MembraneBioReactor MBR

Results of the project MBR II - biogas from slurry, UF-retentate and co-substrates

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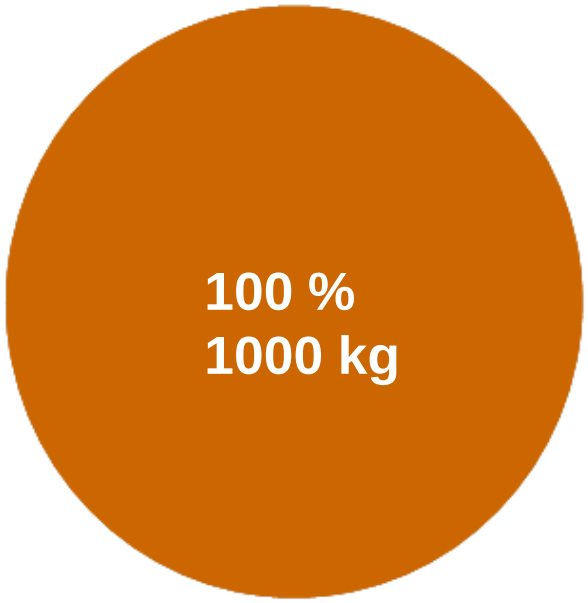
Situation in Switzerland

<u>slurry from agriculture as a challenge</u>

- ¾ of agricultural surface are greenland
- high density of animals means high yield of slurry
- after wood as biomass slurry has the biggest potential
- environmental aspects become more and more important

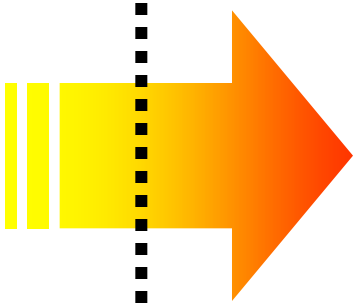
→ combination of matterflux and energy is essential

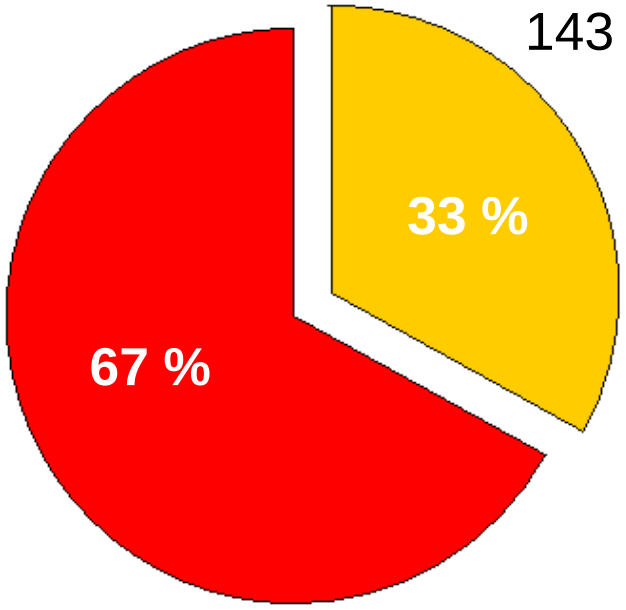
Where is the energy in slurry?



raw slurry (50/50 % cattle/pig)

434 MJ





solid particles
143 MJ

liquid phase of slurry
291 MJ

the liquid phase gets the power

Aim of the project

3 different substrates are examined:

- the liquid phase of separated slurry
- UF retentate (ultrafiltration concentrate from liquid phase)
- liquid phase with liquid co-substrate (whey, glycerine)

The tests were performed in 2 existing plants:

- a pilot plant at half-scale

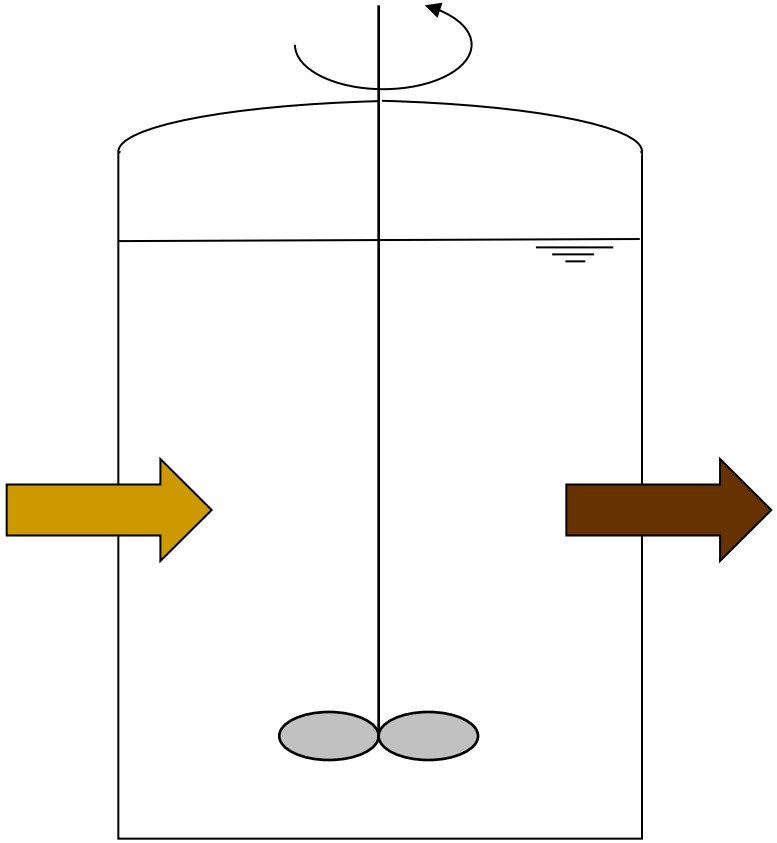
→ for engineering methods, cost effectiveness and implementation

- a laboratory facility

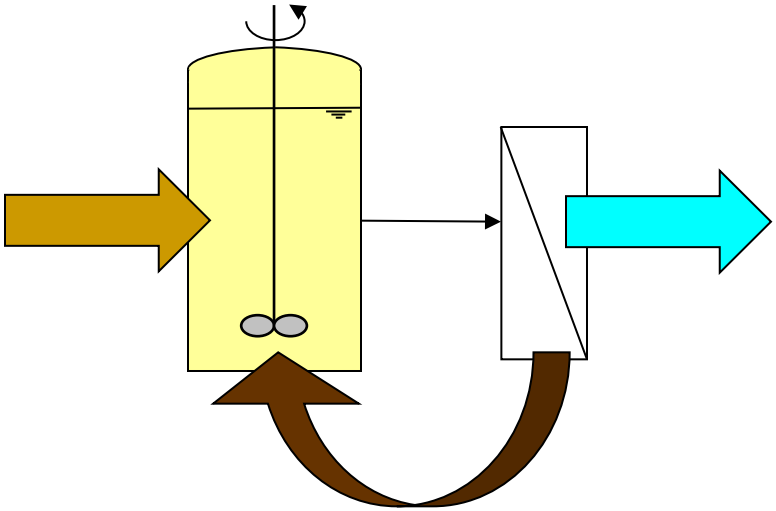
→ for technology and biological limits

Contininous stirred tank reactor vs. MBR

conventional system

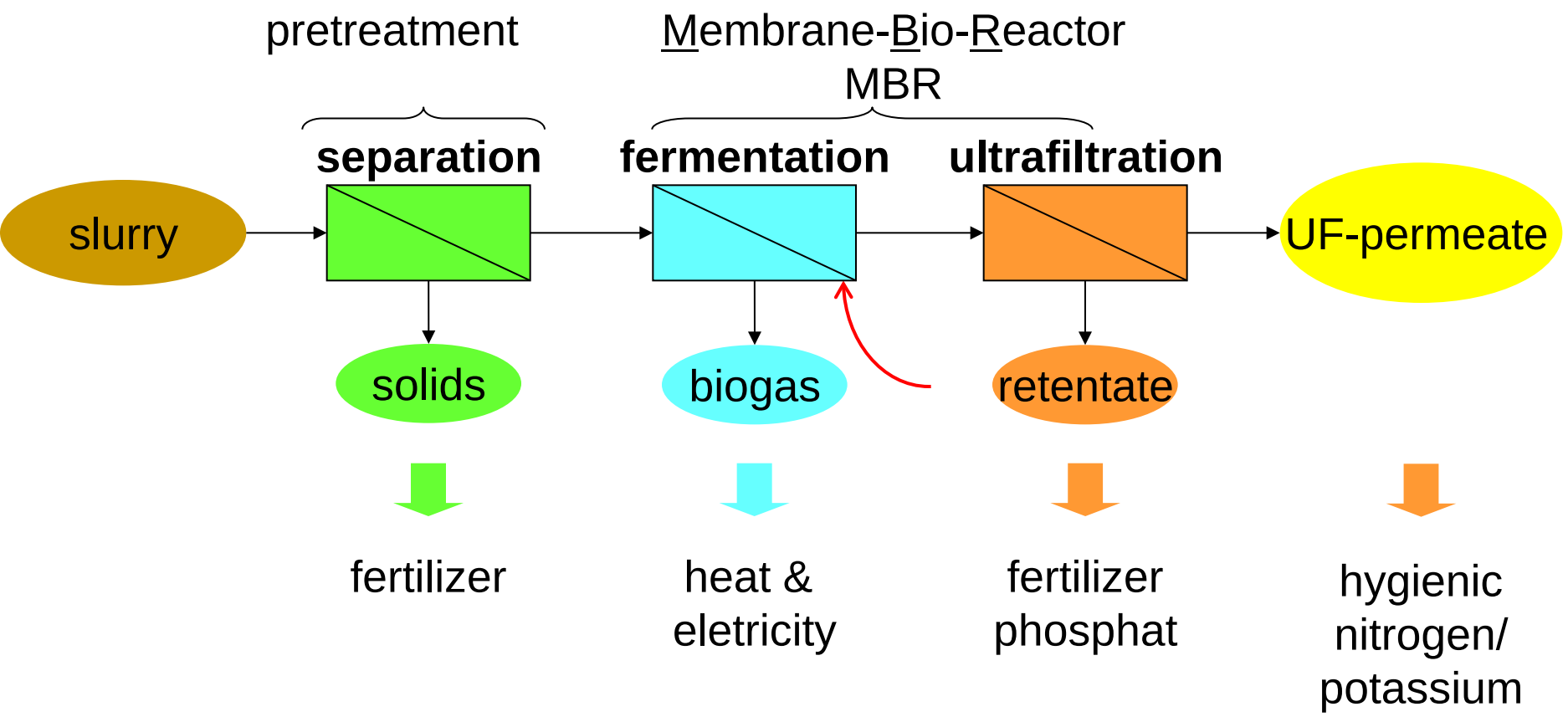


membrane bioreactor

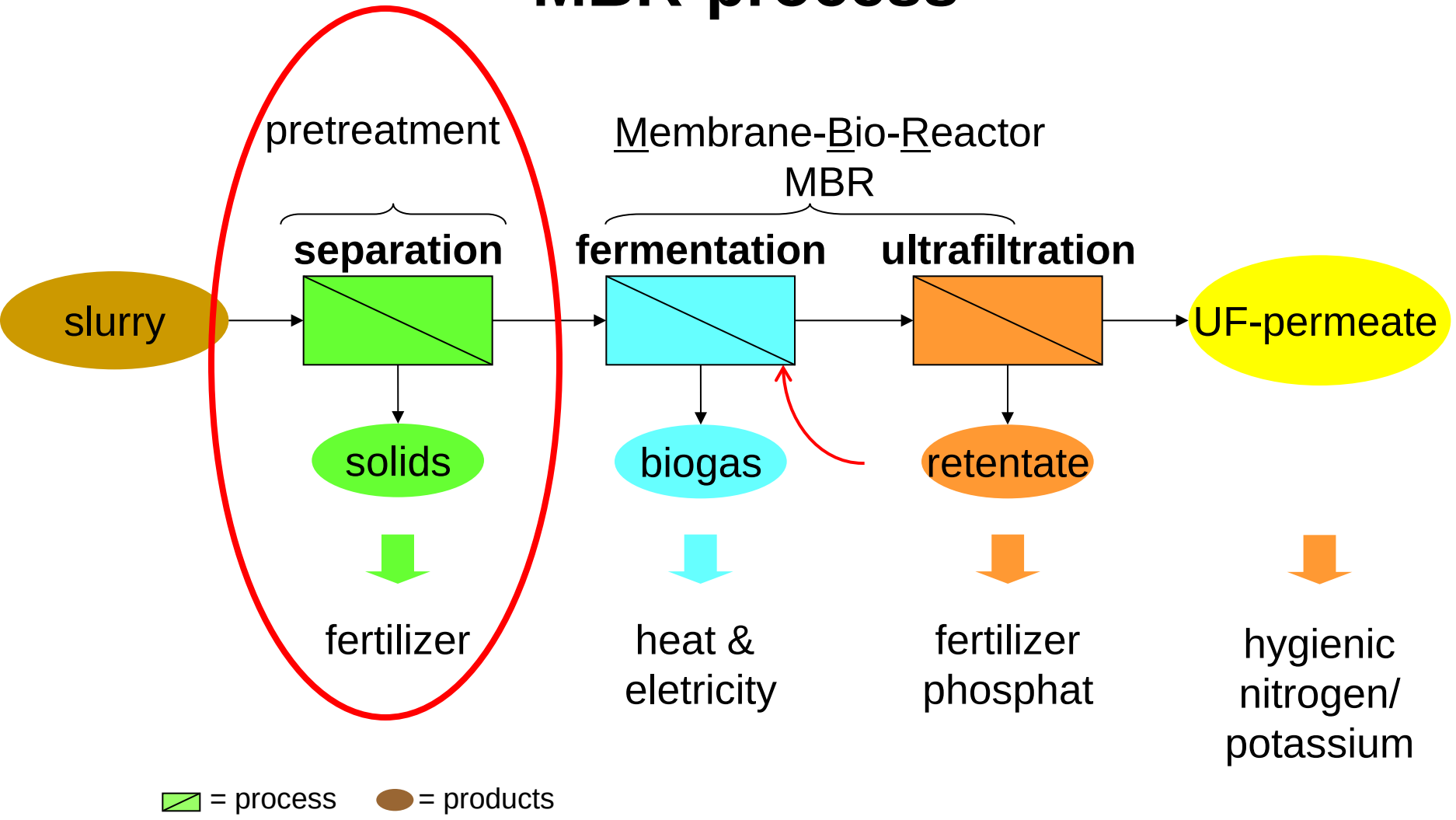


retention and
rejection of bacteria
by ultrafiltration membrane

MBR-process


pretreatment
Membrane-Bio-Reactor
MBR
separation
fermentation
ultrafiltration
slurry
UF-permeate
solids
biogas
retentate
fertilizer
heat &
eletricity
fertilizer
phosphat
hygienic
nitrogen/
potassium
= process
= products

MBR-process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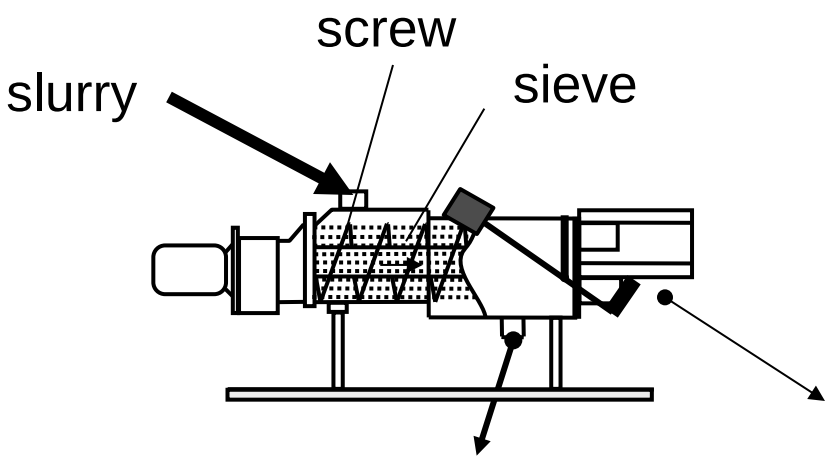
nitrogen/
potassium
= process
= products

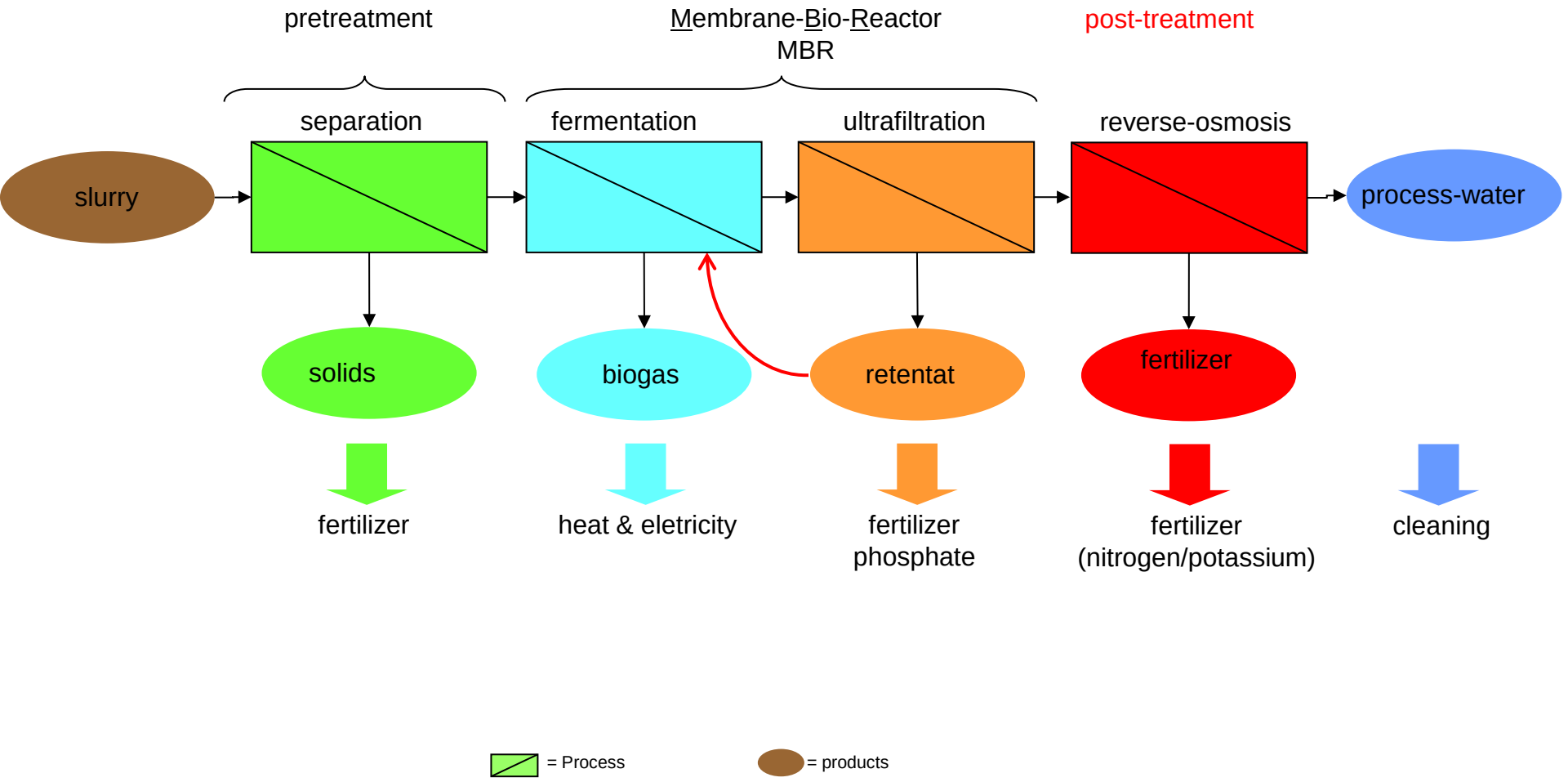
Separation as the first step



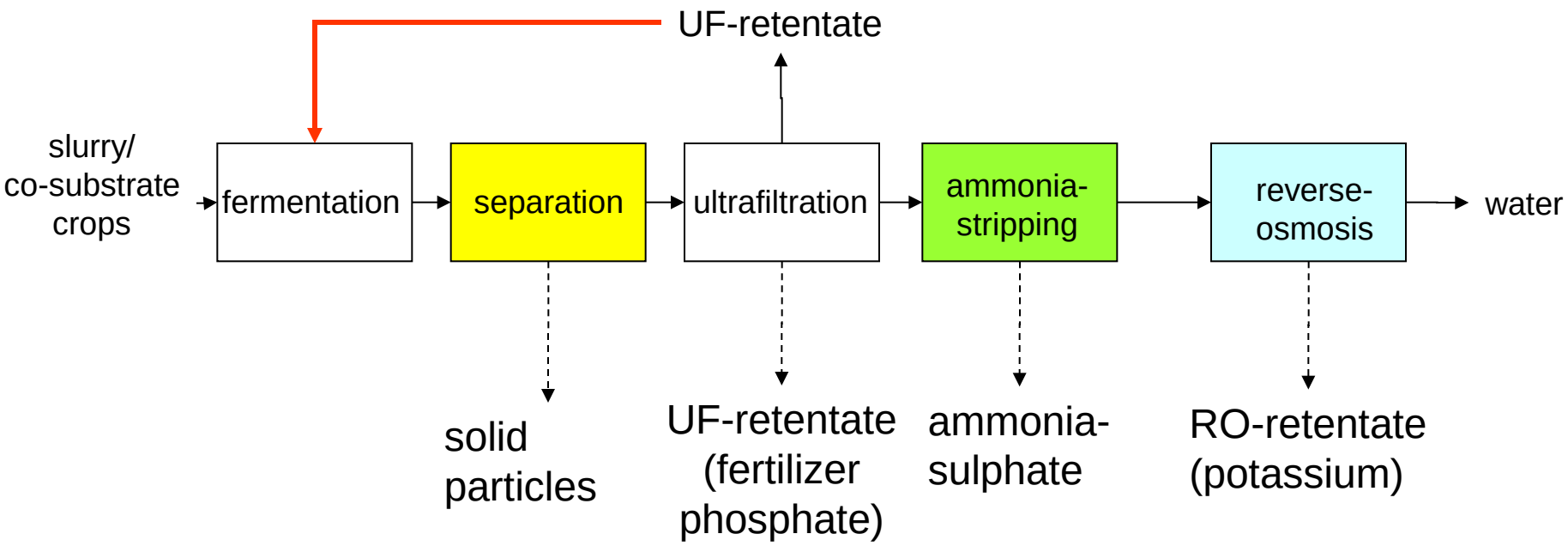
outflow of
separated slurry
(liquid phase)

solid particles

MBR-process opportunities I



MBR-process opportunities II



- reduction of the amount of the spread out ≥ 60 %
- high efficient fertilizer

Results and Conclusions

- biology:
  - stabilized process, robust (even with co-substrate like whey or glycerine)
  - short retention-time up to 4 days possible
  - high loading rate up to 6.5 kg OM/m³ • d achievable (liquid phase of slurry)
  - biogas yield increased from 270 to 620 l/kg OM (liquid phase of slurry)

- technology:
  safety operation (interruption < 0.25 %)
  measurement and control technology is required
  space-saving facilities

Results and Conclusions

- economic aspects:
  the implementation of the MBR system in plants based exclusively on slurry requires several farms
  more economic compared with continuous stirred tank reactors
  reduced volume of digester and post-digester

- further advantages:
  flexible integration in existing plants
  hygienic UF-permeate suitable for post-treatment
  to valuable mineral fertilizer

This project was sponsored by:

• Federal Office for Energy

• Federal Office for Agriculture

• Swiss Electric Research

• Axpo Foundation

Thank you very much for your attention.

- Questions? -