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Nutrient Recovery by Digestate Processing

Roskilde, 13.11.2019

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Digestate Utilisation - a Bottleneck in Biogas Technology

- Legal restrictions for land application (European Nitrate Directive)
- Increasing transport of digestate (cost and GHG emissions)
- Legal demand storage volume (e.g. half a year in Austria)
- Increasing number and size of biogas plants
- Regional nutrient surplus (manure application, supraregional substrates)
- Groundwater protection areas

Possible Advantages of Digestate Processing

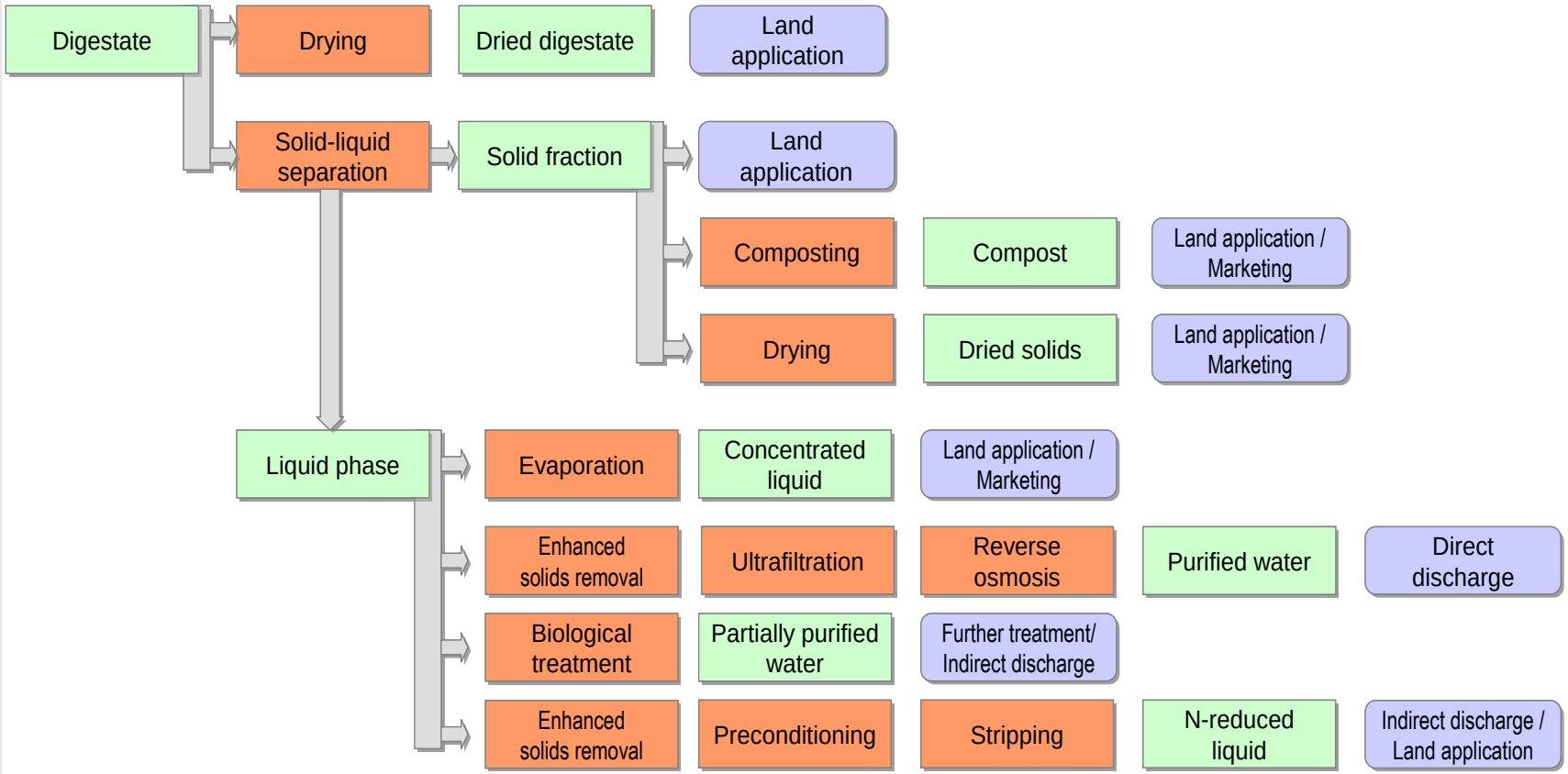
- Possible savings
  - Reduction of transportation costs for application on farmland
  - Reduction of storage costs
- Marketing of generated products
  - Marketable fertiliser (storage, transport, ...)
  - Replace fossil fertilisers
  - Save phosphorous reserves
- Additional advantages
  - Decrease of N loss
  - Decrease of environmental burden
  - Reuse of process water

General Strategies for Digestate Processing

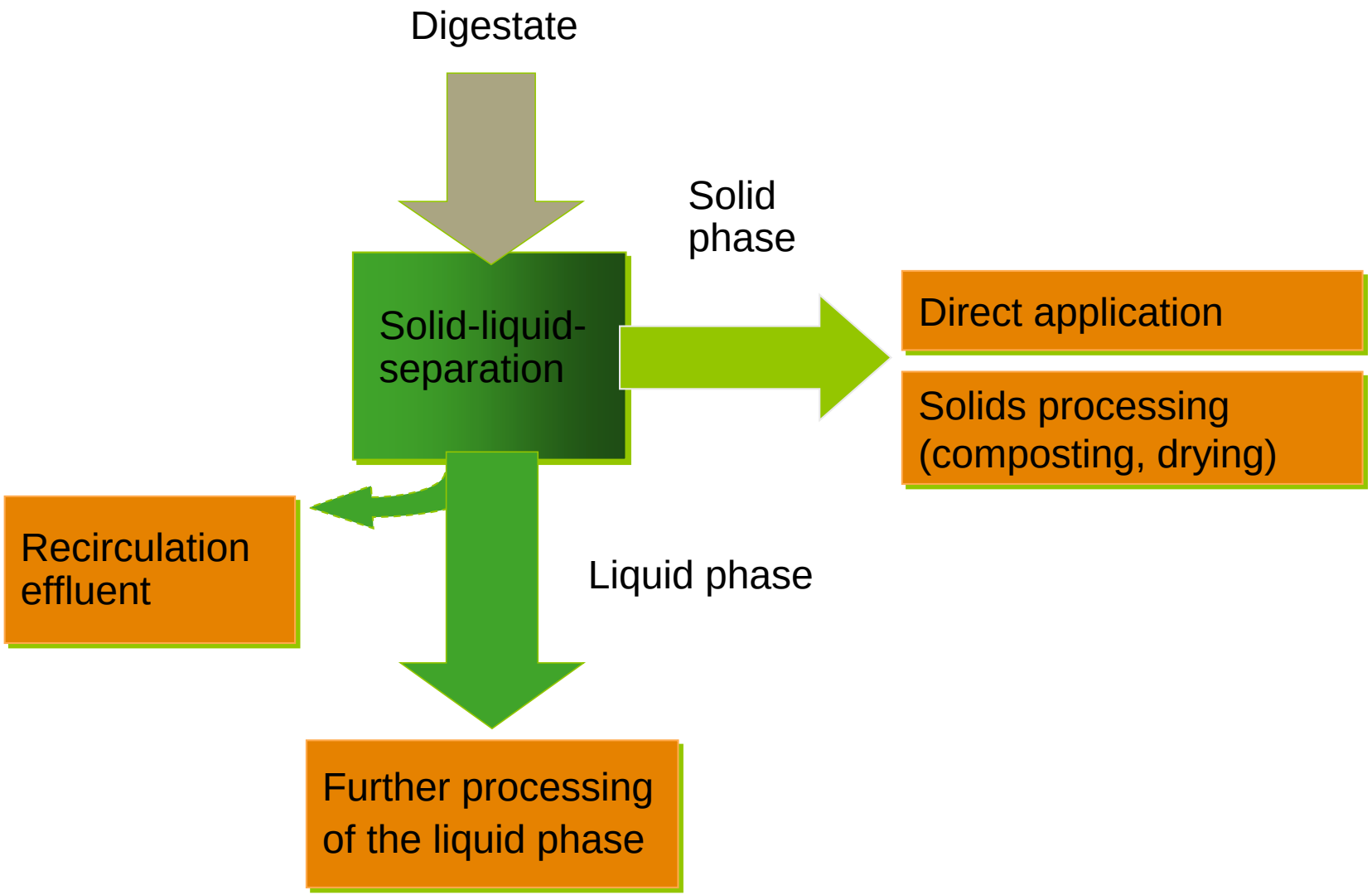
- Partial processing
  - Reduction of quantity

  or
  - separation into individual fractions that can be handled or stored more easily
- Complete purification
  - Separation and concentration of the valuable ingredients (nutrients)
  - purification of the remaining liquid fraction permitting reuse or direct discharge

Overview of Possible Process Combinations



Solid-liquid Separation – the First Step in Digestate Processing



Why Solid-liquid Separation?

- To reduce the amount of digestate by using recirculation effluent instead of fresh water
- Pretreatment step for further processing of the liquid phase
- Areas for digestate land application are available, but there is a regional surplus on phosphorous

Solid liquid separation

Why Drying of the Solid Phase?

- Surplus of thermal energy
- No local utilisation of the solid fraction
- An improvement of the marketability of the solids is ...

not necessary

Drying of solids

Solids Drying + Pelleting

Why Ammonia Stripping?

- Surplus of thermal energy
- Not enough area is available due to high nitrogen load
- Limited storage facilities
- Produced nutrient concentrate can be applied when plants can best utilise it

Ammonia Stripping

Why Aerobic Treatment OR Membrane Purification?

- Practically no area for land application is available, the export of the nutrients is necessary
- Local wastewater treatment plant with enough additional capacity is ...

availabe **not available**

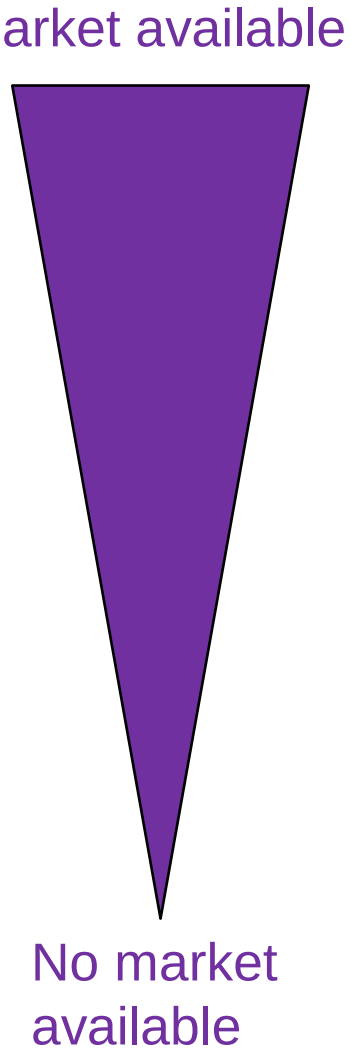
Co-treatment of liquid fraction in wastewater treatment plant

Complete purification by membrane technology

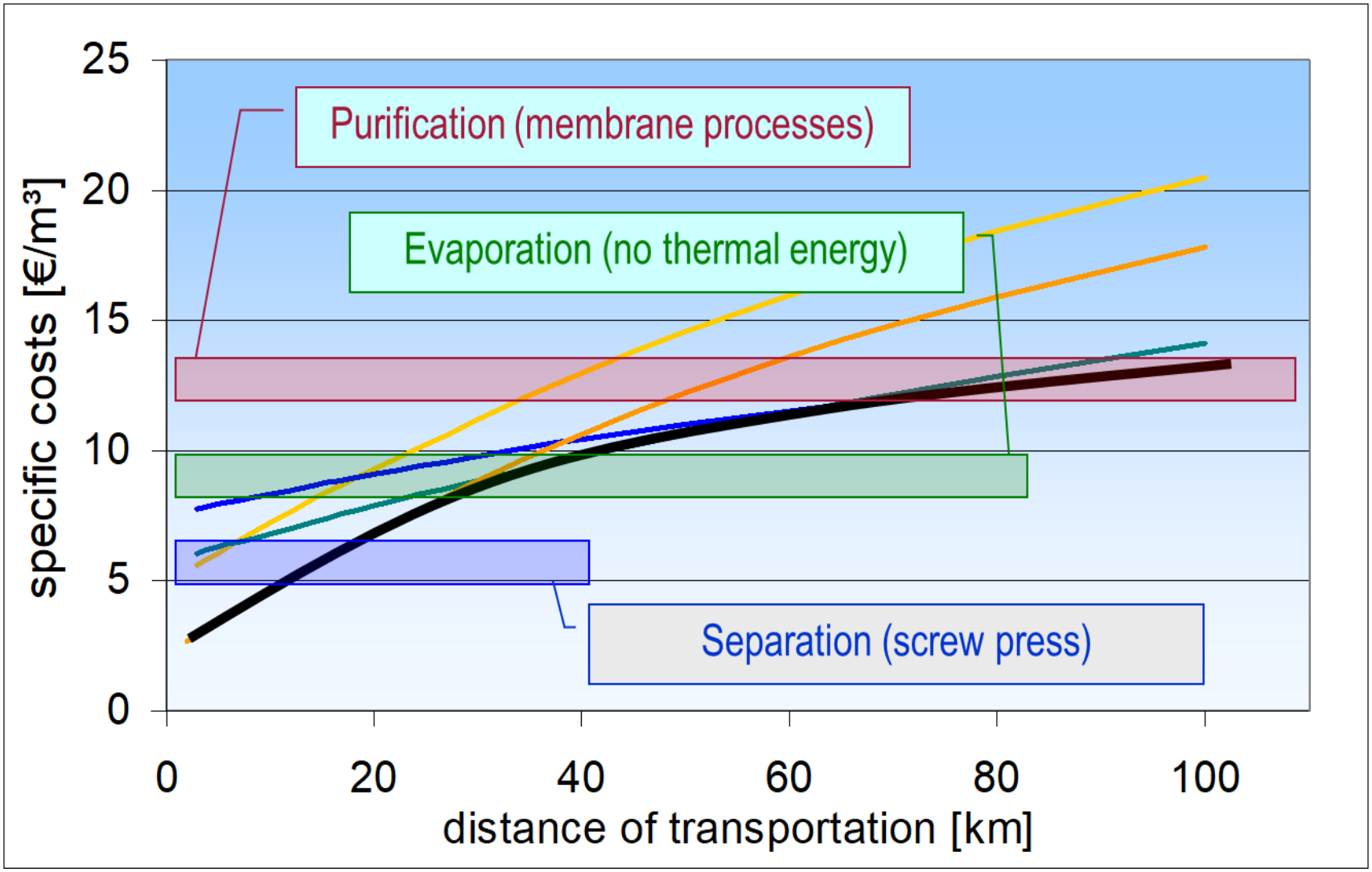
Possible biofertiliser products from digestate

- Digestate compost (solids/fibre fraction, P-rich)
- Nitrogen-fertiliser (after NH_3-stripping)
  - e.g. Ammonium sulphate
- Dried digestate pellets (solids/fibre fraction, P-rich)
  - Recycling of residual carbon (soil improver)
- Struvite precipitation (MAP - $NH_4MgPO_4*6H_2O$)
- Liquid nutrient concentrate (membrane, evaporation)

→ Bottleneck is establishing the market for products



Rough cost estimations



→ Economic data based on the years 2008/2009

Conclusions (I)

- Most digestate processing technologies are only feasible in large-scale biogas plants
- The main reason for investing in digestate processing technology are the lack of available agricultural area for land application
- A large number of different technologies and processing concepts are available depending on the local requirements
- At the moment there is â very limited market for fertiliser products from digestate therefore they have a low market value
- The current legal situation for the utilisation of digestate from waste material is unsatisfactory

Conclusions (II)

- Although digestate processing is often quite expensive there are already feasible scenarios
- The ideal solutions depend strongly on local conditions and requirements
- Huge potential for optimising site-specific digestate processing concepts
- Despite the challenges:
  - increasing demand for technologies for digestate processing
  - increasing demand for recycling phosphorous
  - big strategic importance for increasing biogas production

Detailed report on state of the art of nutrient recovery technologies

Nutrient Recovery by Biogas Digestate Processing

IEA Bioenergy

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SUMMARY

This report reviews various approaches for processing of biogas plant digestate for the purpose of nutrient recovery. It covers both established and emerging technologies and assesses technical performance and where possible economics. Techniques for nutrient recovery from digestate are developing rapidly and aim to improve nutrient management in agriculture and in waste treatment systems.

The report is aimed at biogas plant developers and operators as well as agriculture policy makers and was produced by IEA Bioenergy Task 37. IEA Bioenergy Task 37 addresses challenges related to the economic and environmental sustainability of biogas production and utilisation.

https://www.iea-biogas.net/files/daten-redaktion/download/Technical%20Brochures/NUTRIENT_RECOVERY_RZ_web2.pdf

Other links …

Current Horizon2020 (EU) projects:

https://systemicproject.eu/

https://www.lex4bio.eu/

Other interesting literature:

https://www.digestate-as-fertilizer.com/Download/Digestate_as_Fertilizer.pdf

http://www.wrap.org.uk/sites/files/wrap/Digestates%20from%20Anaerobic%20Digestion%20A%20review%20of%20enhancement%20techniques%20and%20novel%20digestate%20products_0.pdf

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