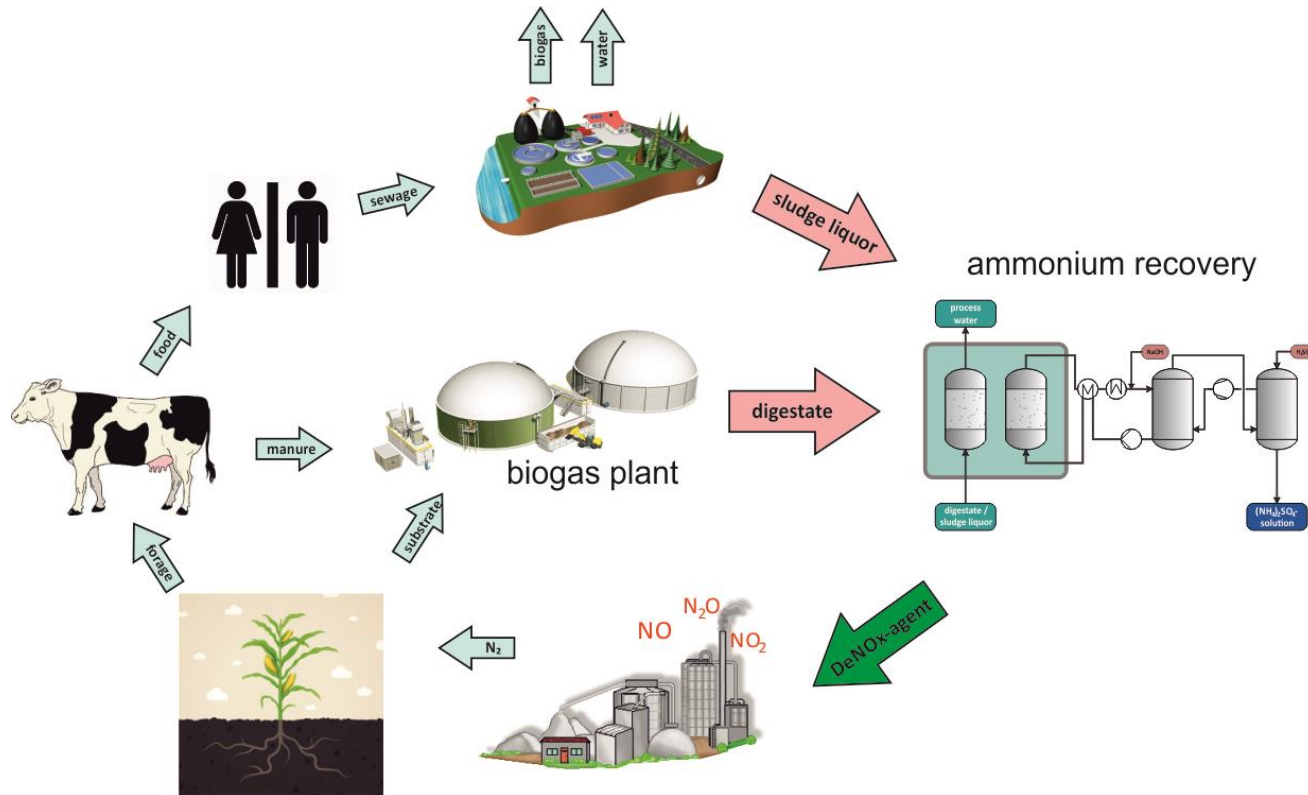


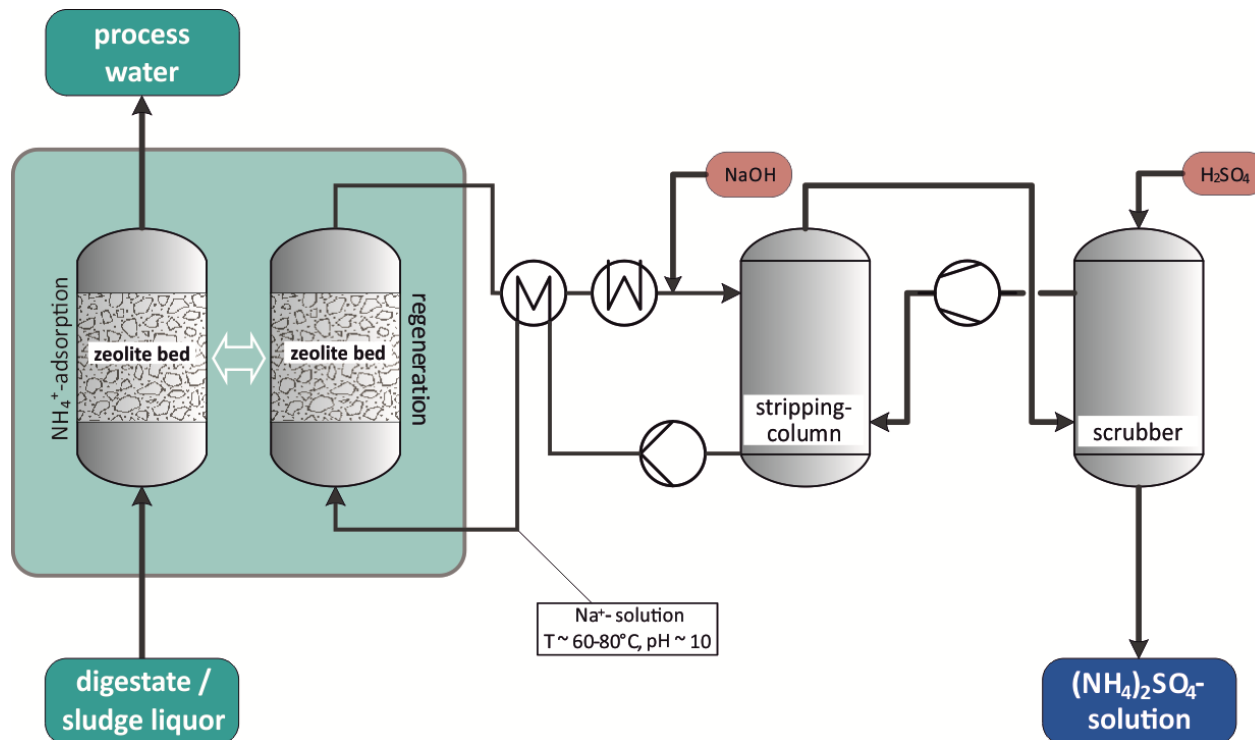
ReNOx - Recovery of ammonium from liquid digestates for industrial NOx-removal

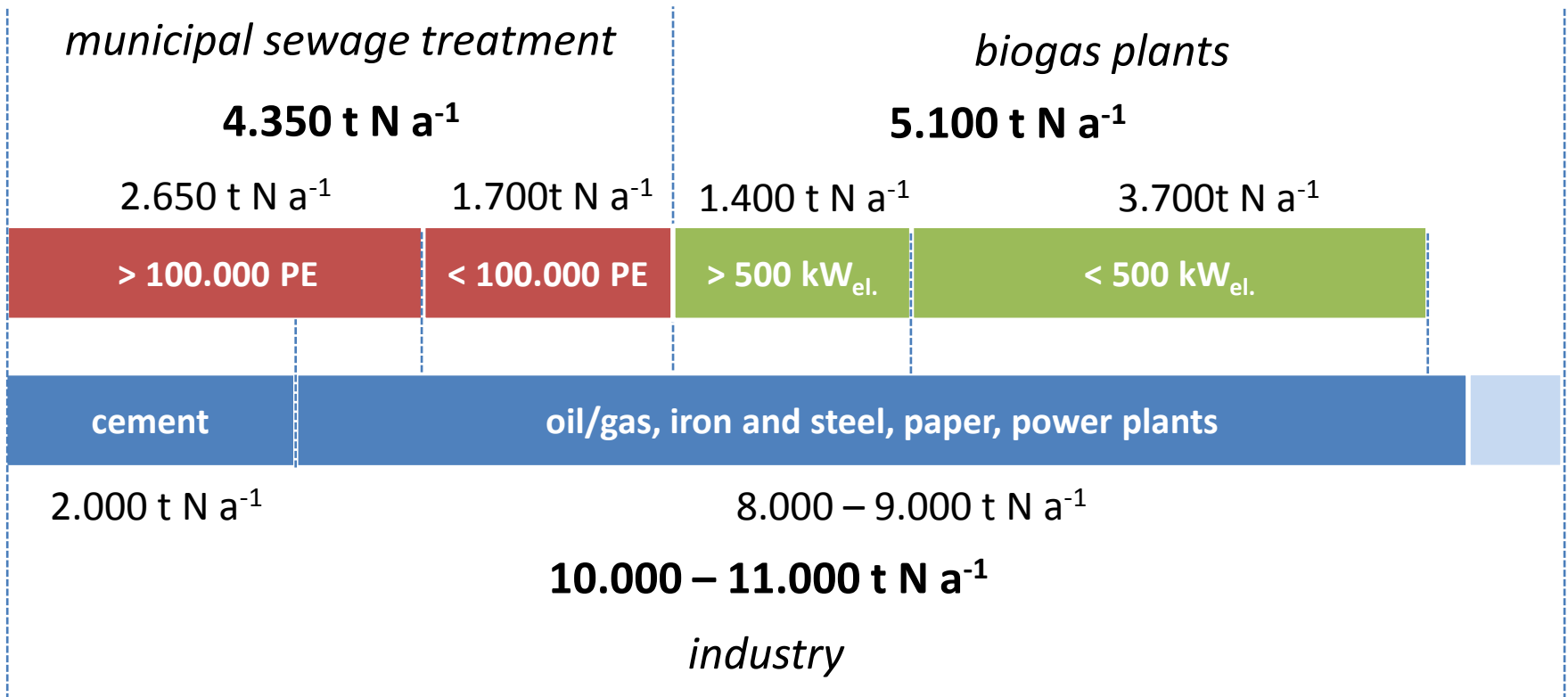
Markus Ellersdorfer, Jan Lubensky,
Andreas Lechleitner, Kristina Stocker

- recovery of excess ammonium from municipal waste water treatment & biogas plants
- concentrated NH_4^+ applied as industrial NO_x -removal agent
- appropriate recovery process needed



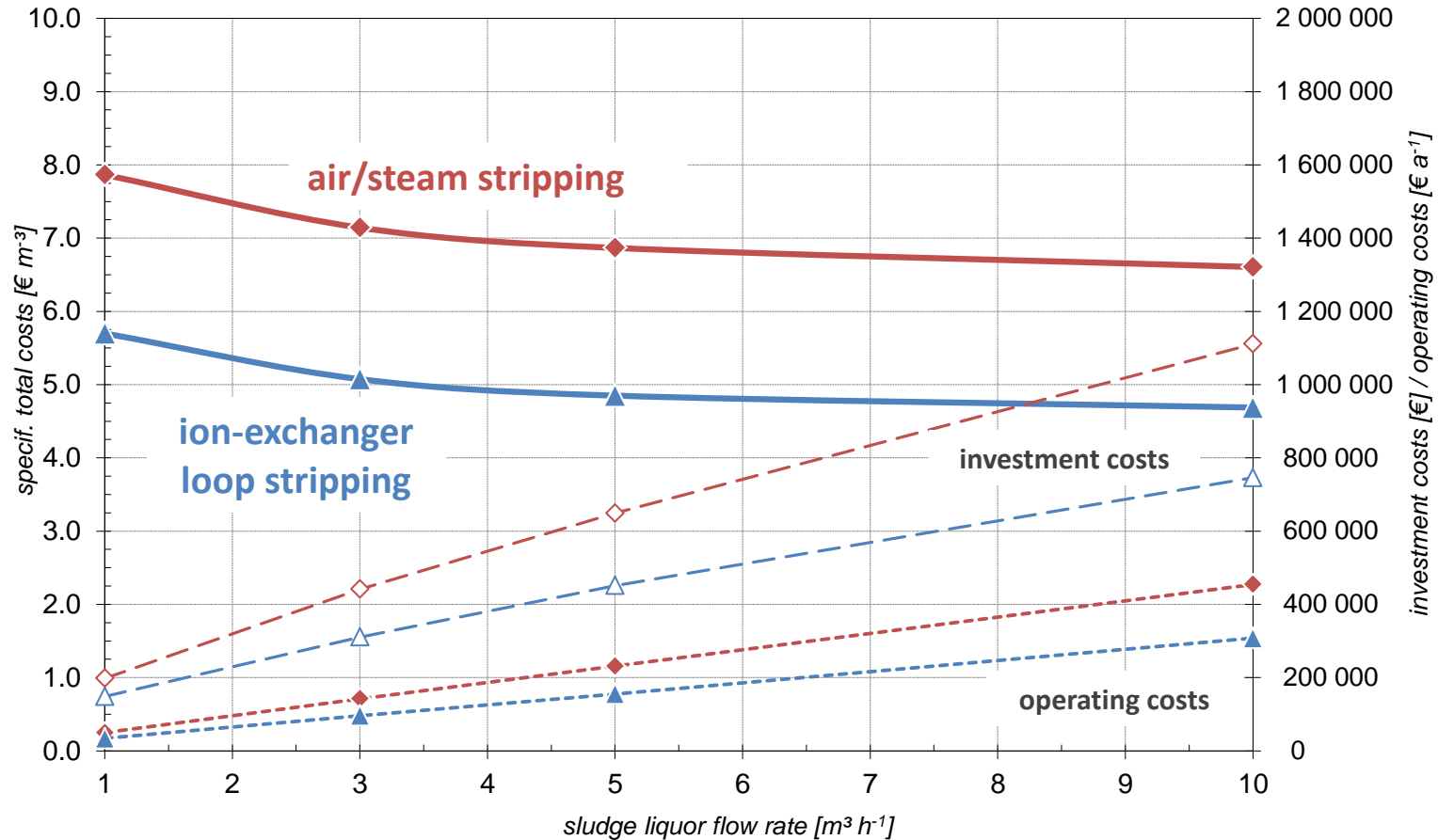
- „Ion-exchanger-loop-stripping“
- combination of ion-exchange (natural zeolite) with air stripping of the regeneration fluid
- enables compact retrofitting units to produce a valuable product by recycling of NH_4^+
- better economics compared to conventional air-stripping





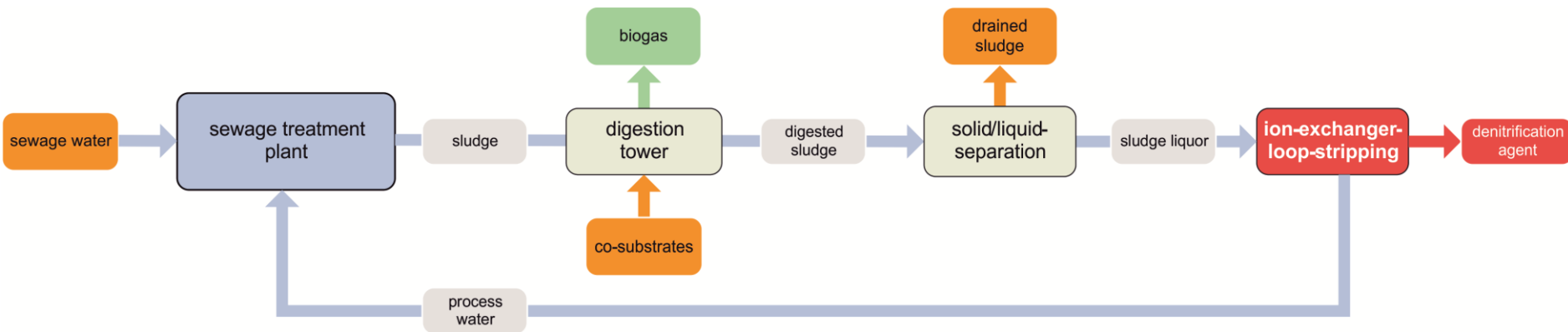
- N-potential municipal sewage treatment plants in Austria (FUCHS, 2015)
- N-potential biogas plants in Austria (FUCHS, 2015)
- N-demand for off-gas denitrification in different branches of industry in Austria (own calculations)

Costs for nitrogen recovery from sludge liquor
(ASPEN-simulation; Investment costs estimated after Lang / Chilton / Miller)



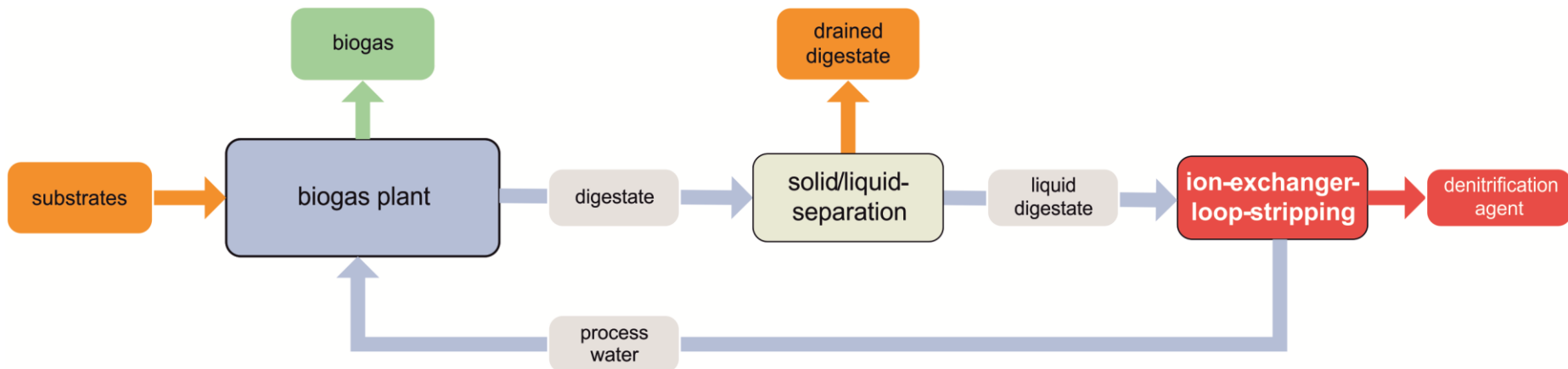
Benefits:

- marketable product out of excess NH_4^+ from sludge liquor
- reduction of aeration costs during nitrification
- reduction of ammonium levels in fermenter (higher co-fermentation rates possible)



Benefits:

- marketable product out of excess NH_4^+ from liquid digestate
- reduction of digestate storage costs and output costs on agricultural areas (seasonal N-limitations)
- reduction of ammonium levels in fermenter (increased substrate potential)





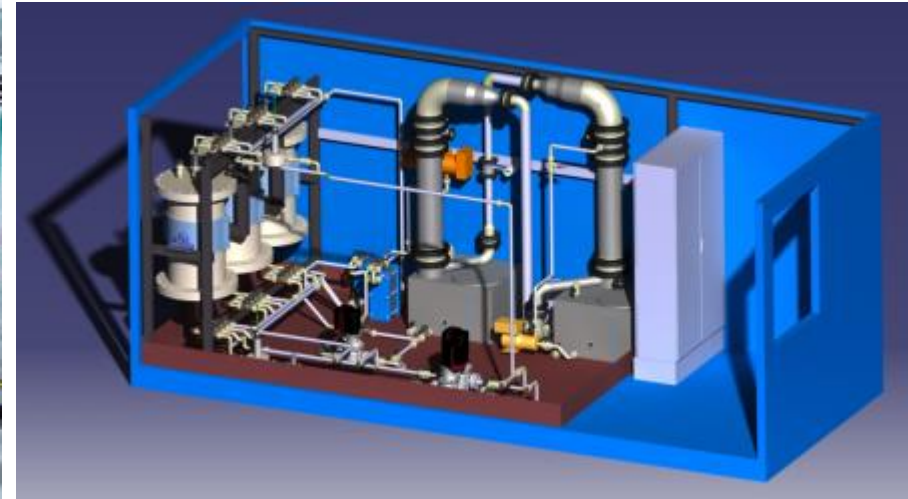
lab scale

ca. 200 g
2012/13



technical scale

ca. 2 kg
2014/15



pilot scale (20-foot container)

ca. 200 kg
2016

values represent the dimensioning of the ion-exchanger columns (mass of applied natural zeolite)



removal rates for NH_4^+ from real effluents (sludge liquor)

pilot plant (May- Sept. 2016) 80-95 %

at sludge liquor concentrations of 350 – 2000 mg NH_4^+ L⁻¹

DeNOx-agent

over 500 L DeNOx-agent produced (20 % $(\text{NH}_4)_2\text{SO}_4$ -solution)

successfully tested for NOx-removal from off-gas in cement work
(Lafarge/Retznei)

simultaneous recovery of ammonium AND phosphorus (PO_4^{3-})

first lab experiments for fixation and energy-saving recovery of
phosphorous via modified zeolite completed

necessary process adaptations to integrate simultaneous N&P-
recovery in ion-exchanger-loop-stripping under investigation



project coordination:



in collaboration with:



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