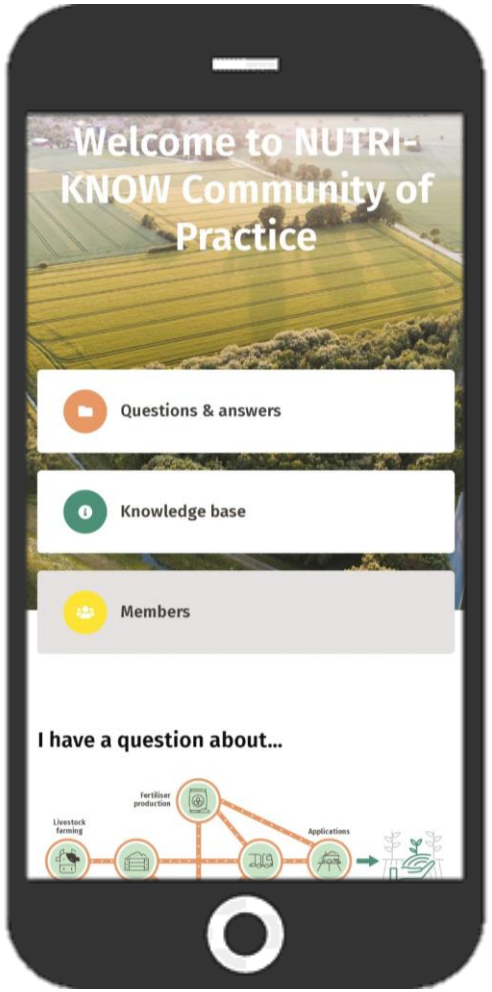
NUTRI•KNOW

WEBINAR Nº4

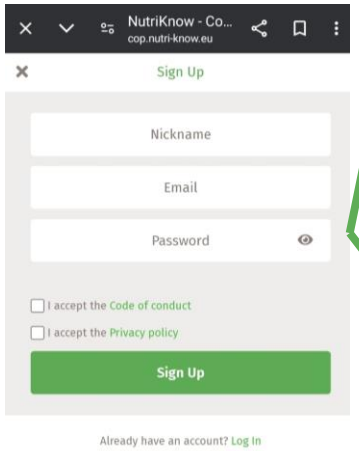
Processing Technologies for Nutrient Management

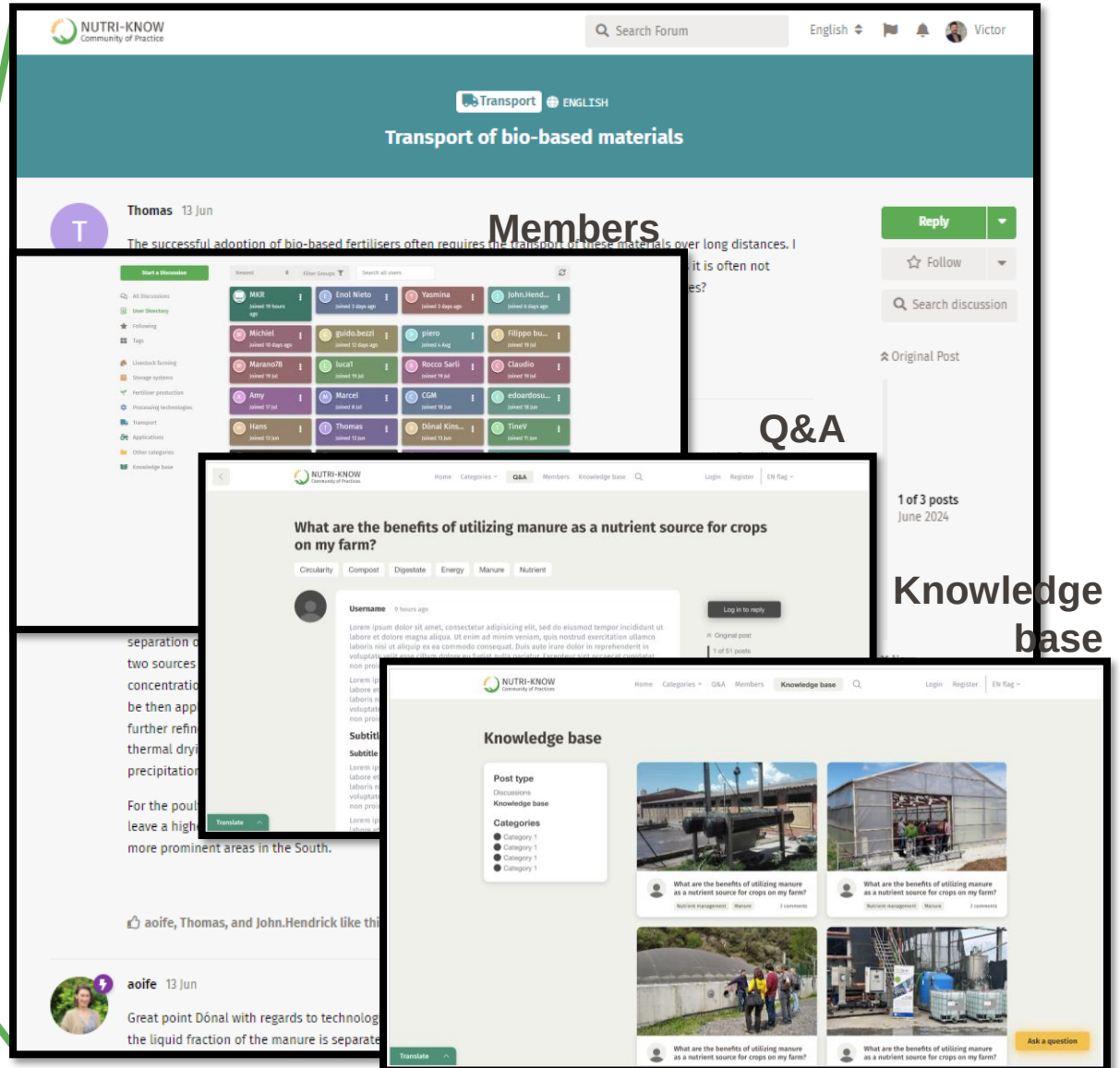
29th October 2024

Join our **Community Of Practice**!



Sign up and explore!





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Overview webinar series

Time: 10:30 – 11:30AM

- October 8: Introduction webinar
- October 15: Livestock Farming
- October 22: Application
- **October 29: Processing Technologies**
- November 5: Fertiliser Production
- November 12: Transport
- November 19: Storage Systems

Register via www.nutri-know.eu/nutri-know-webinars

Processing Technologies for agricultural waste processing


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- Restricted nutrient application on the field
- Intensive livestock
- Nutrient scarcity
- Volatile prices for fossil-based mineral fertilisers

Process agricultural products

- Better quality
- Fertiliser production
- Energy generation
- Mitigation environmental impact

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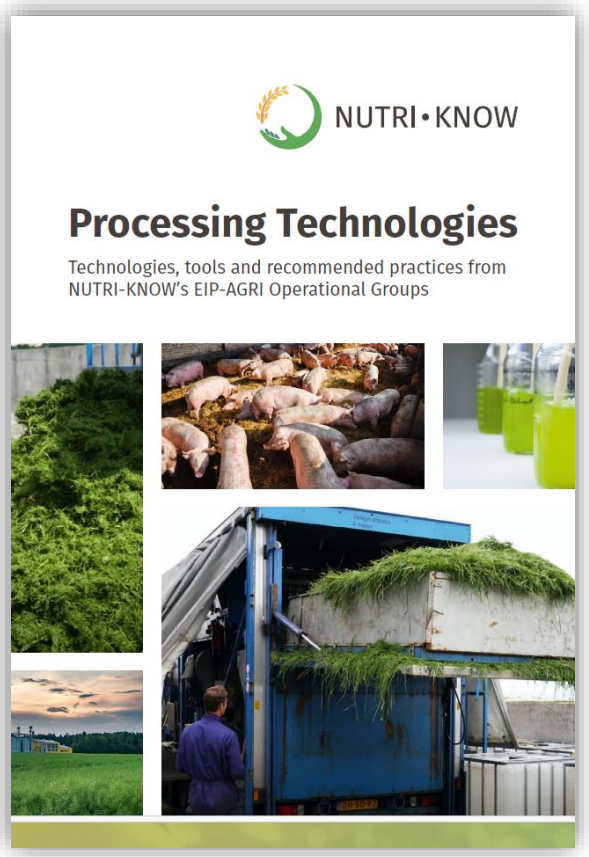
Processing Technologies for Nutrient Management

- Case 1: Slurry Concentrator (UVIC)
- Case 2: Recovery of ammonium salts from manure (UGent)
- Case 3: Struvite (CRPA)
- Case 4: Pocket digestion (Inagro)
- Case 5: Grass Biorefinery (Teagasc)
- Q&A



Information on the other technologies via https://www.nutri-know.eu/wp-content/uploads/2024/10/Nutriknow_Booklets.zip

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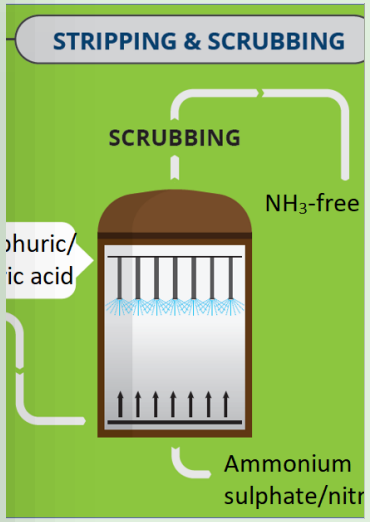
Processing Technologies for Nutrient Management



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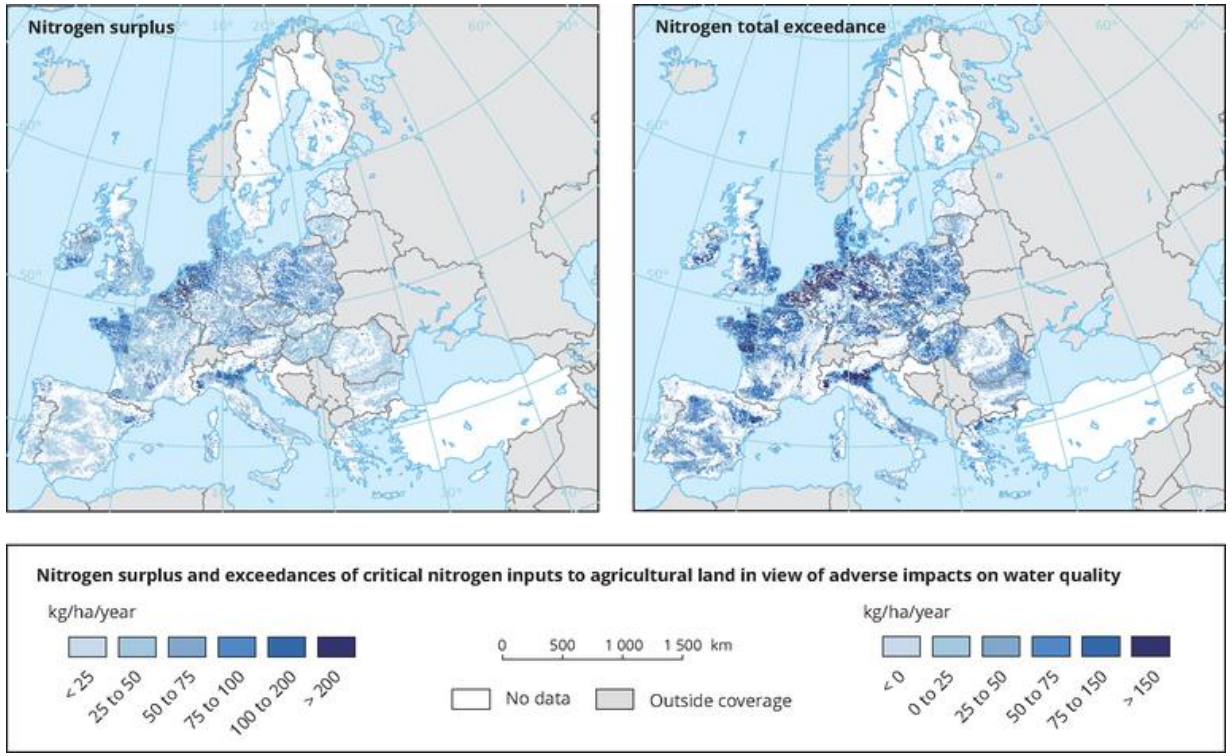
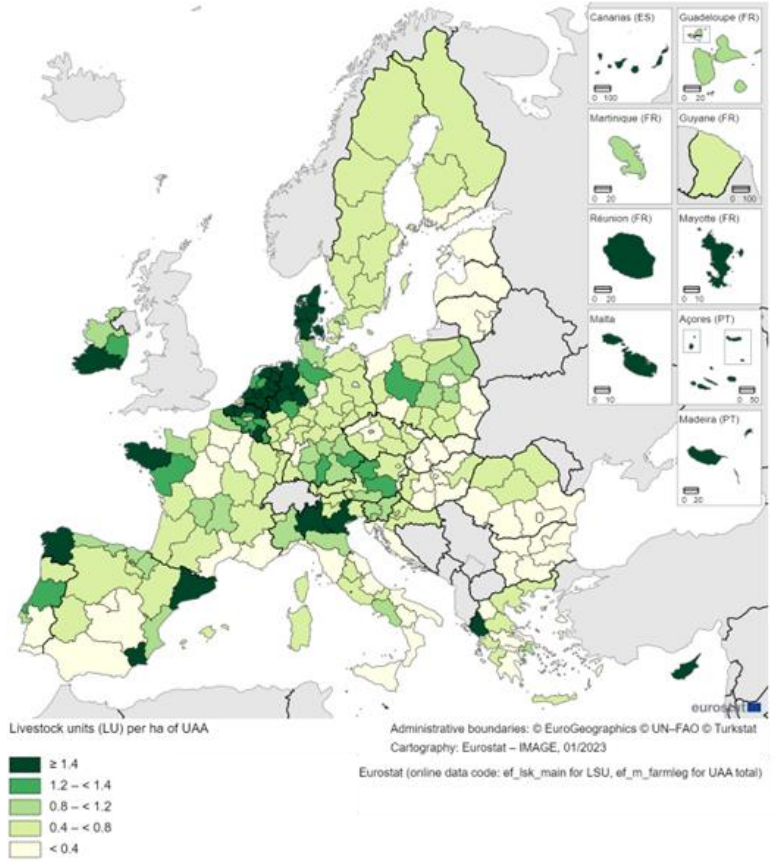
Slurry concentrator Context

Nitrogen surplus



Source: European Environment Agency
Published 03 Dec 2019 | Modified 20 Sept 2024

Livestock density



Source: Eurostat
Data from January 2023. Planned update: 26 January 2026 (with data from the Farm Structure Survey 2023).

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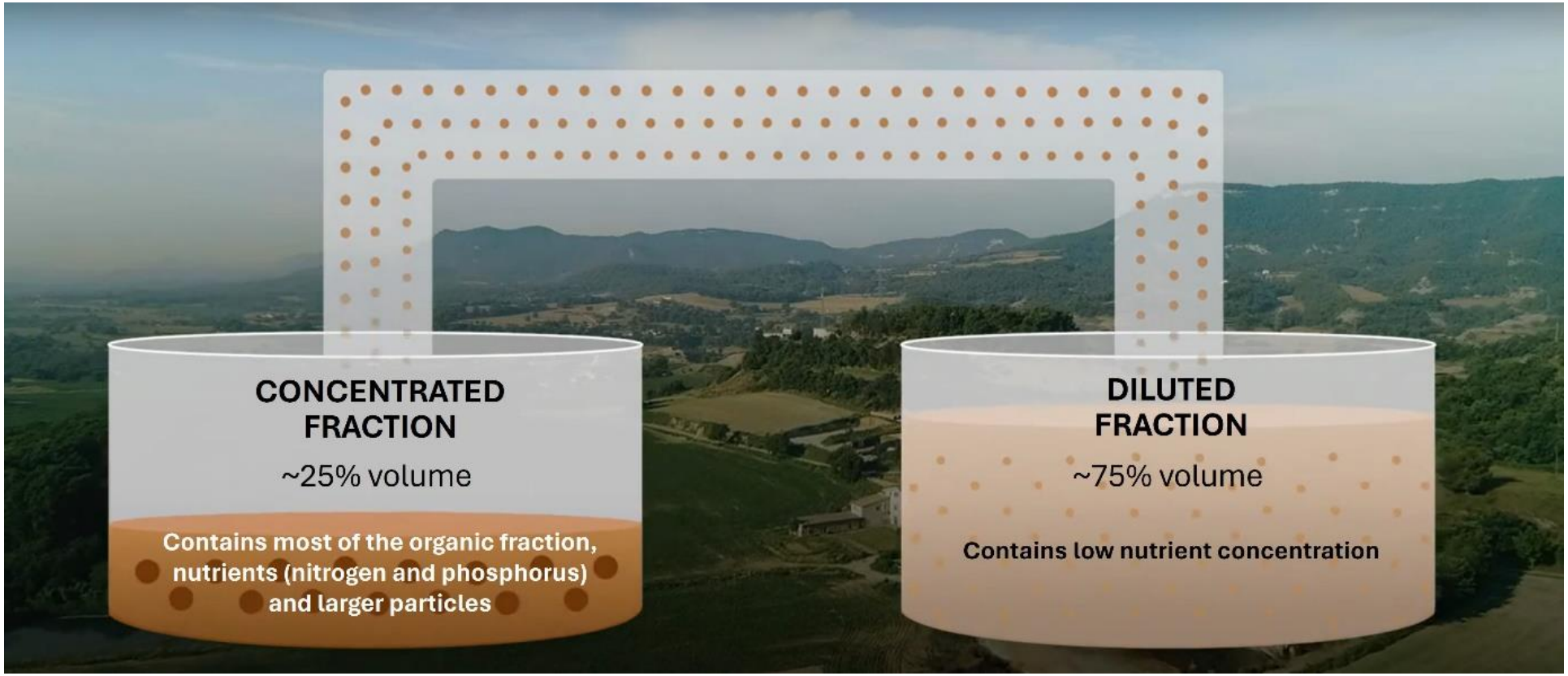
Slurry concentrator Technology



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Slurry concentrator Technology

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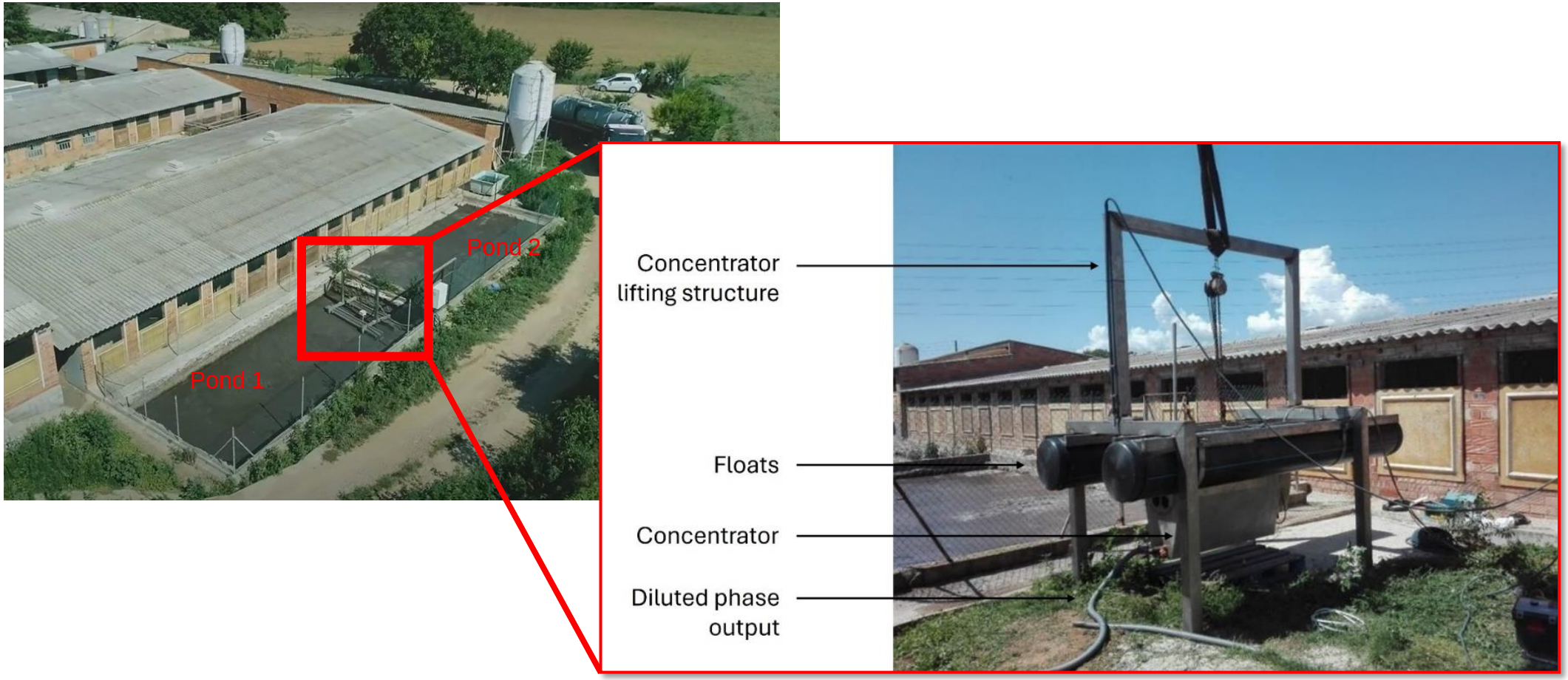
Slurry concentrator
How it works?



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Slurry concentrator

The equipment used to manage the two fractions is the same (tractor with a pump and a slurry tanker) which reduces investment costs, but also operating costs.

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Slurry concentrator RESULTS

- **Increased Efficiency**: differentiated management of the two phases **minimises transport costs** and **optimises nutrient application** to the soil, both from an agronomic and environmental point of view.

- **Cost Savings**: using the **same equipment** for application. Slurry concentrator can be a **shared solution** for a group of farmers.

- **Enhanced Monitoring and Precision**: The system enables easier monitoring of applied nutrients to the soil.

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Slurry concentrator
CURRENT STATUS

- New business model
- Patent at national level
- The Cooperative Plana de Vic offers a free simulation of the viability of the slurry concentrator (CONTECH-ONE) on your farm.
- Contact: Pau Parés ppares@planadevic.cat

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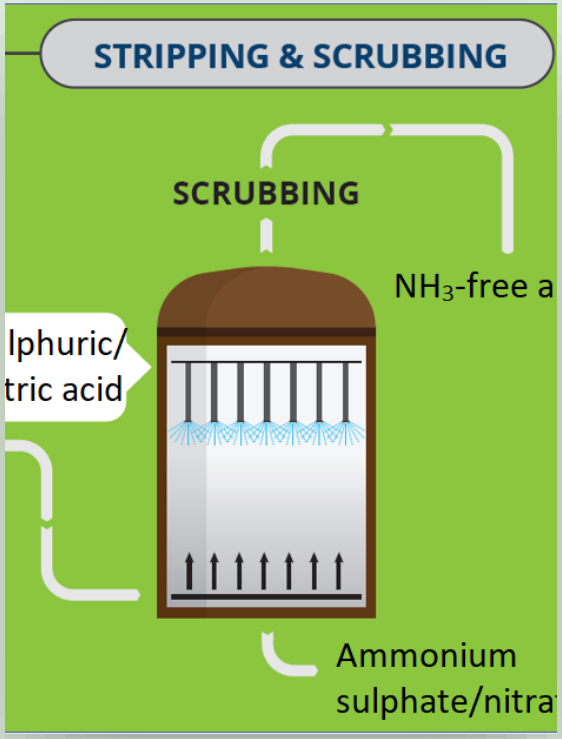
Processing Technologies for Nutrient Management



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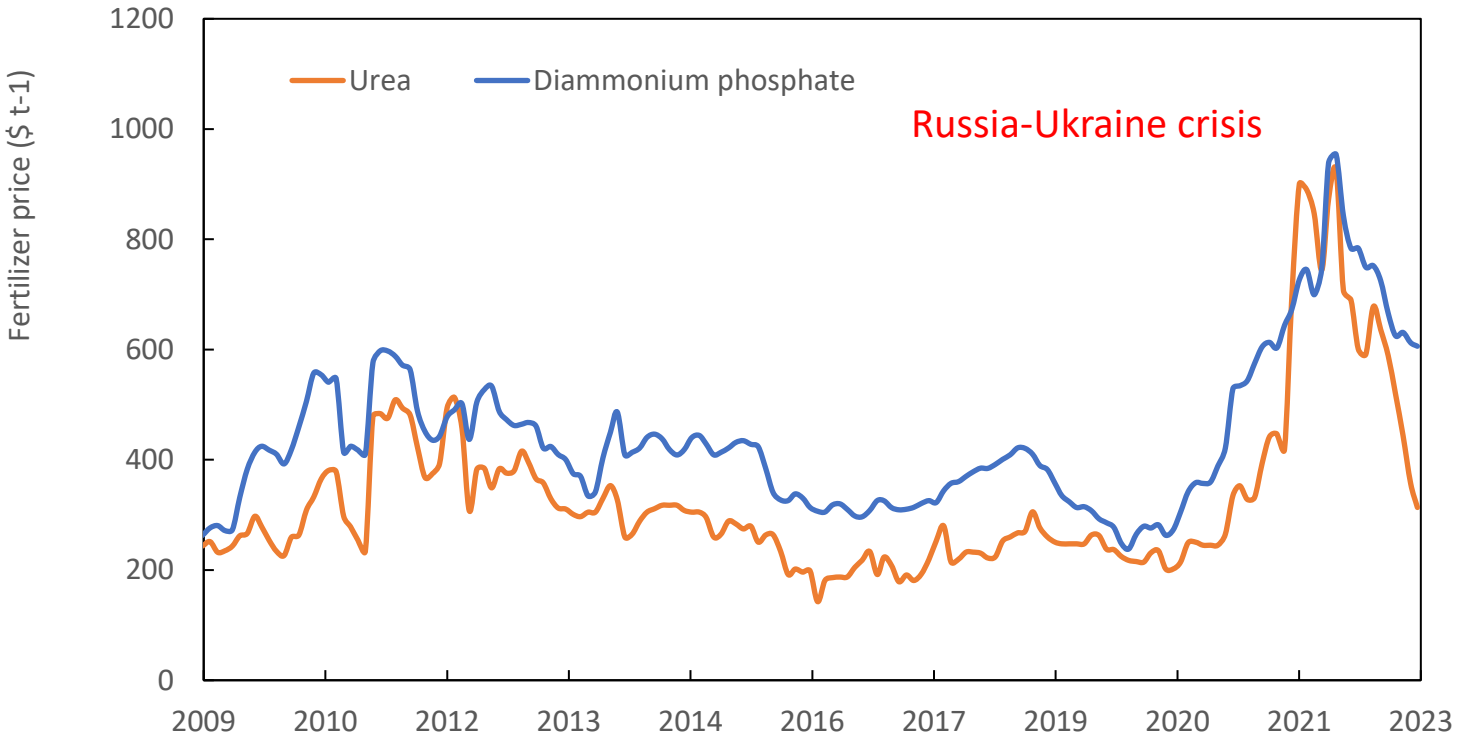
Challenge of manure application



Animal manure & derivatives can be alternative fertiliser sources

Nitrates Directive

In Nitrate vulnerable zones, < 170 kg N ha^{-1} yr^{-1}

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Manure processing technologies

Composting

Compost

Solid-liquid separation

Solid/liquid fractions

Struvite precipitation

Struvite

Animal manure

Anaerobic digestion

Digest ate

Stripping and Scrubbing

Ammonium salts

Evaporation

Ammonia water

Membrane filtration

Mineral concentrate

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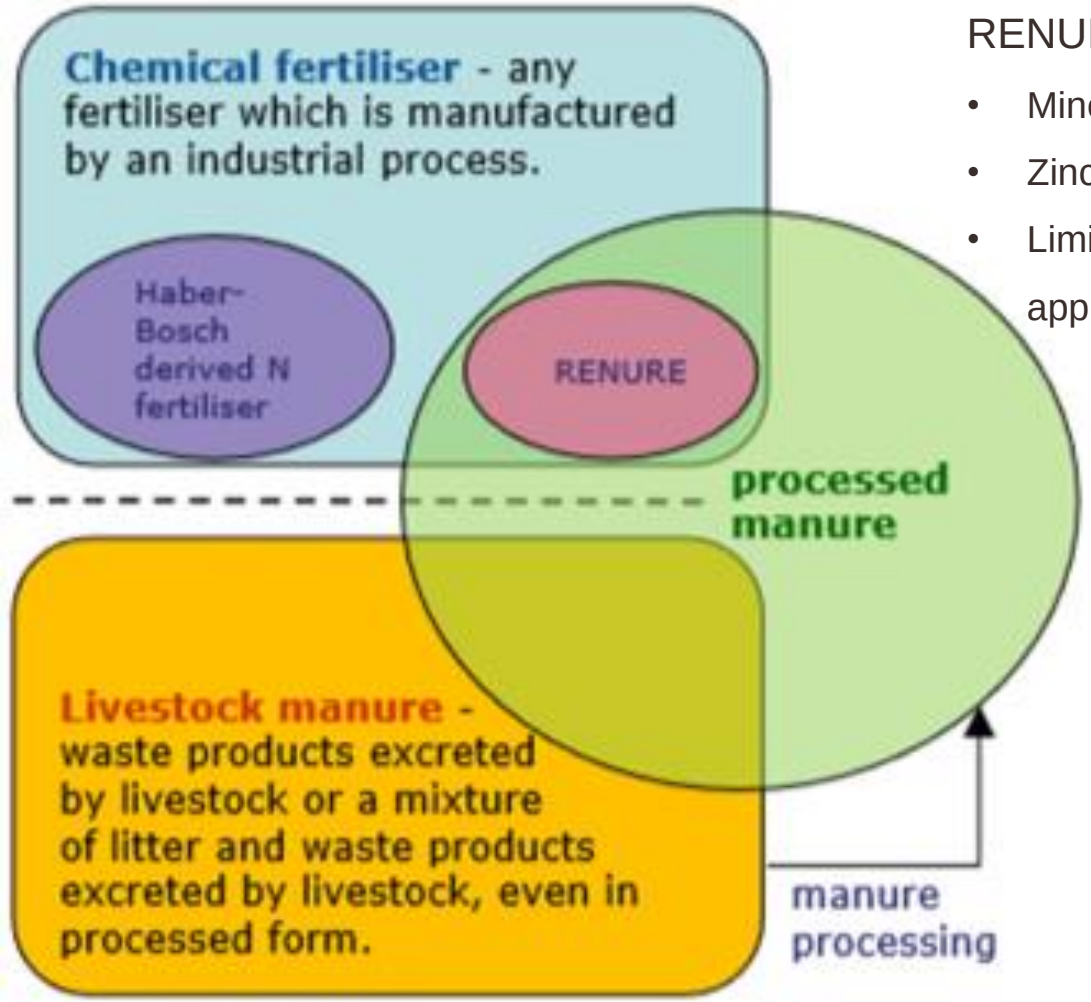
RENURE: recovered nitrogen from manure



RENURE criteria proposed by Joint Research Center (JRC):

- Minerale N /total N ratio > 90% or organic C /total N ratio < 3
- Zinc < 300 mg/kg dw, Copper < 800 mg/kg dw
- Limiting nutrient losses and ammonia emissions during storage and application steps.

Ammonium salts (RENURE products)

Stripping and scrubbing process

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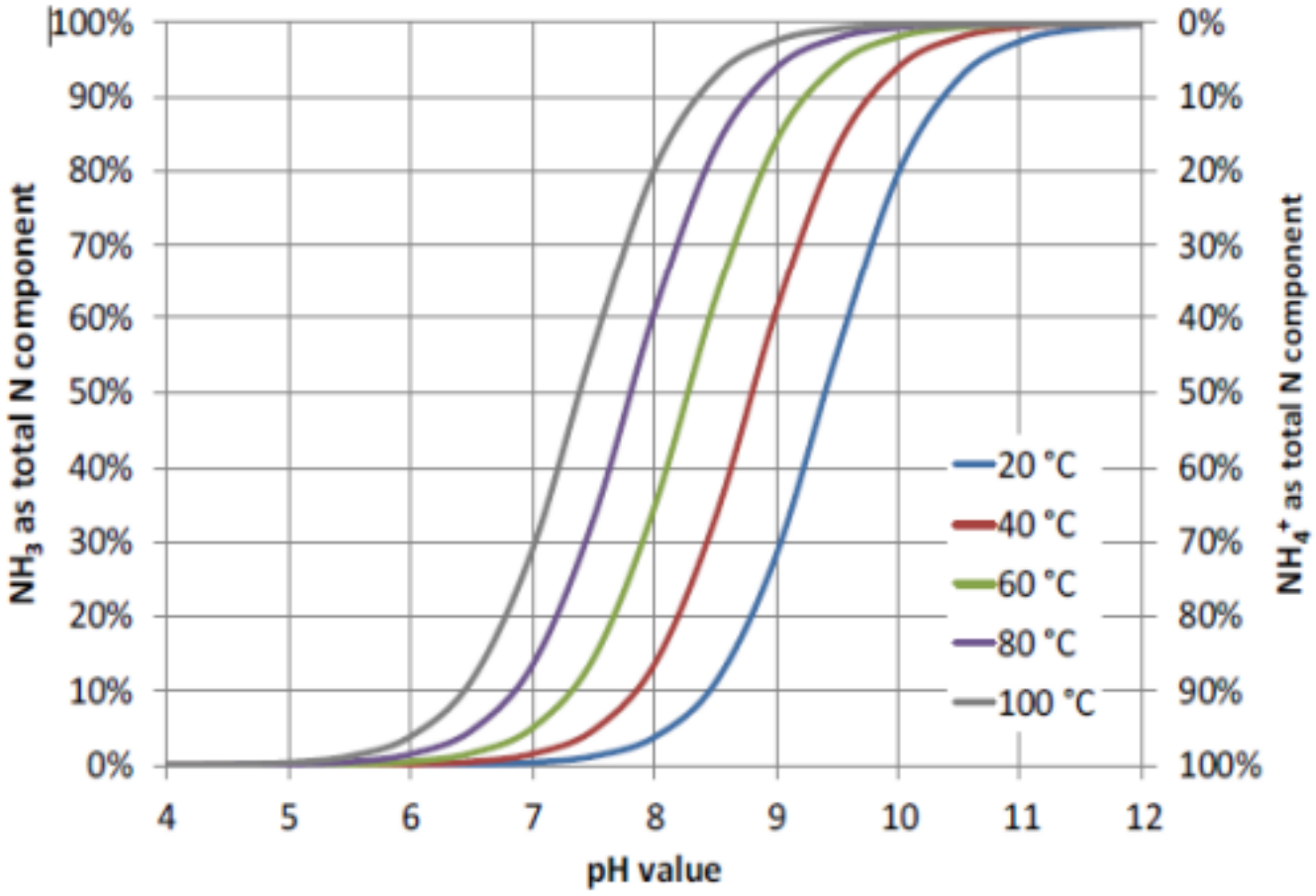
Stripping and scrubbing process

Equilibrium between $NH_3 \Leftrightarrow NH_4^+$



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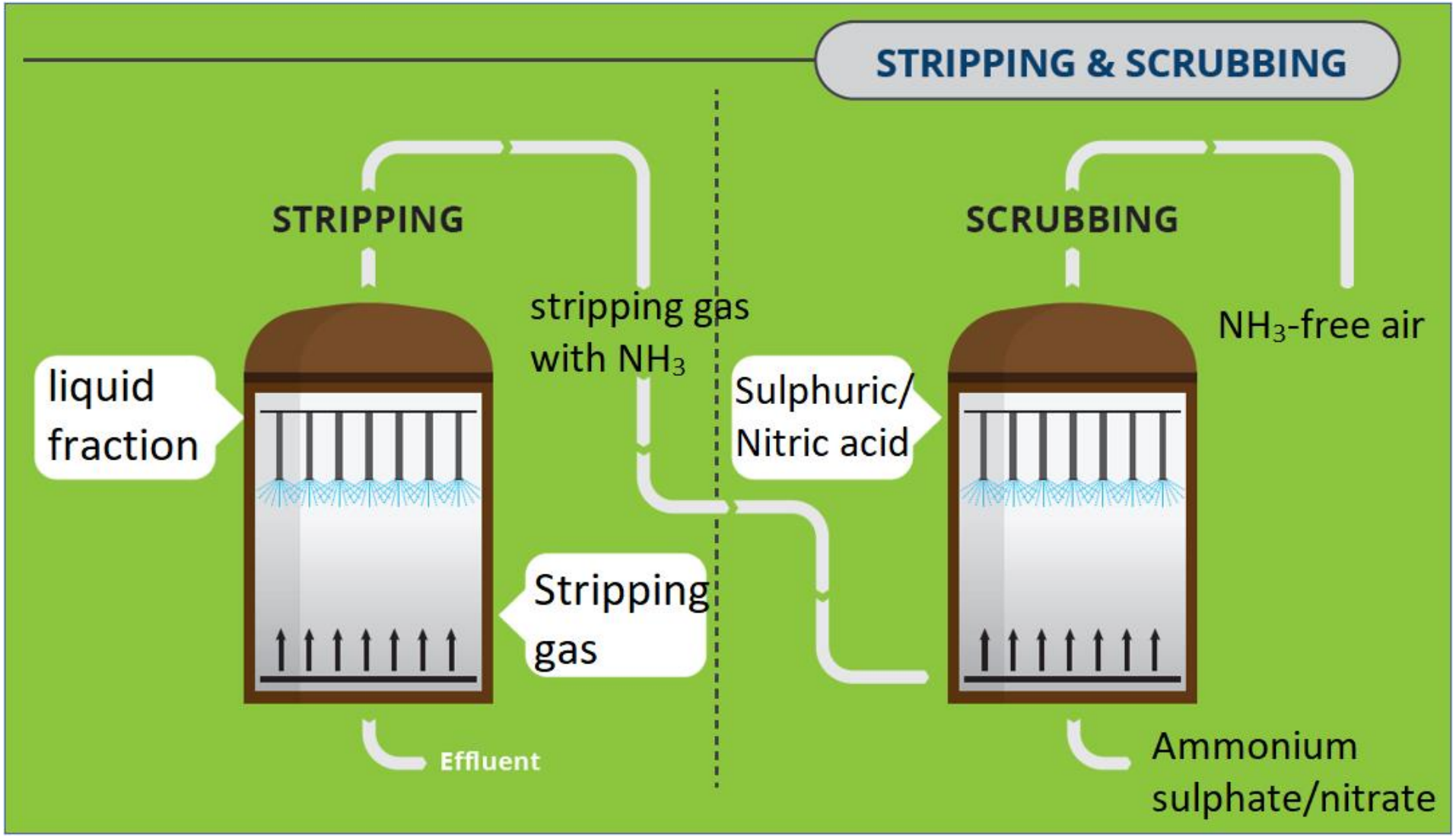
Stripping and scrubbing process



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Ammonium salts as alternative fertilisers

	Ammonium sulphate	Ammonium nitrate
pH	5-7 (slightly acidic)	
Nitrogen %	8%	10-15% (50/50 ammonium/nitrate ratio)
Sulphur %	9 (of 23% SO_3)	0
Density (ton/m³)	1.15-1.2 (pure minerals no organic particles)	

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Injection of ammonium salts to reduce ammonia emissions during application

Five field trials were conducted in 2022 and 2023 with potato, maize and winter wheat.
Results indicated that the **ammonium nitrate recovered from animal manure performs as well as artificial fertilizers (urea and calcium ammonium nitrate) in terms of effectiveness and fertilizing value.**

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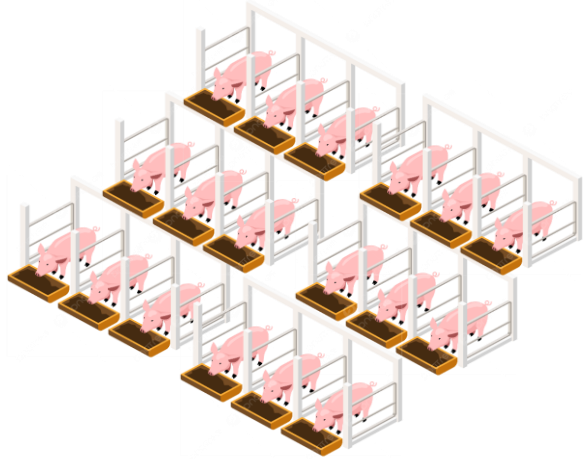
Cost-benefit analysis

The economic viability of implementing an ammonia stripper is highly dependent on:

- The **manure type**: including the amount of total N present in the manure flow to be treated and the ratio of mineral N to organic N.
- The **existing treatment pathway** such as anaerobic digester or nitrification-denitrification
- The **scale** of the farm, i.e. the amount of manure to be processed;
- **Manure pressure** given the Nitrates Directive and the implementation of the RENURE criteria



Desired economies of scale
~20,000 tonnes of manure per year

Installation cost approximately € 100-150 /1000L
(estimated by June 2023)

Current status: intaking RENURE in EU regulations

On 8th March 2024, NUTRI-KNOW contributed to in submitting Joint Feedback on the Nitrates Directive Evaluation of several European Research Projects, highlighting the implementation of the RENURE criterion and the adaptation of the legal status of ammonium salts as alternative fertilisers.

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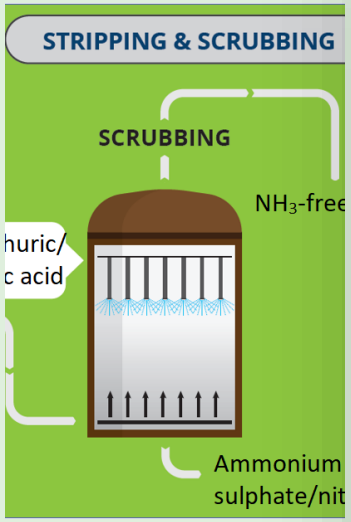
Processing Technologies for Nutrient Management



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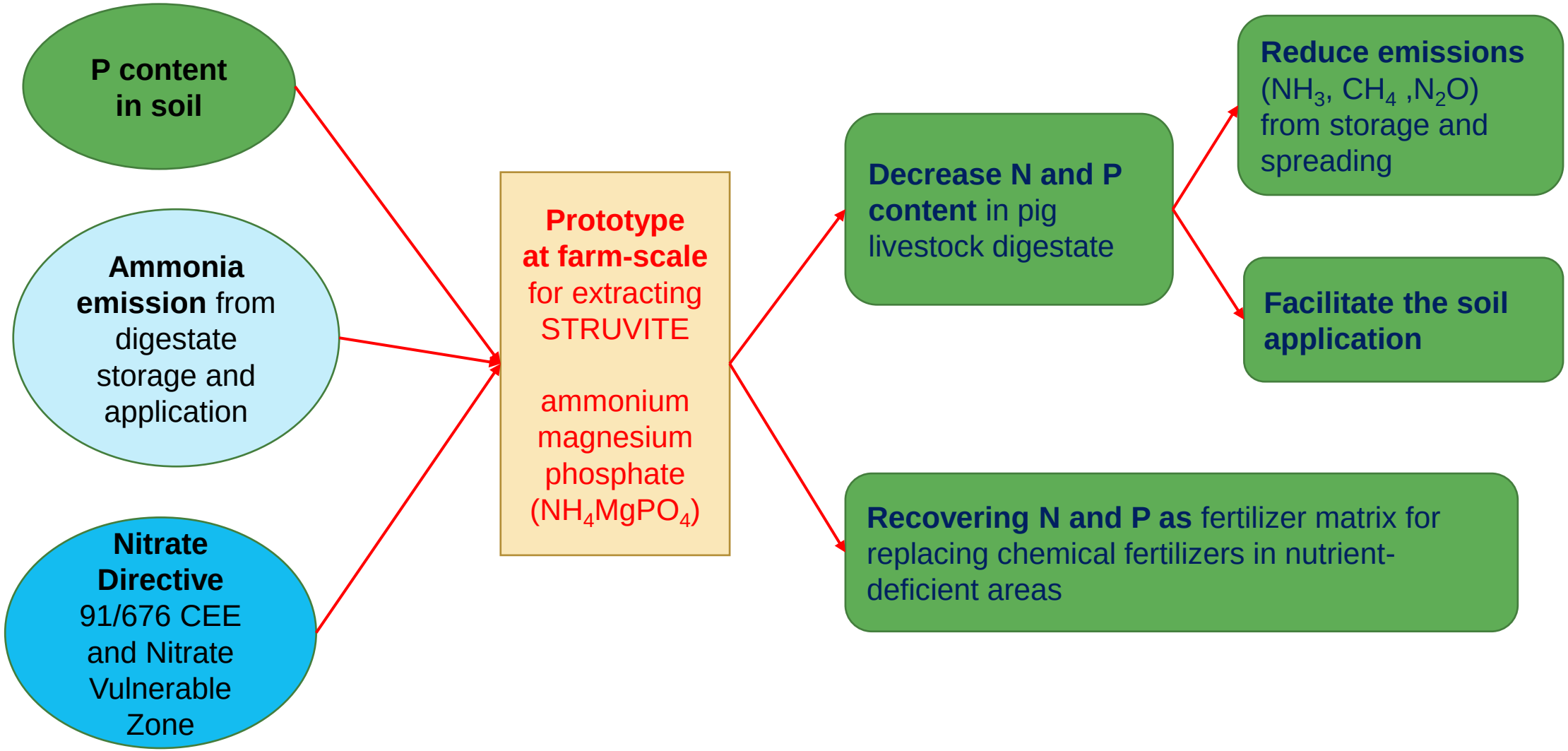
OG Struvite: Context and goals



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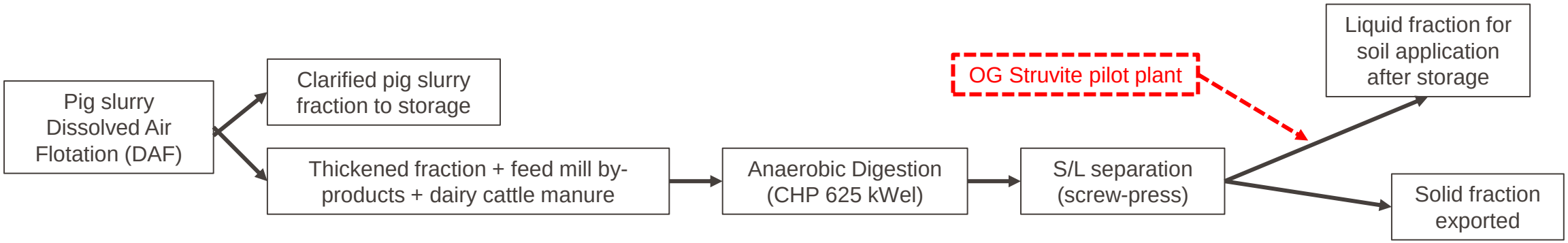
Colombaro pig farm: Modena, Emilia Romagna (IT)

Main pig livestock data

- 15000 animal place
- Growing and fattening pig phase: 30 – 170 kg/pig
- Parma ham PDO suppley chain



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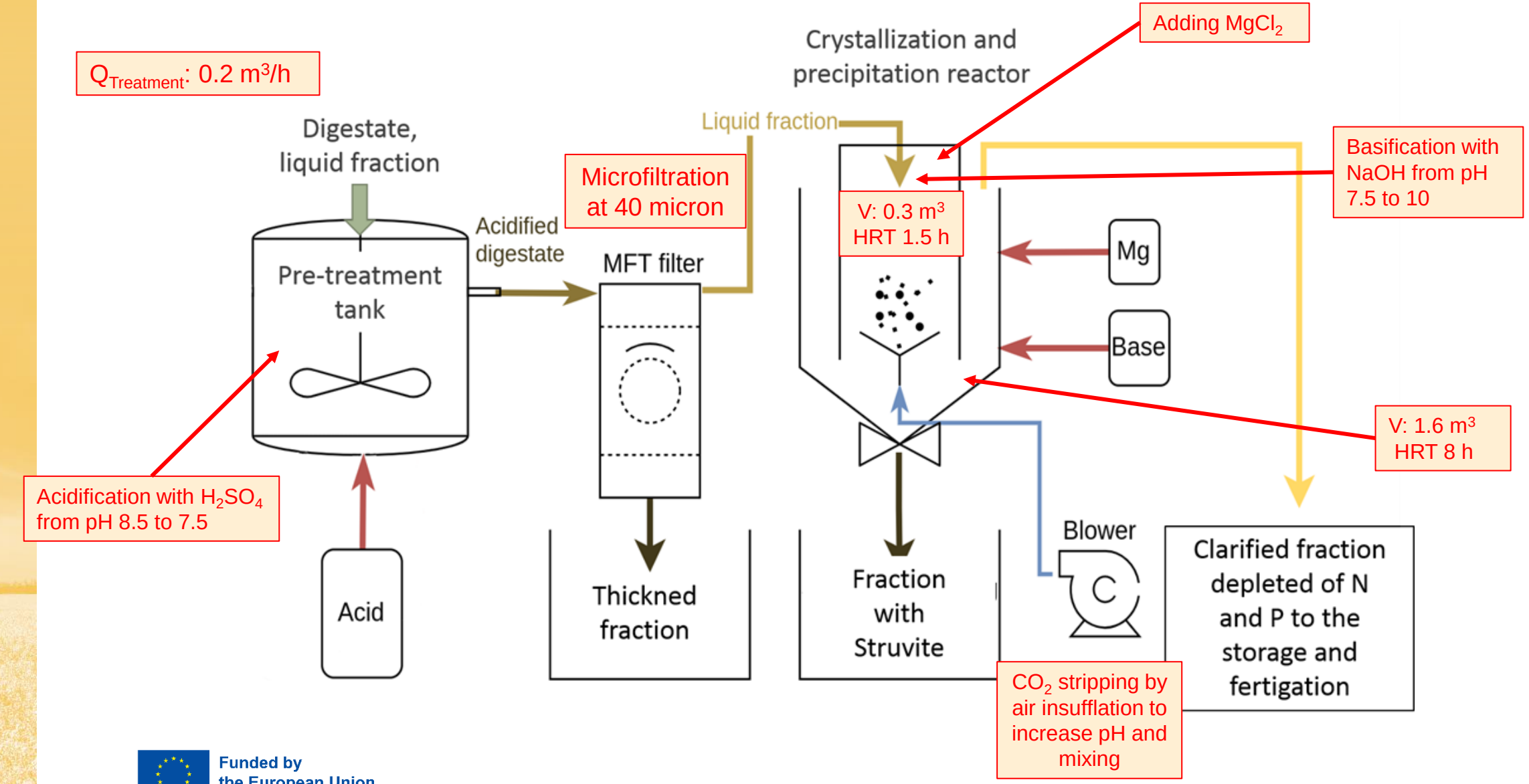
Layout of the treatment



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Struvite prototype

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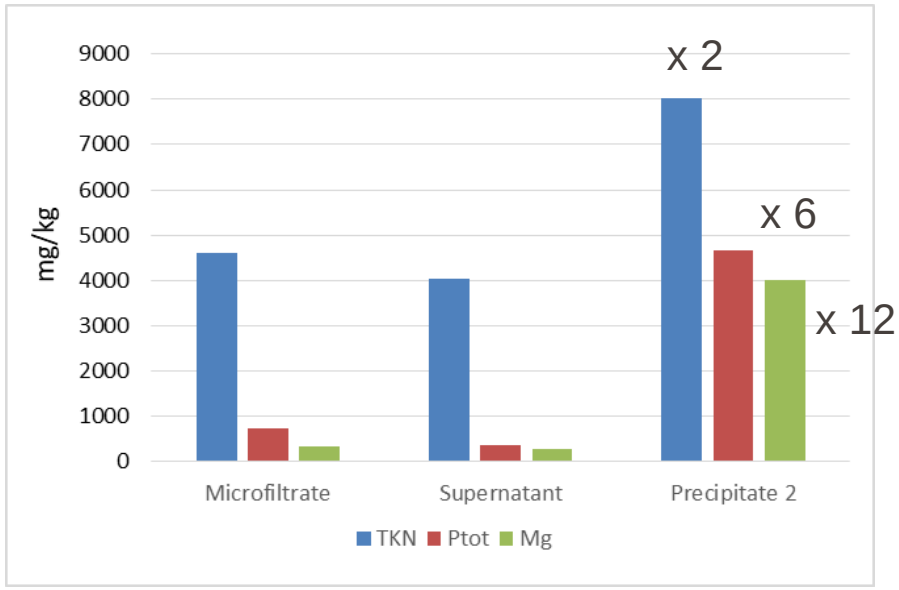
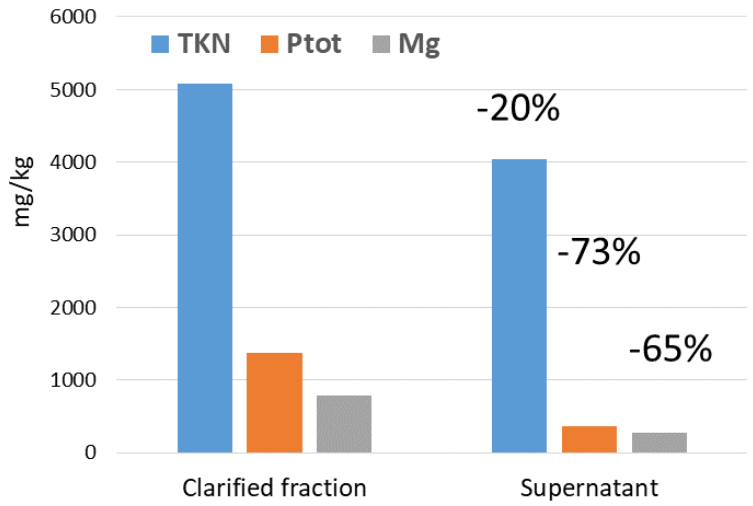
OG Struvite: treatment efficiency

Nutrient concentration by struvite reactor



Digestate nutrient depleting



	Qflow	P recovery efficiency
	%	% input P
Input (clarified digestate)	100	
Thickened fraction	29	37
Supernatant	64	
Struvite Precipitate	7	24 (61) - 63

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Conclusions

- STRUVITE system to recover phosphorus and nitrogen from digestate are technically feasible …. but this treatment has still to be further more efficient;
- Precipitate containing struvite should be used as “raw material” for the production of phosphate fertilizers to replace phosphate rocks;
- Technologies for nutrients recovery also allow to reduce emissions;
- The high concentration of solids in the digestate, even if subjected to S/L separation and microfiltration, is a critical issue.

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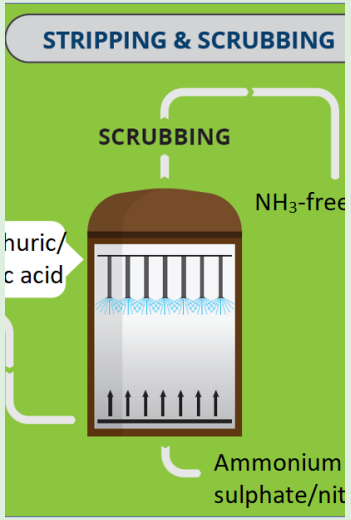

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Farm-scale anaerobic digestion

29/10/2024

ondernemen in west-vlaanderen

inagro

ONDERZOEK & ADVIES IN LAND- & TUINBOUW

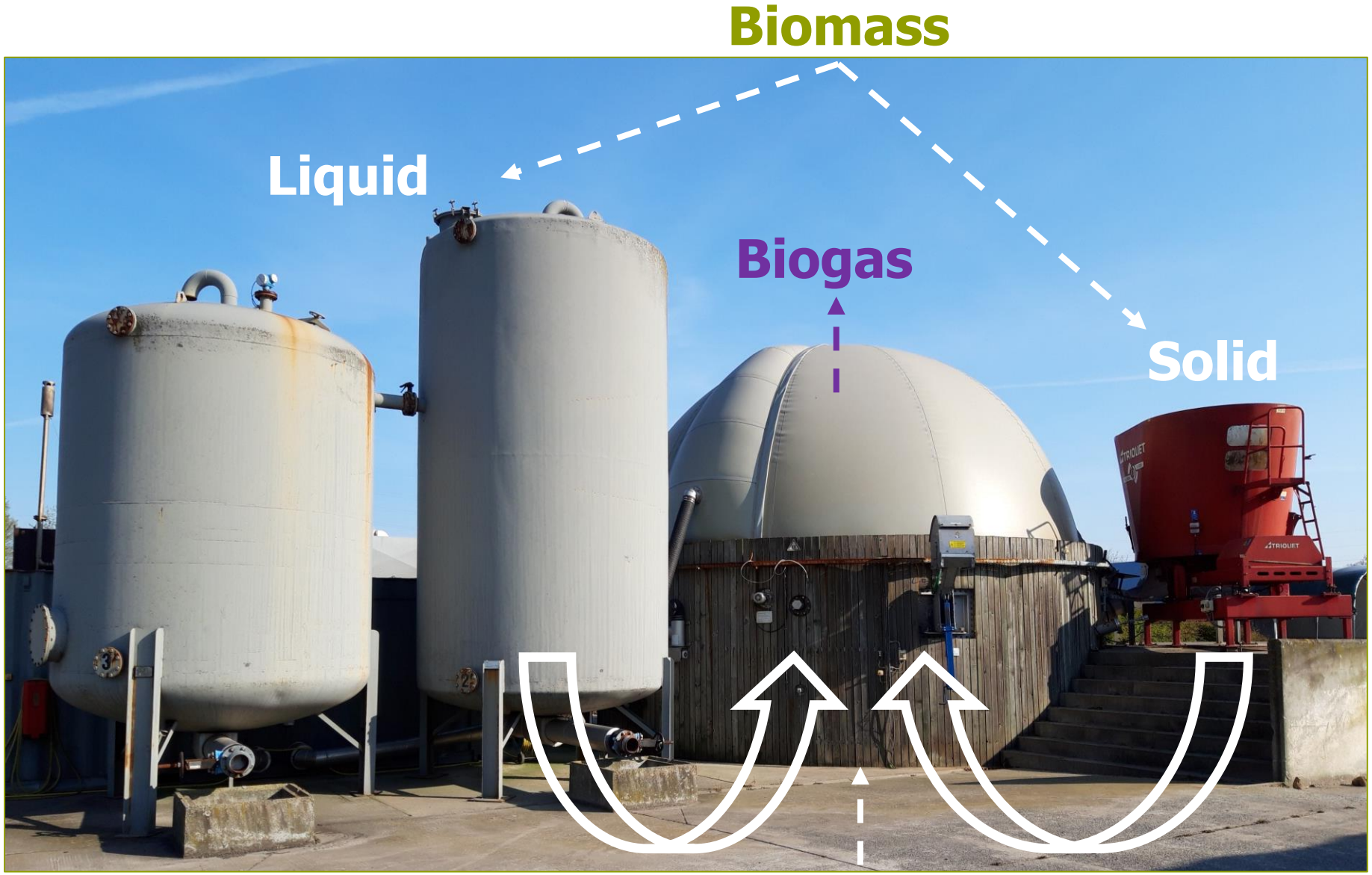
What?

Anaerobic digestion

inagro

ONDERZOEK & ADVIES IN LAND- & TUINBOUW

Anaerobic digestion



Farm

Heat

Electricity

CHP

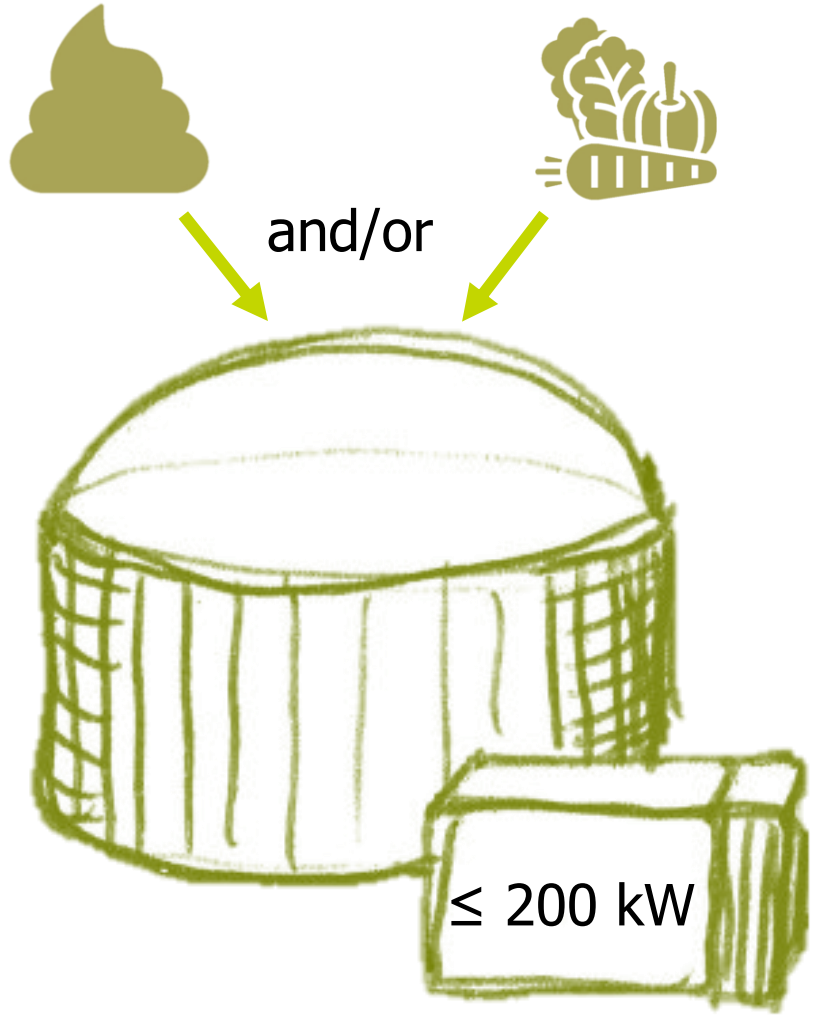
Digestate
(external storage)

Biogas

50-75% CH_4
(methane)

Farm-scale anaerobic digestion

- Proprietary biomass
- ≤ 5.000 ton biomass/year
- Co- vs. mono-digestion



What?

Digestate

inagro

ONDERZOEK & ADVIES IN LAND- & TUINBOUW

Digestate

- = Digested biomass
- Fertiliser
- DM en OM ↓
- Mineral nitrogen ↑

	DM (%)	OM (%)	N_{tot} (kg/ton FM)	N_{min} (kg/ton FM)	P_2O_5 (kg/ton FM)	K_2O (kg/ton FM)
Slurry	9,83	7,54	4,31	2,07	1,6	4,33
Digestate	6,54	4,69	3,91	2,46	1,4	4,33

Source: Inagro & Boerenbond (2014).

Digestate

- Division nitrogen availability
  - 20% more N_{min} → immediately available
  - Difficult to degrade OM → available later
- Crop
  - Quick uptake after application
  - N-uptake in autumn (cover crop)

Why?

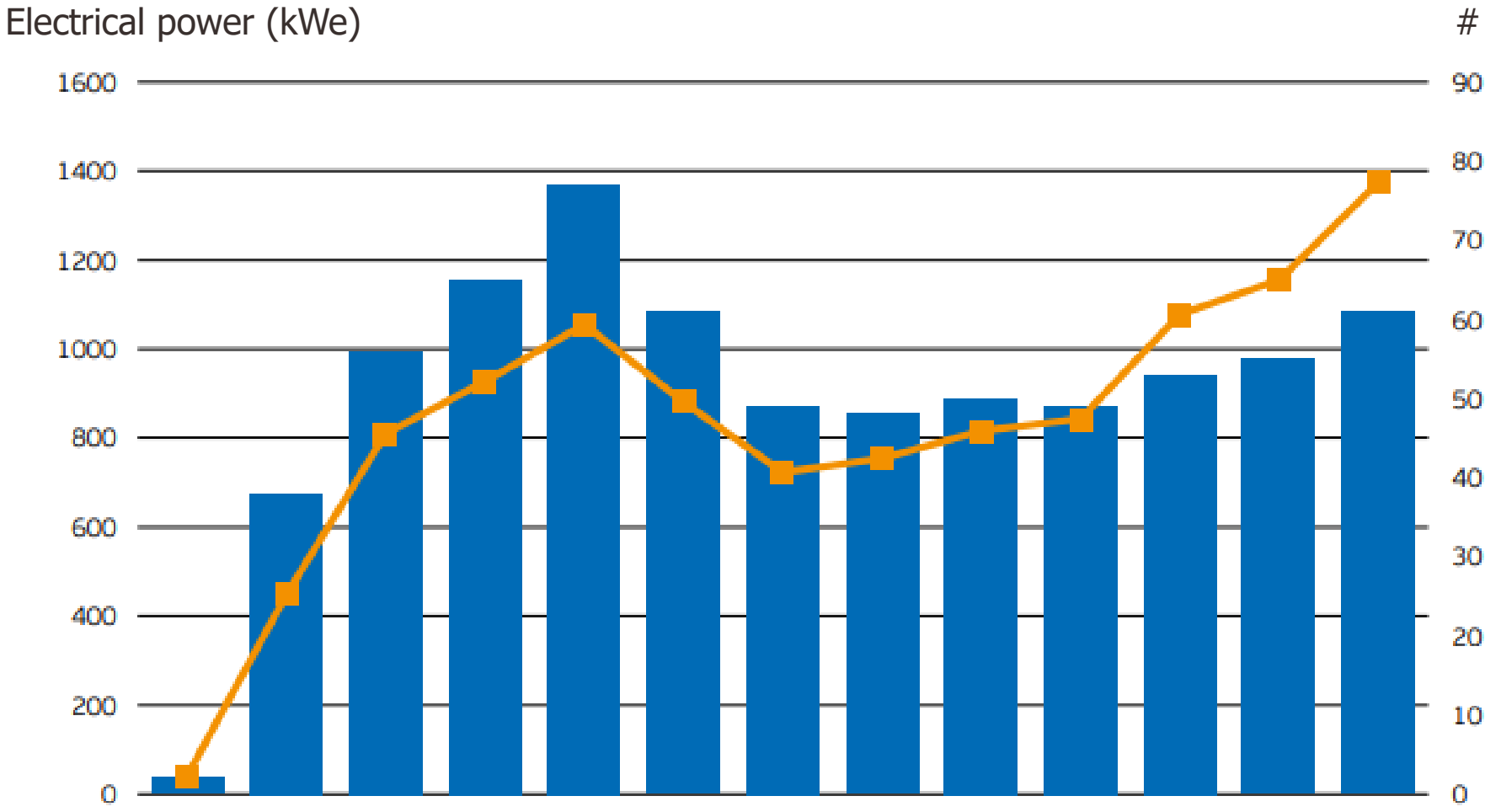
inagro

ONDERZOEK & ADVIES IN LAND- & TUINBOUW

Why?

Pros	Cons
Self-sufficient in energy	Daily monitoring
Continuous, renewable energy	Administrative chaos
GHG ↓	Image
Fertilisation value: N_{min} ↑	Legislative framework
Profitable investment (farm-dependent)	

Flanders



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Number	2	38	56	65	77	61	49	48	50	49	53	55	61
Electrical power	41	448	810	927	1055	881	723	754	816	843	1078	1155	1374

Biogas-E, 2024, The Flemish biogas sector in 2023.

OG PB

OG PB II

Demo Boost P&N

Vlaio-LA Pocket Power

Thank you.

ines.verleden@inagro.be

Europees Landbouwfonds
voor Plattelandsontwikkeling:
Europa investeert
in zijn platteland

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ONDERZOEK & ADVIES IN LAND- & TUINBOUW

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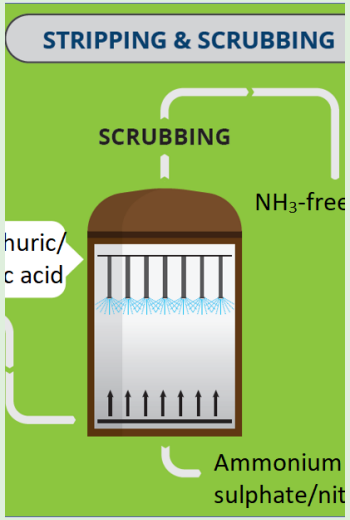

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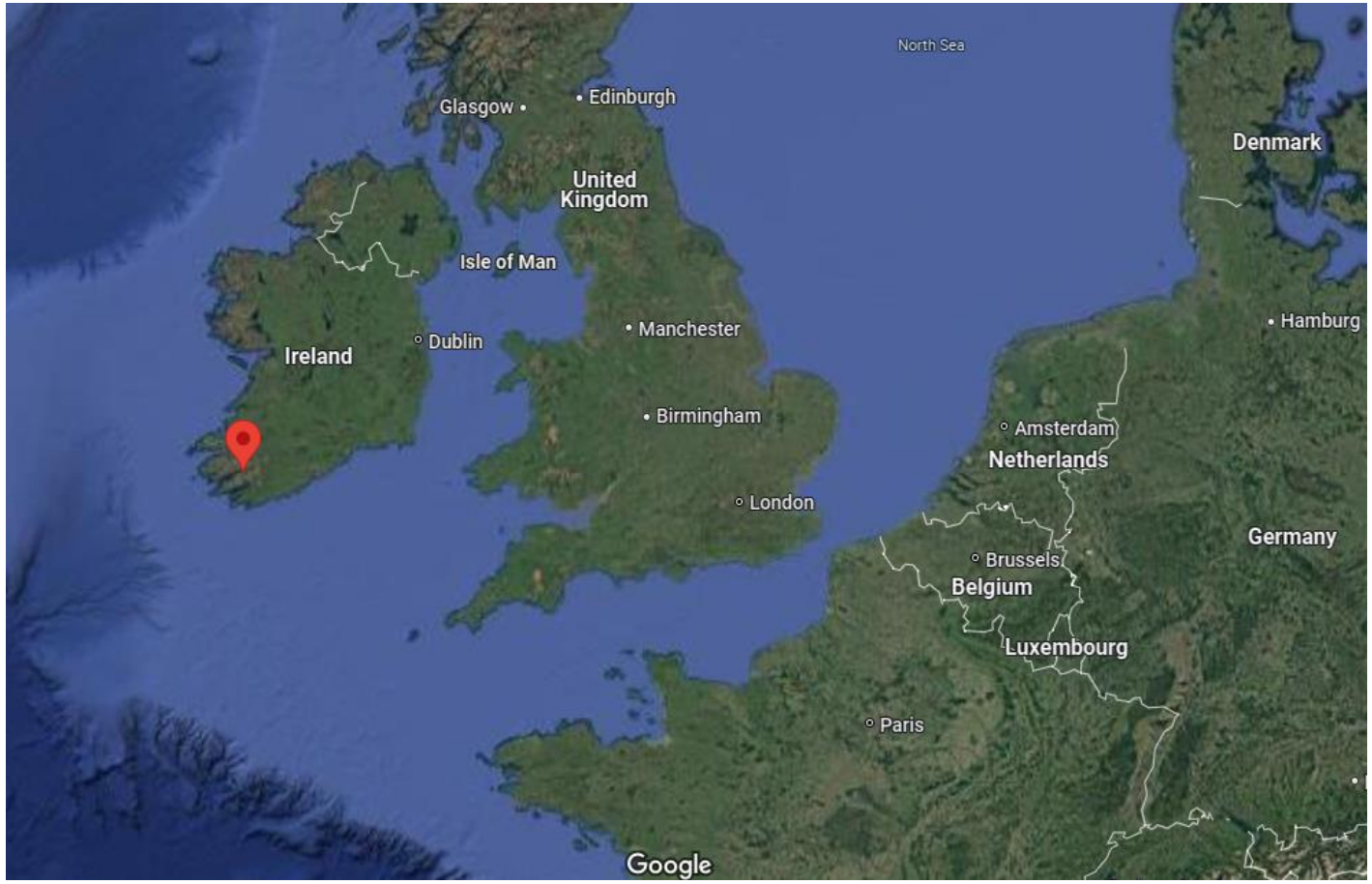
Biorefinery Glas

- Operation group (OG) 10
- South West Ireland.
- Pilot scale.



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Biorefinery Glas

BIOREFINERY GLAS

- Processes grass into four products.
- Refines unused protein.
- 50% into press cake.

- + 40% usable Pr/Ha.
- N and P losses -25%.

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Press Cake Silage.

- Alternative animal feed from grass.
- Grass silage supplementation.
- NUE increase

- Reduces methane concentration in the rumen
- Reduces N and P excreted..
- Increases grass value.

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BIOREFINERY GLAS

High Protein Pig Feed.

- Higher-than-average daily intake
- Higher than average daily gain
- Replaces up to 50% of soya in diet.

- Reduces transport distances and import cost
- Reduced emissions.
- Increased farm efficiency and income.

BIOREFINERY GLAS

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Grass Whey; a Biobased Fertiliser.

- Produced from Biorefinery Streams
- Acts as a bio-stimulant.
- More chlorophyll availability.

- Nutrient values similar to slurry
- Reduces mineral fertiliser costs.
- Increases grass value.

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BIOREFINERY
GLAS

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Q&A

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November 5: Fertiliser Production

November 12: Transport

November 19: Storage Systems