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WEBINAR Nº7

Manure storage

19th November 2024

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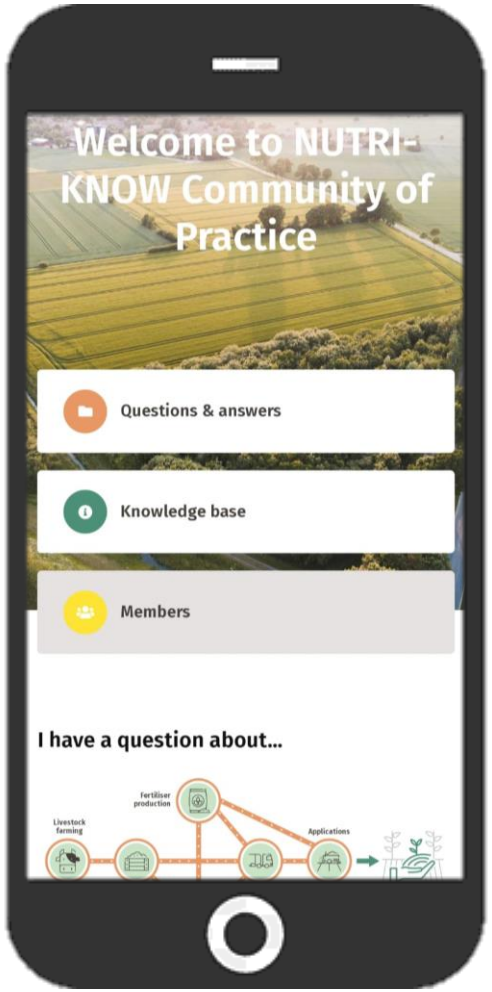

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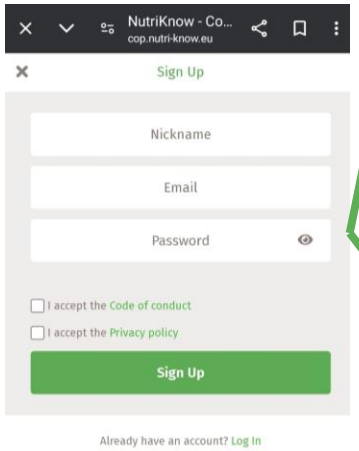

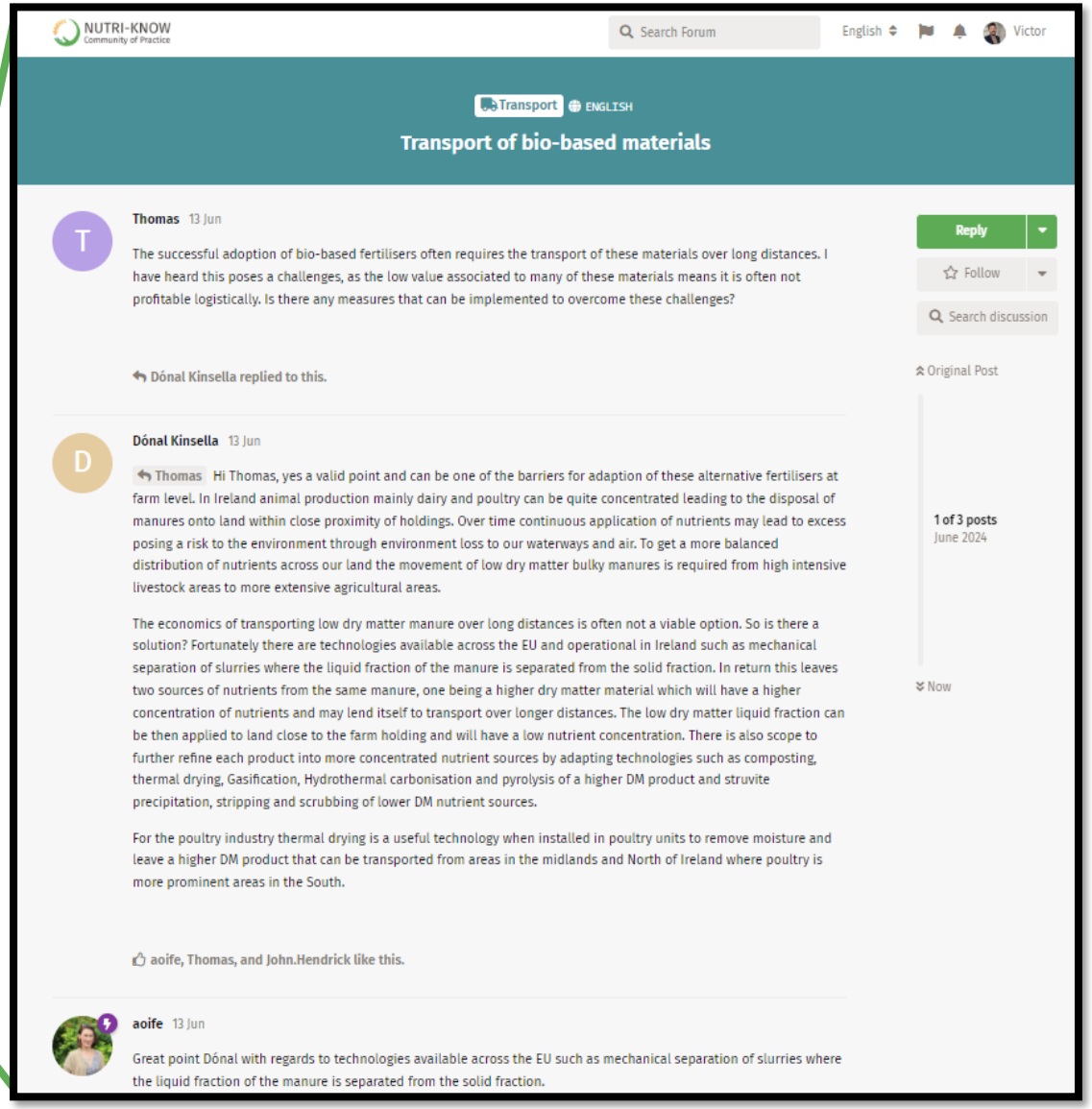

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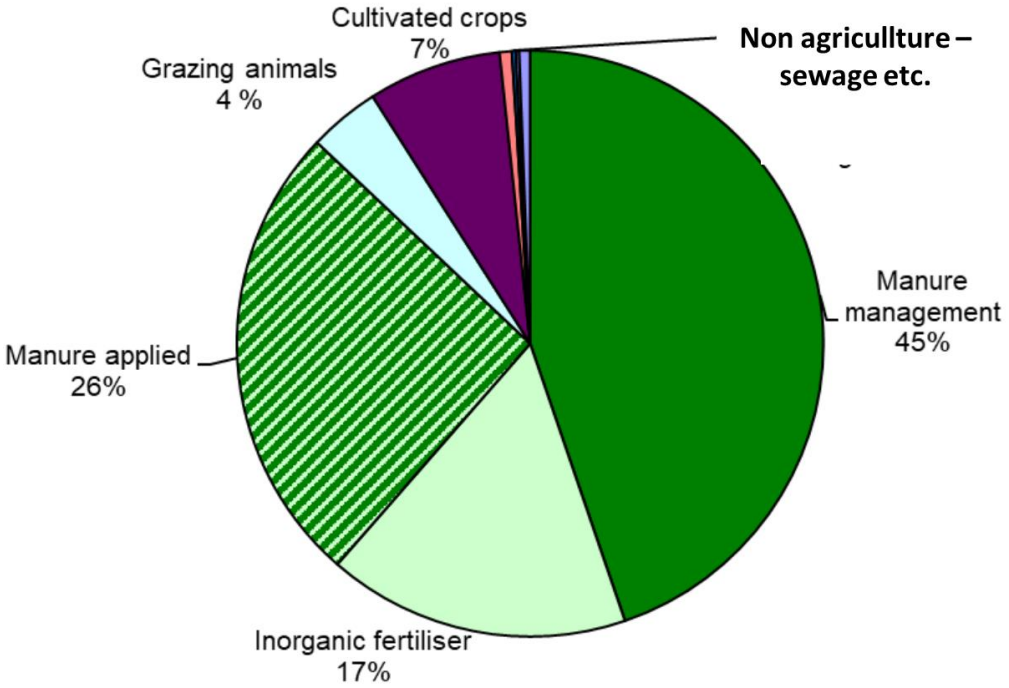
Agricultural NH_3 and greenhouse gas emissions

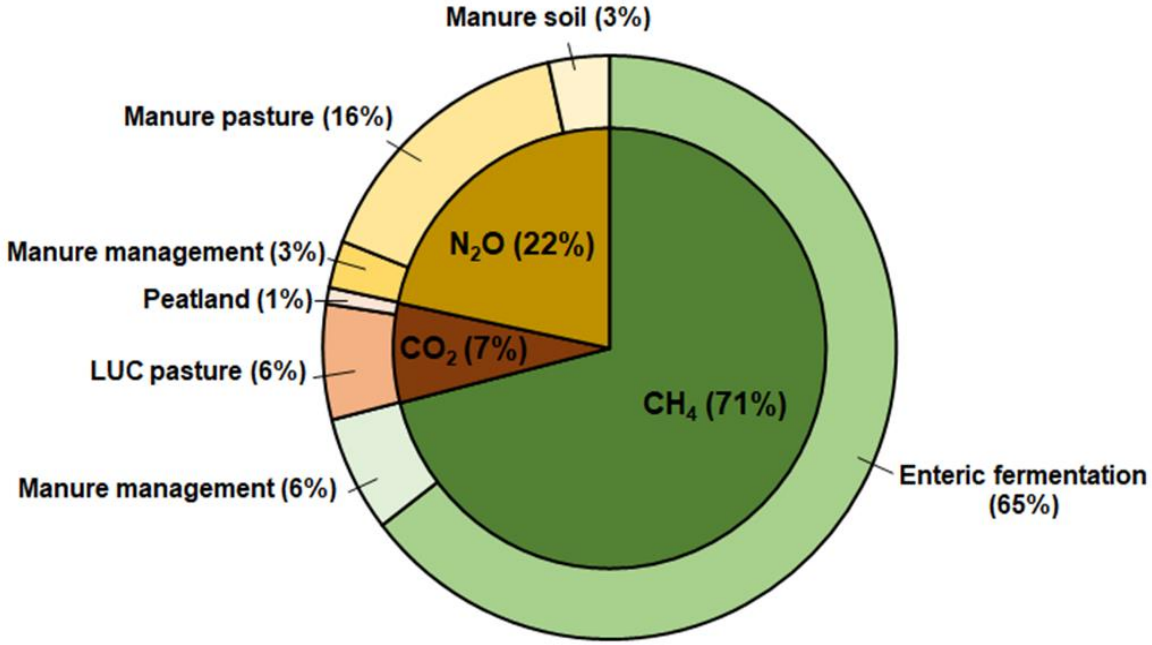
Ammonia

Globally: Agriculture account for 80% of ammonia global emissions.



Greenhouse gas

Globally: agriculture account for 18% of global greenhouse gas (GHG) and livestock 66% of agricultural emissions



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Air particle formation – Big cities

Ammonium part of the air pollution
Beijing and New York

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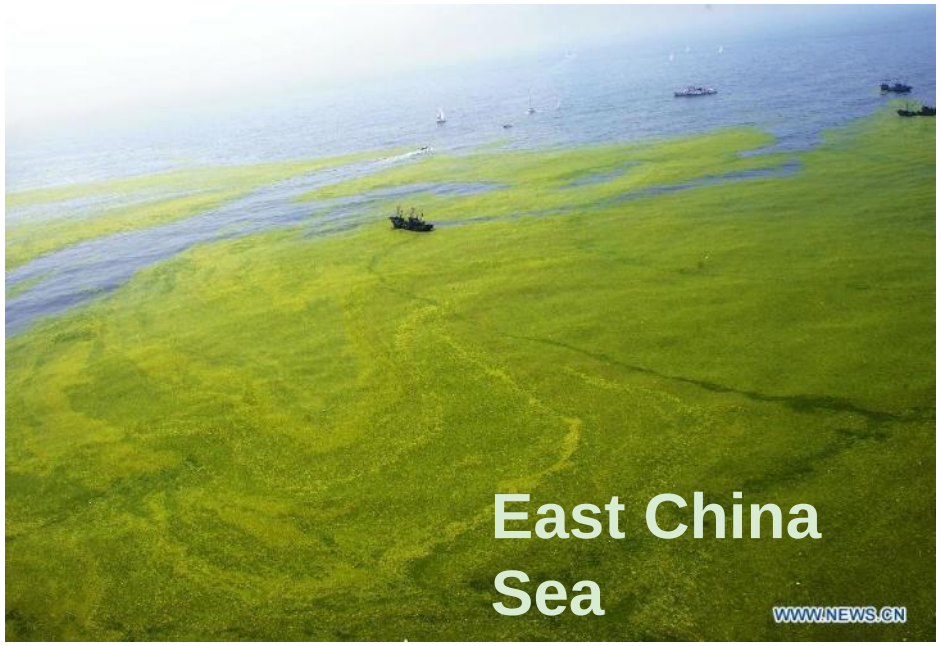
The global pollution issue

Algae bloom – Ocean fertilized with P and N



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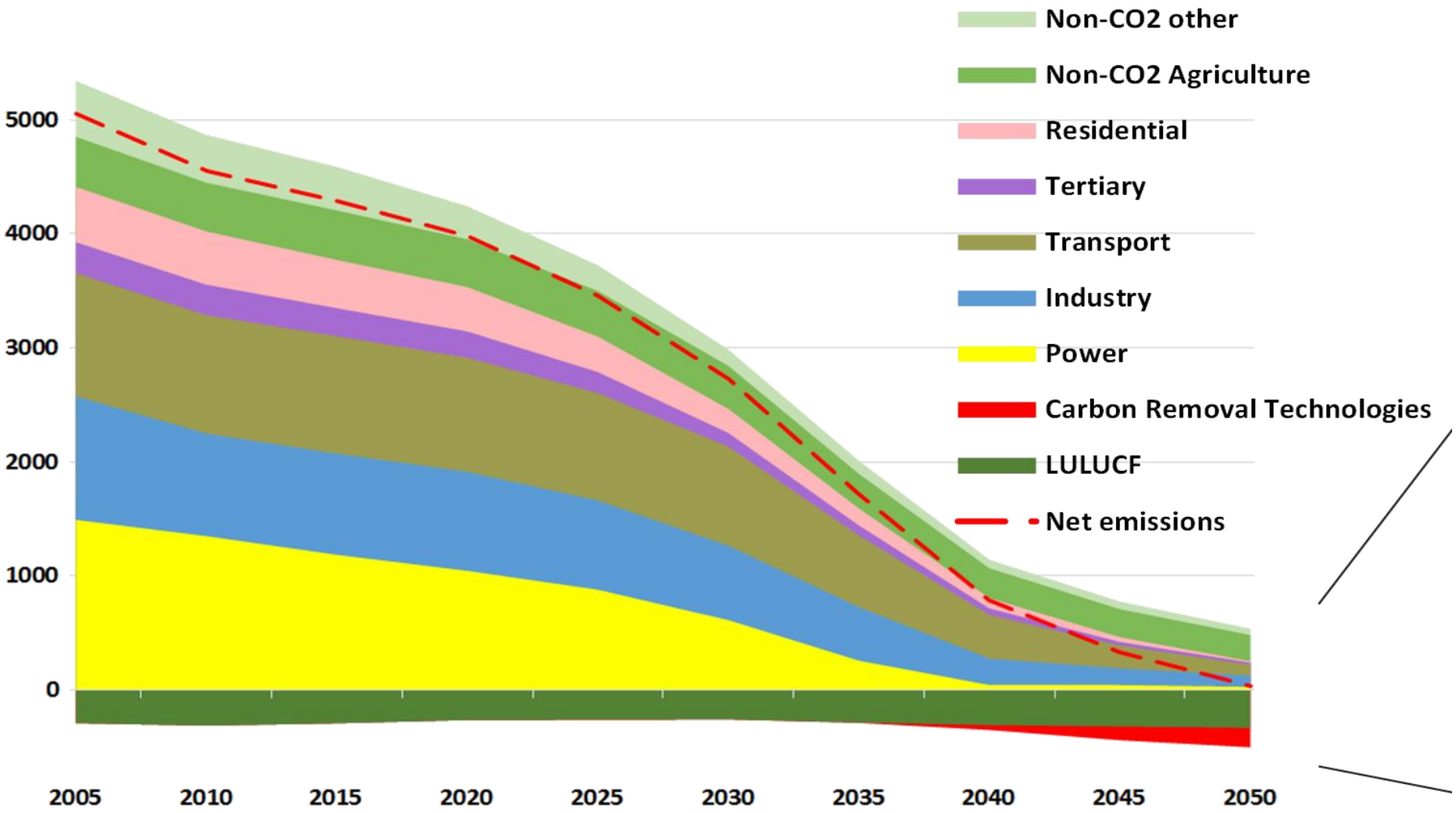
Agriculture contribute an increasing share of Greenhouse Gas – public will demand reductions



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COM(2018) 773 *GHG emissions trajectory in a 1.5° C scenario*

Farmer must substitute lost ammonia with mineral fertilizer at a COST

Nitrogen **U**se **E**fficiency:
Nitrogen in products as a percentage of nitrogen input
(In feed and mineral fertilizer)

- In Asia: 24%
- In Europe: 44-56%

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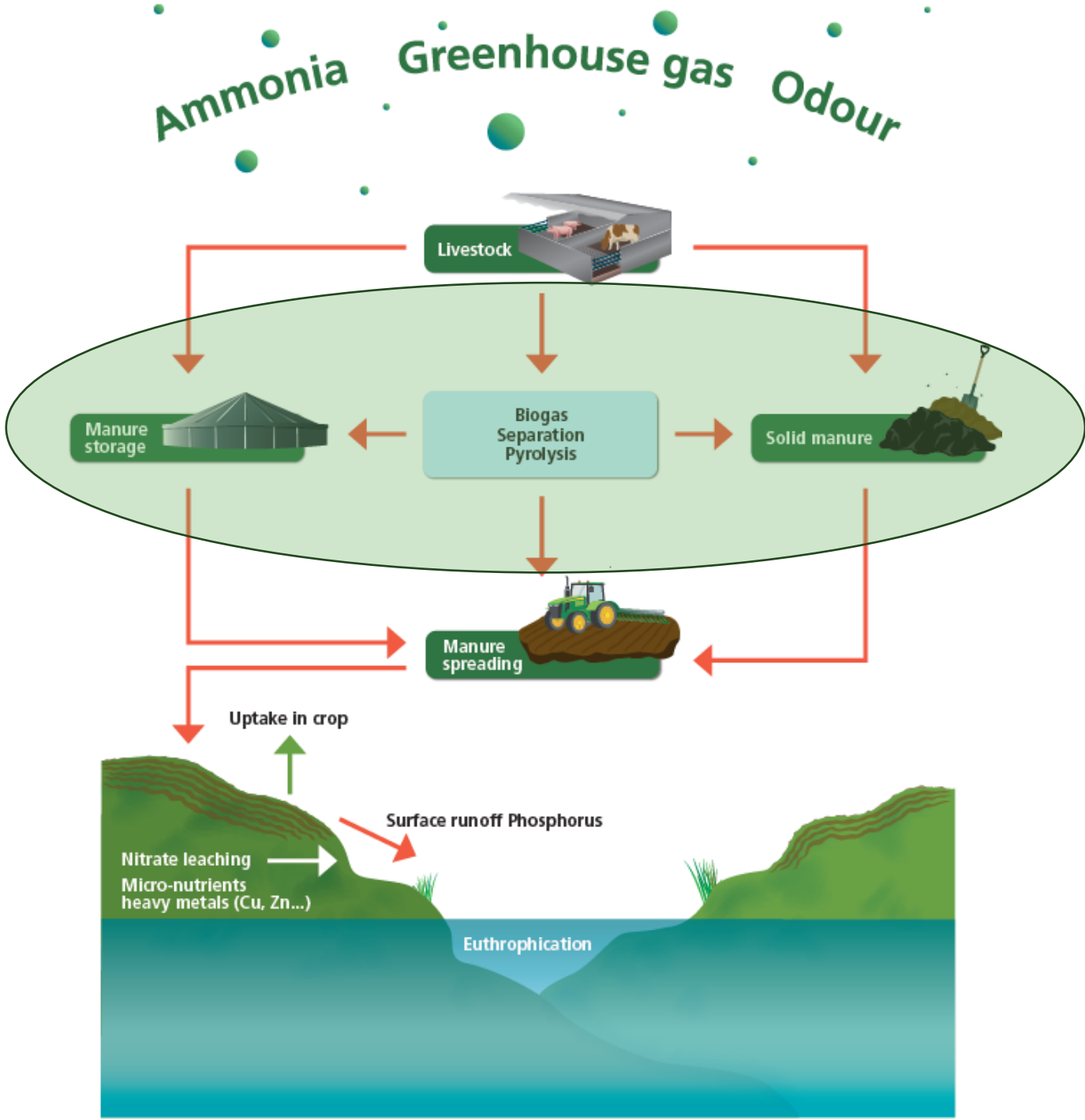
Whole system management approach

When reducing emissions and increasing fertilizer use efficiency.



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Manure Management Tools

- Development of tools for optimising the joint management of livestock manure and the improvement of agricultural fertilisation, crop quality and environmental protection.

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Manure Management Tools

Advise farmers to select the best storage system – considering the whole management chain

Recommend instruments (conductimeter) and IT programs to support decision making

Include the effect in the system of introducing

acidification to reduce ammonia and greenhouse gas

Addition of straw to compost to reduce ammonia

Biogas production to produce energy and reduced greenhouse gas

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Manure Management Tools

- **EMISSIONSANALYSIS**
  - **SLURRY**

Experimental device for measuring emissions in uncovered ponds

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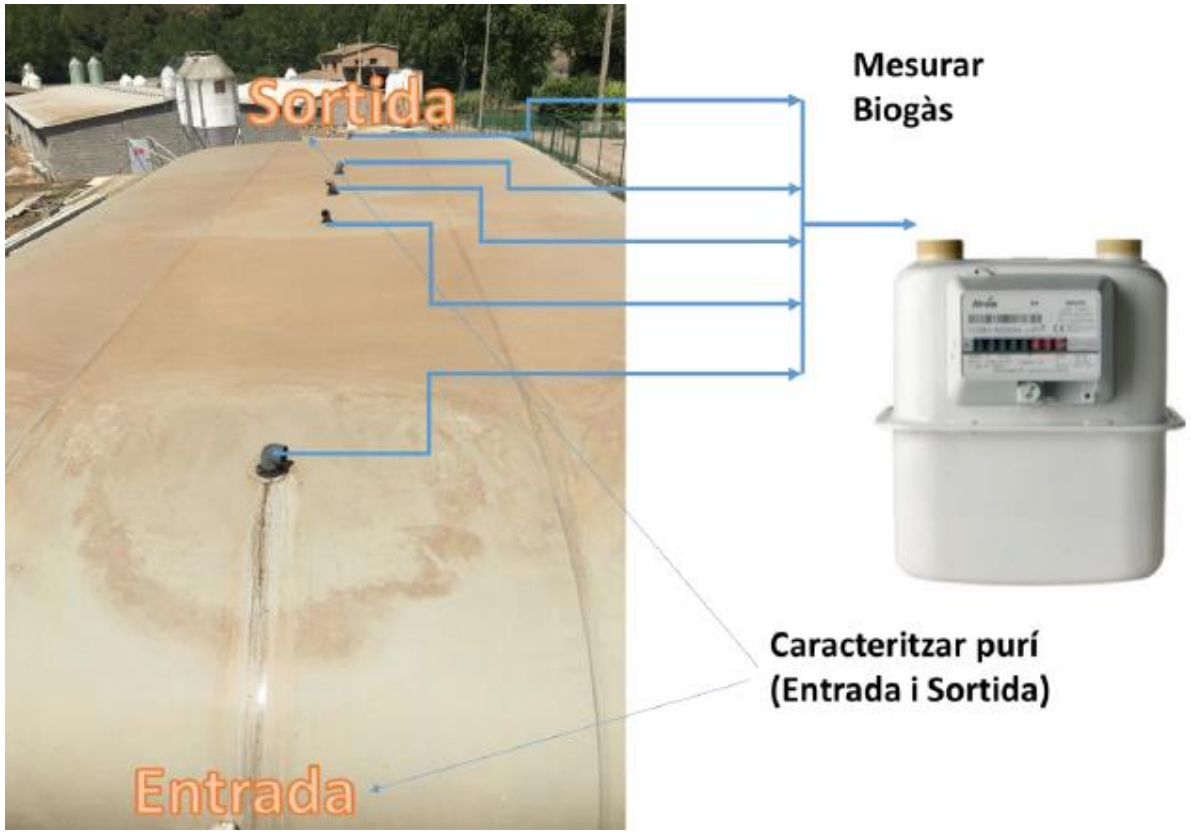
Manure Management Tools

- **EMISSIONS ANALYSIS**
  - **SLURRY**



Flexible pond with meter of the generated biogas

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Manure Management Tools

- **COMPOST ANALYSIS**
  - **BEEF MANURE**

Compost of beef manure at different farms

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Manure Management Tools

- **COMPOST ANALYSIS**
- **POULTRY MANURE**

Compost of poultry manure mixed with cereal straw and gardening spurge

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BIOGAS PRODUCTION

- Influent, effluent and biogas characterization
- Determination of anaerobic biodegradability and the potential of methanization
- Determination of the methanogenic activity of the inoculum

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EMISSIONS ANALYSIS

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EMISSIONS ANALYSIS

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COMPOST ANALYSIS

- The compost analyzed in the different cattle ranches has a high fertilizing quality and a very high stability

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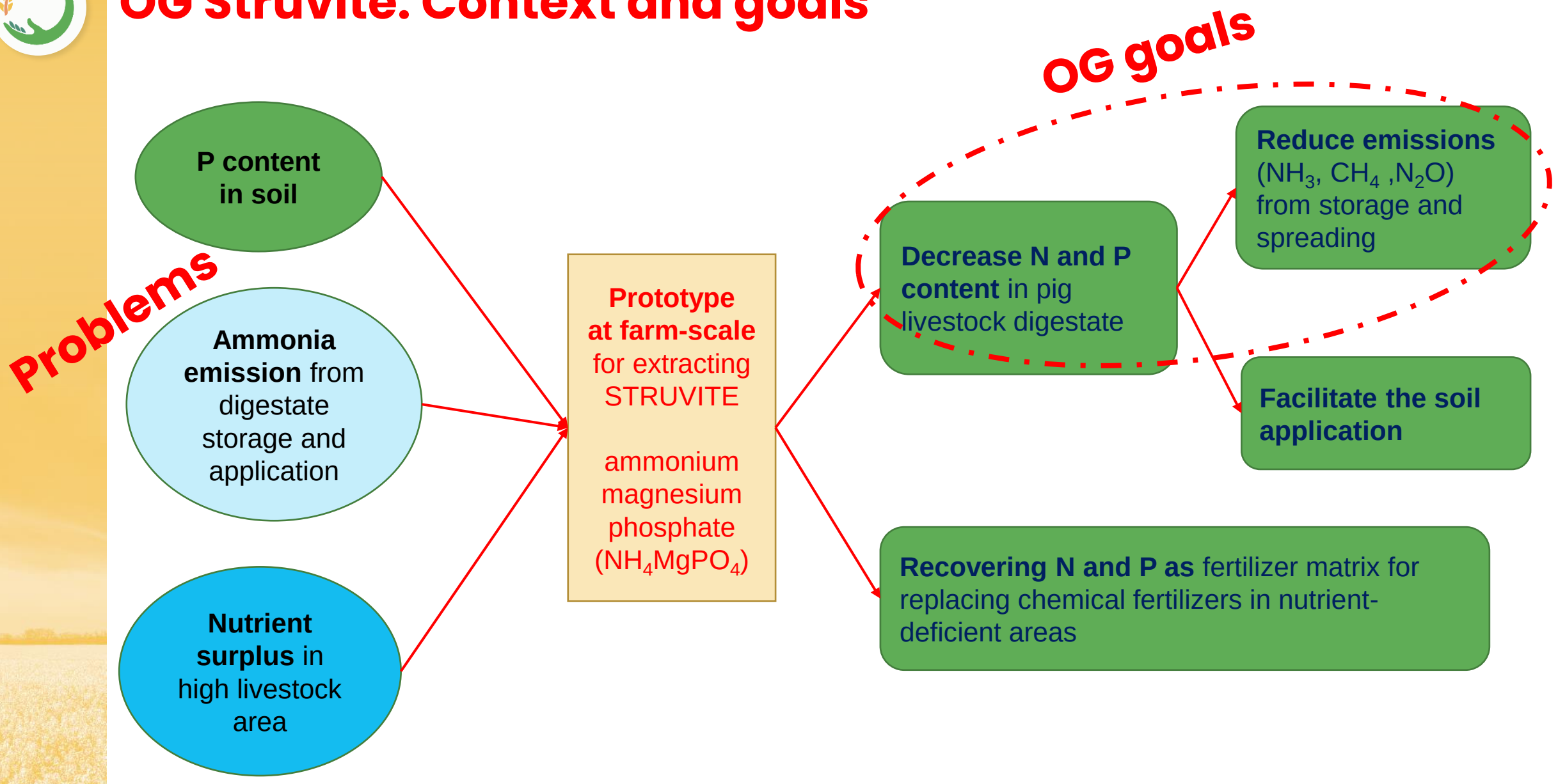
OG Struvite: Context and goals



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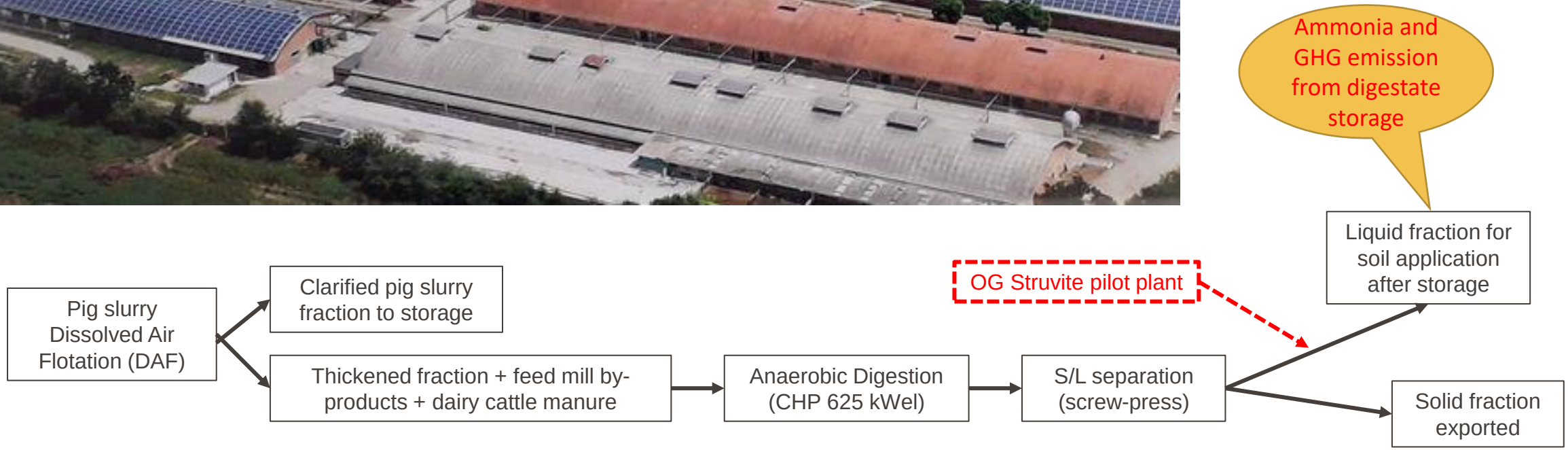
Colombaro pig farm: Modena, Emilia Romagna (IT)

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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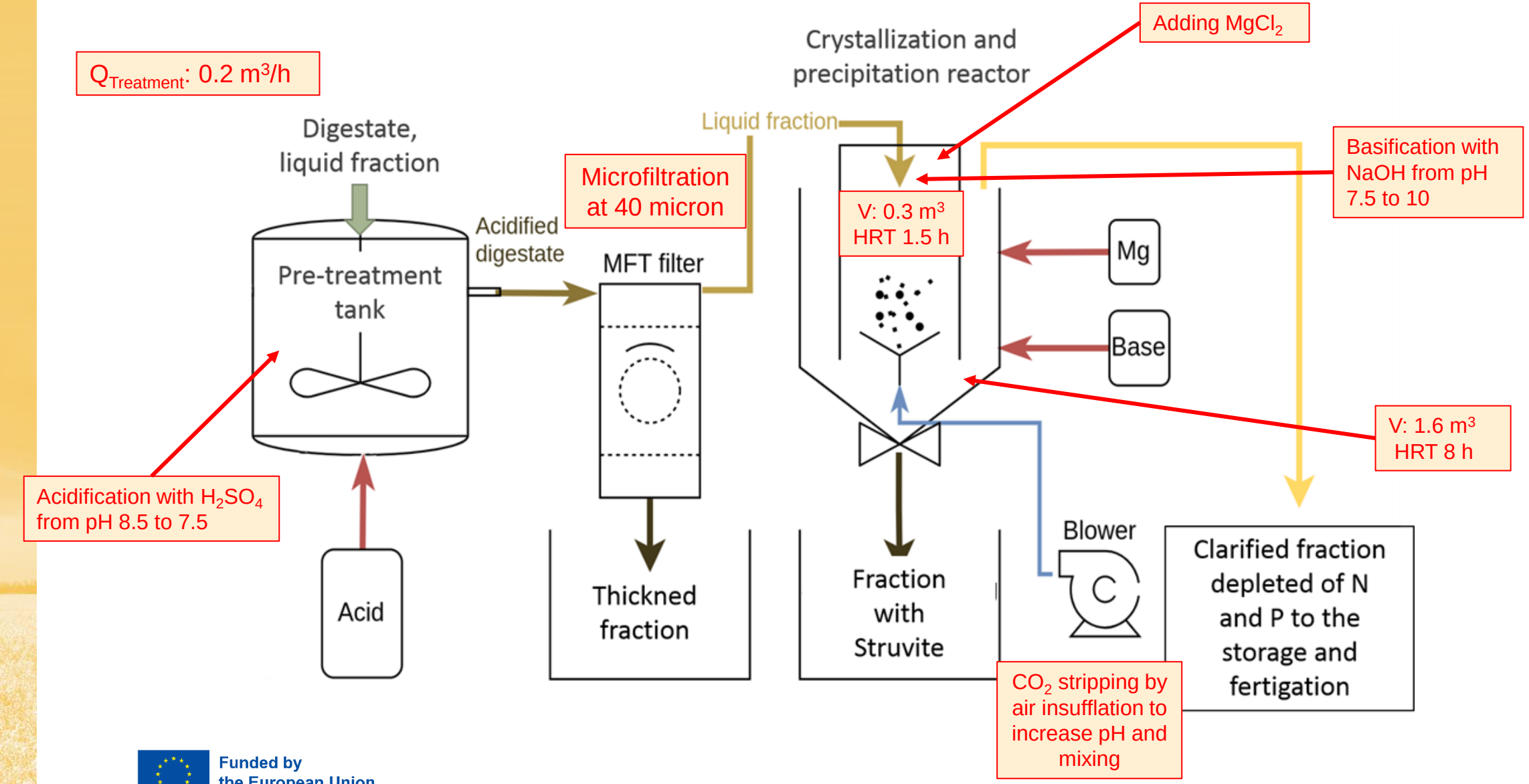
Layout of the treatment



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Struvite prototype

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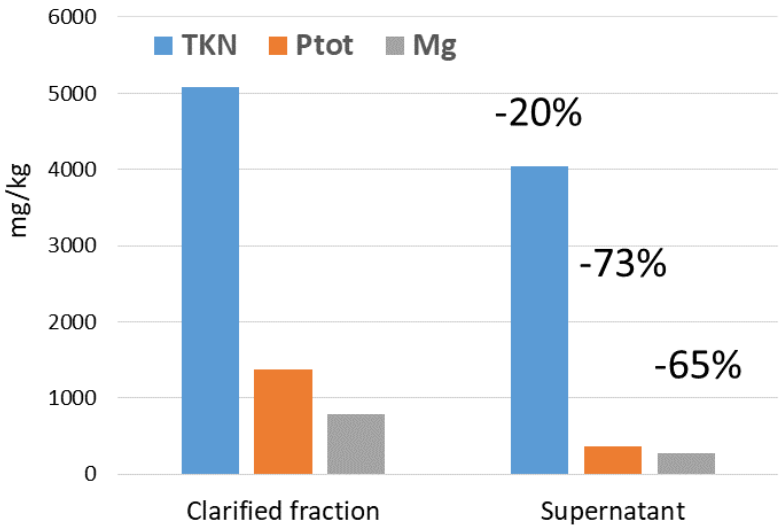
OG Struvite: Digestate treatment to reduce emissions from storage

Digestate nutrient depleted thanks to Struvite crystallization and precipitation



Emission monitoring from storage for 60 days
by Static chamber method and photoacustic multi gas analyzer (INNOVA 1412)
(Denmead, 1979; Hornig et al, 1999; Pedersen et al., 2001)

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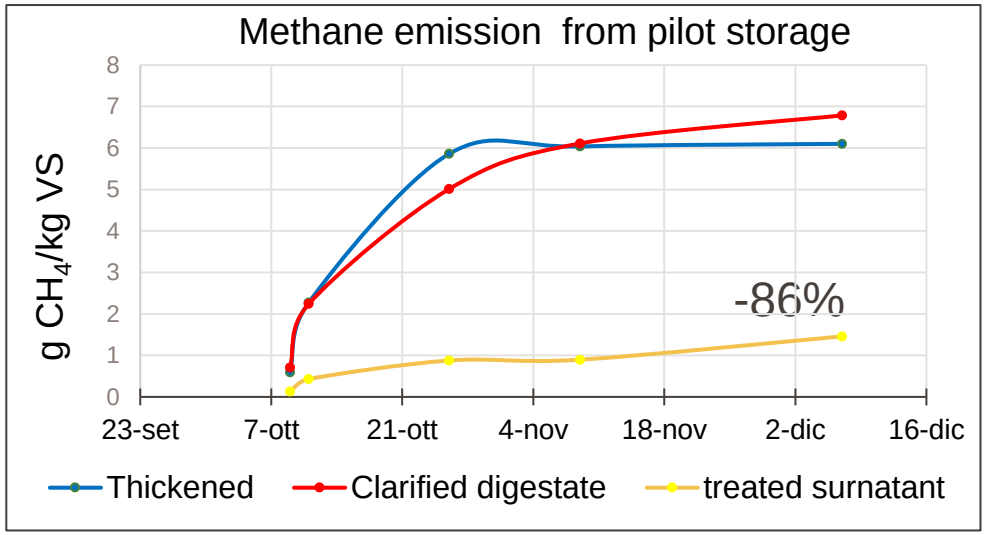
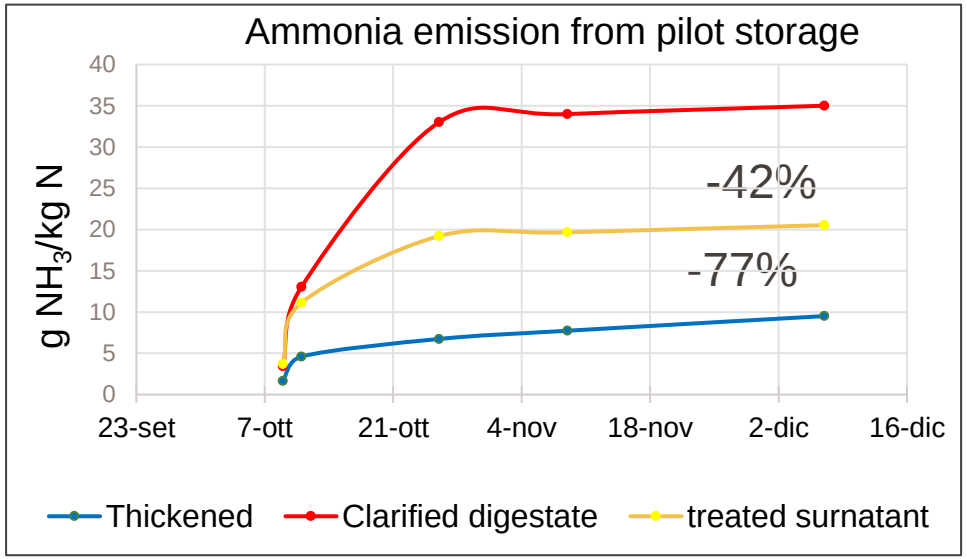
OG Struvite: Digestate treatment to reduce emissions from storage



Low methane emission in g CH4/kg VS from storage because they are digestate clarified and treated fractions



Methane (CH_4) emissions from the treated surnatant showed 86% lower CH_4 emitting potential than the clarified digestate input.

Ammonia emissions from the storage of the treated surnatant and thickened fraction (acidified from pH 8.3 to 7.5) were 42% and 77% lower than the incoming clarified digestate.

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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;
- After the Struvite treatment, the supernatant fraction was significantly depleted in phosphorus, nitrogen and organic matter compared to input clarified digestate;
- … for this Technologies for nutrients recovery from slurry and digestate also allow to reduce emissions derived from storage (methane and ammonia);
- Precipitate containing struvite should be exploited by fertilizer producers and it should be used as “raw material” for the production of phosphate fertilizers to replace phosphate minerals.

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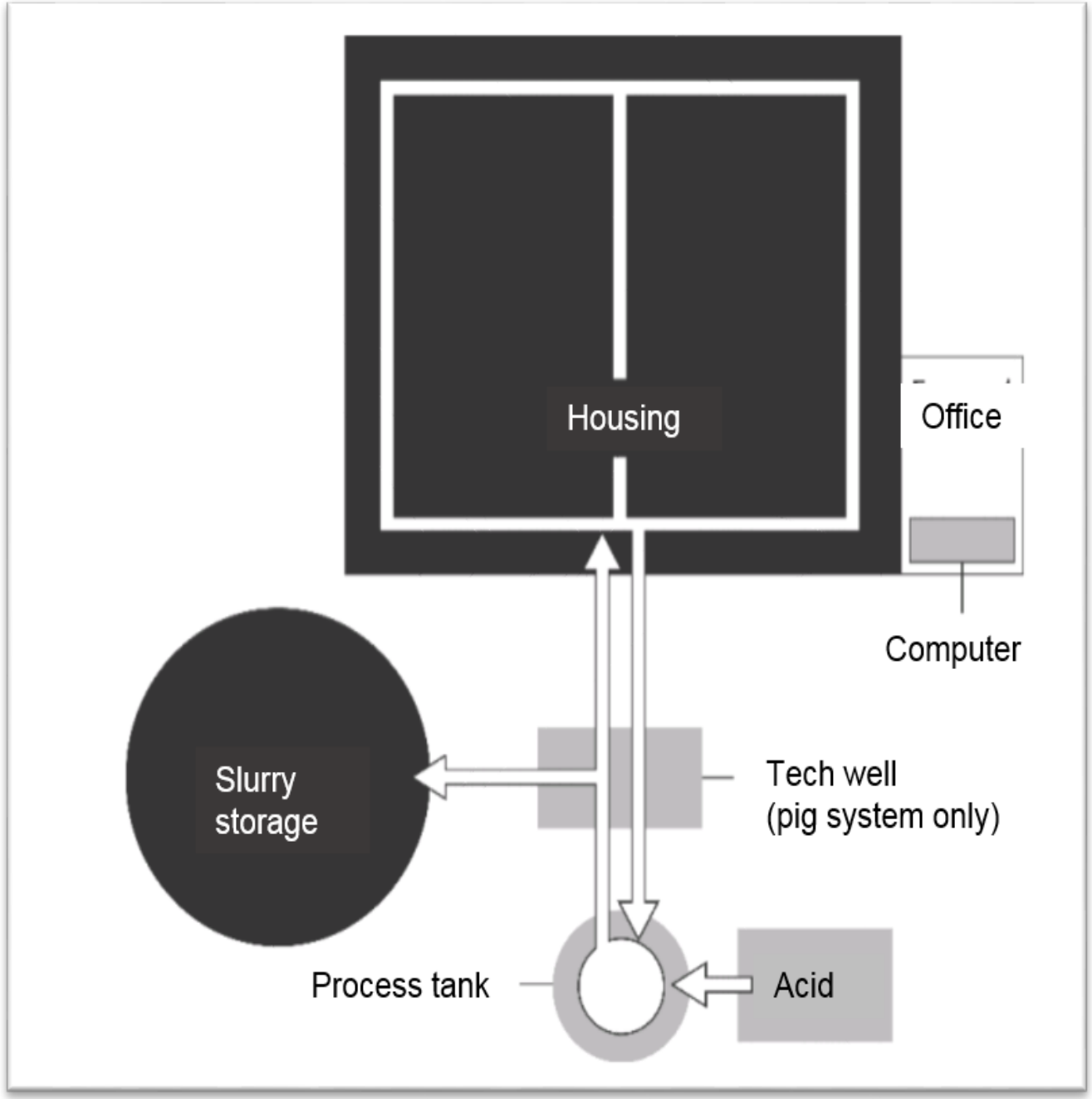
Acidification of slurry

Acidification of slurry in livestock barns



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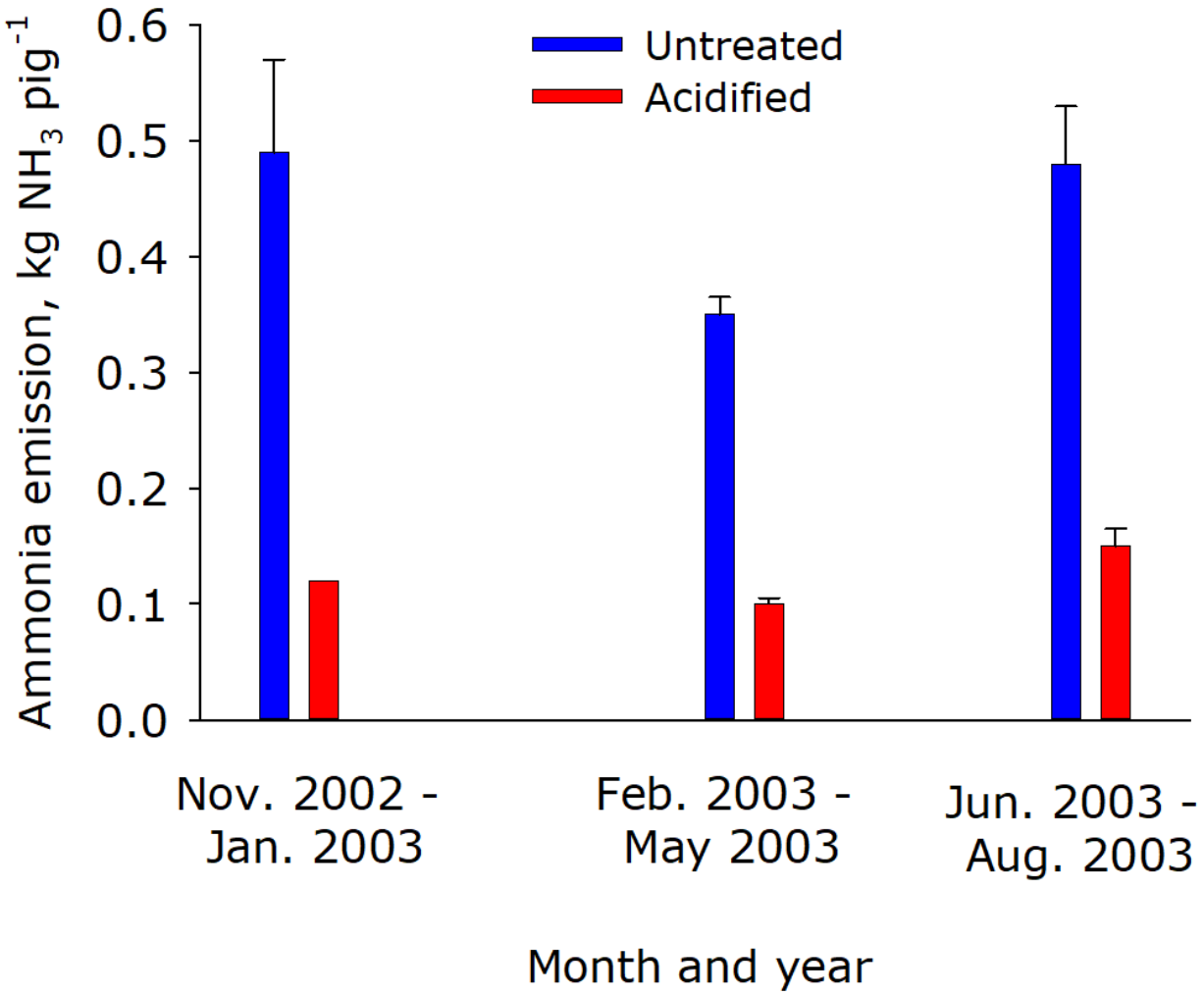
Acidification of slurry

Livestock barns
Ammonia emission reduced from more than 60%



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Acidification of slurry

Outside storage

Ammonia emission reduced from 60 -90%

Reduction efficiency, %	Reference
67	Petersen et al. 2014
90	Reguero et al. 2016
90	Al-Kanani et al. 1992
62	Sommer et al. 2017
59	Owusu-Twum et al. 2017

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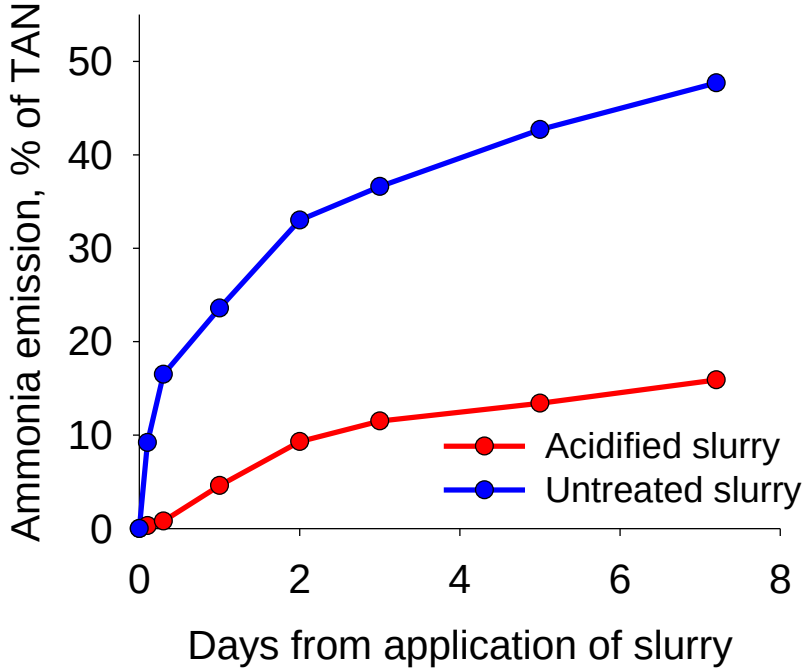
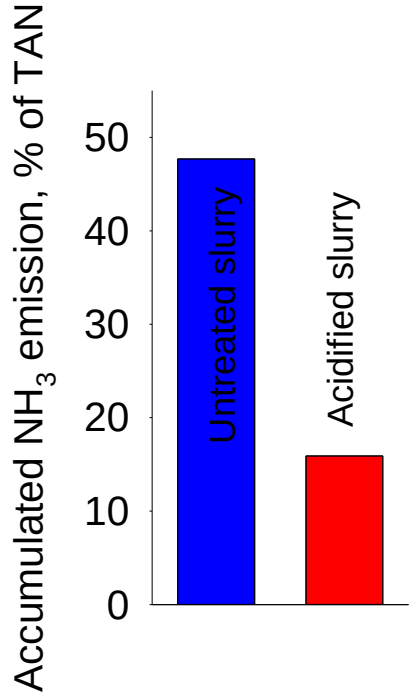
Acidification of slurry

Ammonia emission from field applied slurry

Emission reduction more than 50%





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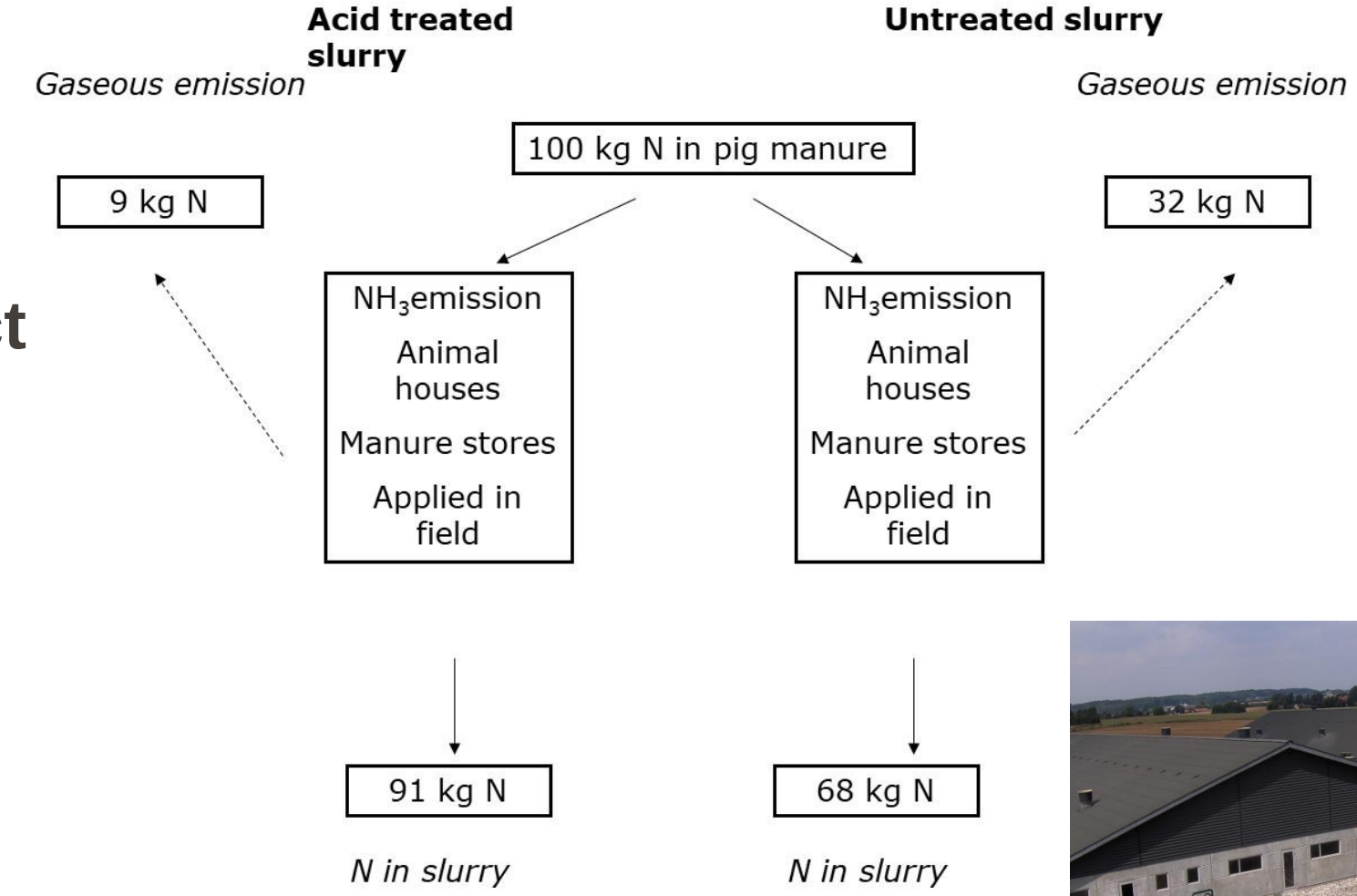
Acidification of slurry

Whole system effect of acidification in house



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Acidification of slurry

Reduced Greenhous Gas Emission

Fattening pig house:

- 50% reduction (Spring Petersen et al. 2016)

Outside slurry store:

- 68% (Sommer et al. 2017)
- >90 % (Petersen et al. 2014)
- >90% (Regueiro et al. 2016)

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Summing up:
Decision support tools support farmers

- Select the best storage systems to minimize pollution (ammonia and greenhouse gas emission) and allow them to apply manure on land with high and predictable plant nutrient uptake and reduced risk of pollution by leachates.
- Efficient use of additives to improve composting processes and provide estimates of the final quality of composting after substrate addition.
- Evaluate the biogas production potential when storing slurry in flexible cover ponds.

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Summing up
Recommendations for technologies tested

- Reducing emissions of gases involves acidification, addition of straw to slurry or storage in impermeable bags.
- Reactor technology is optimized to efficiently produce struvite, which consists of ammonium, phosphorous and magnesium. Struvite is an efficient nitrogen and phosphorous fertilizer.
- The production of struvite will contribute to reduced ammonia emission.

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Q&A