



Italian Phosphorus Platform



# Nutrient circular economy: state of the art in the European Union and Mediterranean-Area

Ludwig Hermann, European Sustainable Phosphorus Platform

## 3rd EUROPEAN NUTRIENT EVENT @ ECOMONDO 2018





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# Framework

[www.smart-plant.eu/ENE3](http://www.smart-plant.eu/ENE3)



# United Nations: Sustainable Development Goals

Transforming our world: the 2030 Agenda for Sustainable Development, adopted by the UN General Assembly (193 nations) on September 25, 2015







European Sustainable Phosphorus Platform



This project has received funding from the EU Horizon 2020 research and innovation programme under grant agreement No. 690323



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Green & Circular Economy  
6-9 Novembre 2018  
Rimini Italy  
KEY ENERGY



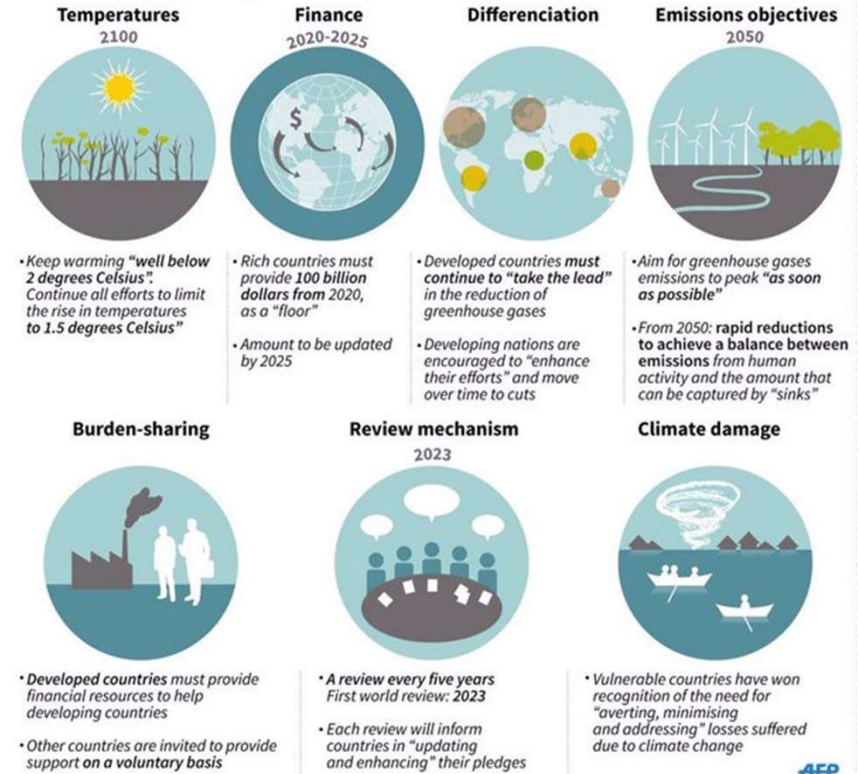
## Followed by The Paris Agreement (COP21)

195 governments agreed at the 21<sup>st</sup> Conference of the Parties of the UN Framework Convention on Climate Change (UNFCCC) on December 12, 2015

- Goal of keeping the increase in global average temperature to **well below 2°C** above pre-industrial levels;
- To aim to **limit the increase to 1.5°C**, since this would significantly reduce risks and the impacts of climate change;
- On the need for **global emissions to peak as soon as possible**, recognizing that this will take longer for developing countries;
- To undertake **rapid reductions thereafter** in accordance with the best available science.

### The Paris climate agreement: key points

The historic pact, approved by 195 countries, will take effect from 2020



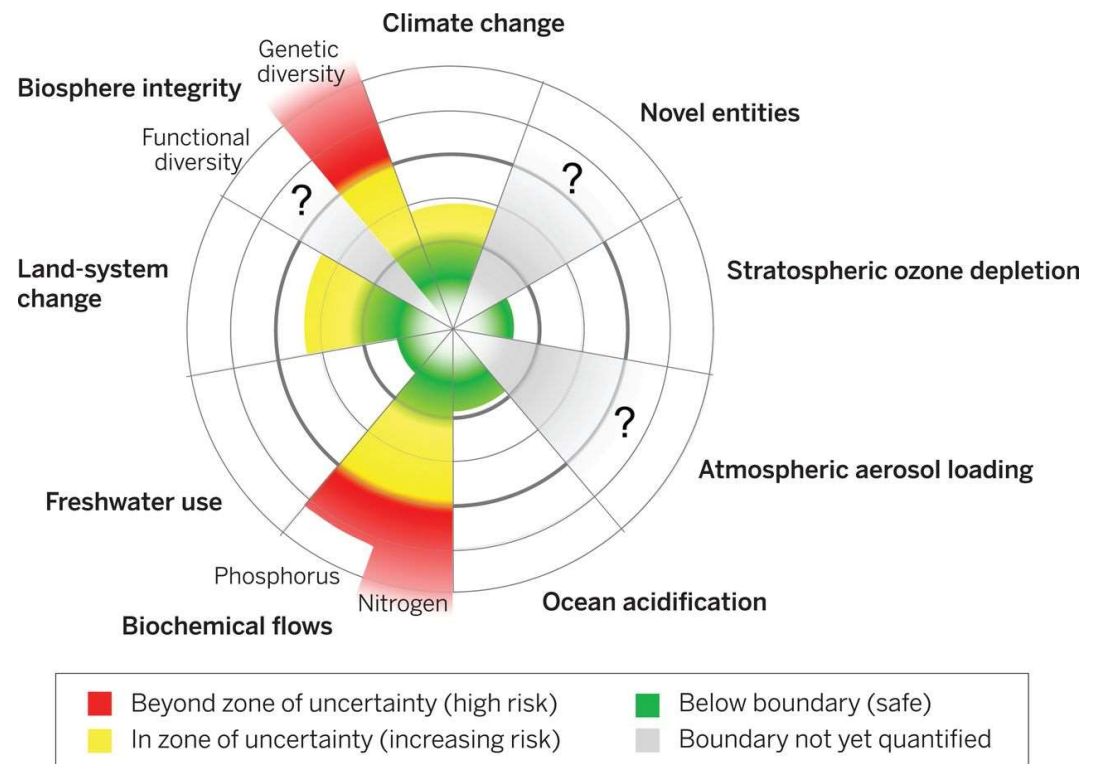
November 2018

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# Planetary Boundaries (Steffen et al., 2015)

- Abrupt global environmental change can no longer be excluded.
- Safe operation within planetary boundaries needed
- Transgressing one or more planetary boundaries may be catastrophic





# “Growth Within: A Circular Economy Vision for a Competitive Europe” 2015 (Ellen MacArthur Foundation and McKinsey, Sept 2015)

A Circular Economy, defined as an economy providing added value without consuming primary resources and based on the principles of

- i. **Preservation of natural capital**
- ii. **Optimization of resource yields** by circulating materials and products
- iii. **Avoiding externalities**, i.e. negative impacts on air, soil and water as well as on animal and human life.





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<http://ec.europa.eu/DocsRoom/documents/15949>

# EU Fertilisers Regulation *(proposal)*

Flagship of Commission ‘Circular Economy Package’  
Currently in Council - Parliament “trilogue” decision process



## Ambitious:

- covers all fertilisers (mineral & organic), plant materials, composts & digestates, soil amendments, growing media, biostimulants, liming materials, etc.

## Precedent: first EU Product Legislation to confer “End-of-Waste” status

Commission proposal March 2016 <http://ec.europa.eu/DocsRoom/documents/15949>

Parliament position October 2017 <http://data.consilium.europa.eu/doc/document/ST-13610-2017-INIT/en/pdf>

Council position December 2017 <http://data.consilium.europa.eu/doc/document/ST-14010-2017-REV-1/en/pdf>





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## ***EU Fertilisers Regulation (proposal)***

- Future markets will have both “National” and CE-mark fertilising products
- EU Regulation will open the European market for recycling technologies

***A CE-marked product must respect  
all of:***

- ***Annex I PFCs***  
***= Product Function Categories***
- ***Annex II CMCs***  
***= Component Material Categories***
- ***Annex III = Labelling Requirements***
- ***Annex IV = Conformity Assessment Procedures***

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# Drivers

## Nutrient Losses + Legislation

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# Pressure to reduce nutrient losses

- **Urban Waste Water Treatment Directive 1991/271**
- **Nitrates Directive 1991/676**
- **Water Framework Directive 2000/2000**  
**- quality objectives 2015 / 2021 / 2027**
- **Groundwater Directive 2006/118**  
**- phosphorus on monitoring list (2014)**

- **Phosphorus is first cause of (non-morphological) quality status failure under the EU Water Framework Directive**
- **55% of UK rivers and 74% of lakes exceed P level for good ecological status**

## ENDS Europe 3 July 2018

### News Threat of legal action after damning EU water report

The European Commission has warned that governments may face legal action over a failure to implement EU water quality legislation, as a report published on Tuesday

EEA Report | No 7/2018  
European waters  
Assessment of status and pressures 2018





# Pressure to reduce nutrient losses

## Proposed new CAP (Common Agricultural Policy)

- EU Commission proposal 1 June 2018
- “Farm Sustainability Tool for Nutrients”
  - information on farm, crops, management
  - complete nutrient budget
- Conditionality requirements:
  - control of diffuse pollution by phosphates
  - nitrate leakages
  - ... buffer strips, soil management ...



[https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/future-cap\\_en](https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/future-cap_en)

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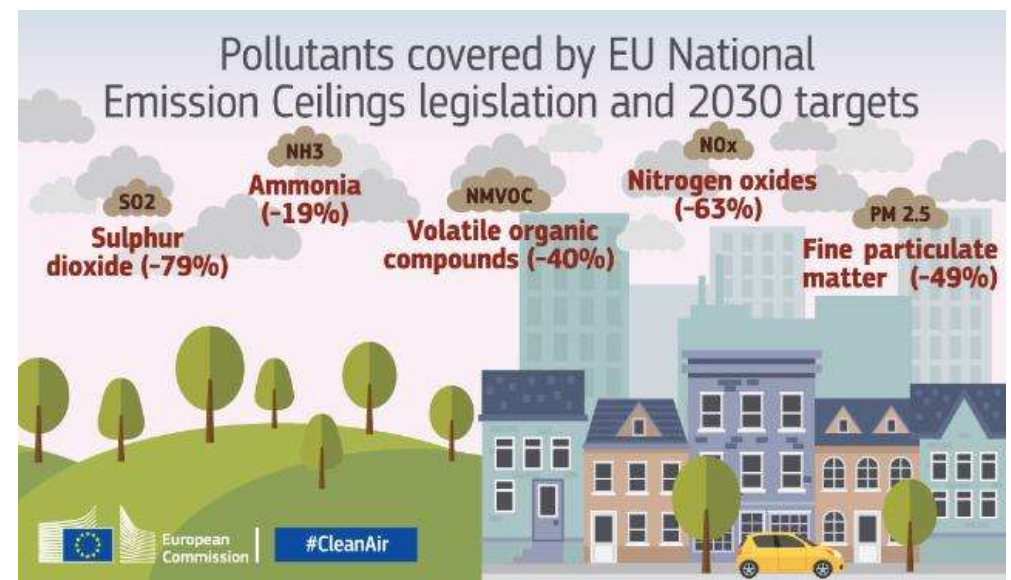


# Pressure to reduce nutrient losses

## National Emissions Ceilings Directive (NECD) revision

- **ammonia emissions**
- Ammonia → particulates → health impacts
- 98% of ammonia emissions from agriculture
- 2016 NECD revision:
  - 19% reduction target for ammonia by 2030

<http://ec.europa.eu/environment/air/pollutants/ceilings.htm>



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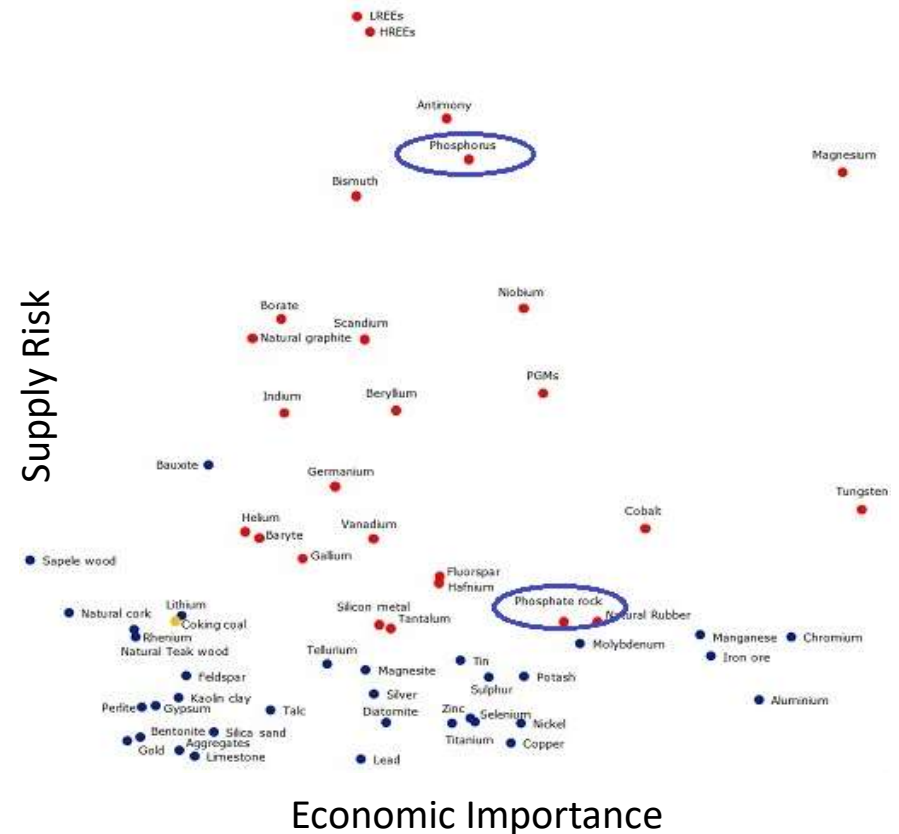


# Pressure to recycle phosphorus

*Phosphate is on the EU Critical Raw Materials List since 2014 and White Phosphorus since 2017*

- Non substitutable
- Non renewable
- Geopolitical resource concentration
- EU 90% dependent on imports

[https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical\\_en](https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en)  
[http://europa.eu/rapid/press-release\\_IP-14-599\\_en.htm](http://europa.eu/rapid/press-release_IP-14-599_en.htm)



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# Pressure to recycle phosphorus

## Switzerland

- **2016 Decree makes phosphorus recovery obligatory by 2026 from sewage sludge incineration ash\* and meat and bone meal ash**
- **2018 “MinRec” requirements to inorganic recycled fertilisers enforced by Bundesrat**
  - \* **Switzerland banned land use of sewage biosolids in 2006**
- **Still under discussion:**
  - %P recovery to be required

Scope Newsletter n°118 <http://www.phosphorusplatform.eu/scope118>

Scope Newsletter n°121 <http://www.phosphorusplatform.eu/scope121>



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

### Principales nouveautés dans l’ordonnance sur le traitement des déchets

L’ordonnance sur le traitement des déchets (OTD) est soumise à une révision totale. Voici en résumé les principales modifications :

- Des exigences sont formulées pour la valorisation de certains déchets, laquelle n’était pas encore réglementée dans le droit fédéral. Il s’agit notamment des biodéchets (y compris réglementation relative aux possibles installations de traitement ) **et des déchets riches en phosphore.**
- Un plan d’élimination des déchets est exigé pour tout projet de construction. Le maître d’ouvrage est tenu de déterminer les déchets dangereux pour la santé et pour l’environnement (p. ex. amiante, déchets de chantier contenant des biobûches

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# Pressure to recycle phosphorus

## Germany

- **Legislation May 2017 makes phosphorus recovery obligatory**
  - within 12/15 years
  - for all wwtp > 50 000 p.e.
  - if sewage sludge P > 2% of dry matter
- **Interpretation under discussion:**  
*%P depends on organics: change with hydrolysis, digestion → will favour mono-incineration*
- **Requires to either recover >50% of P or to reduce sludge P to <2%**
- **Land sewage biosolids use banned for larger sewage works, and lower contaminant limits will reduce spreading for smaller works**



National | Verordnungen | AbfklärV

Verordnung zur Neuordnung der Klärschlammverwertung  
Klärschlammverordnung



Verordnungstext beim Bundesanzeiger  
04.10.2017

Neue Klärschlammverordnung in Kraft

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# Pressure to recycle phosphorus

## Sweden



Government Offices of Sweden

- As part of efforts to ensure toxin-free and resource-efficient eco-cycles, the Government has decided to appoint an inquiry to propose a ban on spreading sewage sludge and introduce a requirement for phosphorus to be recycled from sewage sludge.
- The Government has appointed Gunnar Holmgren (former Governor of Västernorrland County) as Inquiry Chair.

*"It is important that we use our resources responsibly. Phosphorus is a valuable resource, and as such we should use the technologies available to utilise it," says Minister for the Environment Karolina Skog (13 July 2018).*

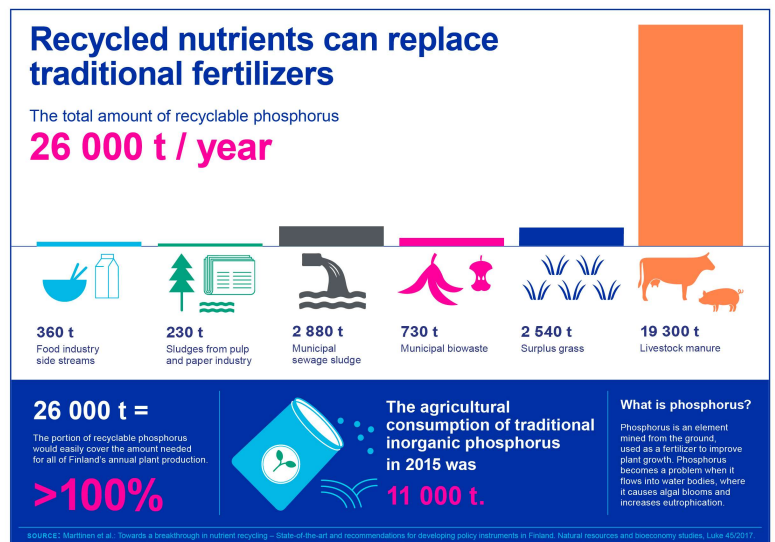




# Pressure to recycle phosphorus

## Finland

- Action program implemented by the Ministry of the Environment, Ministry of Agriculture and Forestry and Ministry of Economic Affairs and Employment.
- Finland among world leaders in Circular Economy by 2025.
- To process 50 per cent of manure and sewage sludge with advanced technologies in areas vulnerable to eutrophication.
- New funding program, so far >50 projects supported
- To develop markets for organic fertilizers in Finland and develop organic fertilising products which are easy to use, competitively priced and high in quality





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www.ecomondo.com  
KEY ENERGY



# Pressure to recycle phosphorus

## Baltic

- **HELCOM:**  
**8 EU Member States, plus Russia and the EU**
- **“Recommendation” March 2017 = obligation**
  - maximise phosphorus and other useful substance recycling
  - regular State reporting on measures taken to implement this
- **Ministerial Declaration March 2018:**
  - define Nutrient Recycling Strategy by 2020





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# Technical Nutrient Recycling Global & EU

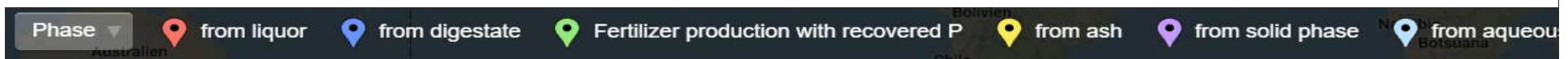
[www.smart-plant.eu/ENE3](http://www.smart-plant.eu/ENE3)



# Global implementation (Source: Kabbe, 2018)



More than 100 full-scale plants operational in Europe, USA/Canada and Japan. 80 struvite plants of which 60 are municipal; some 20,000 t struvite produced.  
 Pilot production of high grade P-products from ash in Varna, Hamburg, Madrid and Helsingborg.  
 Full scale production of ammonium nitrate in Oslo.





# Struvite – essentially a by-product

- Driven and paid-back by maintenance improvements and savings in EBPR plants
- <10% of European wastewater treatment plants qualify for the current „struvite“ process
- Average P recovery rate from the aqueous phase 8-15% of the potential, up to 40% recovery with sludge pre-treatment
- Plants produce a few hundred to few thousands tons of P-fertilizer. Different shapes, impurities, pollutants and fertilizing efficiency.
- Constant high quality products from Ostara.



# P-recycling from sewage sludge ash

## > 85% P-recovery rate

- Several financially sound, industry owned technology suppliers
- Independent of P-removal process in sewage plant
- High value “commodity” products =
  - technical grade acid, DCP (e.g. Ecophos) and / or 100% water soluble MAP (CleanMAP EasyMining)
- Some processes recover iron/aluminium salts for P-removal in wastewater treatment plants
- Some processes recover silicates for cement production



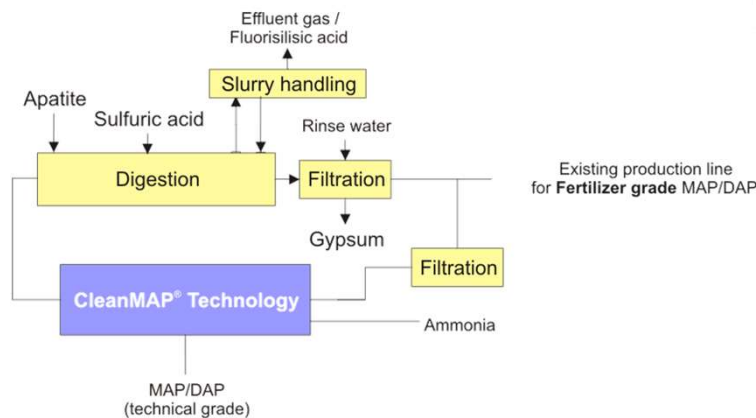
EasyMining  
EcoPhos - Technophos





# P-recycling from tailings (Sources: EasyMining / Yara)

- EasyMining produces CleanMAP (KMAP process) and Rare Earth Elements (REE) from LKAB's iron ore tailings




**LKAB** ABOUT LKAB SUSTAINABILITY INVESTORS CAREERS Sales Supplier News room Contact P8 Svenska

/ NEWS ROOM / PRESS RELEASES / LKAB DEVELOPS NEW TECH...

## LKAB develops new technology for producing strategic minerals from mine waste

NEWS 04 July 2018 PRINT SHARE

LKAB is now investing in pilot plant facilities and, together with environmental services company Ragn-Sells, will industrialise an innovative technology for upgrading mine waste from iron ore production. This may result in LKAB producing phosphorus and rare earth metals, which in the EU are classed as strategic minerals that are of particular importance to the industry.

- Yara has entered in an agreement with another mining company. Yara will use the mineral pyrite from the other mine's tailing ponds as a raw material to help extract P.

## ***N-recycling from sewage plants (Source: Yara)***

### N-stripping + production of ammonium nitrate in Oslo

- A substantial fraction (12-15%) of the total N load entering the VEAS plant is recovered – after anaerobic digestion (AD) of sludge, lime conditioning and filter pressing stages – via ammonia stripping and subsequent capturing (scrubbing) of the ammonia gas ( $\text{NH}_3$ ) with a concentrated nitric acid solution ( $\text{HNO}_3$  – 62% w/w).
- This stripping and scrubbing treatment yields an industrially reusable ammonium nitrate (AN –  $\text{NH}_4\text{NO}_3$ ) side stream.
- Yara acts as a key-enabler in this circular business model through supplying the nitric acid and off-taking the AN side-stream.





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# Mediterranean Business Developments

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# Pressure to recycle nutrients = *business opportunities & cases*

## *“La Belle Bouse” (beautiful cowpat)*

- Lyon based startup
- Locally sourced organic fertiliser for households from cattle manure
- “matured for 9 months like a great cheese”

<http://www.labellebouse.fr/>



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6-9 Novembre 2018  
Rimini Italy

KEY ENERGY



# **Business case:**

## **Italpollina plants nutrition**

- Range of organic and organo-mineral fertilisers, biostimulants and plant nutrition products
- For conventional and organic farming
- Input materials include:
  - processed manures and animal by-products
  - food industry by-products, e.g. stillage
  - vegetal cakes and meals
  - micro-organisms like P solubilisers
- Sales in 80 countries, 5 plants and R&D laboratories,
- 200 000 t/y organic fertilisers
- 5 MI/y biostimulants

[www.italpollina.com](http://www.italpollina.com)

[www.smart-plant.eu/ENE3](http://www.smart-plant.eu/ENE3)



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ECOMONDO  
THE GREEN TECHNOLOGIES EXPO  
22<sup>a</sup> Fiera Internazionale  
del recupero di materia ed energia  
e dello sviluppo sostenibile

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# Business case:

## Acqua e Sole *Biogas, Pavia Province (Lombardy)*

P and N recycling to fertiliser blend

3 digesters 13,500 m<sup>3</sup> with NH<sub>3</sub>  
facility processing

- 60,000 Municipal wastewater sludge
- 20,000 Agro-industry sludge
- 35,000 Food waste liquid fraction
- 5,000 Manure liquid fraction

to organic fertiliser for rice and cereal  
between restored wetlands



[www.smart-plant.eu/ENE3](http://www.smart-plant.eu/ENE3)





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## Business case:

# VEOLIA Spain / Ostarra: Struvite fertilisers

- *In 2016, Canal de Isabel II commissioned Spain's first plant for the recovery of P as struvite at the Sur WWTP (Madrid).*
- *Treats up to 260 kg of P/day from the WWTP's two return streams.*
- *Formation of struvite in an up-flow fluidised bed reactor.*
- *Canal de Isabel II has invested €2.3 million in this initiative, which is in line with the company's commitment to the circular economy, environmental care, sustainable management and investment in R&D.*



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# **Business opportunity:** **Italmatch: -Trialkyl Project**



**An innovative and sustainable continuous process for the development of high quality trimethyl phosphite**

- Up to 100% saving of fresh and waste water
- 100% recovery of solvents
- 20-30% reduction of energy consumption
- Safer chemical process without hazardous by-products

Test phase started in September 2018: the pilot plant is ready and the new innovative and sustainable process is going to be launched and tested.

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# Business opportunity:

## Biomasa Peninsular: TL-BIOFER Project

Nutrient and reclaimed water recycling in WWTPs through twin-layer microalgae culture for biofertiliser production

Pilot tested El-Viso Villaralto wwtp, Cordoba

- 6 m<sup>3</sup>/day sewage throughflow
- 90% nutrient removal
- N and P harvest

Production of granulated and liquid organic fertilisers

<http://www.life-tlbiofer.eu/>



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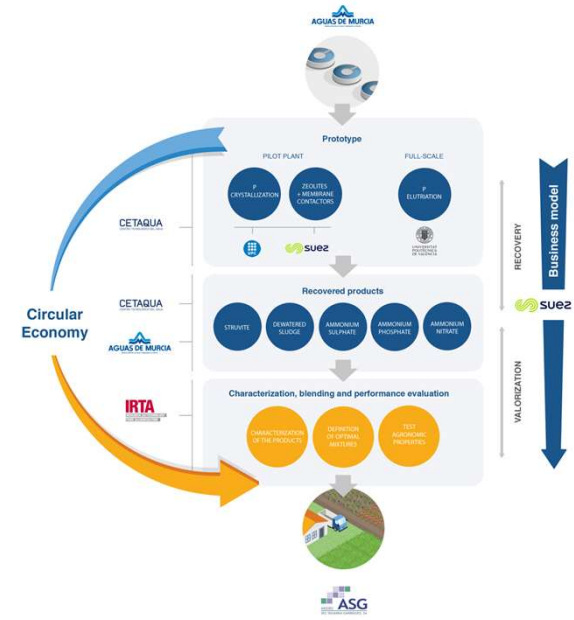


# Business opportunity:

# SUEZ CETAQUA: -ENRICH Project

## Boosting synergies between water and agriculture sectors

- Developing an innovative treatment train to enable an efficient recovery from wastewater
  - 50% Nitrogen
  - 40% Phosphorus
- Producing ammonium salts and struvite
- Products blended to obtain suitable fertilizers for target crops
- Reducing WWTP OPEX by 10%







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# Business opportunity:

**Prophos** (Croce, Northern Italy)

ProPHOS<sup>®</sup>  
C H E M I C A L S

## Phosphate recovery from exhausted fire extinguishing powders

- **Fire extinguishers must be regularly refurbished**
- **100 000 t/y of 'ABC' extinguisher material goes to waste in Europe**  
= mono ammonium phosphate (MAP) + oils + additives

**PHOSAVE project** (H2020, SME Instrument, 2016) :

**Industrial pilot to extract MAP, separate oils, purify and reprocess to fertiliser or flame retardants**

**Process now successfully operating (2018): 5 000 t/y**  
**1-2 industrial plants planned in different countries**

<http://phosave.com/>

[www.smart-plant.eu/ENE3](http://www.smart-plant.eu/ENE3)



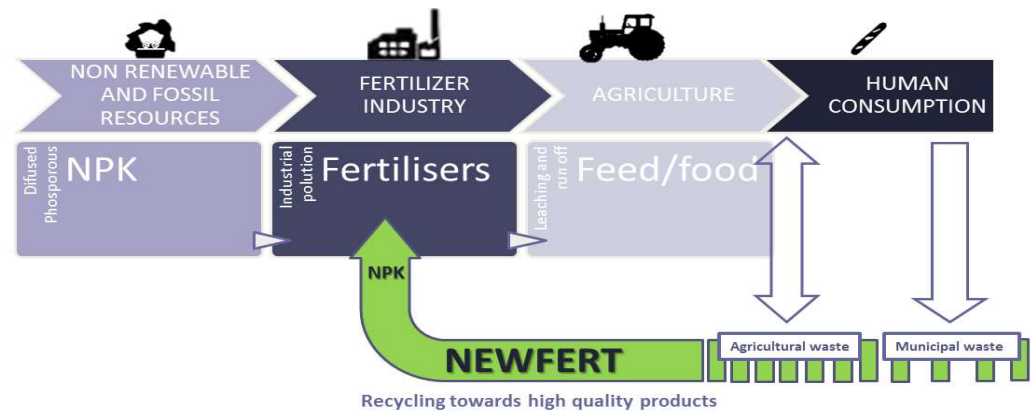
# Business opportunity:

# Fertiberia: NewFert Project



## Nutrient recovery from biological waste streams for fertiliser production

- Standardised NPK fertilisers from biowaste
- New P-recovery process from sewage sludge
- Biological extraction of P from manure





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# ESPP in a Nutshell

## Nutrient Platforms Global

[www.smart-plant.eu/ENE3](http://www.smart-plant.eu/ENE3)



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# ESPP: a coalition for action

- **Wide objectives:**  
**phosphorus stewardship**
  - global food security
  - circular economy
  - environmental protection
  - healthy diet and food safety
- **Bringing together:**
  - water & waste industries,
  - mineral and organic fertilisers, chemicals,
  - P-recycling technology suppliers,
  - national & regional governments,
  - knowledge institutes ...



- **Actions:**
  - vision & awareness
  - stakeholders & networking
  - dissemination
  - policy and regulation dialogue

<http://www.phosphorusplatform.eu/members>

More information: [www.phosphorusplatform.eu](http://www.phosphorusplatform.eu)

[www.smart-plant.eu/ENE3](http://www.smart-plant.eu/ENE3)





# How ESPP operates

Legally established not-for-profit association

→ important for transparency, clarity of decision making, representation

- statutes are public <https://www.phosphorusplatform.eu/platform/about-esp>
- EU Transparency Register no. 260483415852-40 <http://ec.europa.eu/transparencyregister/>

100% membership funded

→ key to credibility, independence

- approx. 40 paying members to date: companies, R&D institutes or projects, cities / regions / governments
- balance between different interests and industries
- in touch with reality (payment = commitment)





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# Nutrient platforms and networks worldwide

Netherlands 2010 <http://www.nutrientplatform.org/>

Germany 2015 [www.deutsche-phosphor-plattform.de](http://www.deutsche-phosphor-plattform.de)

Baltic: ESPP works with Baltic Sea Action Group [www.bsag.fi](http://www.bsag.fi)

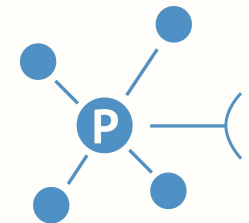
ESPP European Sustainable Phosphorus Platform 2013

North America Sustainable Phosphorus Alliance (SPA) 2017  
(launched as NAPPS in 2015) <https://phosphorusalliance.org/>

Japan PIDO (former P2011 (Phosphorus Industry Development Organization)

Italy, Ireland, Czech Republic, Phosphorus Platforms in the making

Global Partnership for Nutrient Management (UNEP)  
<http://www.unep.org/gpa/what-we-do/global-partnership-nutrient-management>





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# *EU Fertilisers Regulation, a cornerstone to a Circular Economy, is “stuck” in Trilogue*

# Please sign our support letter or contact us for more details

Companies wishing to be added to the signatories list for this Joint Letter should send to [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu) by 16<sup>th</sup> November  
[www.smart-plant.eu/ENE3](http://www.smart-plant.eu/ENE3)





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Email: Chris Thornton [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu)

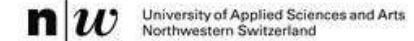
Website: [www.phosphorusplatform.eu](http://www.phosphorusplatform.eu)

News: [@phosphorusfacts](https://twitter.com/phosphorusfacts)

<http://www.phosphorusplatform.eu/members>



Kanton Zürich Baudirektion Amt für Abfall, Wasser, Energie und Luft



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