ifip — Institut du porc

SODALEC Distribution

Development of an innovative bioscrubber system with one third of the investment and operating costs

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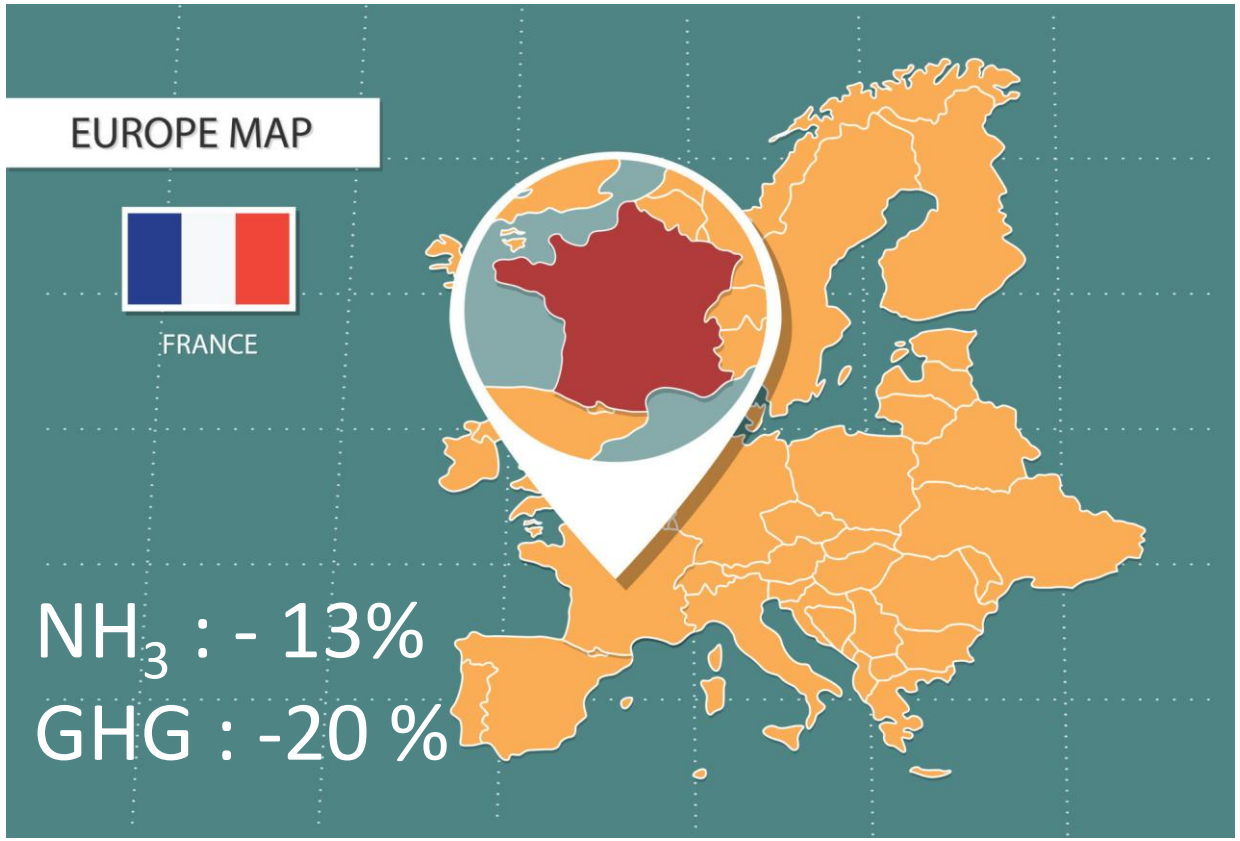
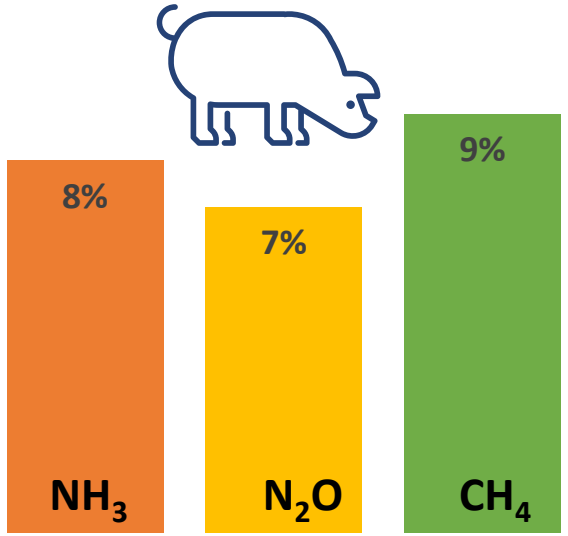
Sodalec, Sodalec Distribution

EmiLi 2024 conference
International Symposium on Gas and Dust Emissions from Livestock

Context



France's committements in 2030



(Citepa, 2022)

Contribution of the pig sector

IMPLEMENTATION OF TECHNIQUES FOR THE REDUCTION OF GASEOUS EMISSIONS

Bioscrubber, already recognized as a BAT

PHYSICAL ACTIONS

Solubilization of NH_3

Sedimentation of PM

BIOLOGICAL ACTIONS

Development of a biofim

Degradation of VOC's

Melse, 2009; Belzile et al., 2010 ; Zhao et al., 2011; Melse et al., 2012; Lagadec et al., 2015; Santonja et al., 2017; Guingand et al., 2020

Bioscrubber, already recognized as a BAT but

INVESTMENT COST

Expensive per place

RUNNING COST

High consumption of water (>200 l per pig)

Difficulties of implementation in existing building because of the management of ventilation (need of centralization)

Design of a bioscrubber

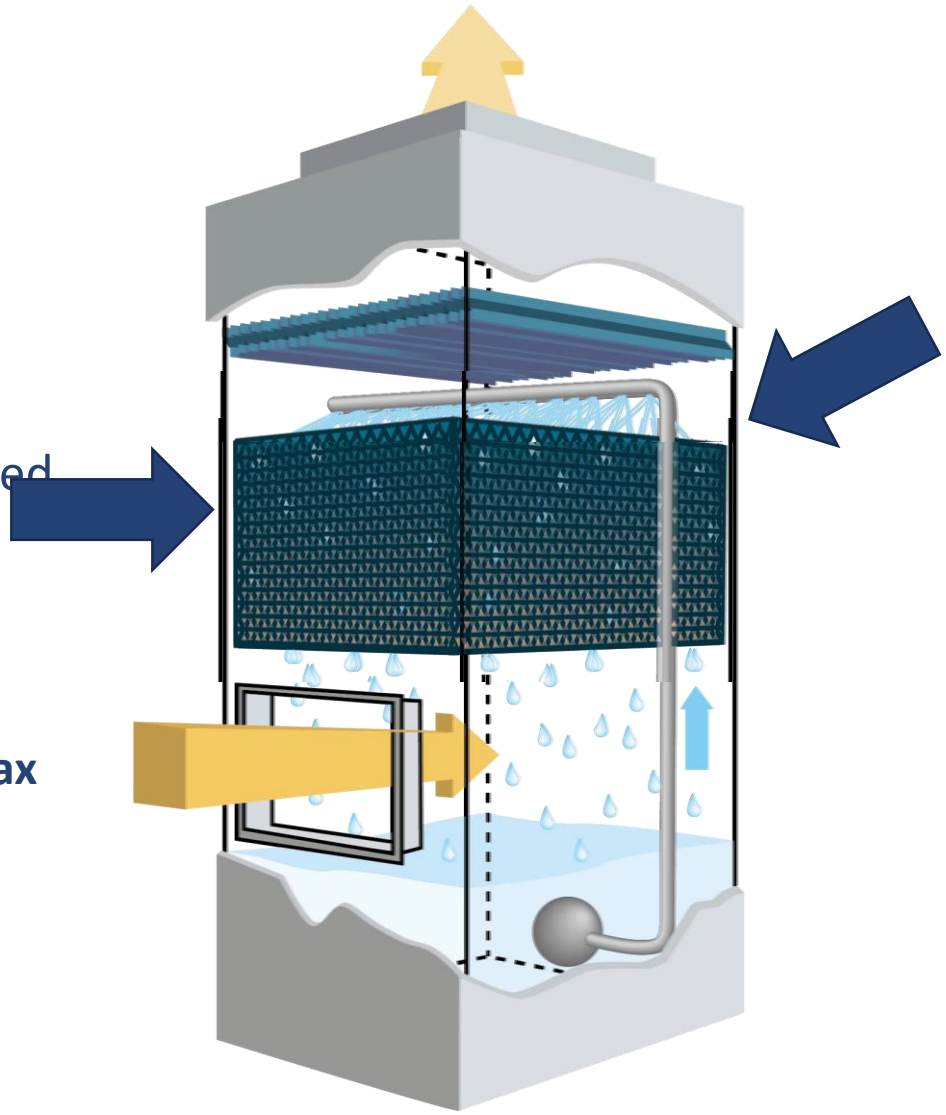
1 CONTACT BED

The surface ($S_{contactbed}$) is calculated in relation with the maximum ventilation flow rate (VFR_{max})

$$S_{contactbed} = VFR_{max}/AV_{max}$$

with VFR: Ventilation Flow Rate
AV : Air Velocity

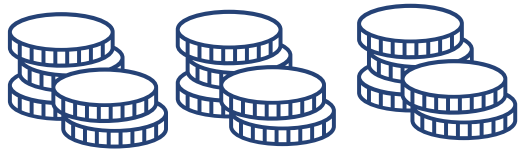
Recommandations : AV_{max}<1m.s^{-1}



2 SPRINKLING DENSITY

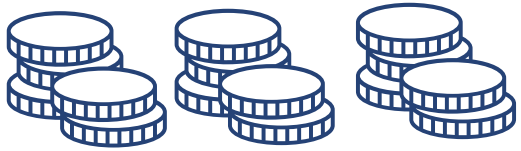
The number and the rate of sprinkling is calculated in relation with $S_{contact\ bed}$

Recommandations : 1 sprinkler.m^{-2}

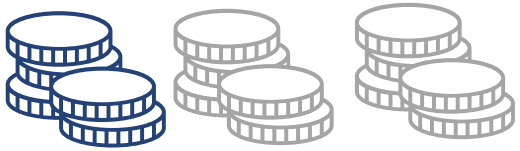


Reduced size, reduced costs

100%



33%



1 CONTACT BED /3

2 SPRINKLING DENSITY /3

Experimental design

54

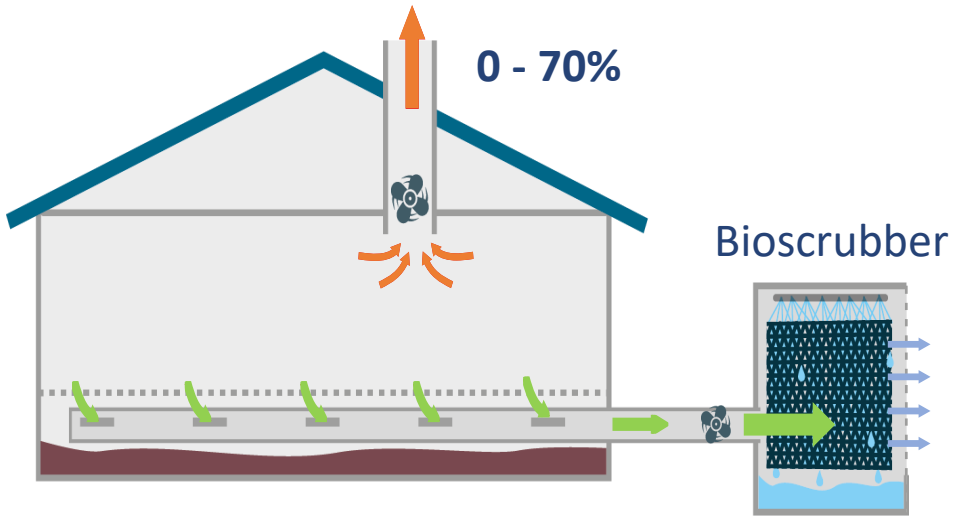
30 to 118 kg

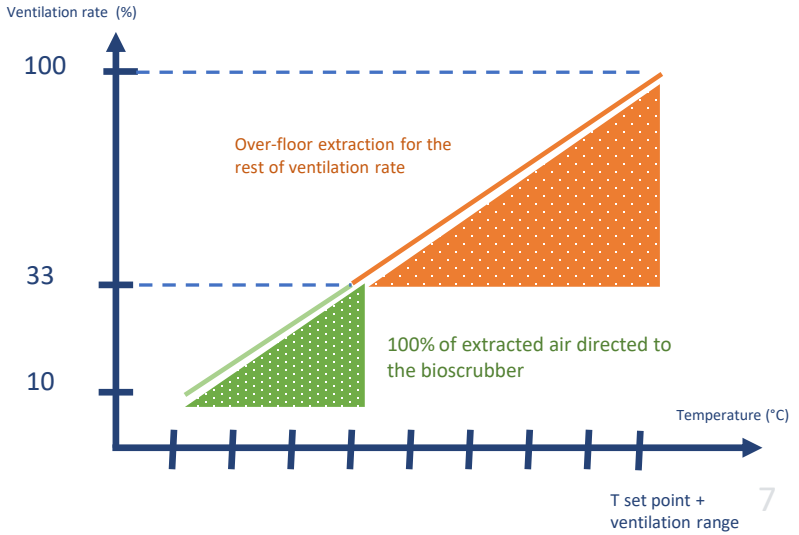
Fully slatted floor

Slurry storage

Multiphase dietary strategy

Partial pit ventilation

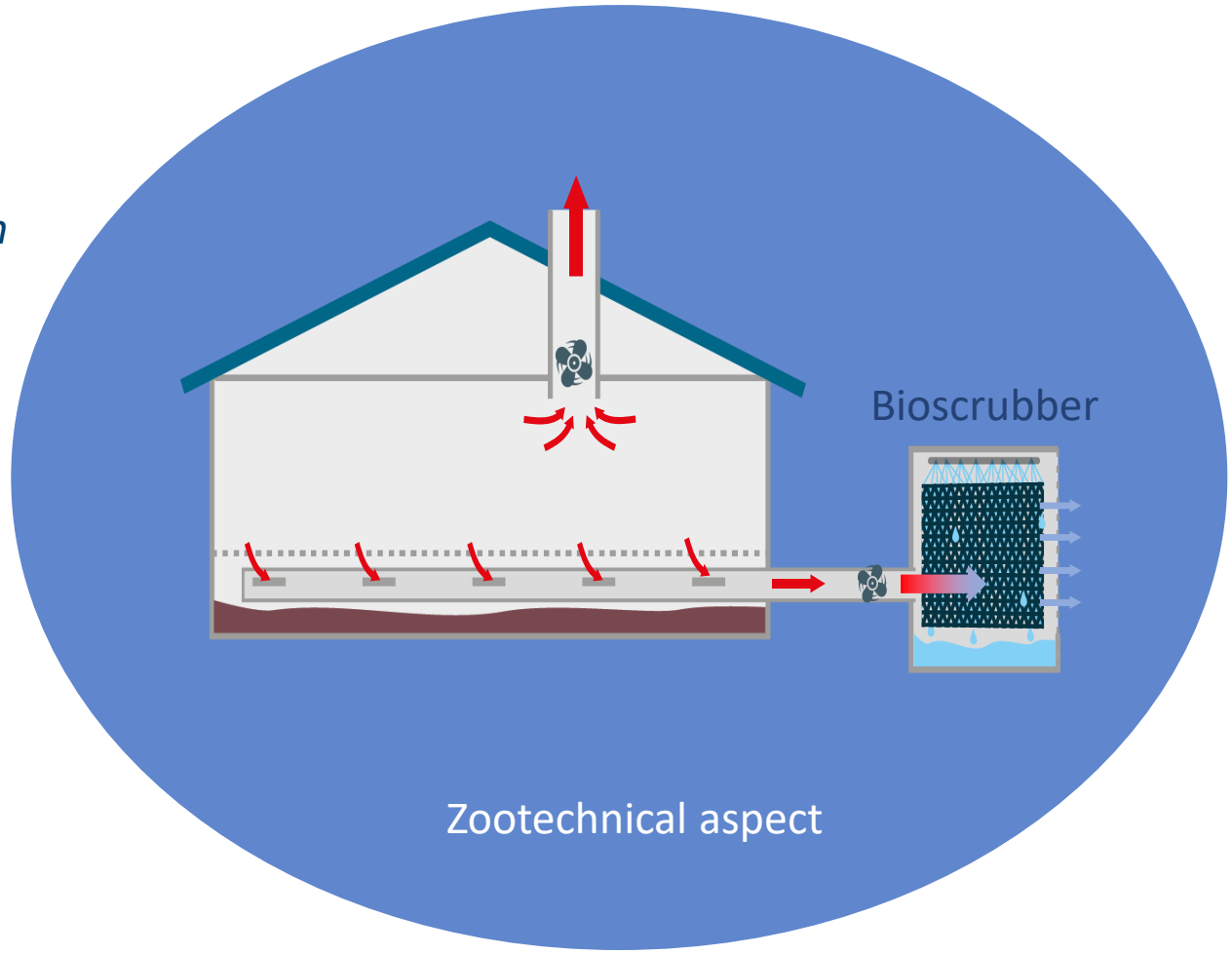




Measurements and recordings

PIG WEIGHING

Entry, feed transition and slaughter + carcass data



FEED WEIGHING

Every day

Use for the mass balance calculation

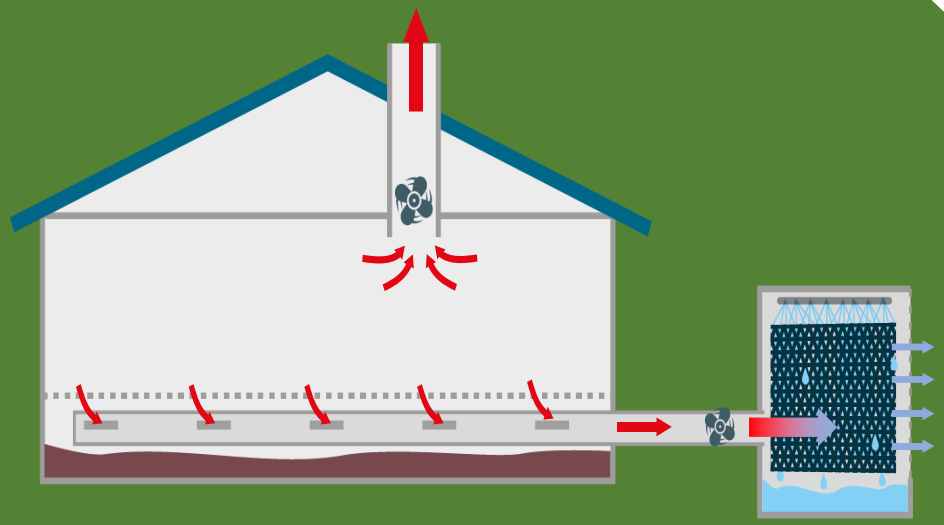
Measurements and recordings

PIG WEIGHING

Entry, feed transition and slaughter + carcass data

FEED WEIGHING

Every day



Environmental aspect

SLURRY

Height every 2 weeks -> volume

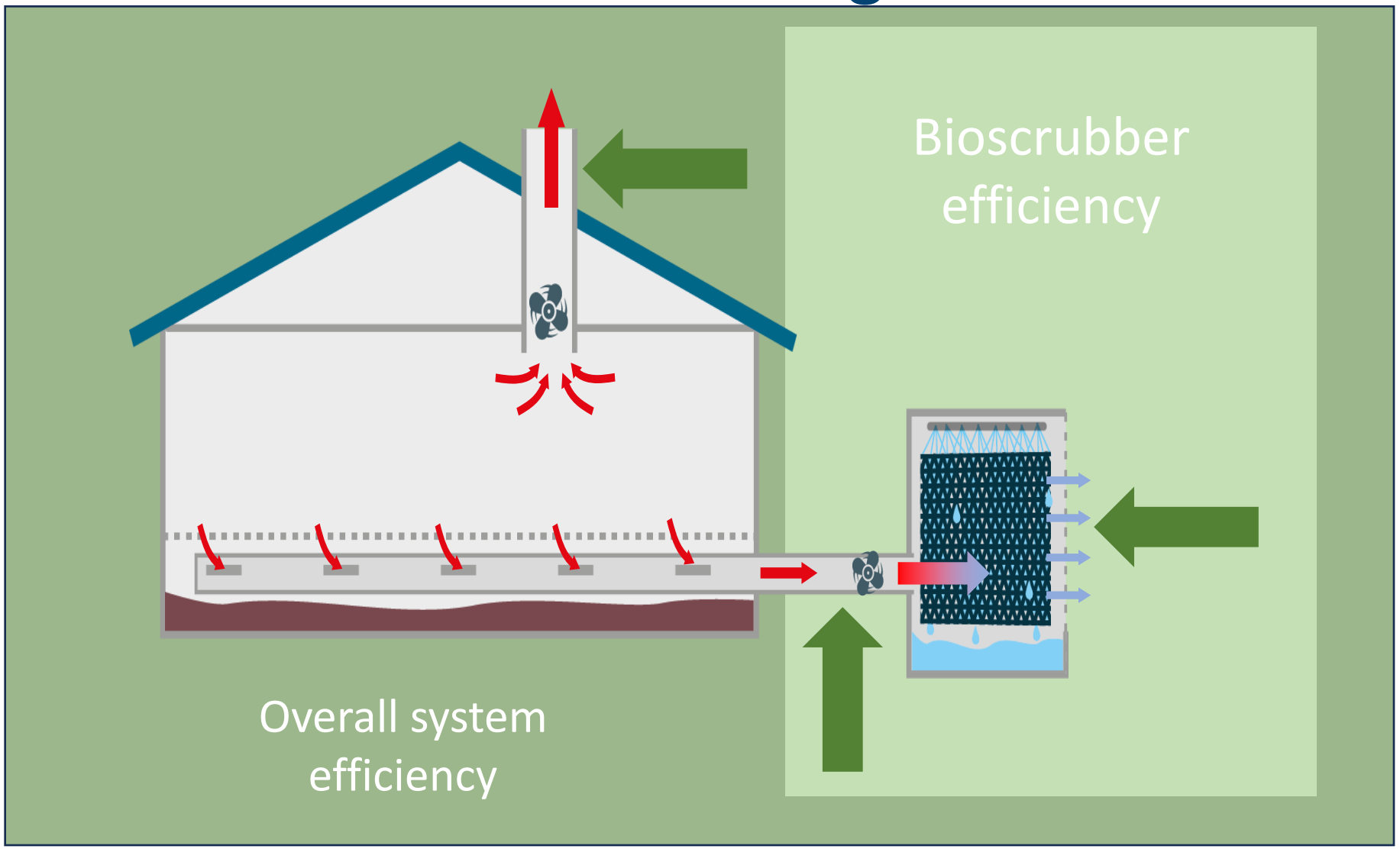
Sampling : feed transition + slaughter

Ammonia

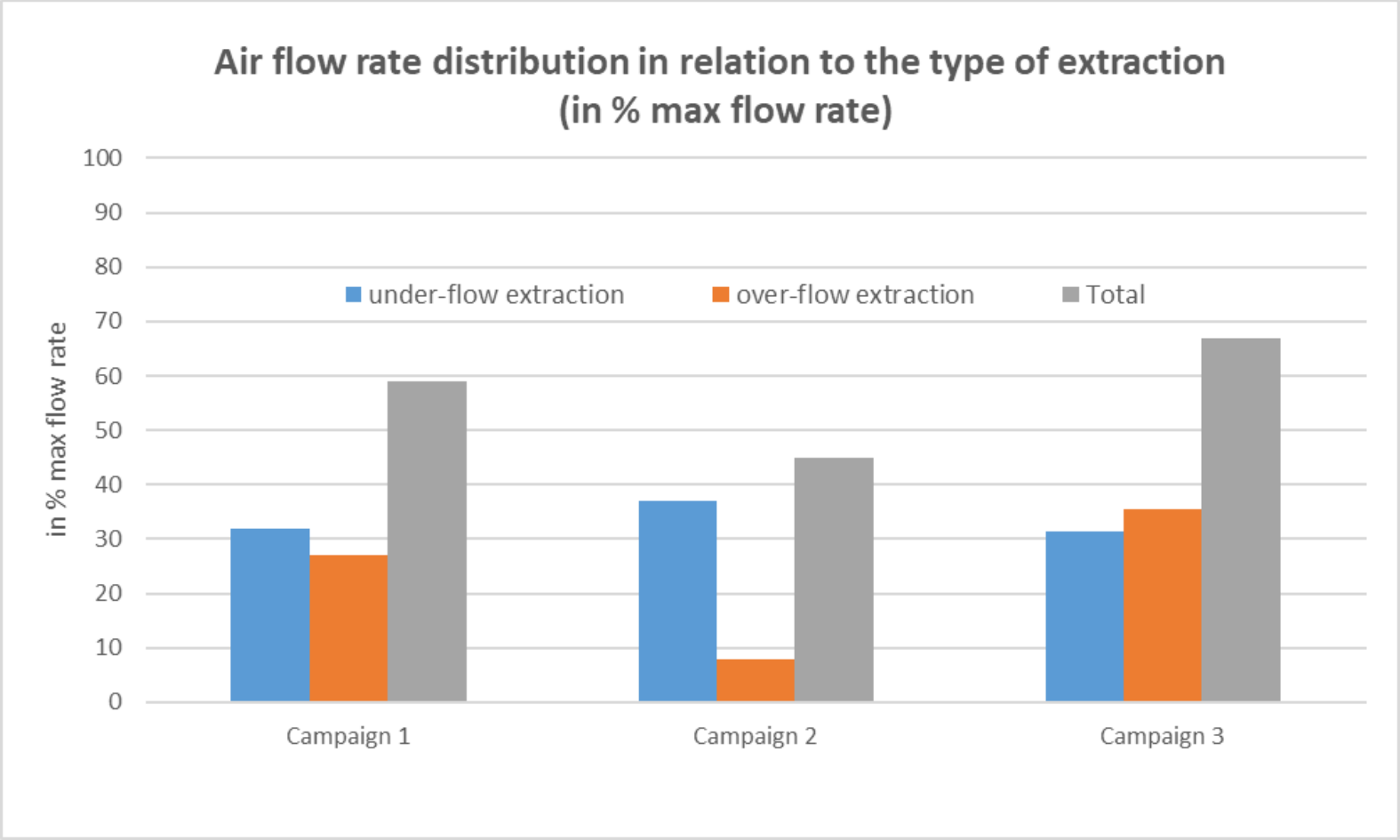
Ambient air - Every 3 minutes

Use for the mass balance calculation

Measurements and recordings – Gaz



Results – ventilation rate distribution



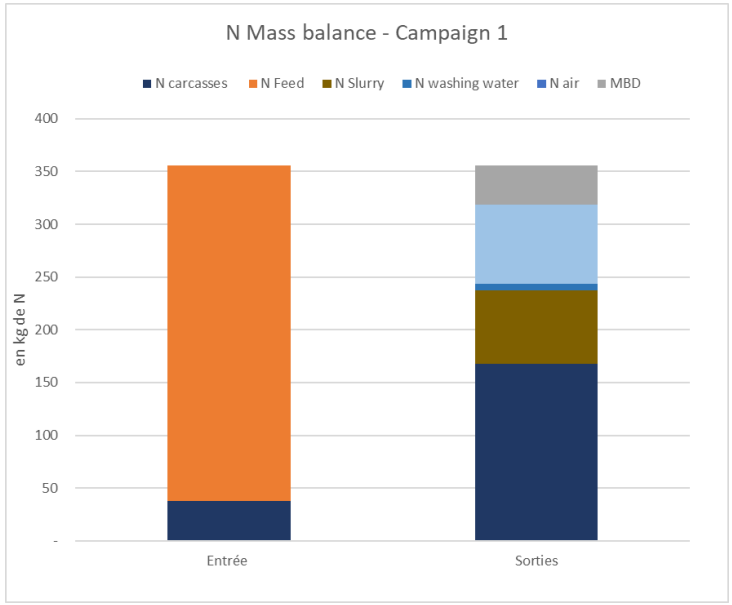
Under-floor extraction

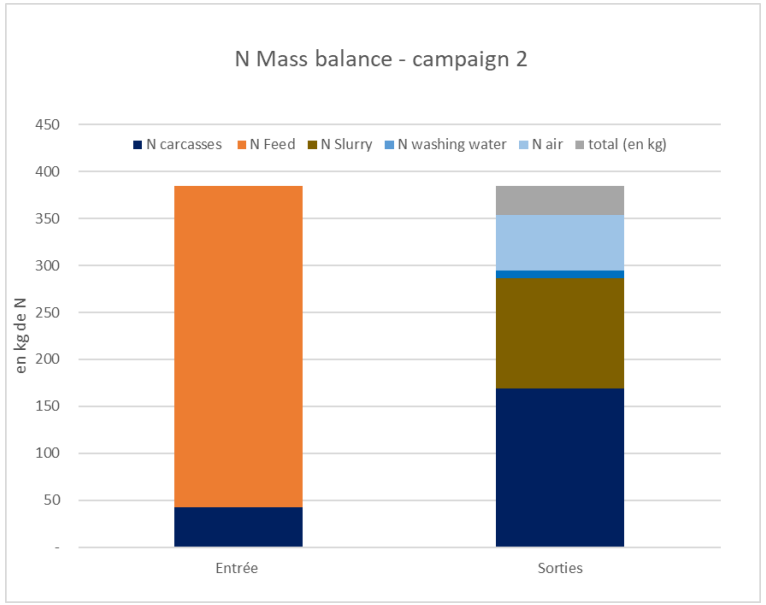
31 to 37%

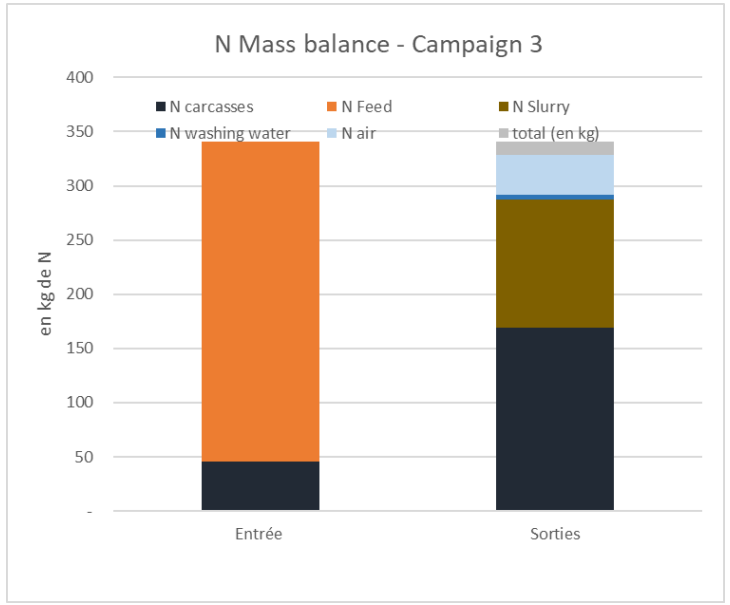
Maximum air flow rate

➔Compliance with the initial specification

Results – N mass balance

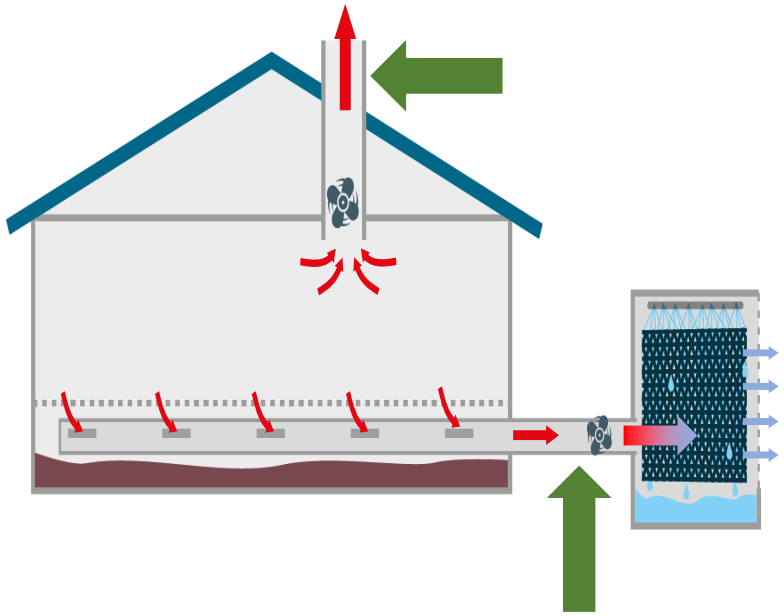


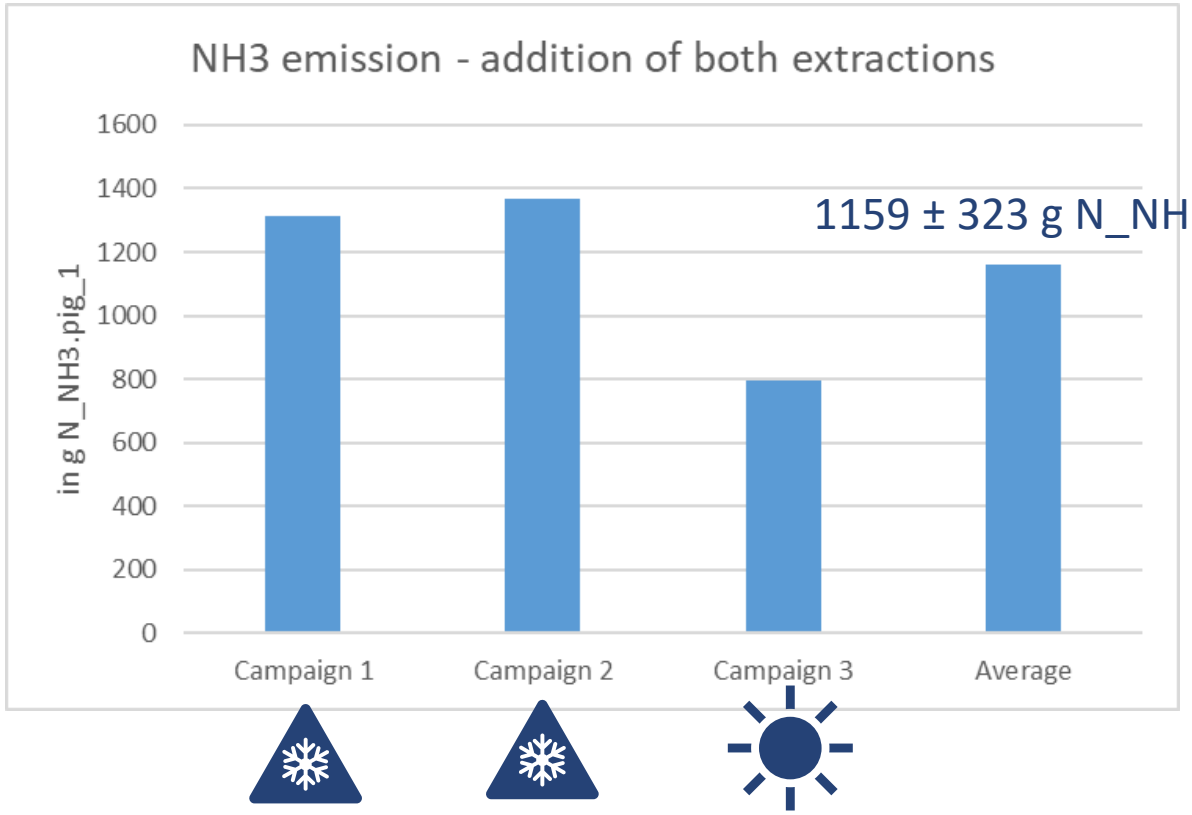




N Mass balance default : 6 to 20%

Results – NH3 emissions per pig

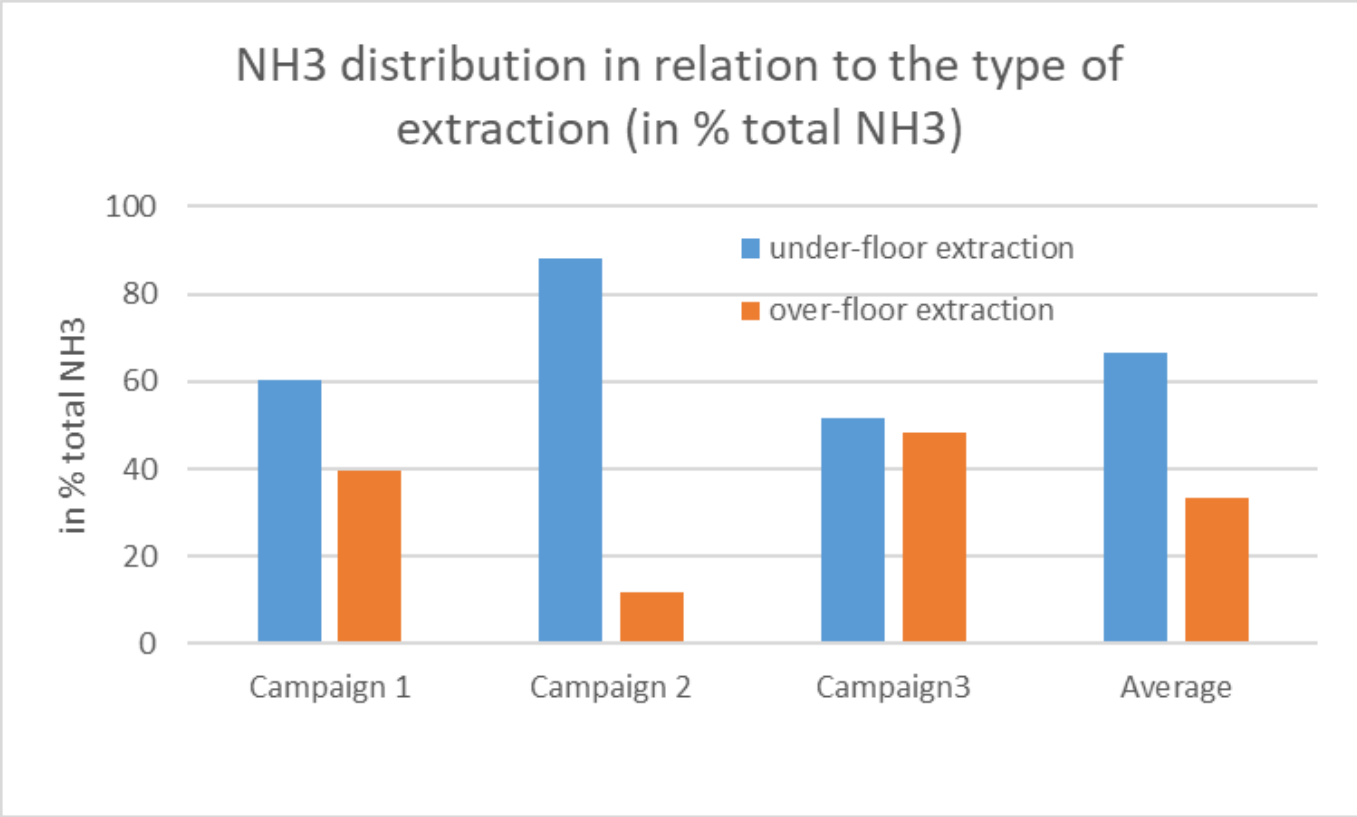




Authors	Em in g N_{1}_NH3.pig^{-}
Philippe et al., 2011	838
Bittman et al., 2014	823
Guingand et Courboulay, 2019	811

Increase of NH3 emission with partial pit ventilation? (Zhang et al., 2014)

Results – NH_3 distribution before the bioscrubber

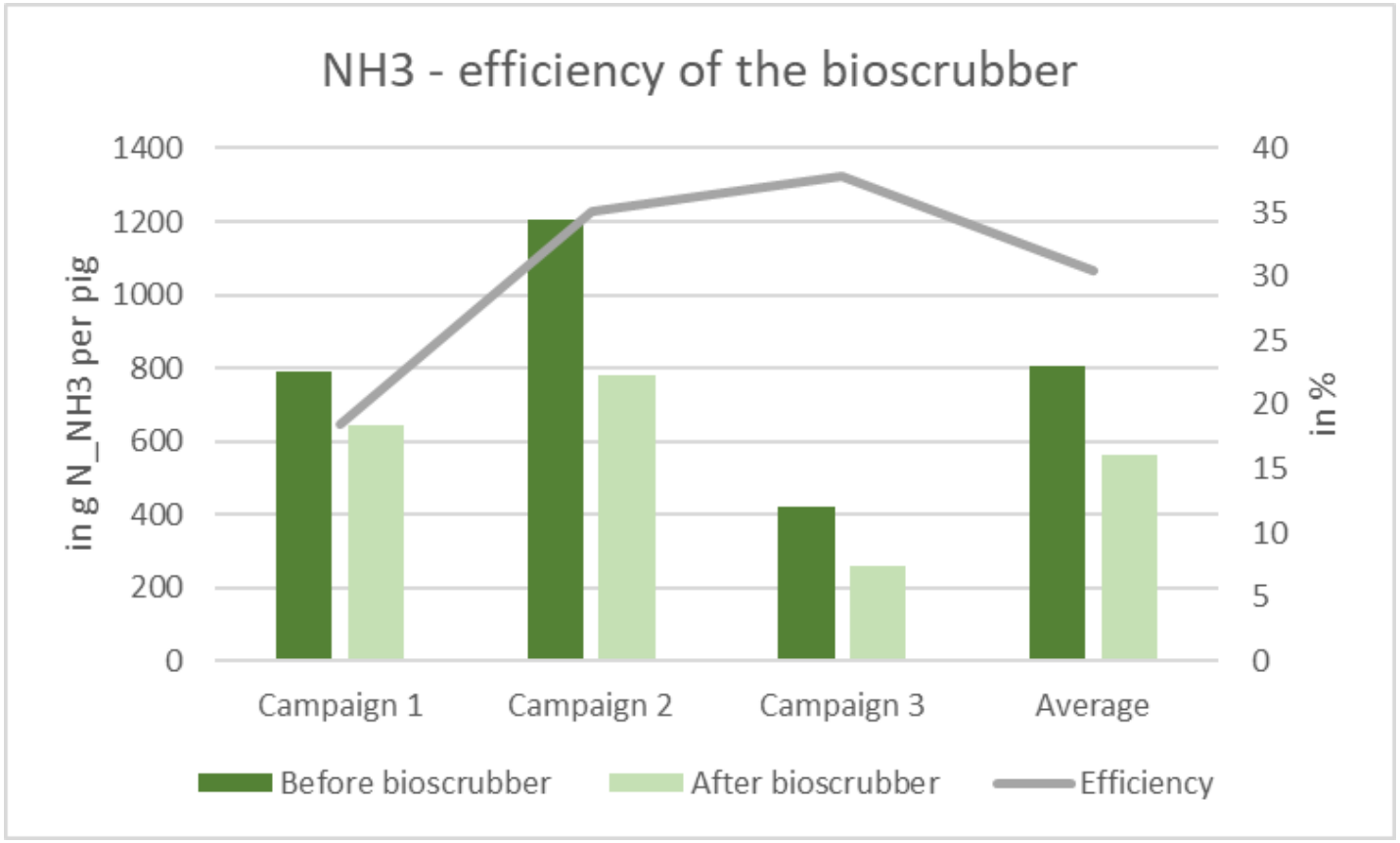


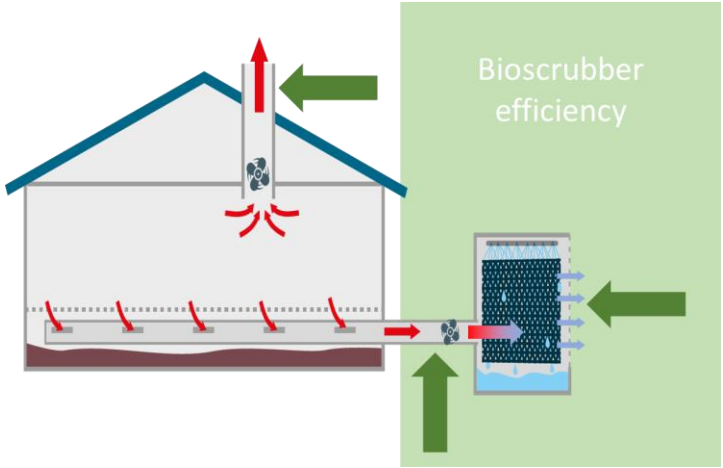
2/3 of NH3 emission is extracted by the under-floor way

Authors	% flow rate via UFE	Max flow rate in m3/p/h	% NH3 via UFE
Saha et al., 2010	17%	80	43%
Zong et al., 2014	10 %	100	50%
Rong et al., 2020	10%	100	70%
Our study	**33%**	**60**	**66%**

Maximization of air flow rate extracted by UFE

Results – NH_3 efficiency of the bioscrubber



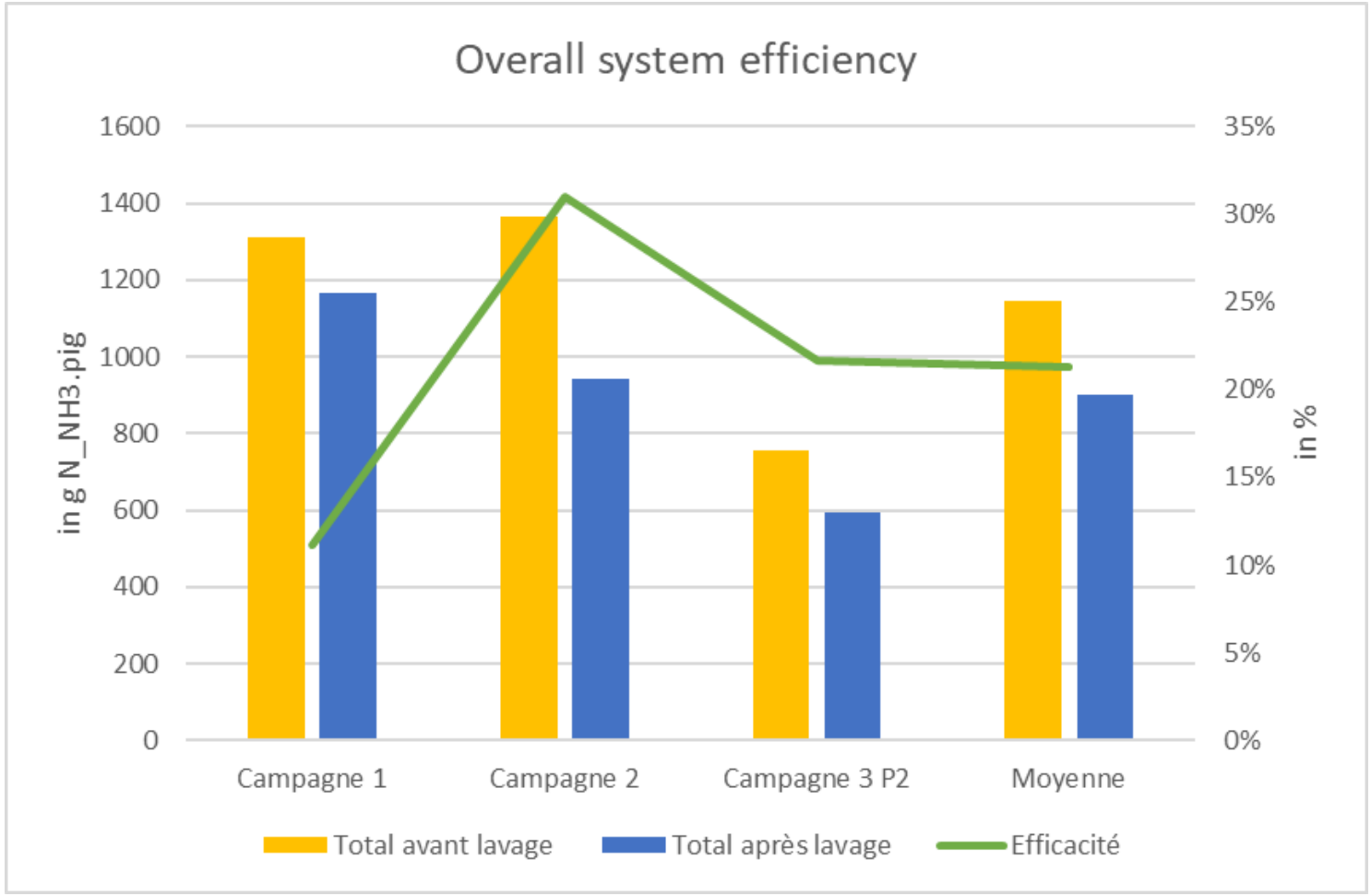


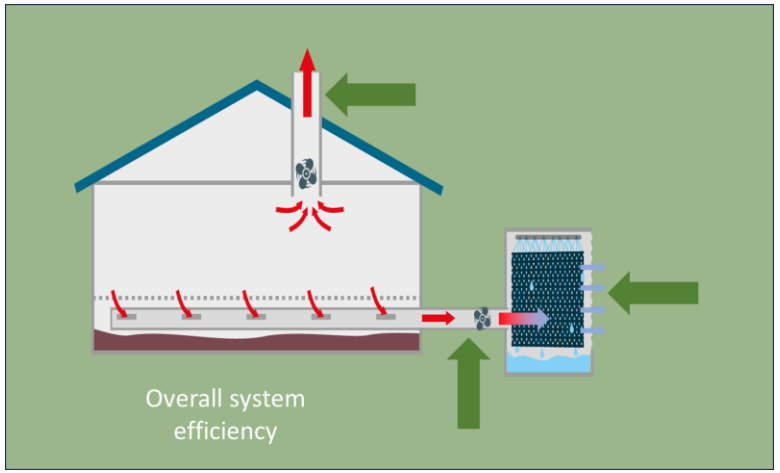
18 to 37%

Campaign 1: clean contact bed
Campaign 2 and 3 : high removing of washing water

Efficiency close to previous data (Lagadec et al., 2015)

Results – NH_3 efficiency of the overall system





11 to 31%

Low efficiency of the overall system during campaign 3

Conclusions

Development of a « one-third » bioscrubber and operating in breeding conditions with partial pit ventilation (33%)

Increase of NH_3 emission due to partial pit ventilation –> need further investigations

Reduction of investment by 2.5 and running cost close to 3

Low efficiency of the overall system -> essentielly based on the efficiency of the bioscrubber -> need further investigations

Thanks for your attention !

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IFIP – Pacé - France

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ET DE LA FORET

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