Principles of emissions from housing, storage, spreading, grazing

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Training Course Programme **Livestock and Climate Change**

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Principles of emissions from housing, storage, spreading, grazing

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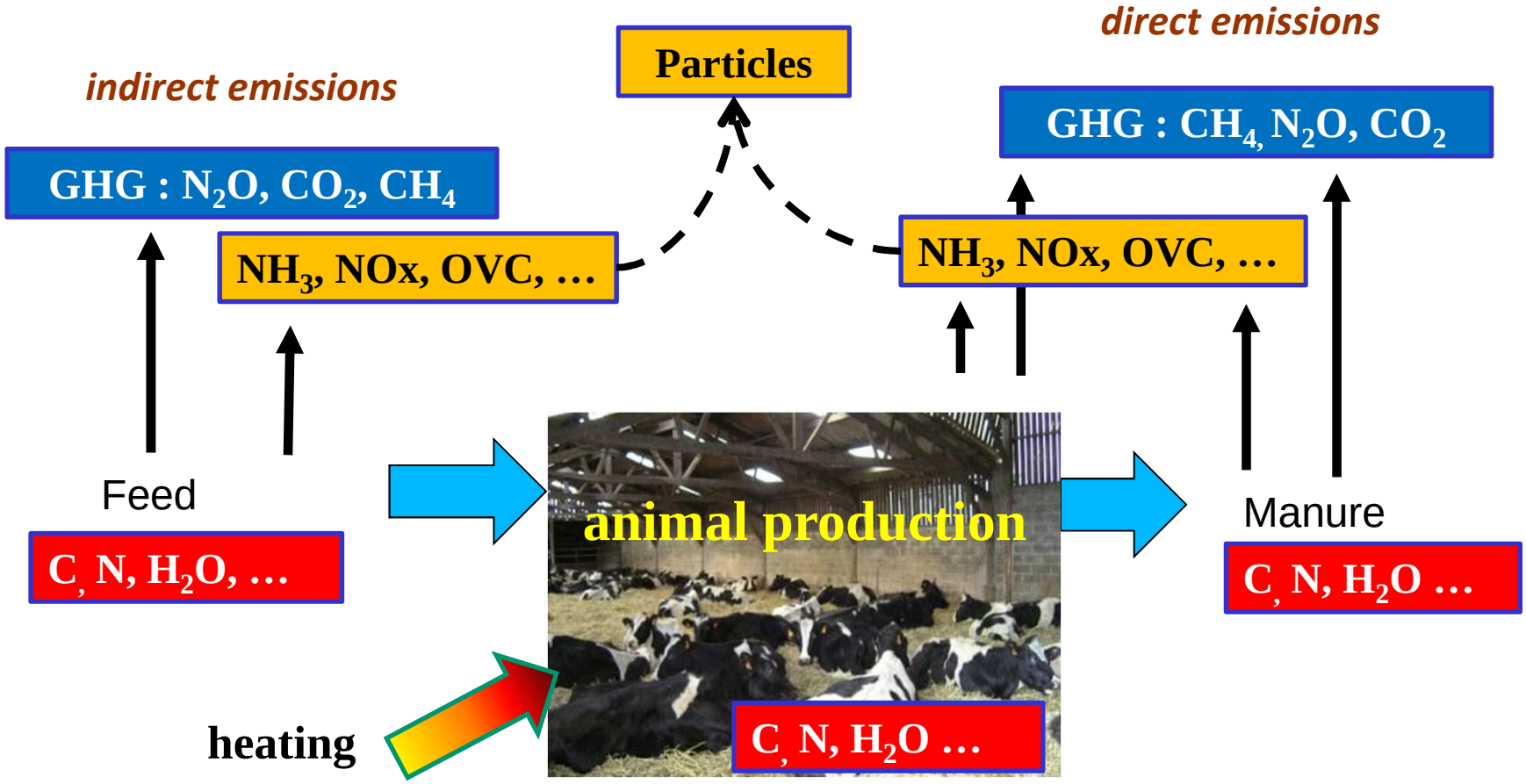
Outlines

- Introduction: 3 basic questions (gas, system, trend)
- Diversity of animal farms: size, species, etc.
- Emitting intensity: activity, duration, interactions
- Uncertainty evaluation
- Take home messages

Introduction

1. Which gas(es)?

Question 1 = input efficiency or polluting gases?



Question 2 = local or global use?

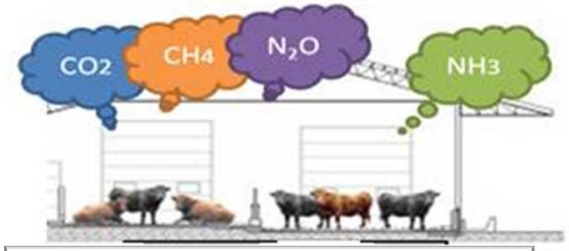
Introduction

Thresholds for Life Cycle Assessment/multicriteria comparisons?

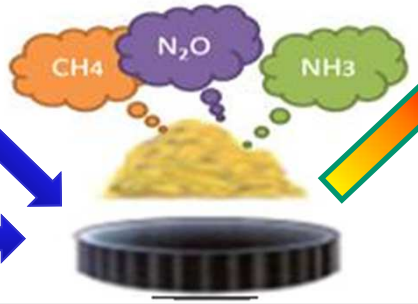
2. Pollution transfer/ complementarity: which system?

Biogenic emissions?

Treatment of imported byproducts



Animals & manure in housing



Manure storage

Heating, kWh

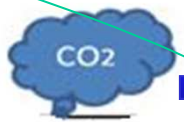
allocation?

oil

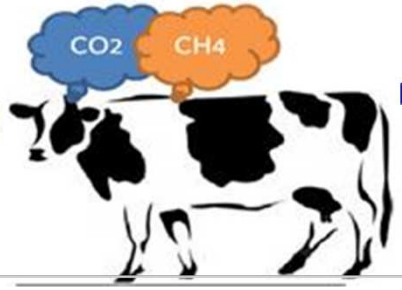
fertilizers

Fabrication des intrants

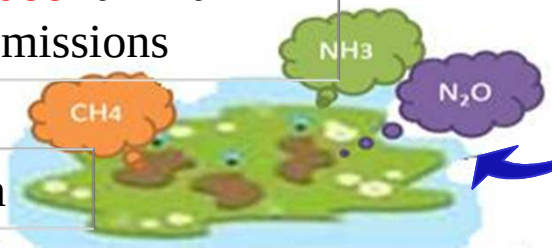
Transport des intrants



production & transport of inputs



Outdoor animal emissions



Outdoor excretion

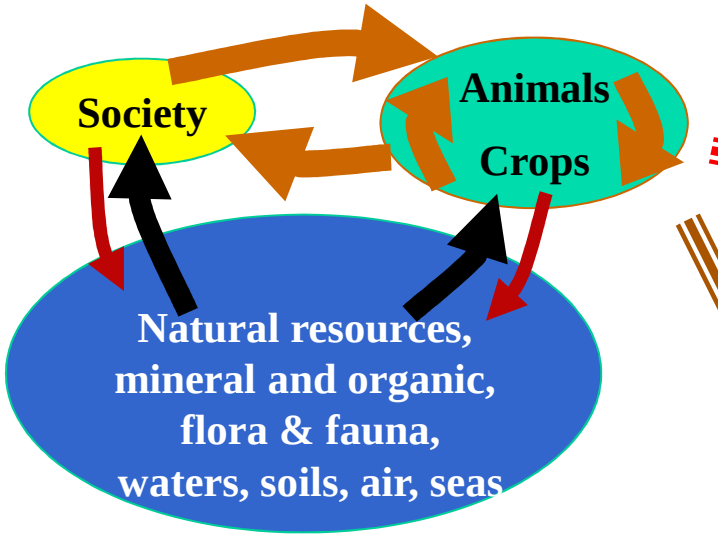
C stock (OM)?

(IDELE, 2013)

Introduction

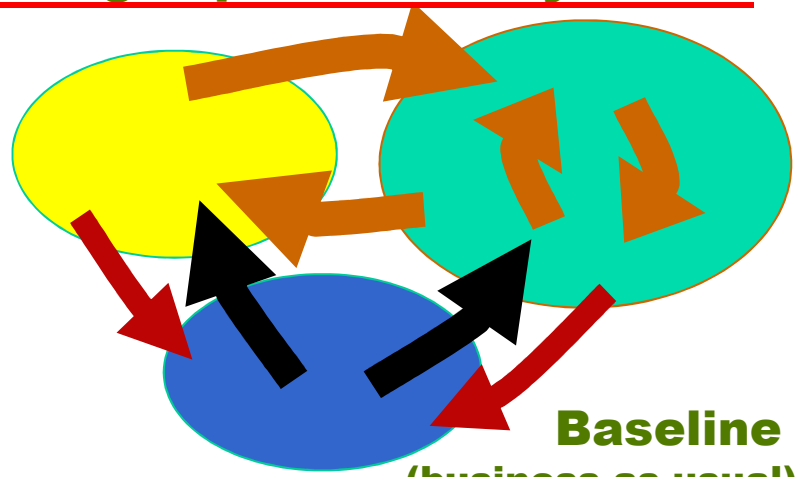
3. Which trend per gas and per system?

« ecological footprint »



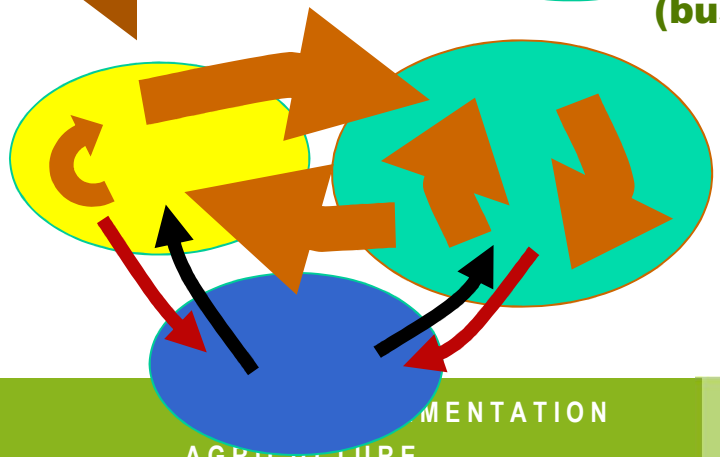
Population increase
& needs for non food products

unchanged production systems



Baseline
(business as usual)

Increase recycling,
decrease emissions
with ecological
intensification



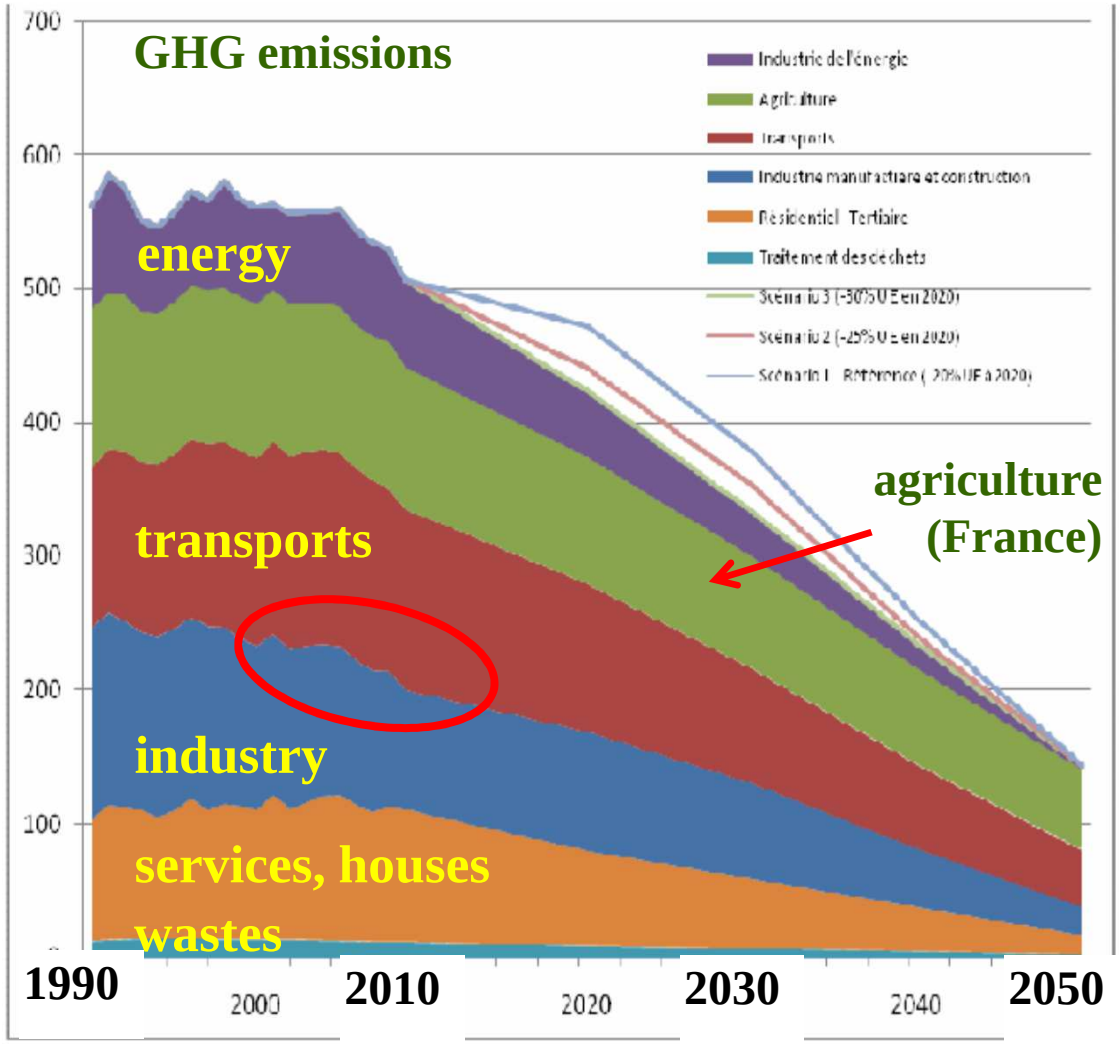
Introduction

3. Which trend per gas and per system?

- **Expected decrease of the emissions of transports, industry, energy sectors**

=> Increase in agricultural emissions: percentage (France); value (World)

Which trend compared to baseline and to the trend of other sectors?



Source Trajectoires 2020-2050 (De Perthuis, 2011)

Diversity of animal farms

Existing knowledge of GHG emissions from current animal farming systems?

➡ ***Factors that may affect GHG emissions***

➔Environment

➔Various climates
➔ Natural/urban landscape
➔ Different animal species/commercialization

wild

ducks

turkeys

cattle

etc…

ANIMAL CHAIN

ALIMENTATION
CULTURE
ENVIRONMENT

INRA

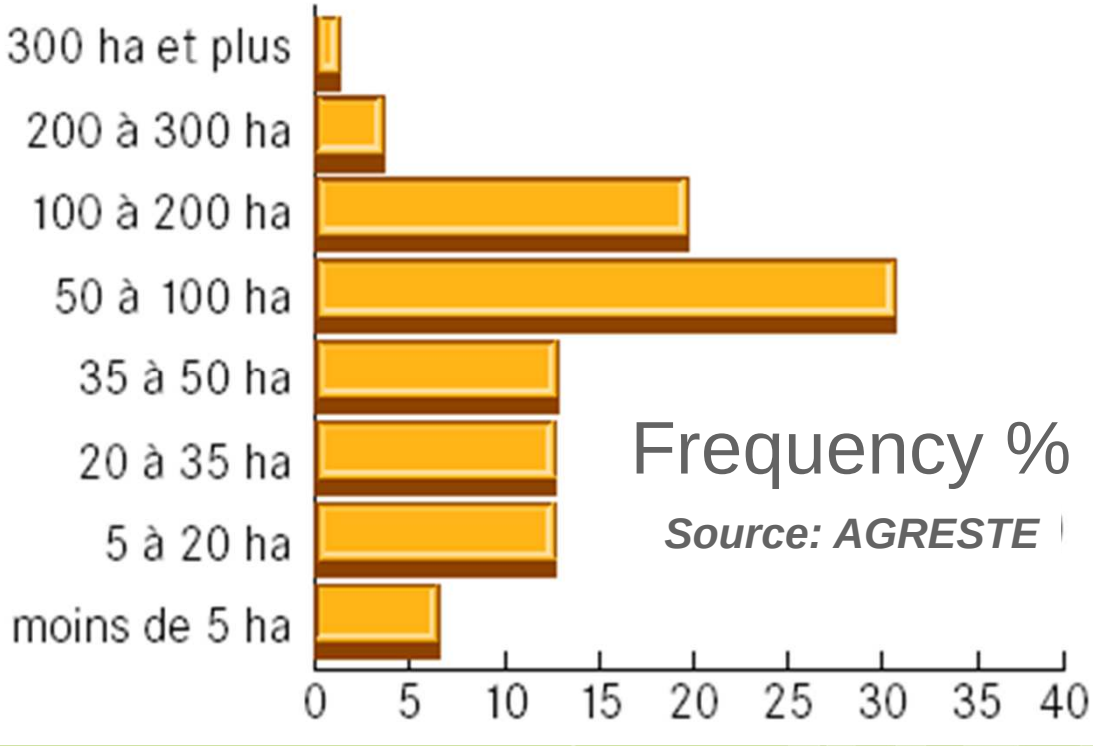
Diversity of animal farms

Existing knowledge of GHG emissions from current animal farming systems?

➔**Environment**

➔**farm size:**

- **86,000 very small farms within 262,000 animal farms**
- **varying crop area**

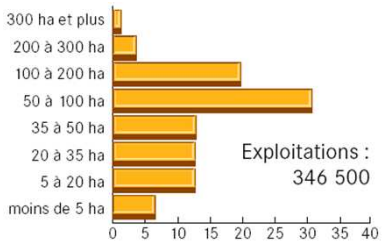


Diversity of animal farms

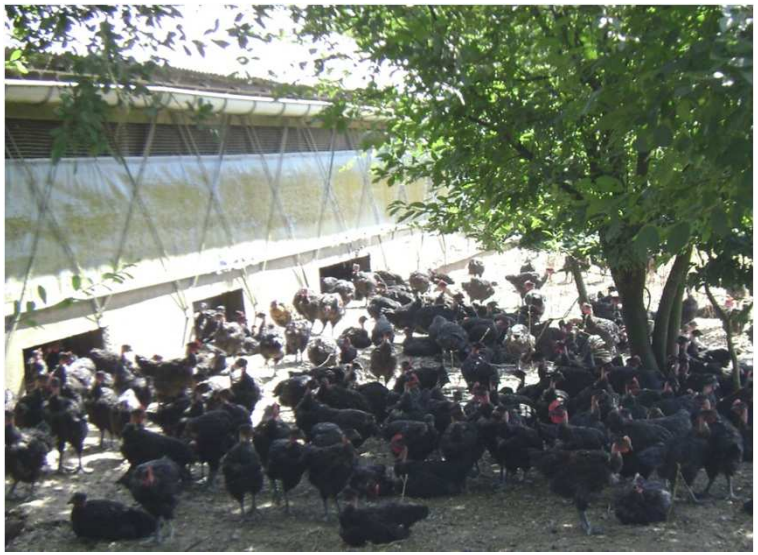
Existing knowledge of GHG emissions from current animal farming systems?

➔**Environment**

➔**farm size**



➔**building / outdoor**

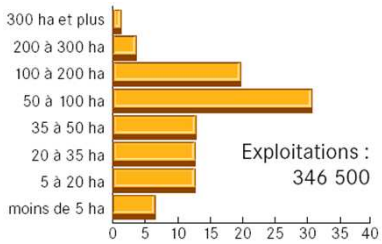


Diversity of animal farms

Existing knowledge of GHG emissions from current animal farming systems?

➔**Environment**

➔**farm size**

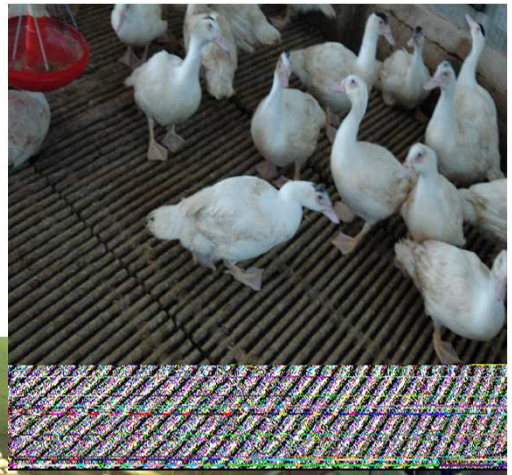


➔**building / outdoor**

➔**manure management**

Dried droplets

slurry



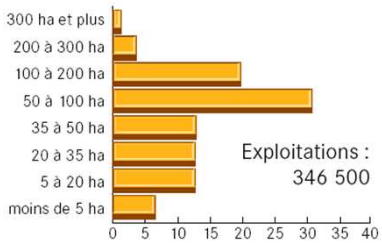
AGRI

Diversity of animal farms

Existing knowledge of GHG emissions from current animal farming systems?

➔**Environment**

➔**farm size**



➔**building / outdoor**

➔**manure management**

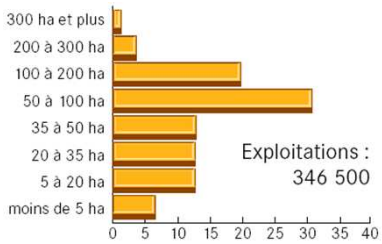
- **Animal house management: rearing, feeding, ventilation**
  - **animal density: 7 – 26 birds/m²**
  - **dry/wet feed, feed size**
  - **natural / mechanical ventilation**

Diversity of animal farms

Existing knowledge of GHG emissions from current animal farming systems?

➔**Environment**

➔**farm size**



➔**building / outdoor**

➔**manure management**

➔ **Animal house management**

➔**feed inputs / produced**

➔**industry integrated**

➔ **For all systems, if "organic":**

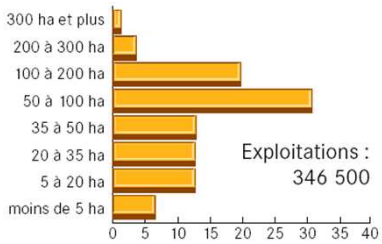
- **small size**
- **low animal density**
- **no chemicals**
- **local organic feed production**

Diversity of animal farms

Existing knowledge of GHG emissions from current animal farming systems?

➔Environment

➔farm size



➔ building / outdoor

➔manure management

➔ Animal house management

➔feed inputs / produced

➔industry integrated

Challenge:
improve knowledge transfer between farmers to accelerate adaptation and limit errors

Conclusions:

- **Difficulties to have BMP that will achieve the same results in all animal production systems**
- **Difficulties to decrease emissions/improve recycling in all systems**

Emitting intensity

1. Increase in biological activity increases gas losses: recycling or pollution?

- Increase in aerobic activity: CO_2, H_2O losses (N_2 ?)
- Increase in anaerobic activity: CH_4 increase => collected?
- Decrease in biological activity or size of the system increase the climate influence (température, precipitations) on the emissions

- e.g. stocking density (or daily gain) increase heat production and water input per m^2 => litter more anaerobic
- e.g. compost stabilization induce emission decrease

Emitting intensity

2. Increase of process duration increases gas losses and climate interactions

- Short term operations have usually a small impact on overall GHG emissions
- During long term processes special attention must be given to GHG emissions

  - Compost turning itself has a small impact on emission, induced processes should be considered
  - Long term compost stabilization can induce emission of N_2O or CH_4 when C and H_2O (moisture) are not adequate
  - Litter accumulation for several poultry batches increase emissions (idem for cattle manure)
  - Excretion removal from animal house reduce emissions

Emitting intensity

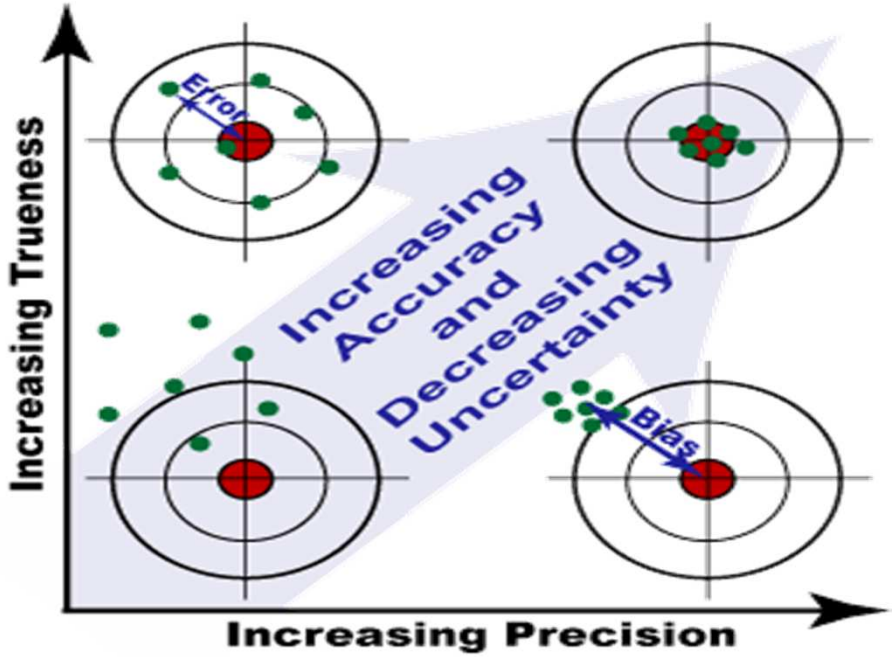
3. Dilution of nutrients and increase in biological interactions/diversity reduce emissions

- Emitting processes are not governed in the same way for extensive/intensive animal groups (e.g. house/grazing)
- Increasing biological interactions in concentrated substrates can help to decrease emissions but increases the risk

- Grazing/outdoor animals have different impact depending on local concentration: increase in stocking density and duration increase emissions
- Increasing interactions assumes that moisture-temperature-organisms are controlled by the farmer: improved skill is important to ensure reduced emissions

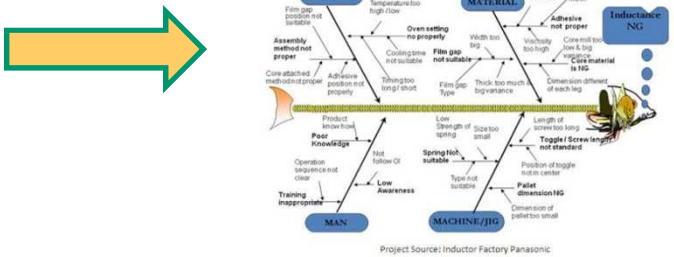
Improve uncertainty knowledge

GUM, 2008: Guide for Uncertainty Measurement



VIM : International vocabulary of metrology

Fish bones analysis

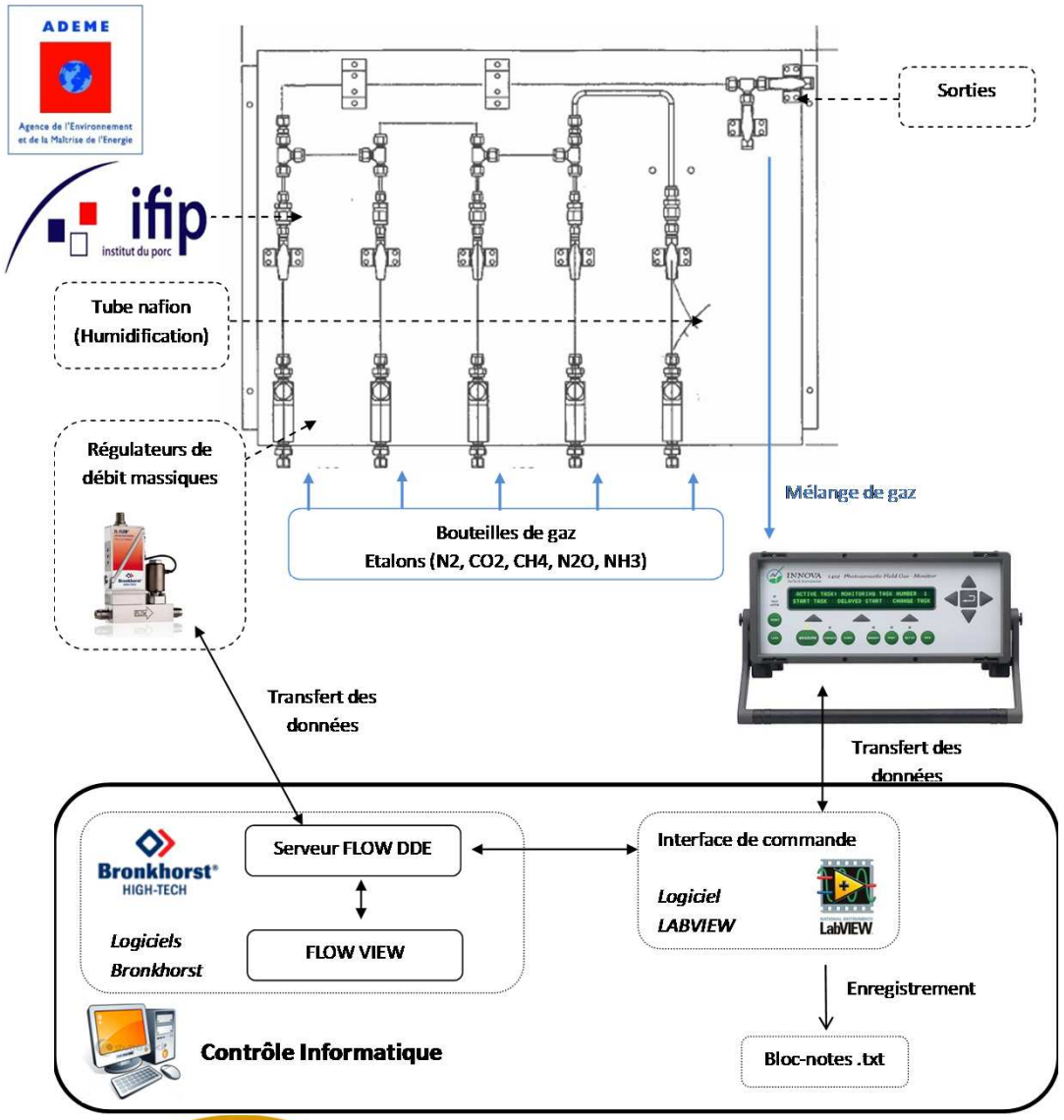


- **Uncertainty is difficult to estimate, it depends on several measuring details**
- **Improved description of measuring procedure can help to improve uncertainty calculations; repeated controls are necessary**

➔**general procedures for uncertainty estimates need further work**

Reduce uncertainty

Contribute to reference method and reference system



Laboratory conditions not real conditions (complex gas mixture)

Reference source

Comparison and calibration

Take back home

- **Define specific objectives: which gas(es)? Which system(s)? Which trend(s)?**
- **Describe existing variability of chosen systems**
- **Indentify the main factors governing emission variability IN FARMS (from process knowledge & observations)**
- **Always remember to improve uncertainty knowledge**

Thanks for your attention

EMILI 2015 International Symposium on Emissions of Gas and Dust from Livestock

http://www.emili2015.com.br/english.php

EMILI 2015 - March 24-26, 2015 - Florianópolis, Brazil