

Emission reduction in pig meat production

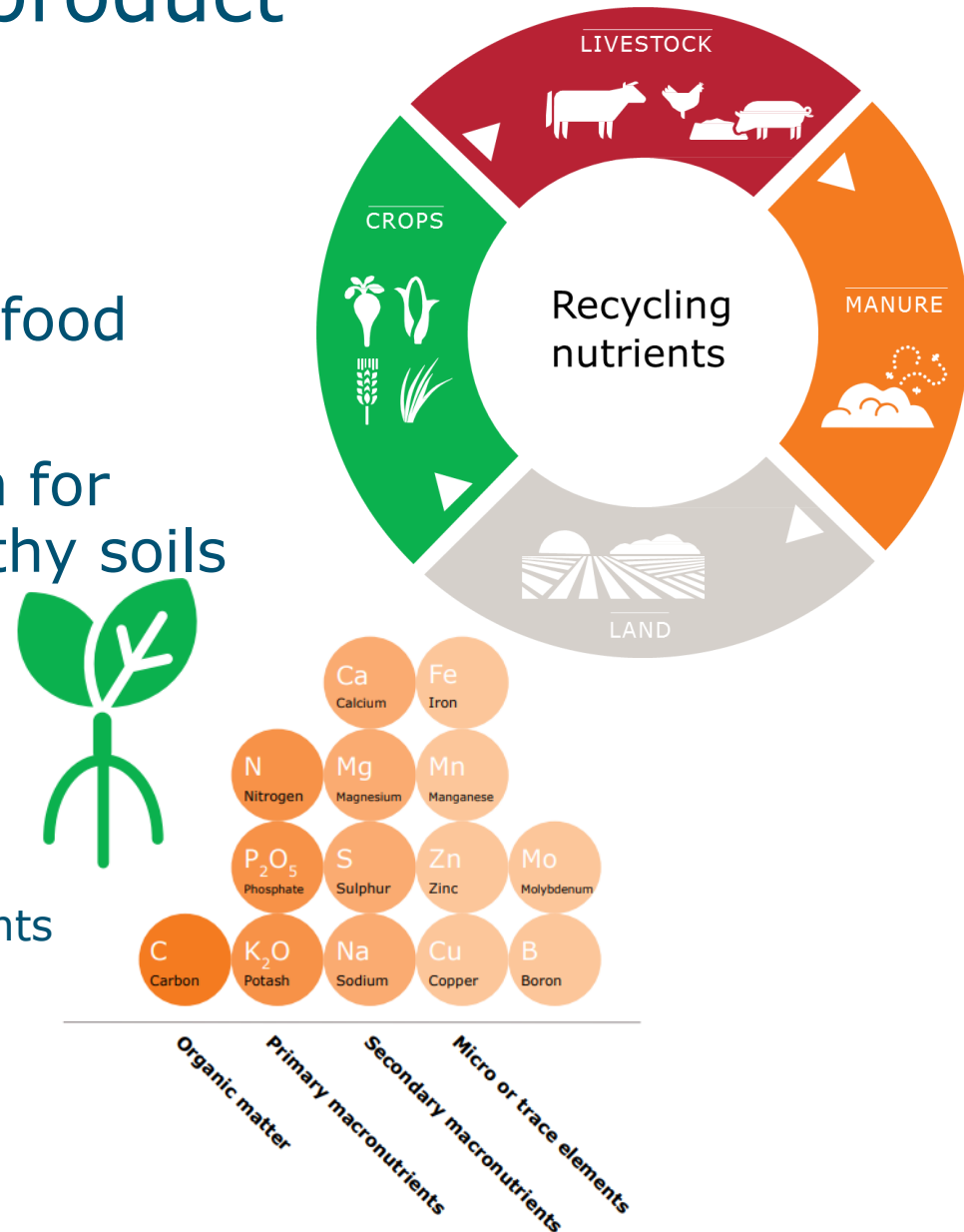
4 July,

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Manure: a valuable product




- Essential resource for our food supply
- Provides valuable nutrition for plants and maintains healthy soils
 - Organic matter
 - N, P, K
 - Ca, Mg, S, Na
 - Micro nutrients and trace elements
- Source of energy



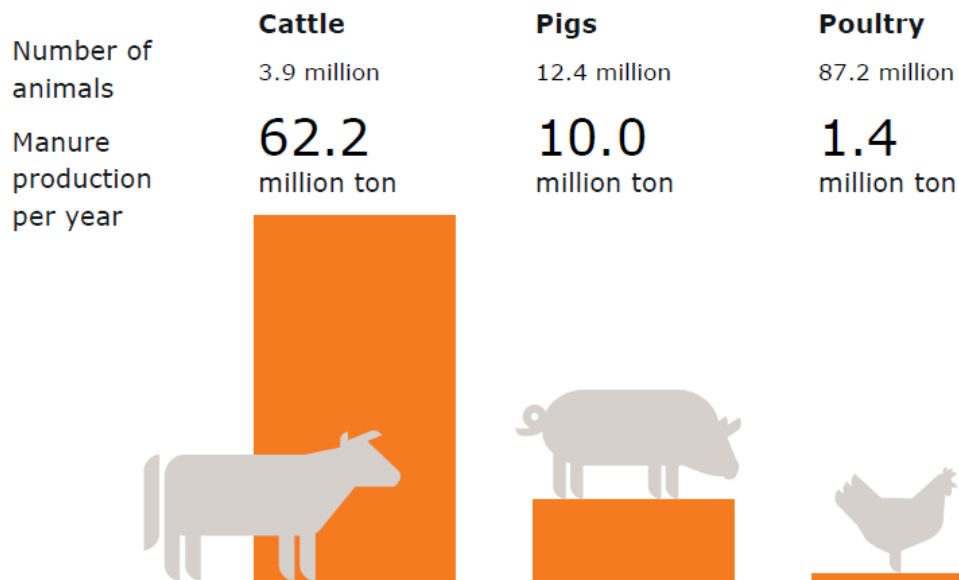
Manure in The Netherlands

The Netherlands



	Population	17 million
	Surface	40,000 km ²
	Agricultural land	17,500 km ²
	Manure production	76.2 million ton/yr
P_2O_5	Phosphate surplus	8 kg/ha/yr
N	Nitrogen surplus	131 kg/ha/yr

Manure production in the Netherlands (CBS Statline 2018)

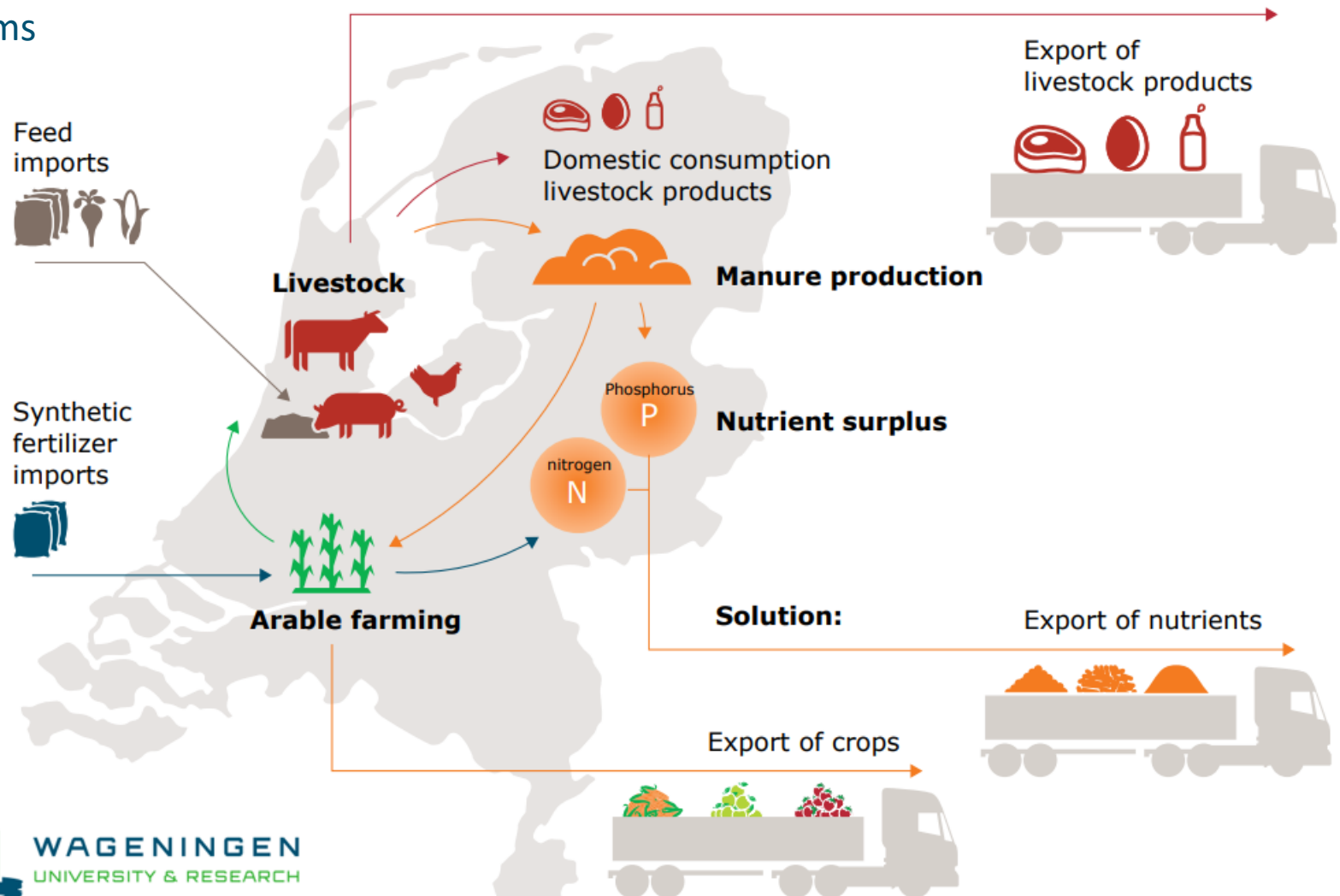


Manure in The Netherlands

- Small but densely populated country
- Large numbers of livestock
- Nutrient surplus caused by high import of animal feed and use of synthetic fertilizer
- Manure has acquired a negative reputation
- Loss of nutrients and dispersion into environment
 - Greenhouse gas and N emissions, leaching of N

Nutrient cycles in The Netherlands

Mandatory manure processing or exporting based on phosphate surplus of individual farms



Manure policy in The Netherlands

- Prevent or limit nutrient dispersion in the environment by regulating manure application
- Application standards for nitrogen (N) and phosphate ($P_2O_5 = P * 2.29$):
 - Manure N only: 170 kg N / 230 kg N per ha
 - Manure N + fertilizer N: max. 385 kg N/ha/year
 - Manure + fertilizer P_2O_5 : 50-75 kg for arable land; 80-100 kg for grassland
- Surplus manure that cannot be used on farmer's land must be (partly) 'processed'
- Emission of Ammonia in environmental permits, emission reduced.

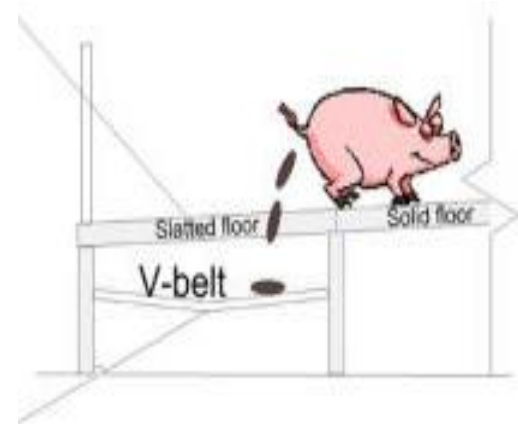
Manure and emissions

- Housing system (NH_3 , CH_4 , N_2O)
 - Storage (NH_3 , CH_4 , N_2O)
 - Manure processing (NH_3 , CH_4 , N_2O)
 - Storage (NH_3 , CH_4 , N_2O)
 - Application (NH_3 , N_2O)
-
- Also odour and fine dust

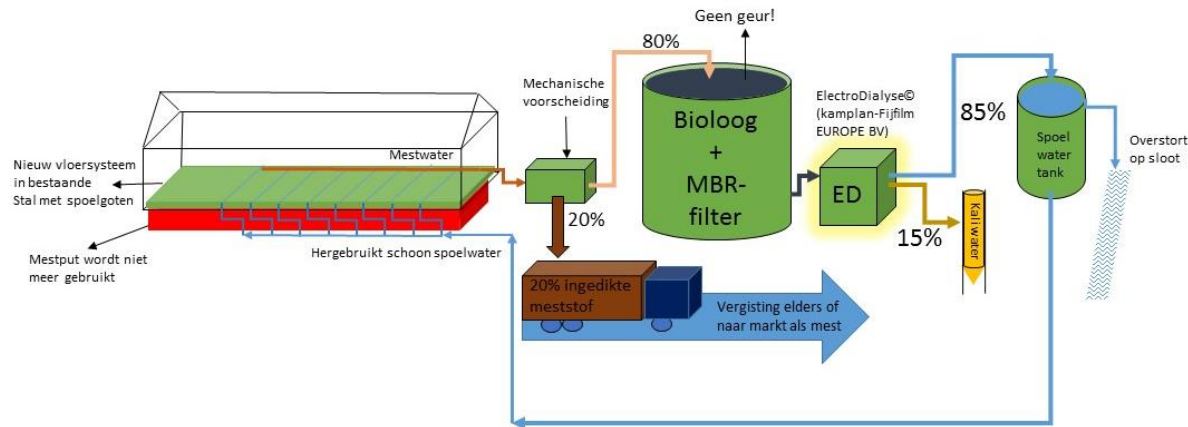
Manure management in the barn

- To prevent emissions:
- End of pipe solution:
 - Air scrubber: 70-95% reduction of NH_3 , no reduction of CH_4 , climate in stable will not improve
- Reduction of emissions at the source (reduction of 30-70% of NH_3):
 - Quick manure removal from barn (scrapers piping systems, flushing, manure belt)
 - Dilution of manure (low ammonia liquid)
 - Decrease of emitting surface (manure pit design)
 - Separation urine and faeces (perforated manure belt, scrapers with urine drain)
 - Preservation by cooling, acidifying, air tight storage

Examples new emission low housing systems



Total Circulaire Farm Concept met ED©
door Kamplan en Fuijfilm Europe BV



Manure processing

- Why manure processing?:
 - Extract water to decrease transport costs
 - To make manure products better suited for crop and soil with less losses (increase circular use of manure, RENURE)
 - To reduce amounts of manure that have to be transported from farm
 - Produce green energy
- Centralized manure processing
- Manure processing on farm



Manure processing

Processing techniques:

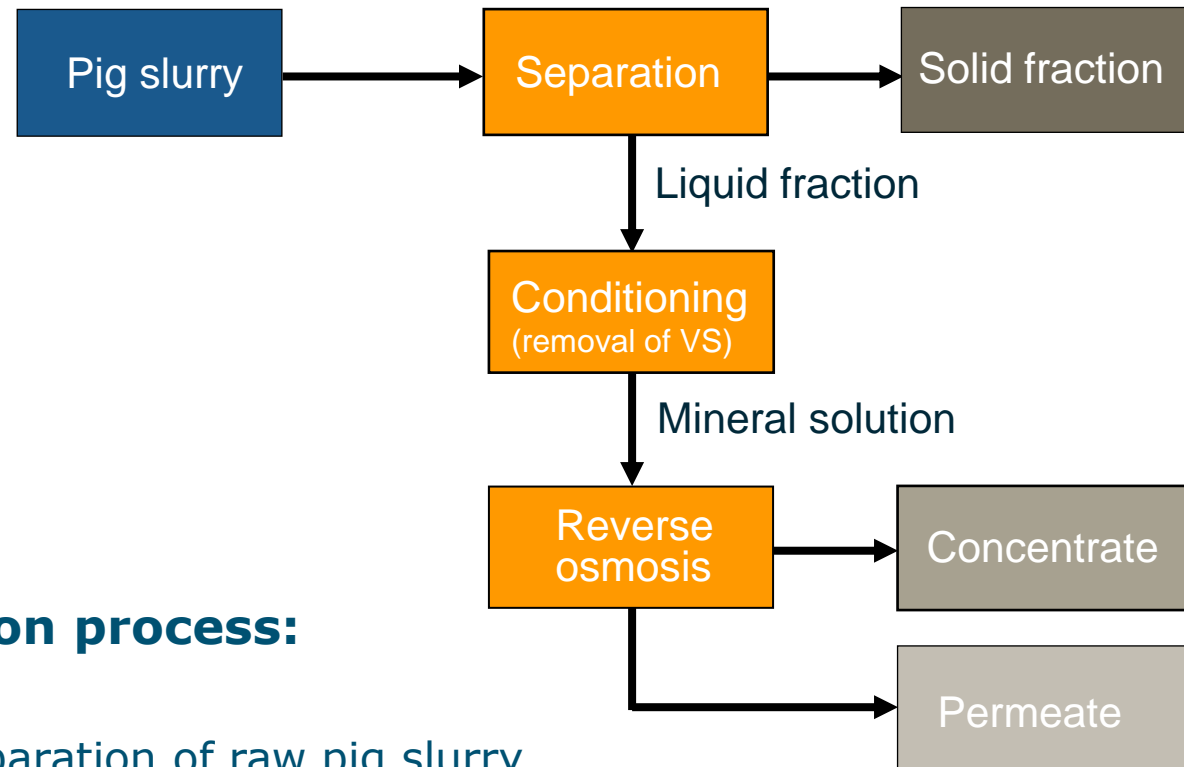
- Slurry separation
- Production of mineral NK-concentrate by reverse osmosis (liquid fractions of pig slurry, veal slurry)
- Stripping scrubbing
- Nitrification/denitrification (veal slurry)
- Composting (solid manure and solid fractions)
- Drying and pelletizing (poultry manure)
- Incineration (poultry manure)
- Fermenting (biogas production)

Slurry separation

With mobile centrifuges and export of the high P_2O_5 solid fraction



Production process of mineral concentrates



3 step production process:

- (1) Solid/liquid separation of raw pig slurry
- (2) Removal of volatile solids from liquid fraction
- (3) Concentration of dissolved minerals leaving a concentrate and a permeate

Producing clear water fraction

Reverse Osmosis removes dissolved salts and pathogens (e.g. *E. coli* bacteria), pilot mineral concentrates



Anaerobic digestion of slurry: biogas production

- Organic carbon is transformed into flammable methane (CH_4)
- All nutrients remain in the digestate



Composting

Composting poultry manure and solid fractions
pigs and cattle manure in rotating drums or in
buildings



Biological treatment of veal calf slurry

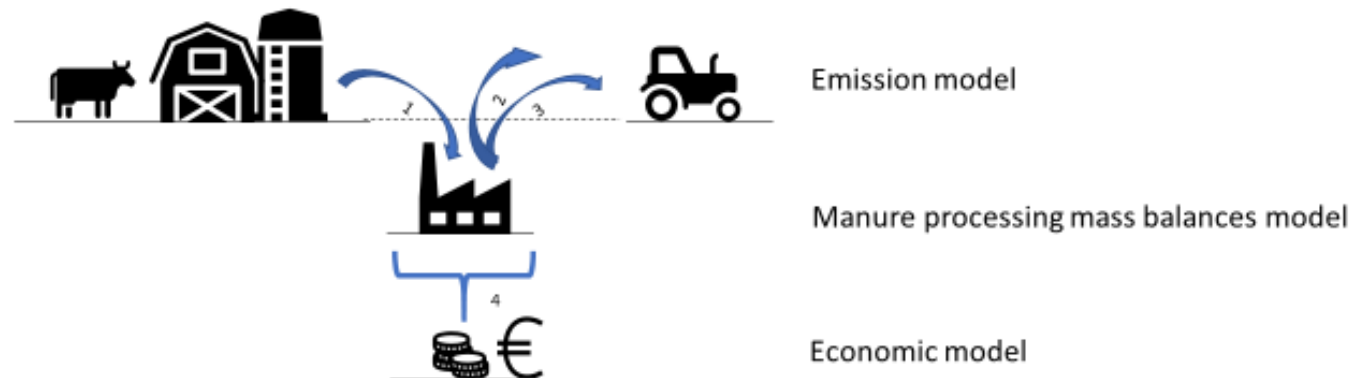


Nitrification and denitrification

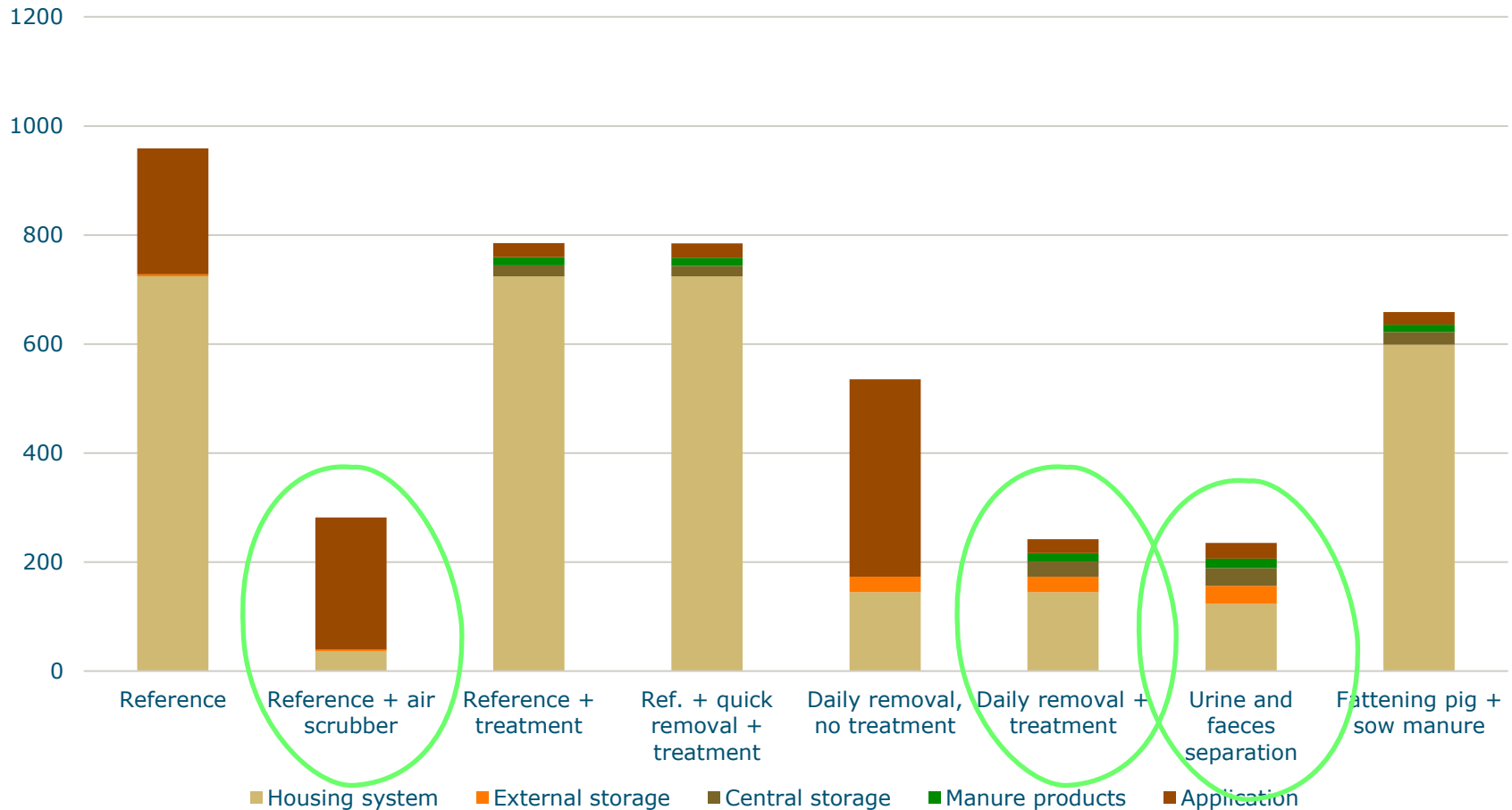
- Nitrogen is lost as N_2
- Phosphate is precipitated into sludge

NL Next Level manure valorisation

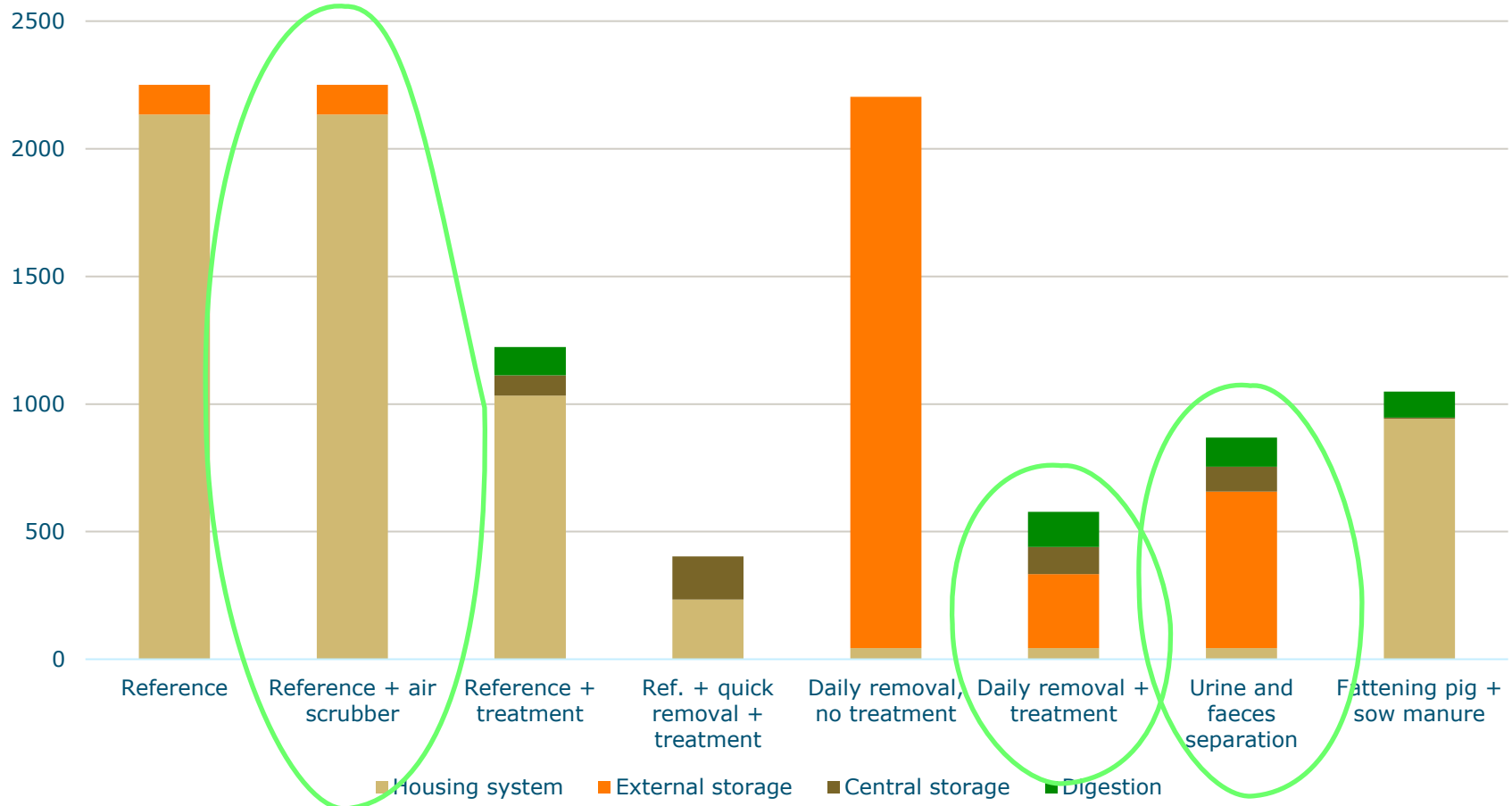
- Processing of manure in order to make high value organic or mineral products for agriculture:
 - Study of soil and crop needs
 - Determine processing routes (flow schemes, mass balances, costs)
 - Innovative techniques for manure processing
 - Innovation of animal housing systems
 - Modelling national manure market



Total ammonia emissions (tonnes/year) for pig manure (250 kton manure)



Total methane emissions (tonnes/year) for pig manure (250 kton manure)



Conclusions

- If you want to reduce ammonia and methane emissions:
 - Quick removal from barn or separations of urine and faeces
 - Important for methane reduction processing of manure: avoid long-time storage of slurry
- Conclusions on finances central processing plant:
 - Daily removal of manure: lowest gate fees because of higher yields of biogas.
 - Further processing of solid fraction at 250 kton manure processing plant is not profitable.

Thank you for your attention



Measurement on a nitrification/denitrification unit with floating Lindvall box