Closing waste water cycles for nutrient recovery

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WalNUT. Closing waste water cycles for nutrient recovery

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CENTRO TECNOLÓGICO CARTIF

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WALNUT

Consortium

BIOPHOSPHATE 100% NATURAL

Aquafin

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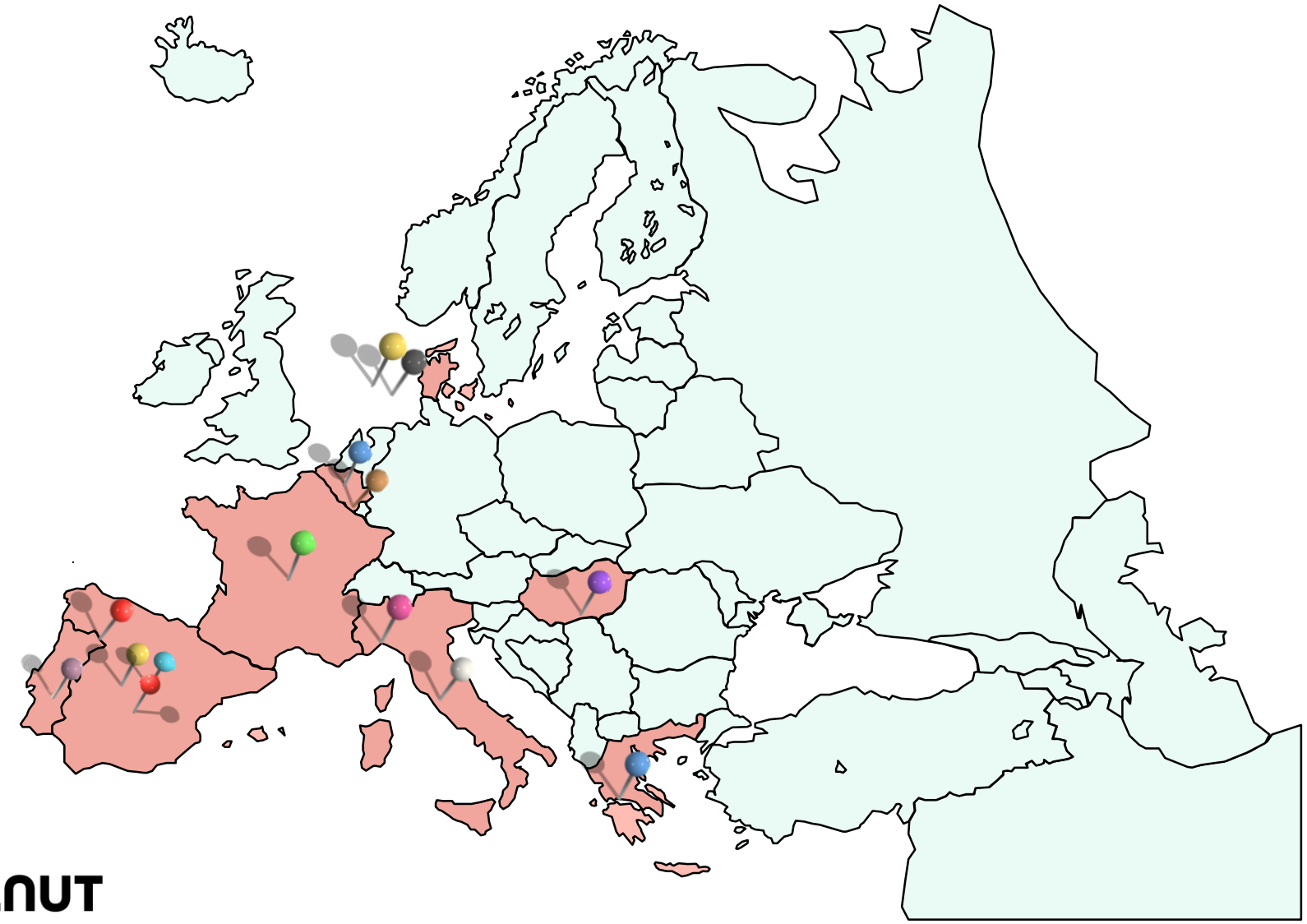

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Overview

Overview

The high growth rate of world population and relative consumption demand is putting significant pressure on the food industry at different levels to multiply its production capacity.

To meet this additional demand requires an increase of the already intensive agricultural practices, leading to a high land, water, energy, and fertilisers use.

The request for effective and high-performance plant nutrients is expected to reach unprecedent level.

Overview

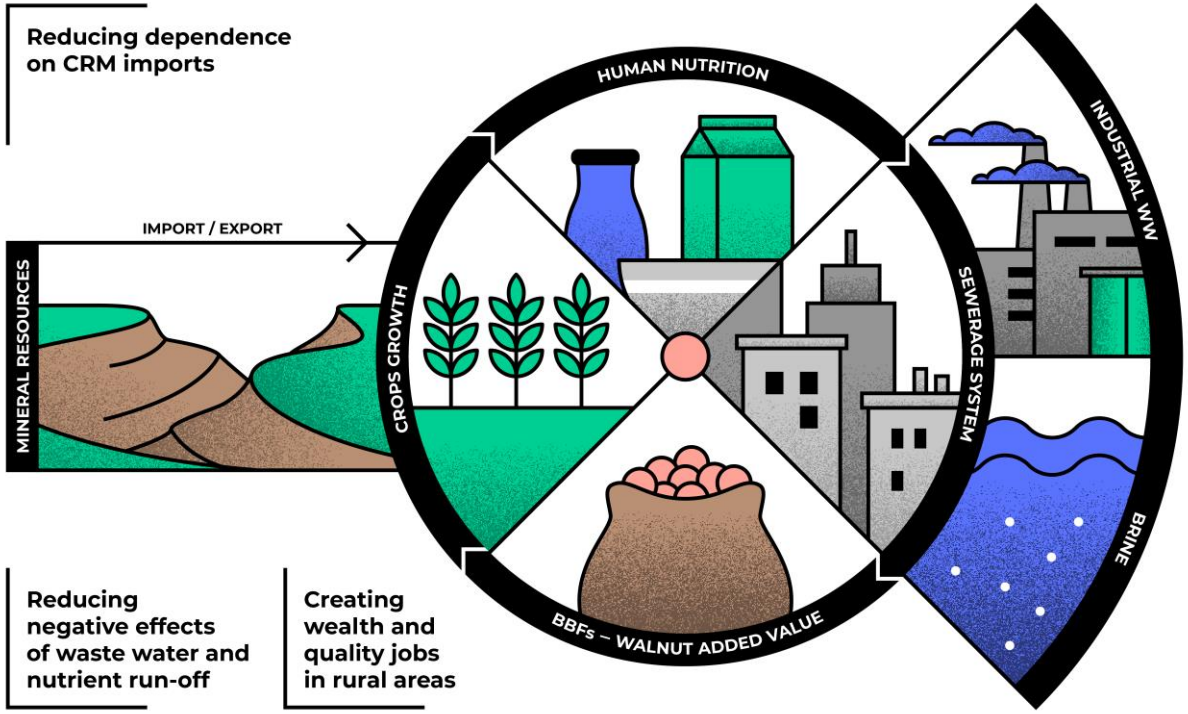
Waste water streams are considered a promising resource to mitigate the soil nutrient imbalance and to recover nutrients for plant fertilising purposes.

Nutrients from this large-scale recovery process can be used for bio-based fertilisers offering a new, circular and sustainable model to tackle the limited nutrient-mineral reserves and its crucial environmental issues.

Objectives and methodology

WalNUT's ambition

WalNUT aims to redesign the value and supply chain of nutrients from wastewater and brine, creating innovative solutions for nutrient recovery while contributing to circular economy and sustainability in the EU agricultural sector.



Objectives

- Analyse inter and intra-regional EU nutrient imbalances.
- Develop sustainable and resource-efficient technological solutions for nutrient recovery.
- Environmental and socio-economic impact assessment of the proposed solutions.
- Assess the agronomic efficiency of safe bio-based fertilisers.

Feedstock

- The project will valorise waste water streams of 5 different typologies:

- Urban waste water.
- Sewage sludge.
- Industrial waste water.
- Agri-food waste water.
- Brine from desalination plants.

- Although agri-food waste water is really industrial waste water, we have preferred to study it separately, due to its own characteristics in terms of nutrient content, organic matter, etc.

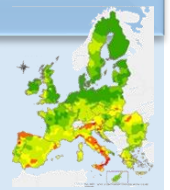
Feedstock nutrient content

	Pilot 1	Pilot 2	Pilot 3	Pilot 4	Pilot 5
Type of feedstock	Industrial WW	Urban WW and sewage sludge	Agri-Food WW	Brine from seawater desalination	Urban WW and sewage sludge
COD (mg O_2/L)	5,061	350	73,300	-	2,568
NH_4^+(mg N-NH_4^+/L)	5.30	30.6	25	-	1,475
Total nitrogen (mg N/L)	118.88	43	1,204	<0.01	1,939
PO_4^{3-} (mg P-PO_4^{3-}/L)	15.72	2.4	678	<0.01	17.34
Total phosphorous (mg/L)	17.44	5.5	870	0.08	24.18

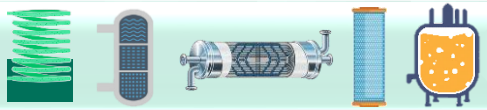
WalNUT Concept

Baseline

+ Imbalances
+ Policy
+ Farmers
+ WWTP managers



Technologies



Lab → **Pilot**

WalLAB

Pot | **Quality Safety** | **Field**

LSCA - Impact Assessment

Products - BBFs

Business Models

Policy Implications

Replace mineral fertilisers

Reduce agriculture footprint

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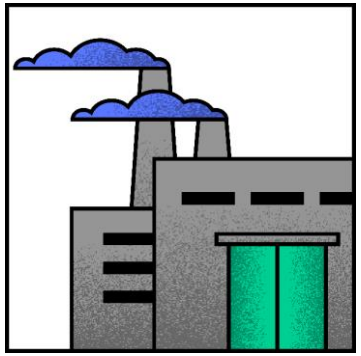
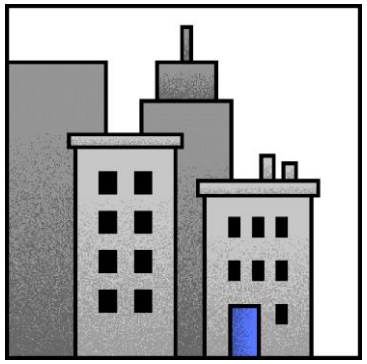
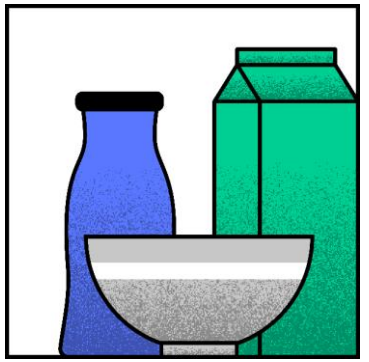
Pilots



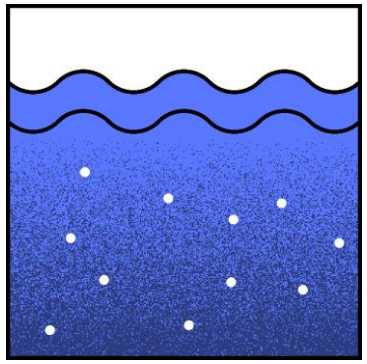
Industrial (Spain central)



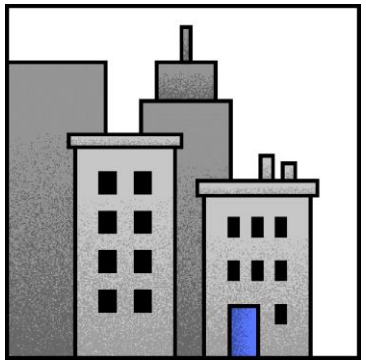
Urban (Belgium)



Food (Hungary)



Brine (Greece)



Sewage sludge (Spain Northwest)

WalNUT technologies*

	Pilot 1	Pilot 2	Pilot 3	Pilot 4	Pilot 5
Place	Spain (Centre)	Belgium	Hungary	Greece	Spain (Northwest)
Type of feedstock	Industrial WW: paper, food-processing, bottle water and cosmetic	Urban WW and sewage sludge	Food industrial WW in combination with food industrial by-products	Brine	Urban WW and sewage sludge
Capacity	500 L WW/day	1,500 L WW/day	150 L WW/batch	500 L brine/day	1,440 L WW/day
Process technologies	- Hybrid system of photoautotrophic and heterotrophic microalgal cultivation or - Microbial Fuel Cell	- HRAS - Ion exchange or - CAS -Absorption / Desorption	-High temperature pyrolysis for biotech carrier/adsorber production -Liquid fermentation -Solid fermentation and formulation -Liquid phase adsorption	- Nanofiltration - Multiple Effect Distillation - Selective crystallisation	- Ion exchange - Membrane contactor - Formulation technology
Nutrients recovered	N, P, K, C and micronutrients	N, P and/or K	N, P, K, C and micronutrients	K, Mg, Na, and Ca	N
Final TRL	5	5	5	5	5

*This information is an estimation.

Final products

WalNUT project expects to obtain different types of fertilisers:

- **BBF from Pilot plant 1:** A BBF with an organic (C) and mineral (N, P) base will be obtained, so as it is an **organic-mineral fertiliser**, its market share is expected to come from organic and mineral fertilisers.

- **BBF from Pilot plant 2:** A BBF with a mineral base will be obtained with a majority composition of N, so it can act as a substitute for **nitrate fertilisers.**

- **BBF from Pilot plant 3:** A BBF enriched in Ca/P with better properties (organic content) than mineral fertilisers of phosphate origin will be obtained. It will therefore share the market for **phosphate fertilisers**.

Final products

WalNUT project expects to obtain different types of fertilisers:

- **Bio-products from Pilot plant 4:** A series of micro-nutrients will be recovered which will update the BBFs obtained by WalNUT or may replace **micronutrient fertilisers** on the market (complements to plant nutrition).

- **BBF from Pilot plant 5**: a BBF mixture of inorganic (N) and organic components will be obtained. Therefore, the Smart BBF will compete with products that are currently present in the market **of organic and inorganic fertilisers.**

Expect impacts

Expect impacts

WalNUT's ambition is fully aligned with the agenda set by the **EU Green Deal strategy** and the priorities of the **EIP on Agrifood and Raw Materials**, promoting a robust and resilient agri-food sector.

- 5 new solutions tested at relevant scale and 12 technologies validated to develop a new generation of commercial, sustainable and safe fertilisers based on by-products.

- Replace conventional, non-renewable mineral fertilisers, especially the critical raw material phosphate, reducing EU external dependence/risks for depletion.

- Balance nutrient concentrations between or within regions, thus increasing resource efficiency.

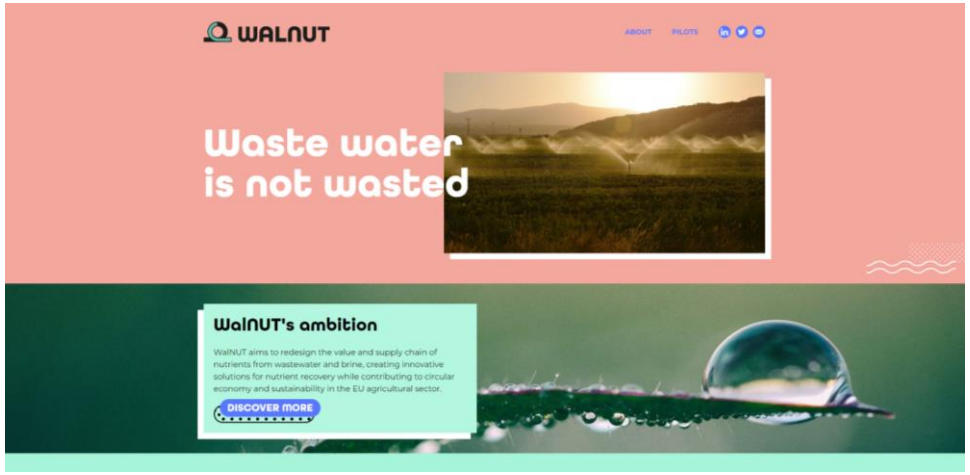
Expect impacts

- Reduce the environmental impacts linked to the dispersion of nutrients present in waste flows, to the emissions of greenhouse gases or to the production of fossil-based fertilisers.

- Contribute to a thriving, sustainable and circular bioeconomy through the development of new business models that are synergetic with other economic sectors, and therefore to the creation of wealth and quality jobs in rural areas.

- Set up a coherent policy framework for the sustainable production and use of BBFs.

Website and Social Networks



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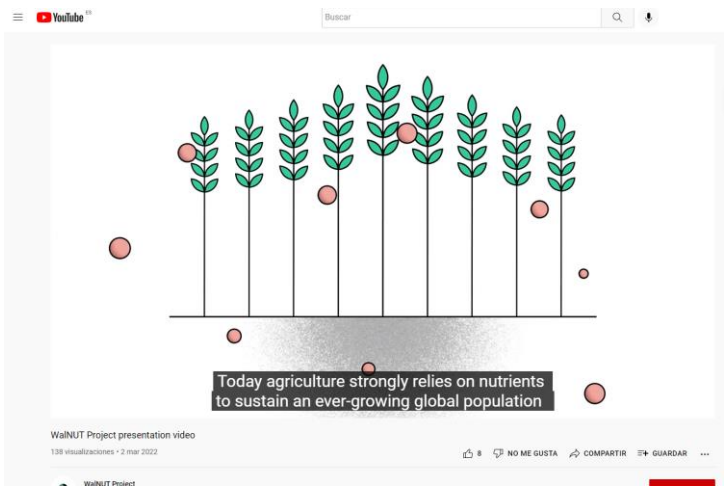

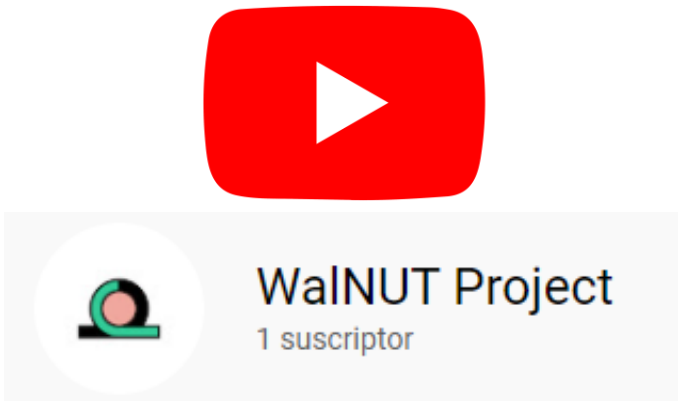

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BIOREFINE CLUSTER EUROPE

Thank you • Gracias • Grazie • Merci
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