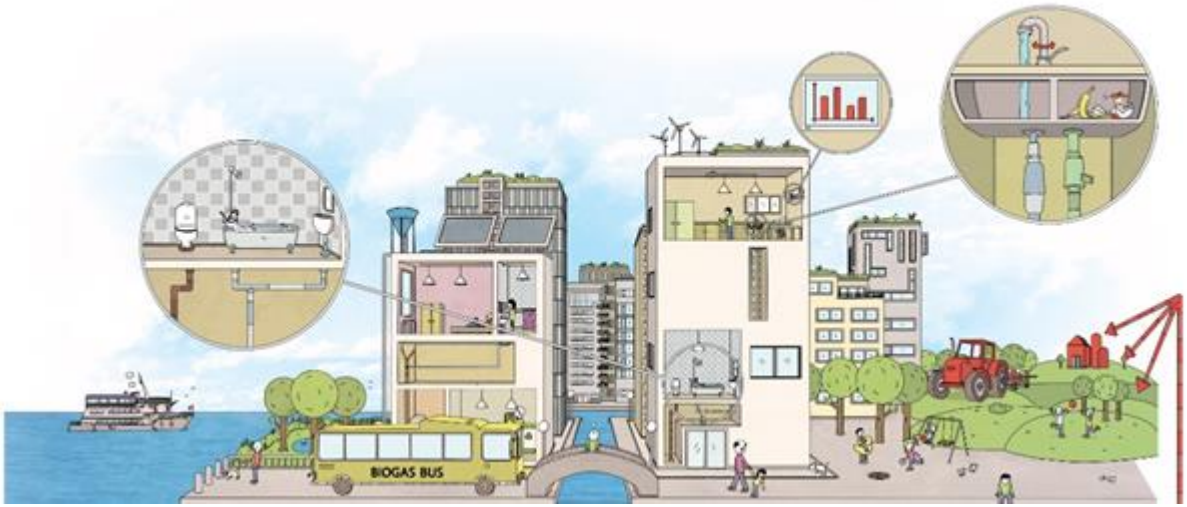
Environmental impact of source separation systems

for blackwater, greywater and food waste in the **H+ urban renewal project, Sweden**



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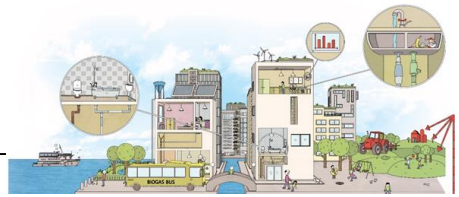
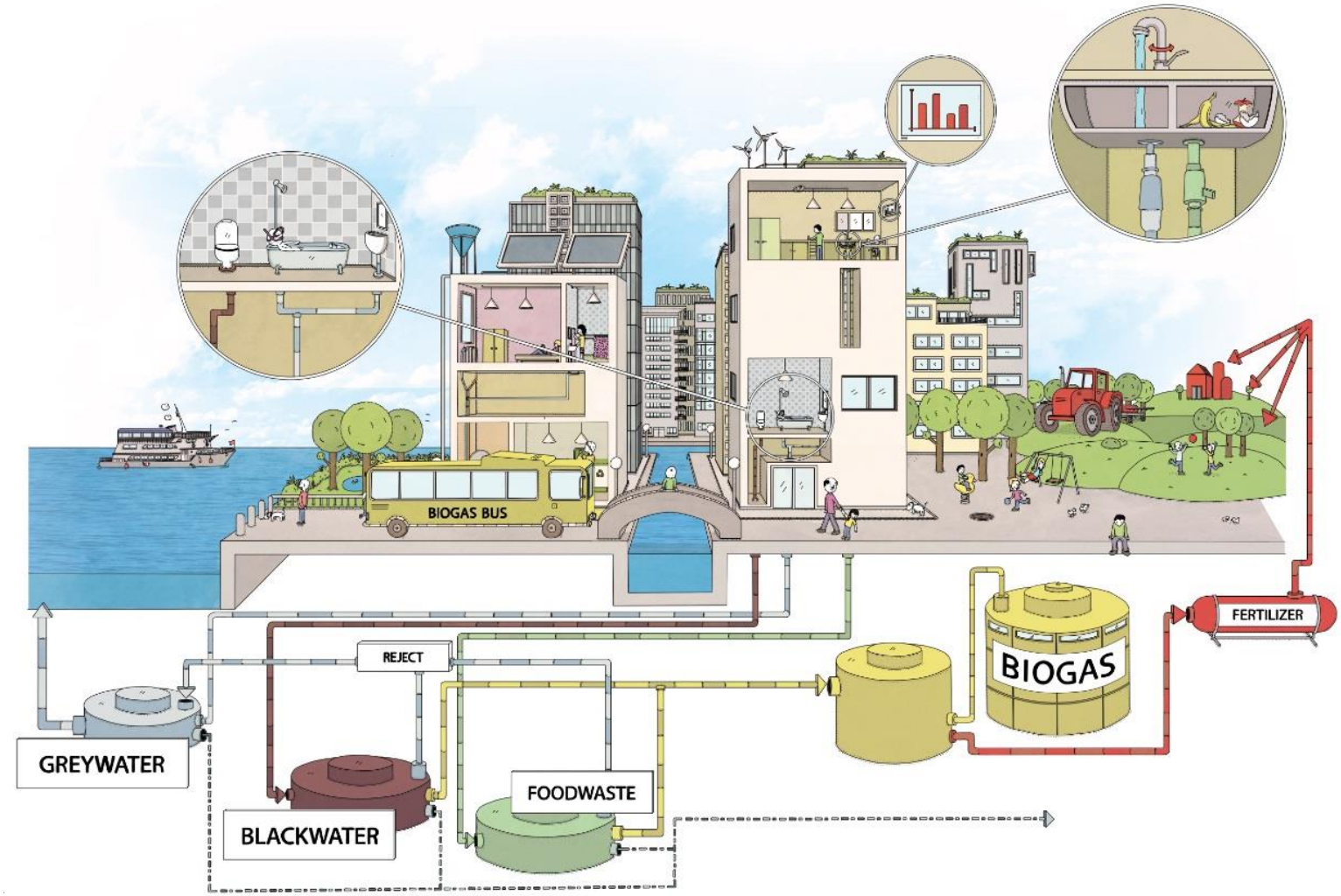
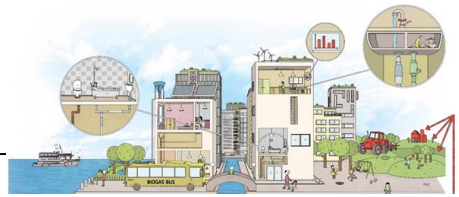
Background

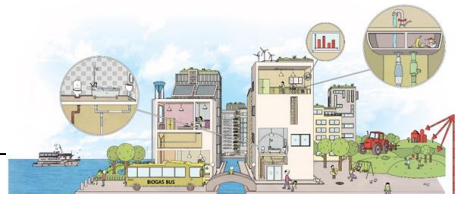



BIOGAS BUS
REJECT
GREYWATER
BLACKWATER
FOODWASTE
BIOGAS
FERTILIZER



Method:

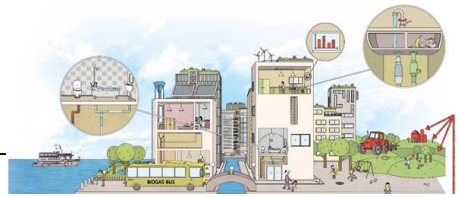
- Life cycle assessment with system boundary to include entire management chain.



DESCRIPTION OF SYSTEMS

- Conventional system

- Source separation system



Conventional system

FW

100%

Food waste plant

BW+GW

WWTP

Biogas upgrading & use

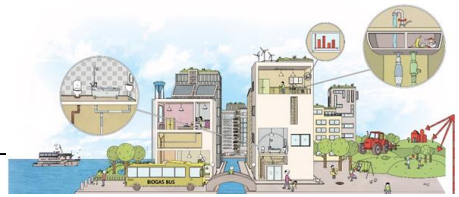
75%

25%

Soil improver

Ocean recipient

Soil storage and agriculture



Source separation system

FW

BW

GW

Nutrient recovery

WWTP

Biogas upgrading & use

75%

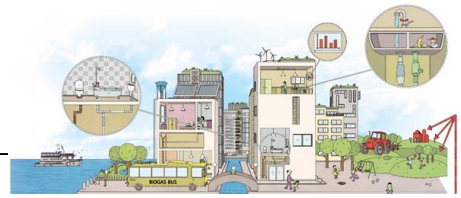
Soil improver

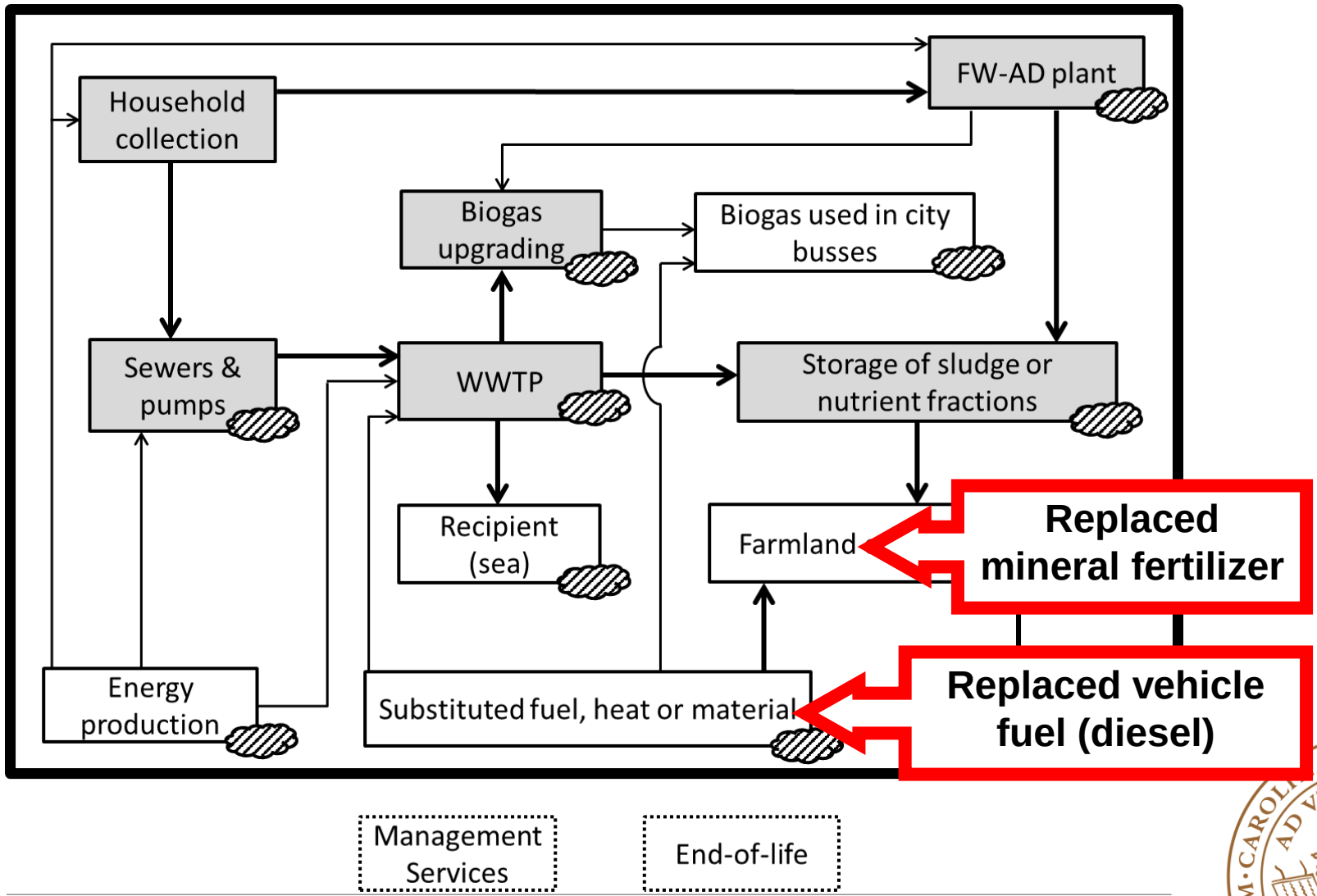
Ocean recipient

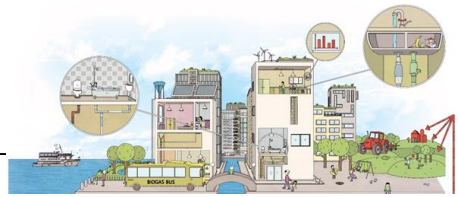
25% sludge

100% struvite and amm. sulphate

Soil storage and agriculture




Household collection
FW-AD plant
Biogas upgrading
Biogas used in city busses
Sewers & pumps
WWTP
Storage of sludge or nutrient fractions
Recipient (sea)
Farmland
Energy production
Substituted fuel, heat or material
Replaced mineral fertilizer
Replaced vehicle fuel (diesel)
Management Services
End-of-life



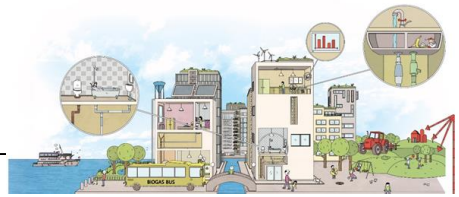
Indata:

- Process data from litterature (EcoInvent database v.3), real plants or suppliers.
- Mass balances for organic material, phosphours and nitrogen.

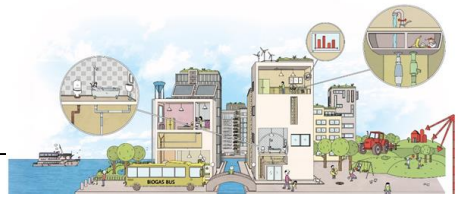
Impact categories

Climate change	Return of nitrogen to farmland	Return of phosphorus to farmland
Kg CO_2 eq	kg N	kg P

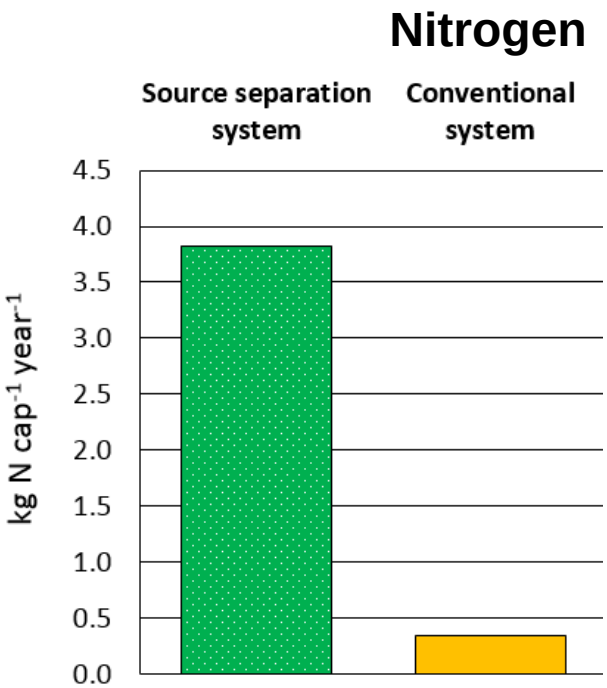
$$\textbf{Functional Unit} = \frac{\textbf{Management of 1 capita load of FW, BW and GW}}{\textbf{year}}$$

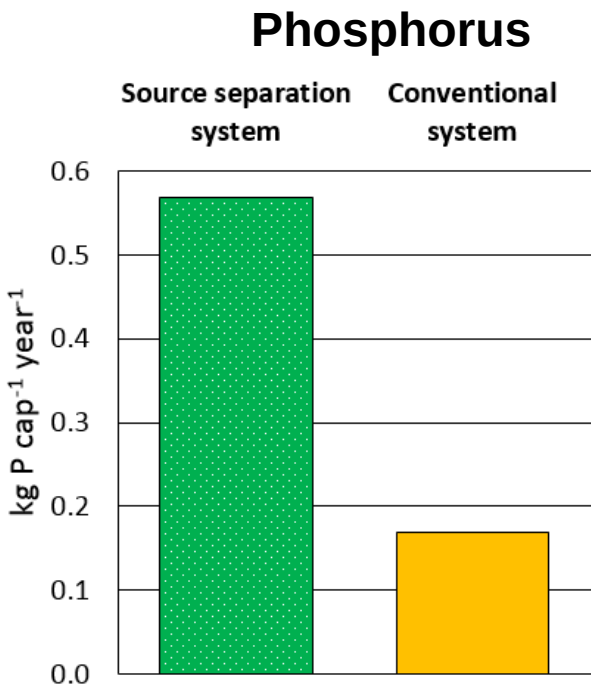


RESULTS

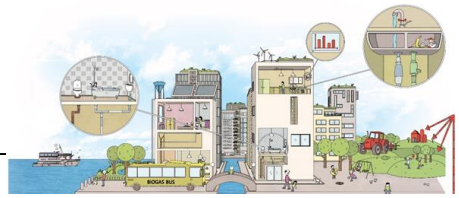


Potential for nutrient recovery to farmland



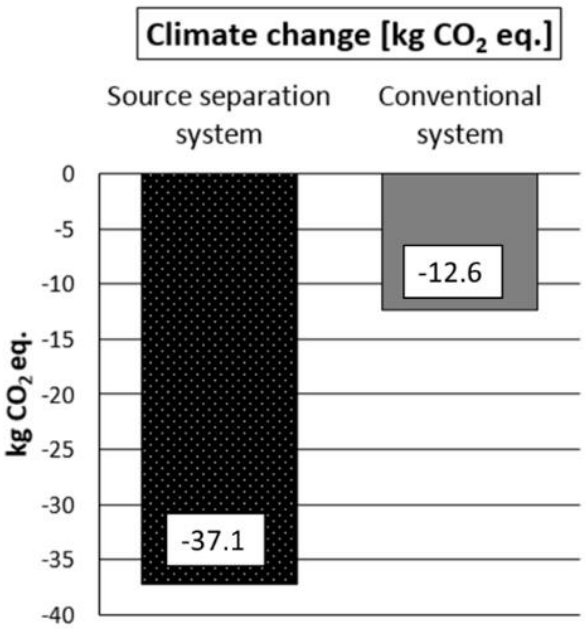


- Source separation system increases nutrient return due to usage of struvite and ammonium stripper.

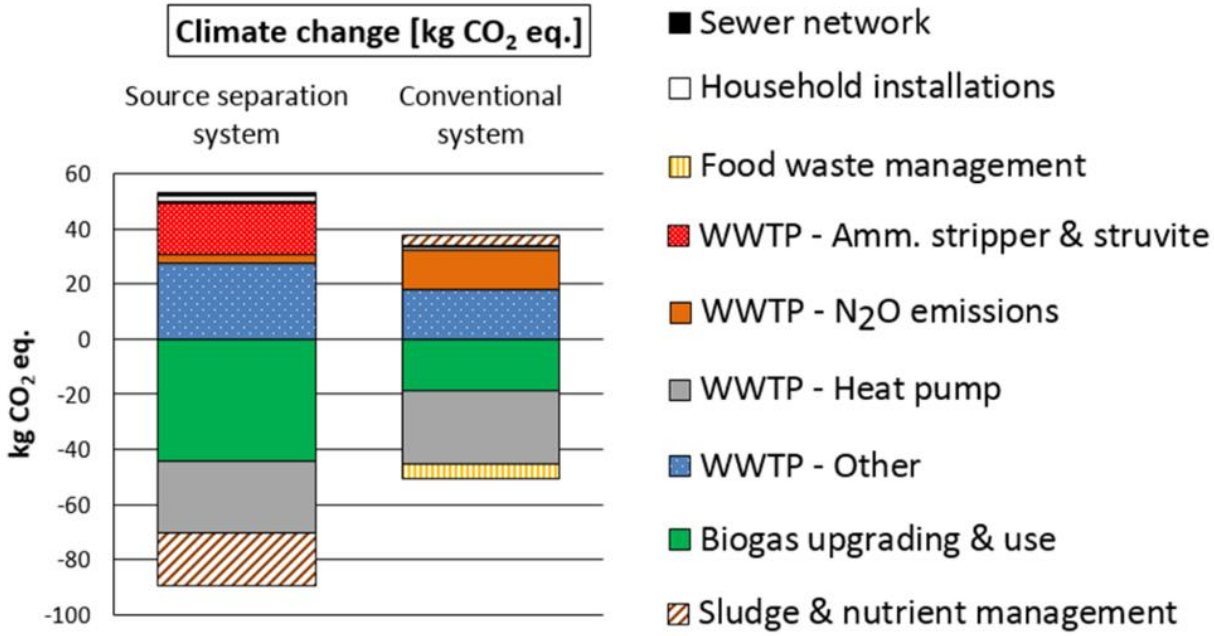


Impact on climate change

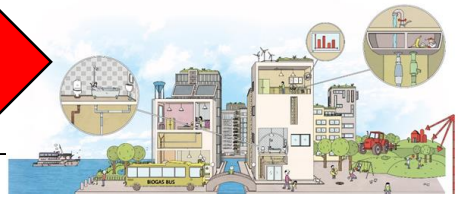
Net results



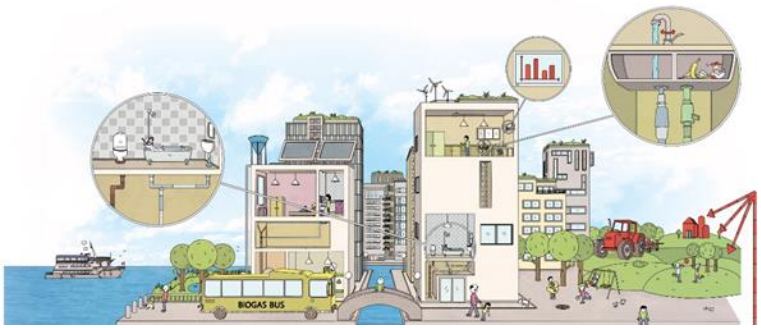
Detailed results

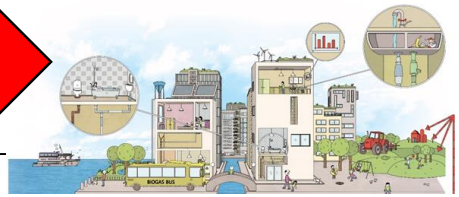


- Source separation systems decreases climate impact due to:
  - *increased biogas production (replace diesel as vehicle fuel)*
  - *less N_2O-emissions from activated sludge (strong greenhouse gas)*
  - *Replaced nitrogen mineral fertilizer (nitrogen fixation is energy demanding)*
  - *Less emissions from sludge storage (methane and N_2O)*



CONCLUSIONS

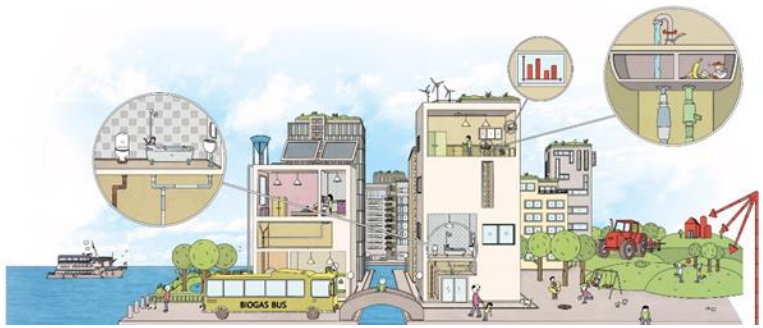


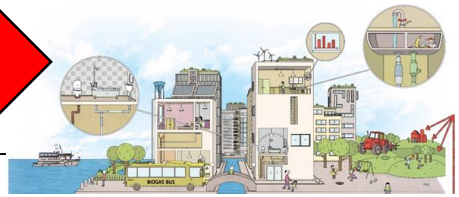


Conclusions:

- Source separation systems have a high potential for recovery of nutrients.

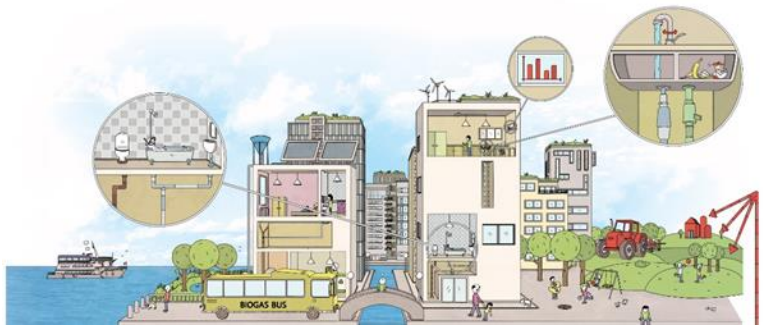
- Source separation systems decreases climate impact (with 21-56 kg CO_2 $capita^{-1}$ $year^{-1}$). Benefit is increased with ”dirtier” european electricity mix.





If you want to reduce climate impact:

- Maximize biogas production and replacement of mineral fertilizer.
- Decrease emissions of nitrous oxide (N_2O) from your activated sludge plants.
- Decrease emissions of methane and nitrous oxide from sludge storage (dewater and cover the sludge storage).



Thank you for your attention

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