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Techno-economic assessment

DES pretreatment of common reed for phenolic compound extraction and biogas production

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DES pretreatment of common reed for phenolic compound extraction and biogas production

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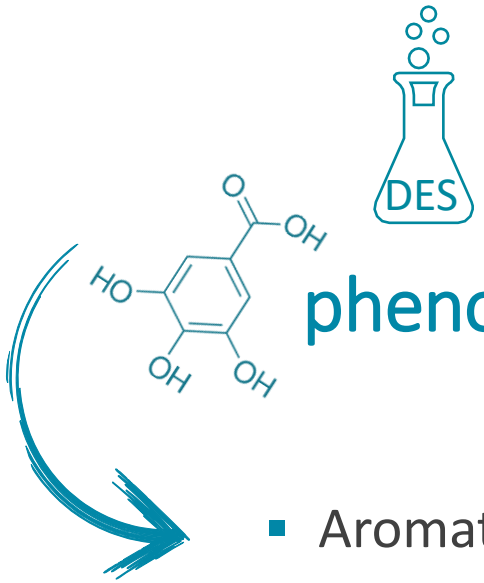
phenolic compound extraction and biogas production

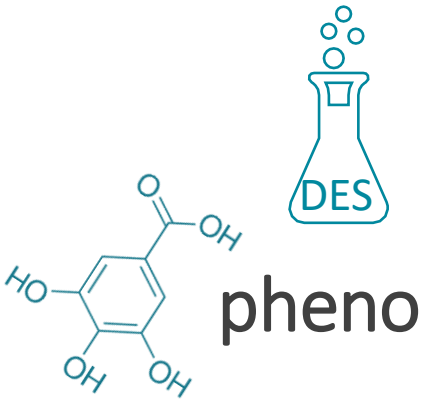
DES pretreatment of common reed for phenolic compound extraction and biogas production

- Composed of hydrogen bond donor and hydrogen bod acceptor
- Strong hydrogen bond network & ionic structure → good solvation properties
- Considered as green solvents



DES pretreatment of common reed for phenolic compound extraction and biogas production

- Aromatic hydrocarbon + hydroxyl group(s)
- Bioactive compounds (antioxidants, anti-inflammatory, antimicrobial, anti-proliferative)
- Application is studied in pharma, food, cosmetics, packaging & textile industry

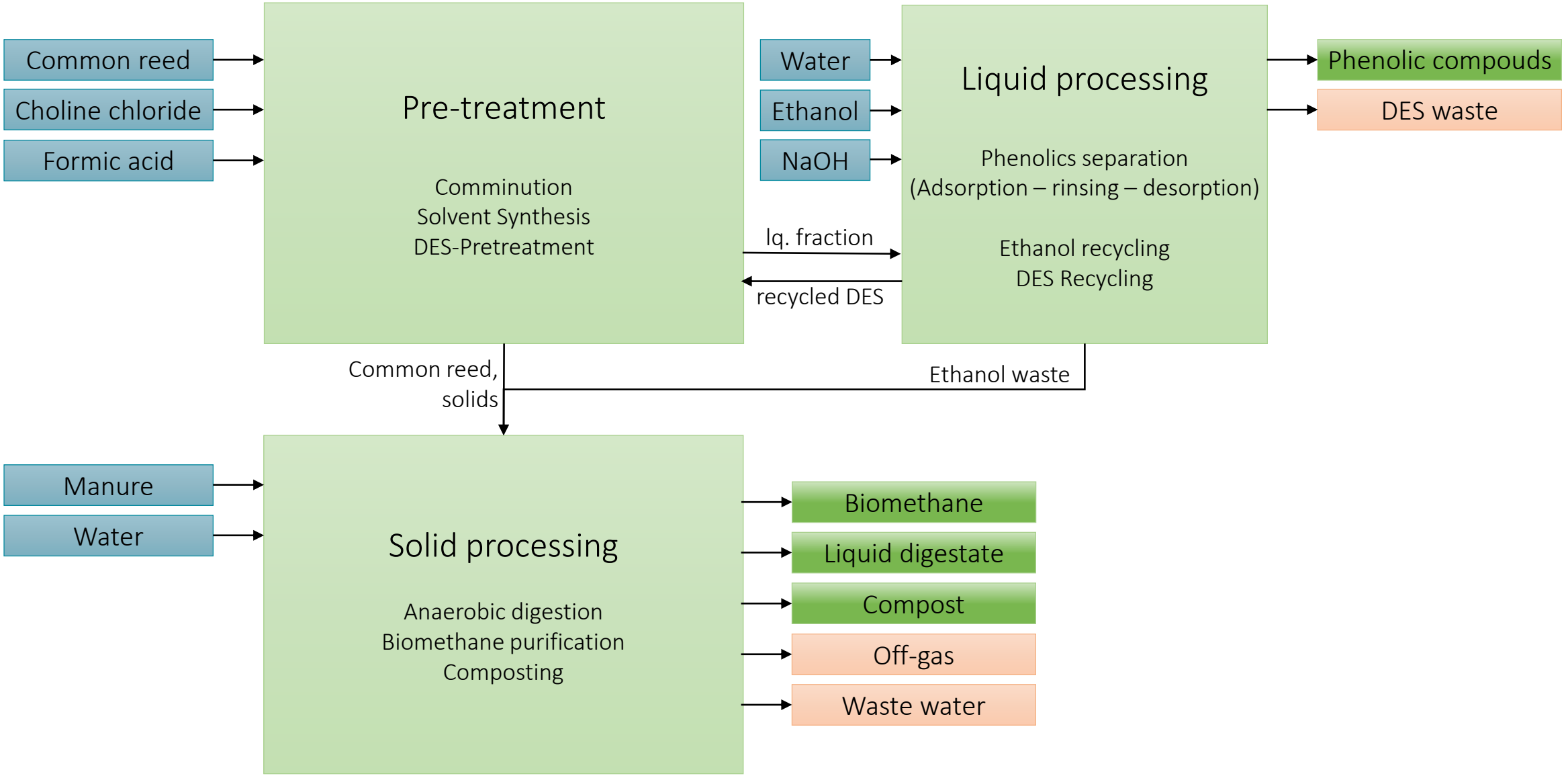


DES pretreatment of common reed for phenolic compound extraction and biogas production

- Utilization of processing residues via anaerobic digestion
- Biomethane purification

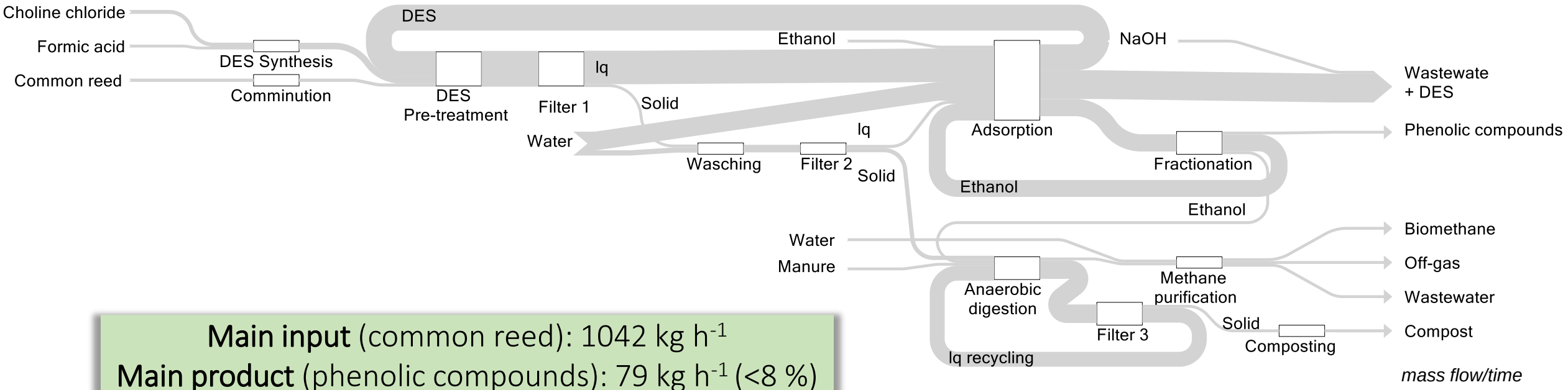
Process design

Biorefinery of common reed



Mass flows

Biorefinery of common reed



Main input (common reed): 1042 kg h^{-1}

Main product (phenolic compounds): 79 kg h^{-1} (<8 %)

Side products

Biomethane 209 m^3 h^{-1}

Compost 555 kg h^{-1}

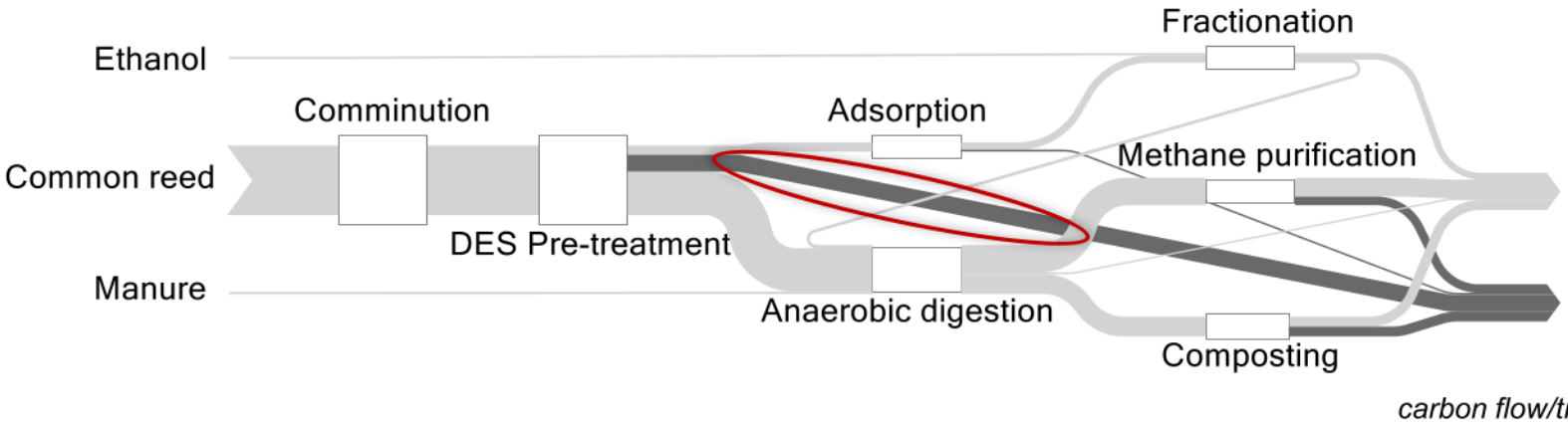
Large mass flow of auxiliaries

Large wastewater outflow

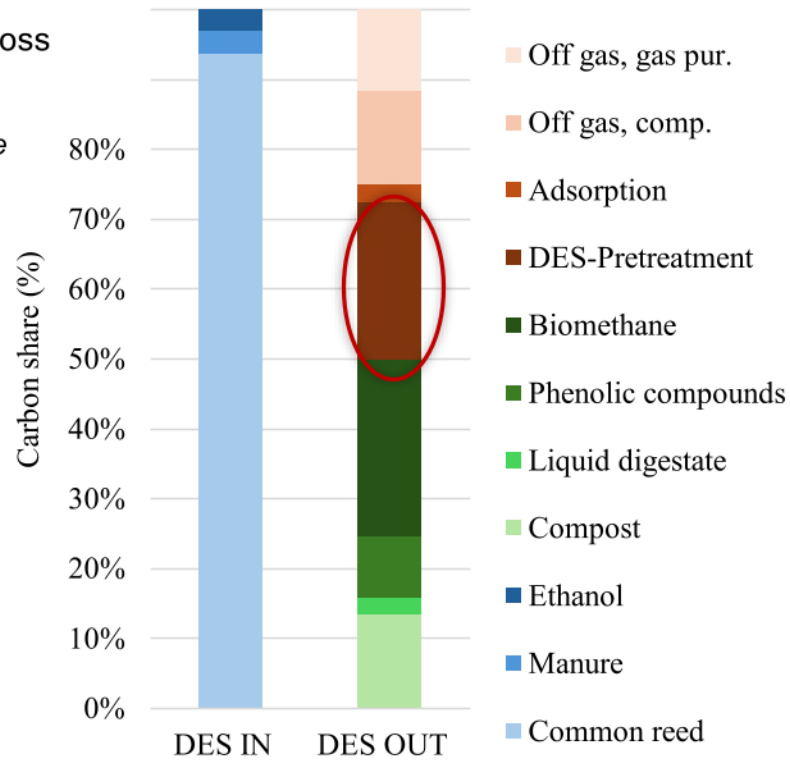
lq: liquid

Carbon flows

Biorefinery of common reed



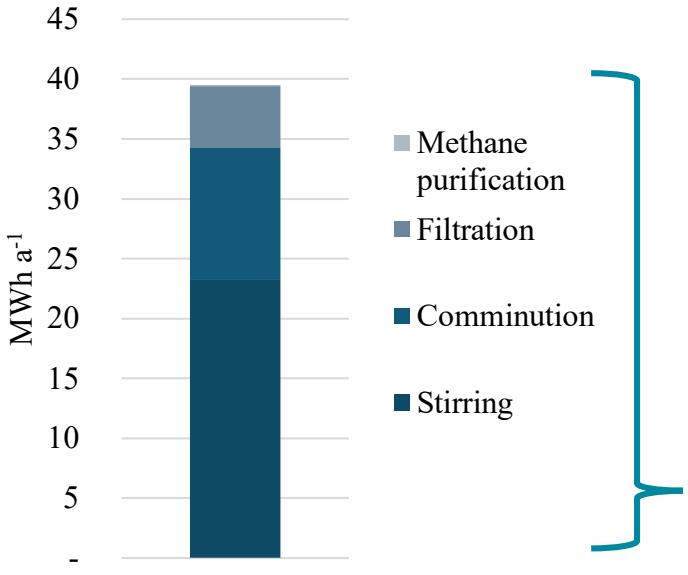
DES: large carbon loss during pre-treatment



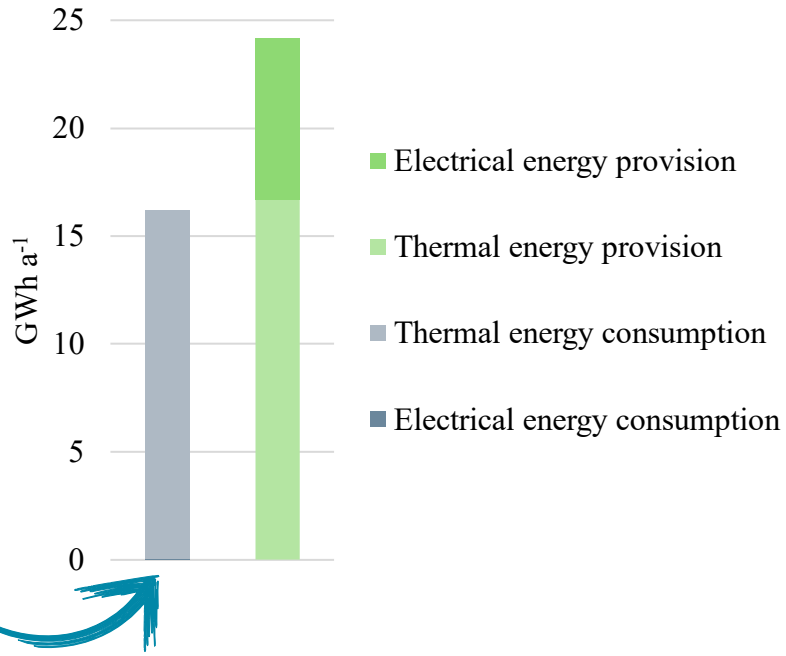
Energy consumption

Biorefinery of common reed

Electrical energy consumption



Energy consumption & provision



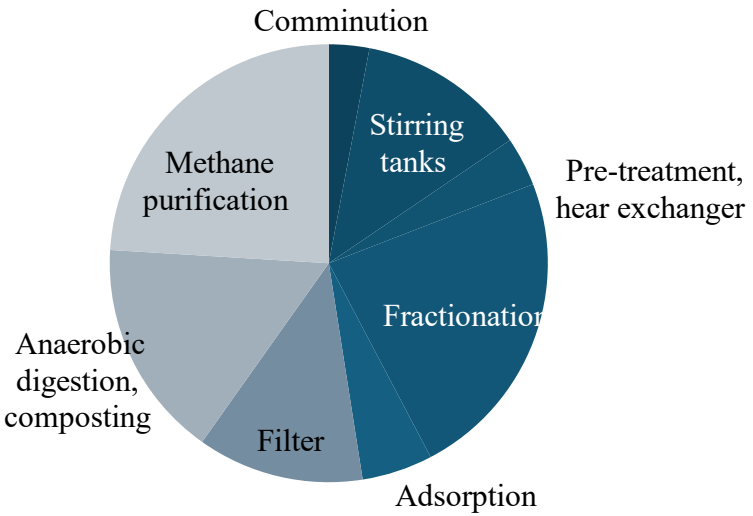
Evaporation is
major driver of energy consumption

Process consumes most of the
(potentially) produced thm. energy

Costs

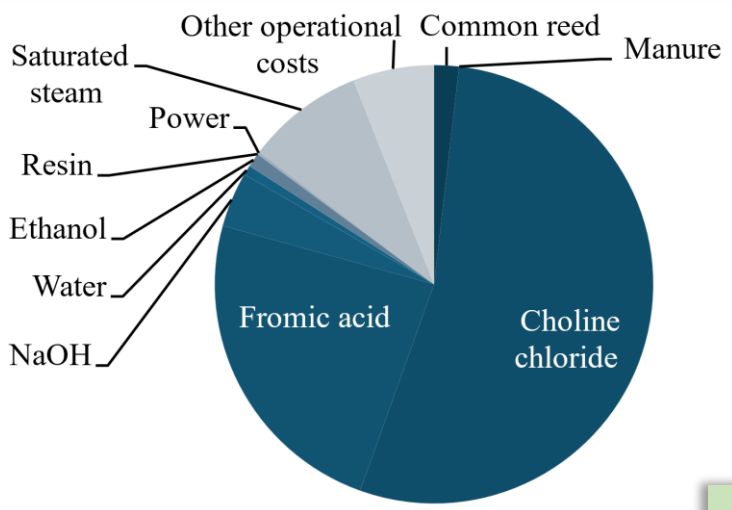
Biorefinery of common reed

CAPEX



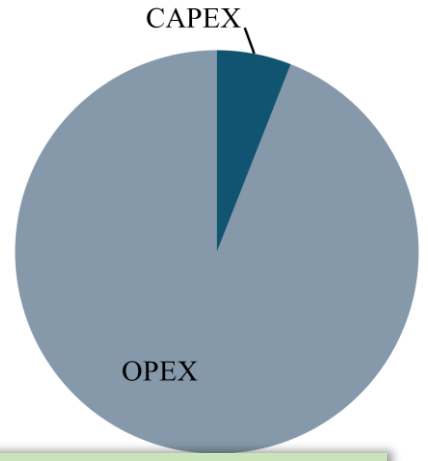
~19 Mio € CAPEX
8.3 t biomass/year

Opex



~36 Mio €/year OPEX
8.3 t biomass/year

Annuities



OPEX >> CAPEX
High costs for auxiliaries

Minimum selling price
57 €/kg

Costs

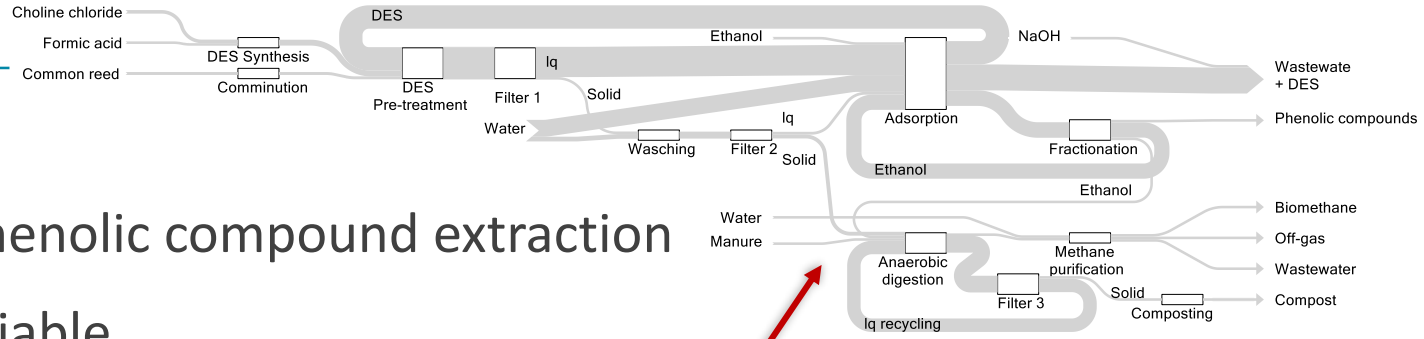
Biorefinery of common reed

- Phenolic compounds
  - Minimum product selling price MPSP (present study) 57 €/kg
  - Phenol, laboratory supply (reference) 98 €/kg
  - Gallic acid, laboratory supply (reference) 531 €/kg
  - Catechin, laboratory supply (reference) 273 €/10 mg

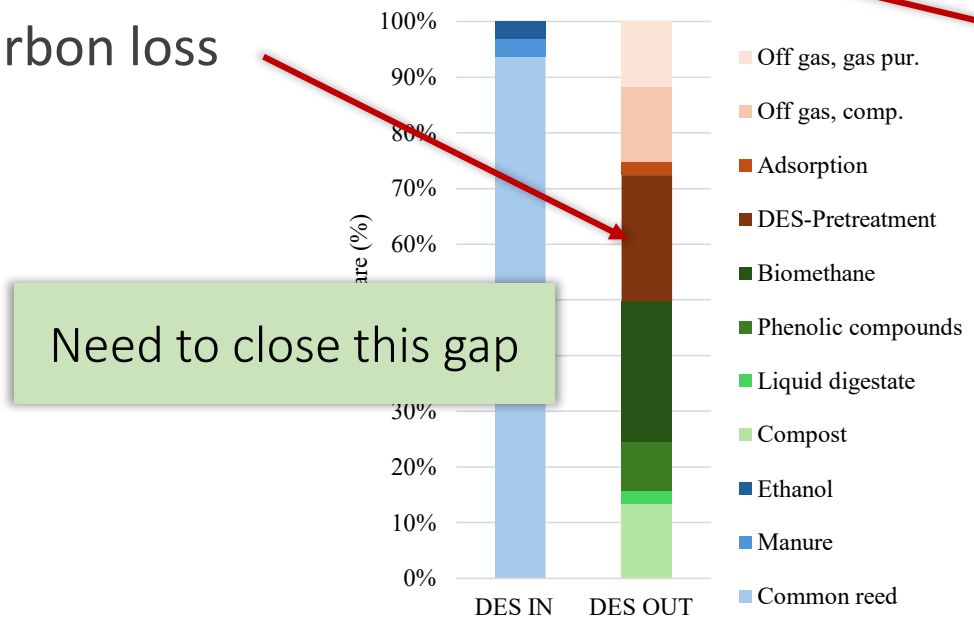
Competitive,
Further processing costs expected

Conclusion

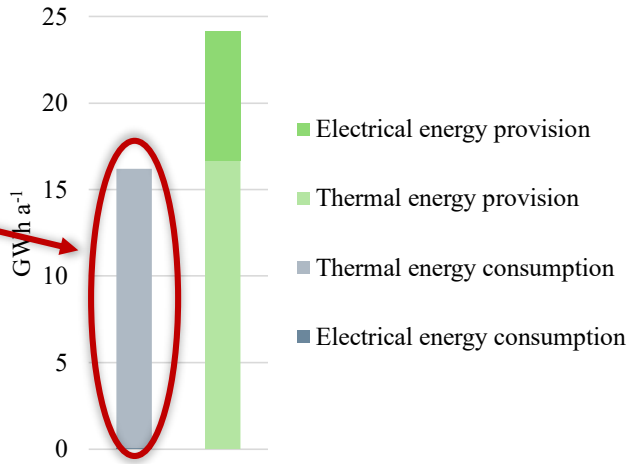
Biorefinery of common reed



- Technical process solution for phenolic compound extraction
- Process could be economically viable
- Energy consumption and costs driven by large mass flow of auxiliaries
- Energy provided is largely consumed by the process
- Considerable mass/carbon loss



Need to close this gap



Thank you for your attention!

Questions?

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