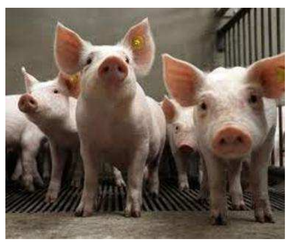
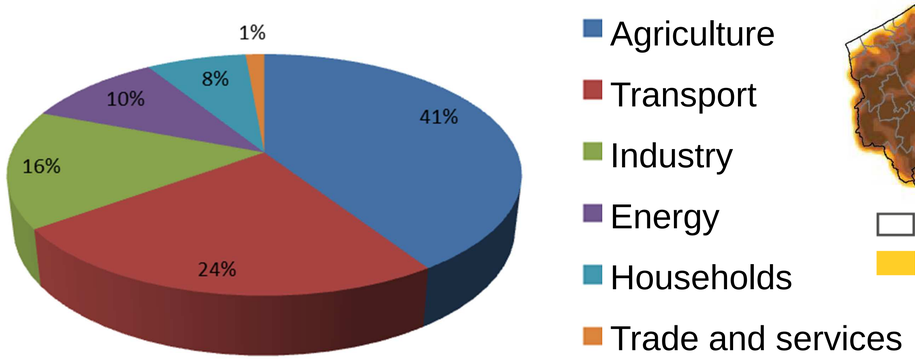
Design and control of air scrubbers for pig housing facilities in Flanders

Problem statement

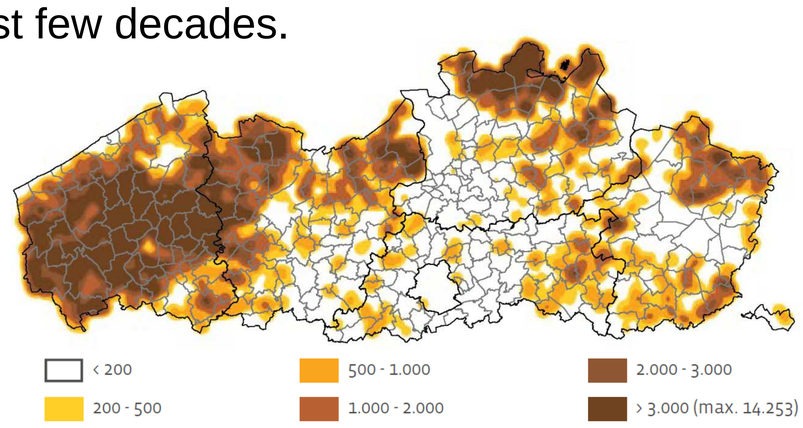
Pig density and farm scale has grown significantly in Flanders over the last few decades. This leads to a potentially large impact of individual farms in terms of emissions of

- Ammonia
- Odour
- Greenhouse gases





Origin of acidifying emission sources (83% NH_3, 4% SO_2 and 13% NO_x) in Flanders, expressed in acid equivalents (VMM, 2010)



Importance of pig farms in Flanders (€/ha)

(Departement Landbouw en Visserij, 2010)

Since 2004, newly built pig housing facilities in Flanders are legally required to be emission-low with respect to ammonia. This can be achieved by applying chemical or biological air scrubbers.

Air scrubbers

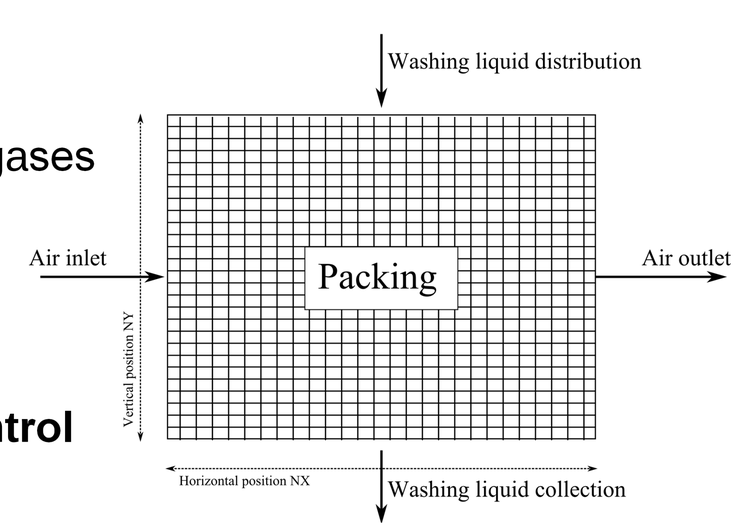
At least 70% ammonia has to be removed, however

- Still insufficient knowledge of process engineering aspects
- Performance of odour reduction remains unknown and/or suboptimal
- Little is known about removal and potential formation of greenhouse gases

Research objectives

Optimization of air scrubbers for pig housing facilities in view of minimal ammonia (NH_3), odour (H_2S) and greenhouse gas (N_2O and CH_4) emissions

- Focus on process engineering aspects, i.e. **process design and control**



Operating principle of a cross flow air scrubber

Methodology

Set-up of a mechanistic model for chemical and biological air scrubbers

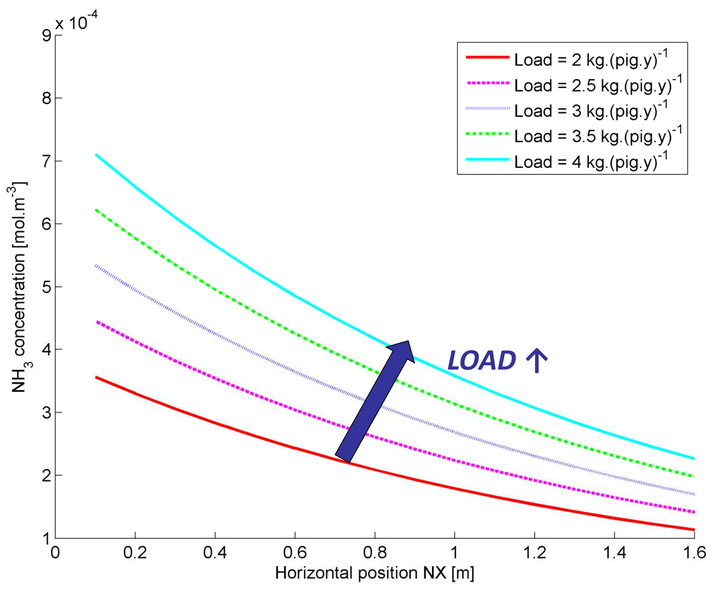
- Interaction between removal of NH_3, H_2S, N_2O and CH_4
- Taking into account drainage of surplus water and water losses through evaporation

Simulation study in view of process optimization

- Identification of control handles and disturbance variables
- Sensitivity of process outputs (emissions, energy requirements,…) towards operation variables and process parameters
- Optimization of process design and process control (scenario analysis)

Full-scale measurements

- For model calibration and validation
- To test the most promising design and control options



Gas phase NH_3 profile in cross flow air scrubber

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