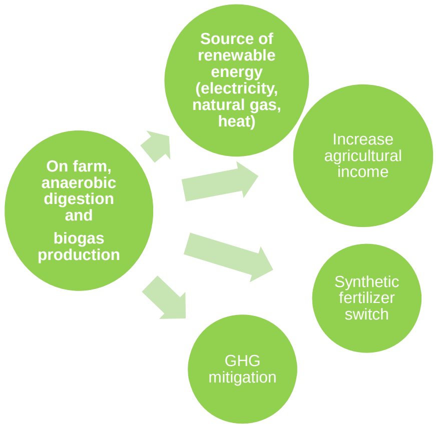
Environmental interests of agricultural biogas plants: the functional unit matters !

Aurélie Wilfart[(1)], Armelle Gac[(2)], Lynda Aissani[(3)], Sandrine ESPAGNOL[(4)]

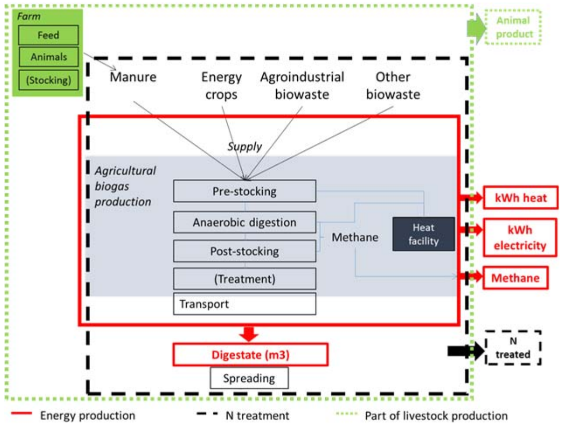
[(1)]INRA, UMR 1069, Sol- Agro et hydrosystème- Spatialisation, Rennes, France ; [(2)] Institut de l'Elevage, Le Rheu, France [(3)] UR OPAALE, IRSTEA, Rennes, France ; [(4)] IFIP, Le Rheu, France

Introduction & objectives



What is the purpose of agricultural biogas ?
What are the consequences on the functional unit ?

Perimeters



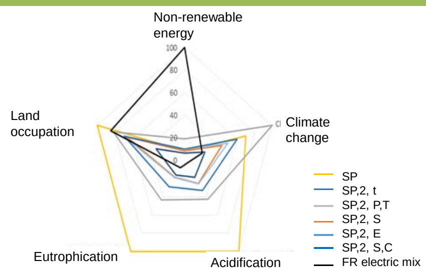
Scenarios

Species	Plant size	Manure type	Other inputs	Digestate treatment	Code
Pig	50 kW	Pig slurry	Exogenous slurry	Spreading	SP
Youg bull	50 kW	Cow manure	Green waste, broken straw	Spreading	SYB
Dairy cow	50 kW	Cow slurry	-	Spreading	SD
Pig	200 kW	Pig slurry	Energy crops, Agri-food waste	Spreading	SP,2,S
Dairy cow	200 kW	Cow slurry	Manure, Energy crops, Agri-food waste	Spreading	SD,2,S
Pig	200 kW	Pig slurry	Agri-food waste	Long distance transport	SP,2,E
Pig	200 kW	Pig slurry	Agri-food waste	Phase separation + composting	SP,2,C
Dairy cow	200 kW	Cow slurry	Manure, Energy crops, Agri-food waste	Phase separation	SD,2,P
Pig	200 kW	Pig slurry	Agri-food waste	Drying Belt + bioscrubber	SD,2,B
Pig	200 kW	Pig slurry	Agri-food waste	Biological treatment + composting	SP,2,T

LCA methods

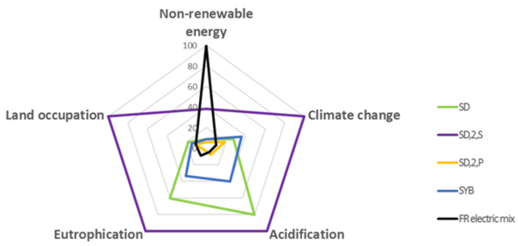
- 3 perimeters for 3 functional units : kWh produced and valorized, kg N treated, kg of animal product at farm gate
- Scenario modelling based on Agribalyse ® 1.3 for pig and dairy cow production
- Background data based on ecoinvent ® 3.3
- Characterization methods
  - Recipe (Climate change)
  - CML 2.0 (Eutrophication and acidification)
  - CED 1.8 (Cumulative energy demand)

Results



a)

Figure 1: Relative environmental impacts of one kWh produced by the French electric mix or by anaerobic digestion based on pig manure (a) or dairy manure (b) with different digestate post-treatments



b)

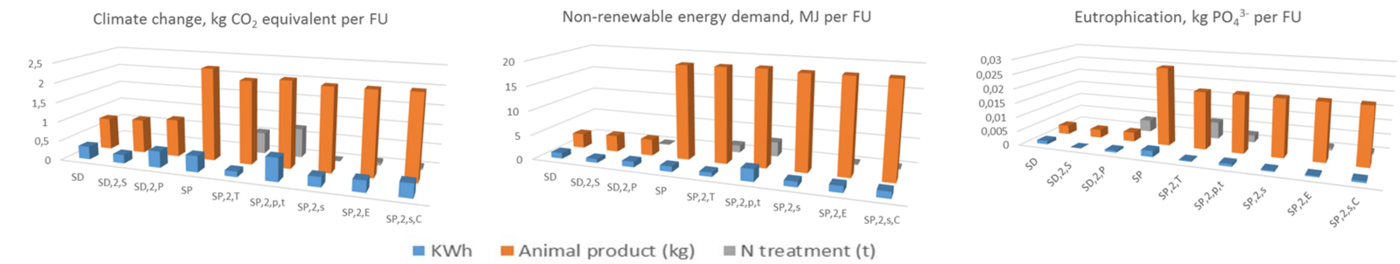


Figure 2: Climate change, non-renewable energy demand, and eutrophication impacts of scenarios of agricultural anaerobic digestion based on pig (SP) or dairy cattle manure (SD) and different digestate post-treatments

Take home messages

- **UF choice influences greatly the results**
- **AD in livestock system is not only for producing renewable energy but also a new way to manage manure and mitigate carbon footprint of animal products**
- **Micro agricultural AD is less effective than macro AD in regards of environmental impacts mitigation**
- **The impact mitigation highly depends on the system considered and its associated technology**
- **Agricultural AD still needs to be optimized at farm scale**
- **Emission factors and losses evaluation need to be refined**

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