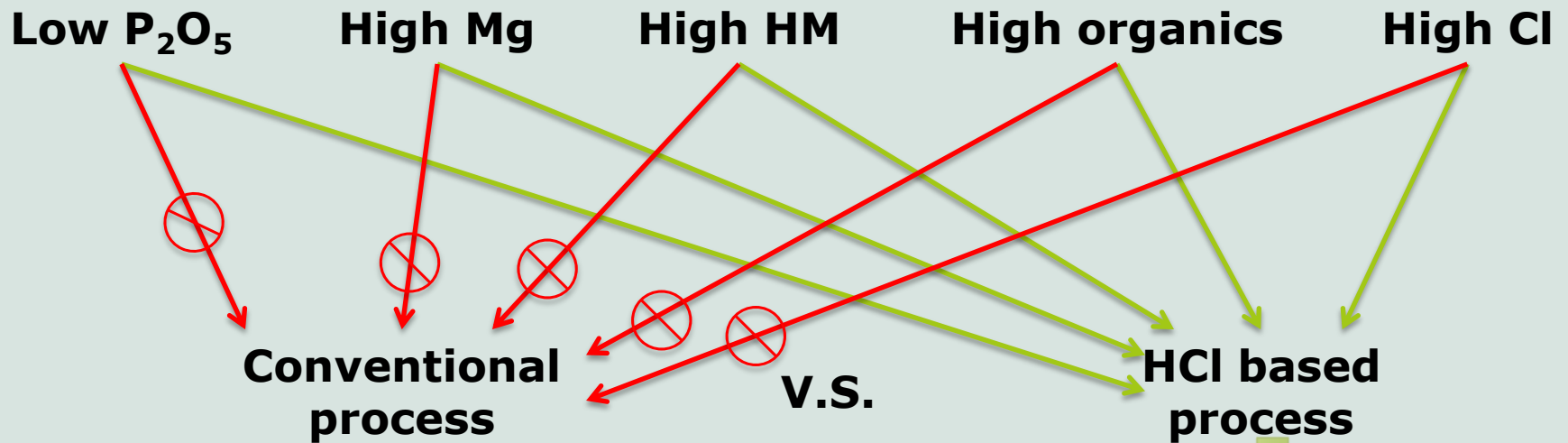
## 2/ Low grade rock phosphate

Rock containing too much impurities to be used in the conventional wet process. As impurities we can consider high level of Mg, Fe, Organics, Heavy metals, Al,...

# EcoPhos, to a modern use of phosphorus



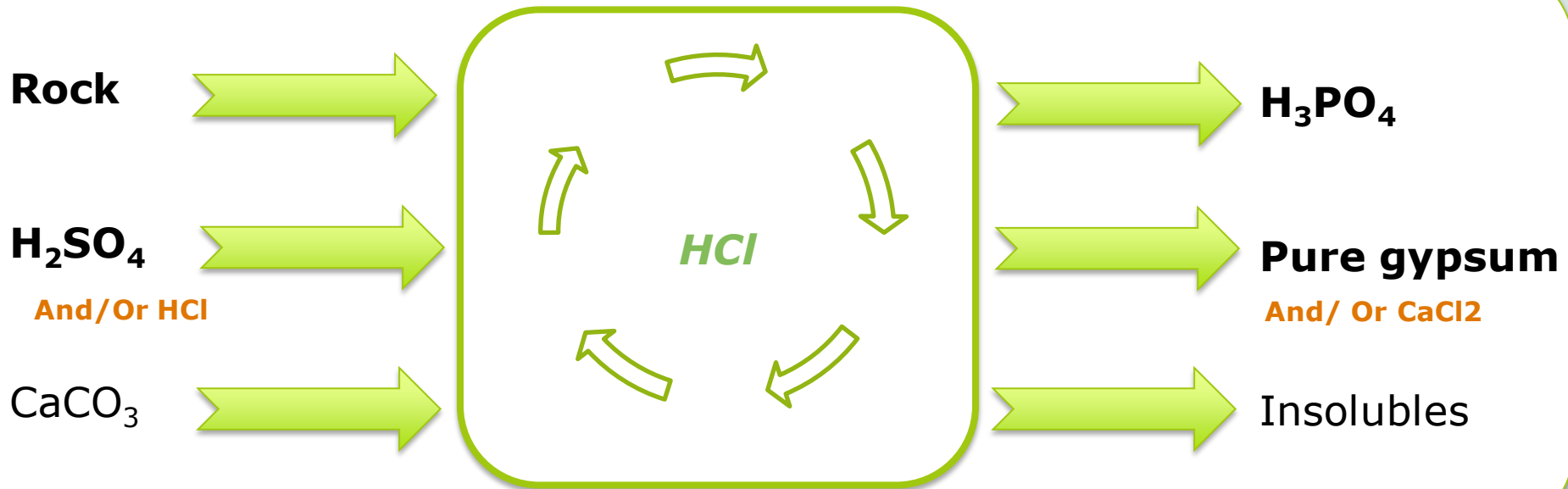
# Low-grade rock = No Beneficiation



**Viable process using low-grade rock**

- Reduced production cost
- Expended mine resources

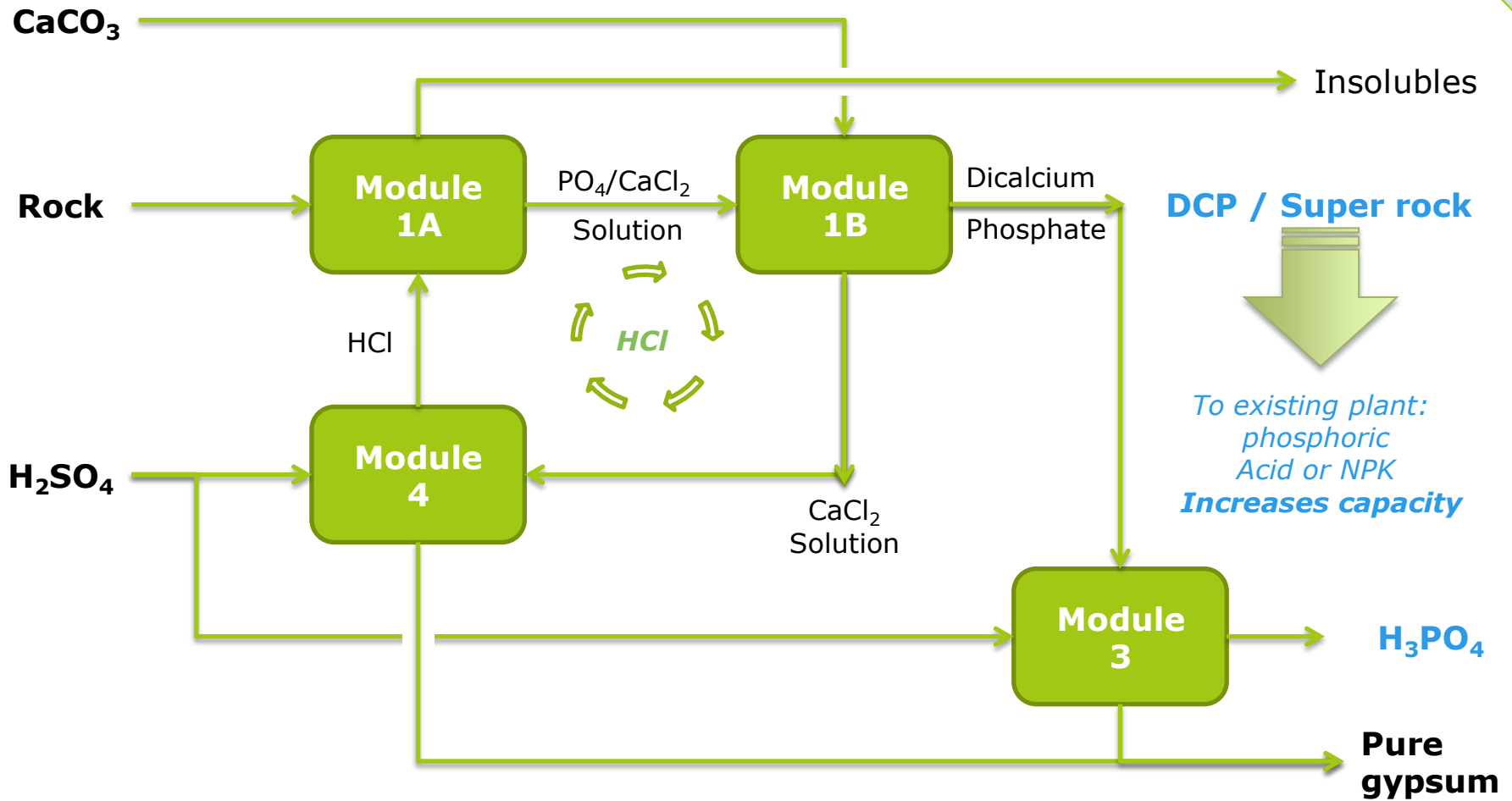
# HCl based process



HCl is used as vector of the acidity from sulfuric acid:  
= H<sup>+</sup> transporter

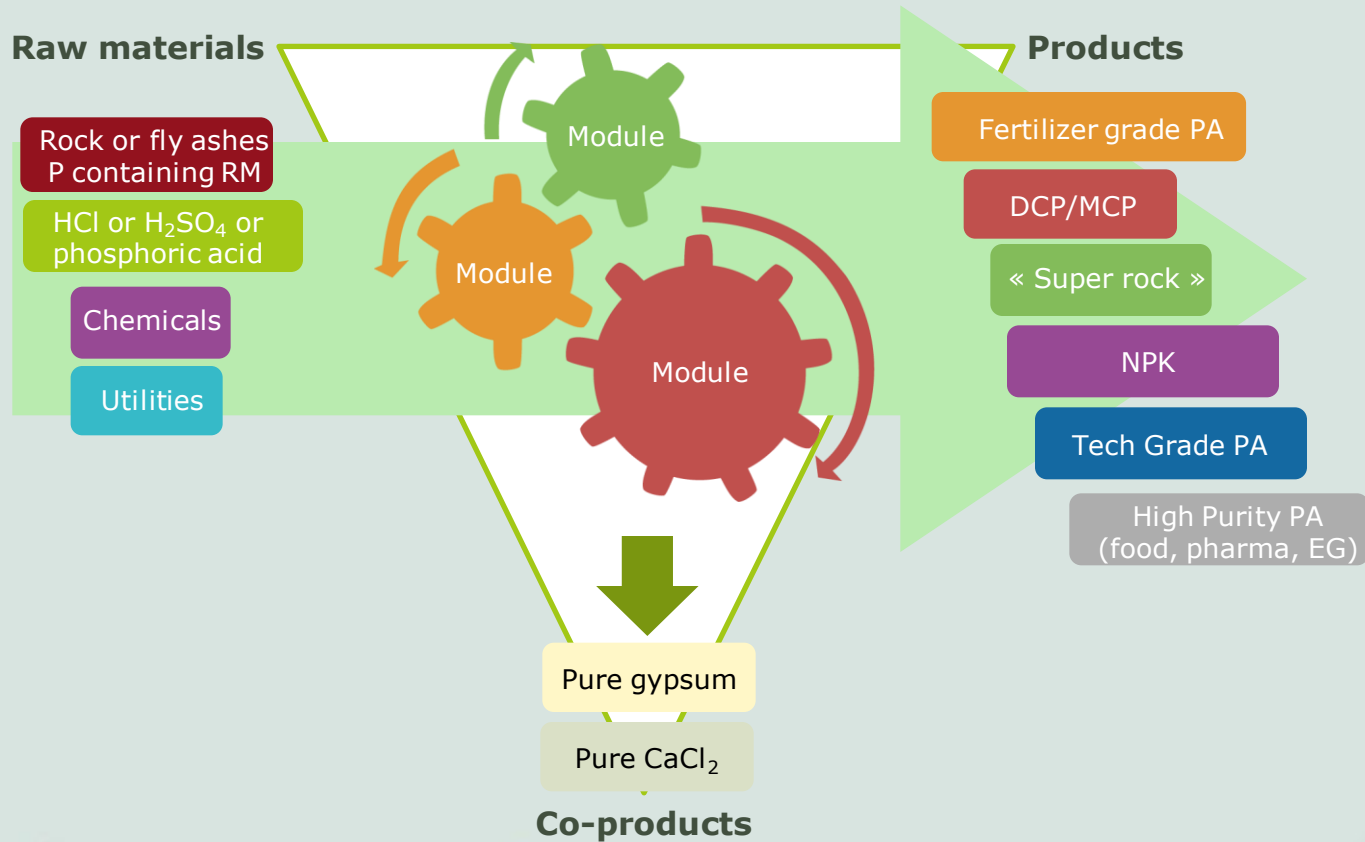


# EcoPhos process



# EcoPhos technology

- Modular Technology:
  - Adapt process to raw-material, products and co-products



# Advantages of this Innovation

- 40% lower investment cost compared to conventional process
  - No rock beneficiation
  - Short residence time (45min-1h)
  - High process yield (up to 99%)
  - Reasonable temperature, atmospheric pressure
  - Highly concentrated phosphoric acid out of filter (min 42% P<sub>2</sub>O<sub>5</sub>)
  - Simple material of construction (PP, CS rubber lined...)
- Up to 50% lower variable cost
  - Low-grade phosphate rock
  - Low energy consumption
- Limited fixed cost
  - State of art plant automation

# Advantages of this innovation (2)

- Green process:
  - 6 times less waste !
  - Low energy consumption !
  - Pure and valuable co-products: non radioactive pure gypsum
- Safe process:
  - No solvent
  - Atmospheric pressure
  - Reasonable temperature
- Highly flexible plants:
  - Single line from 25 to 100Kt P<sub>2</sub>O<sub>5</sub>/y
  - Process adapted to client's raw materials and products



## Fly ashes vs. Phosphate rock

Element	Unit	Fly ash	Phosphate rock
P <sub>2</sub> O <sub>5</sub>	%	<b>23.6</b>	20-27
Ca	%	<b>12.7</b>	35
Si	%	<b>10</b>	1.1
Al	%	<b>6</b>	0.2
Fe	%	<b>9.4</b>	0.9
Mg	%	<b>1.7</b>	0.9
K	%	2.2	0.09
Na	%	0.77	1
As	ppm	35	9.3
Cd	ppm	3.8	49
Cr	ppm	130	200
Cu	ppm	<b>1200</b>	200
Ni	ppm	67	125
Pb	Ppm	<b>250</b>	21
Ti	ppm	<b>2900</b>	160
Zn	ppm	<b>3300</b>	230
F	%	<b>0</b>	3.2
SO <sub>4</sub>	%	<b>7.7</b>	2.7
TOC	%	<b>0</b>	3.35
CO <sub>2</sub>	%	<b>0</b>	7.2

- Need of an innovative approach to get rid of impurities
- Mono-incineration is a must to avoid P<sub>2</sub>O<sub>5</sub> dilution

- Two patented process options developed by EcoPhos for the use of fly ashes from sewage sludge incineration as phosphate source:
  1. **Hydrochloric acid route**
    - Adaptation of EcoPhos process used for low-grade rock to fly ashes
    - For integration of the process into a larger plant
  2. **Phosphoric acid route**
    - New approach developed for integration of the fly ashes treatment in the incineration site: satellite plant
- Processes validated in pilot conditions using fly ashes from SNB and HVC in the Netherlands

# Dunkerque Site

Unloading station for  
HCl by train

Phase 1 : 11 ha

Phase 2: ~4 ha

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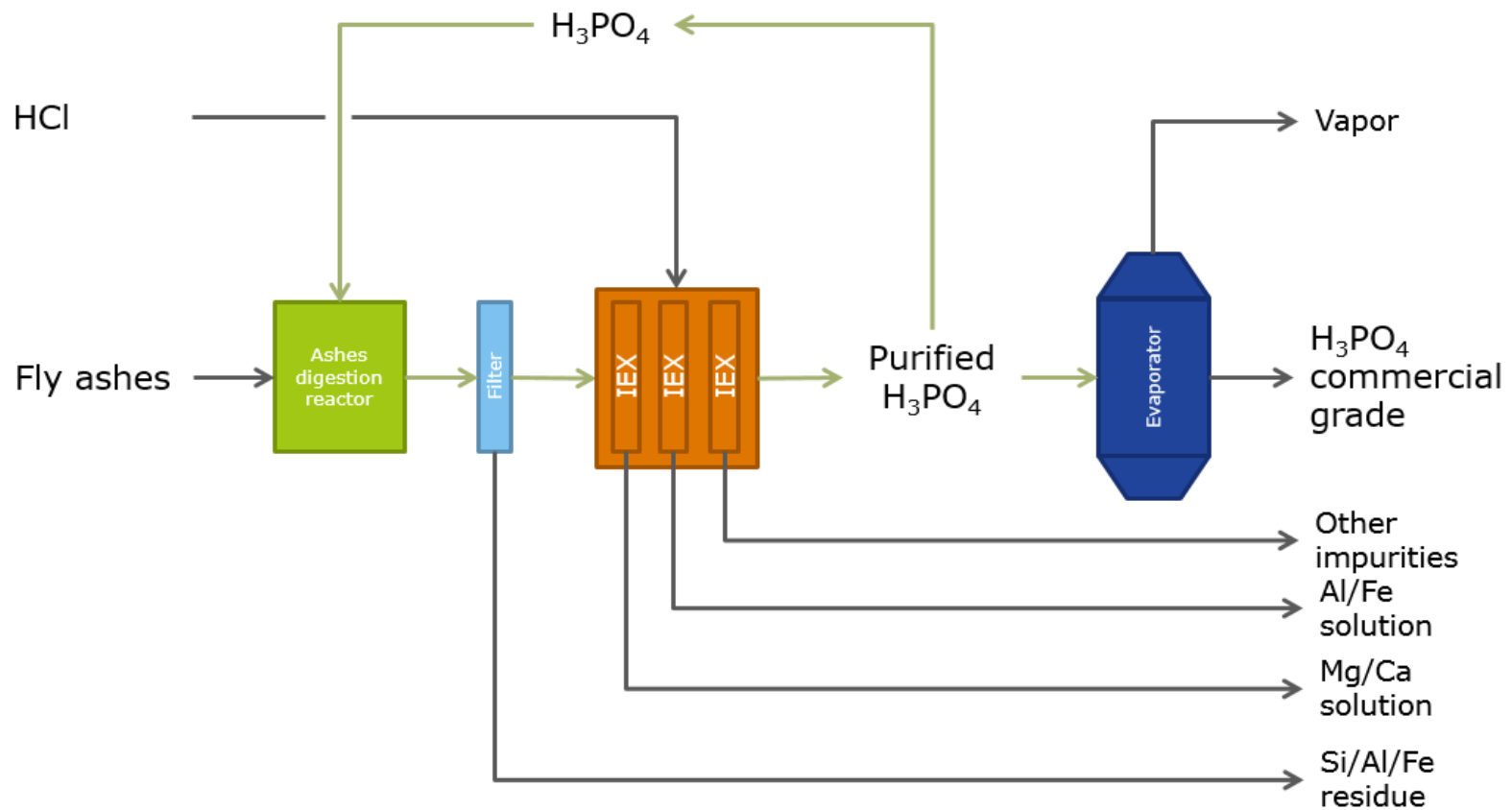
Google earth

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## Phosphoric acid route





- **P recovery**

- > 90% of P extracted and recovered in phosphoric acid

- **Quality of product**

- 99% of impurities removed
- Phosphoric acid 62% technical grade
- Pure aluminium and iron chloride

- **Process advantages**

- Simple process-full automation
- Liquid plant, only solid raw-material is ashes
- Integration: heat recovery, residue disposal

- **Business case**

- Incineration company provides
  - Site
  - Fly ashes
  - Utilities
  - Plant operation (limited: fully automated plant)
  - Residue disposal (sand, gypsum)
- EcoPhos provides
  - Patented technology
  - Necessary chemicals
  - Investment,
  - Design and construction of the plant
  - Offtake of  $\text{H}_3\text{PO}_4$  and co-products

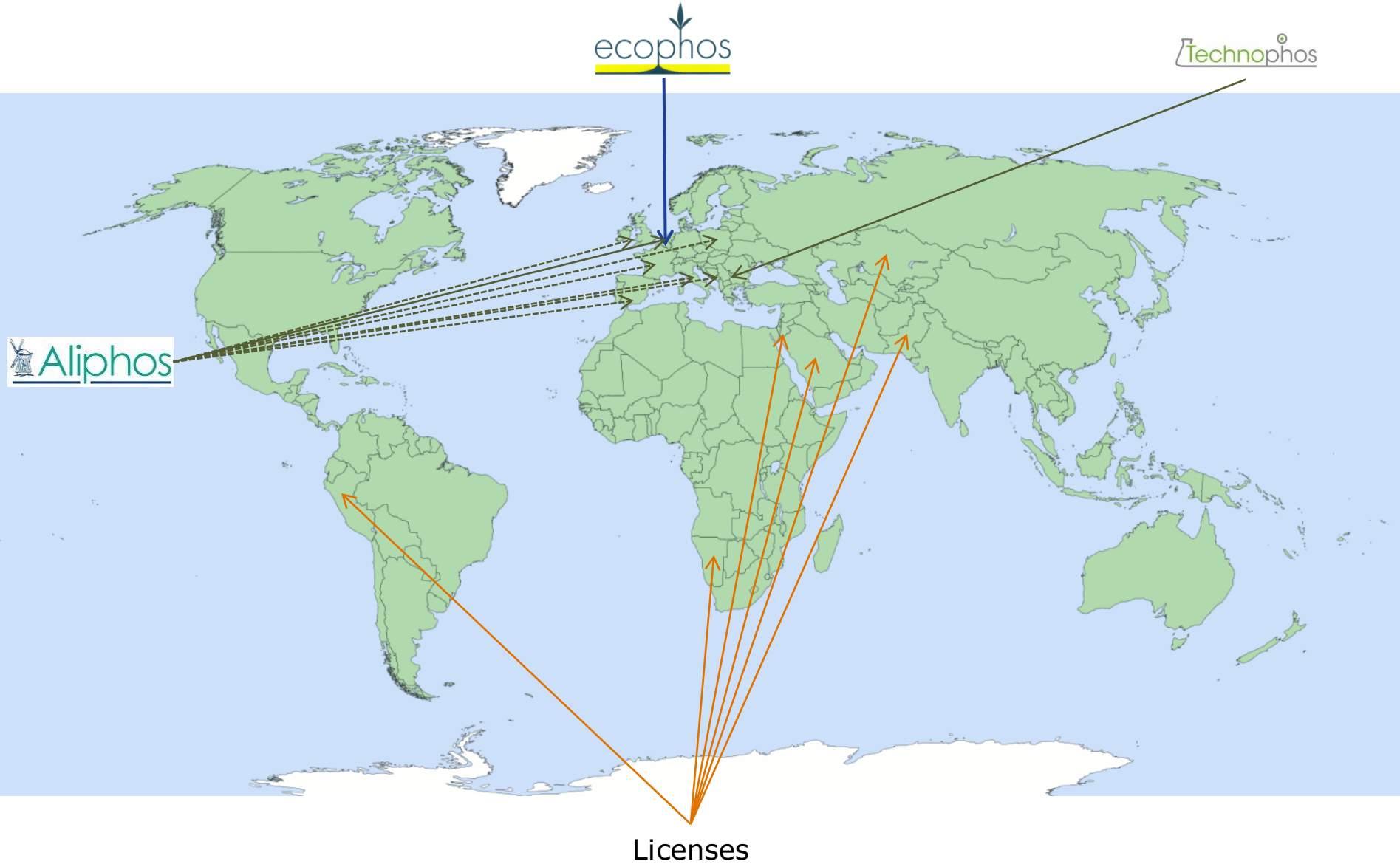
# Is er Fosforschaarste?

# Conclusie

- Geen fosforschaarste:
- Wel aandacht voor:
  - Innovatie → JV's met Noord Afrika?
  - Secundaire grondstoffen → HVC, SNB
  - Geopolitiek → Noord Afrikaans monopolie



# EcoPhos' worldwide activities



UCCI



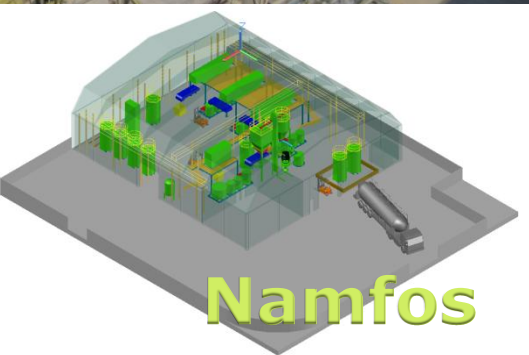
Decaphos



Quimpac



Technophos



Namfos

