NUI Galway

Factors determining successful wastes to biogas projects

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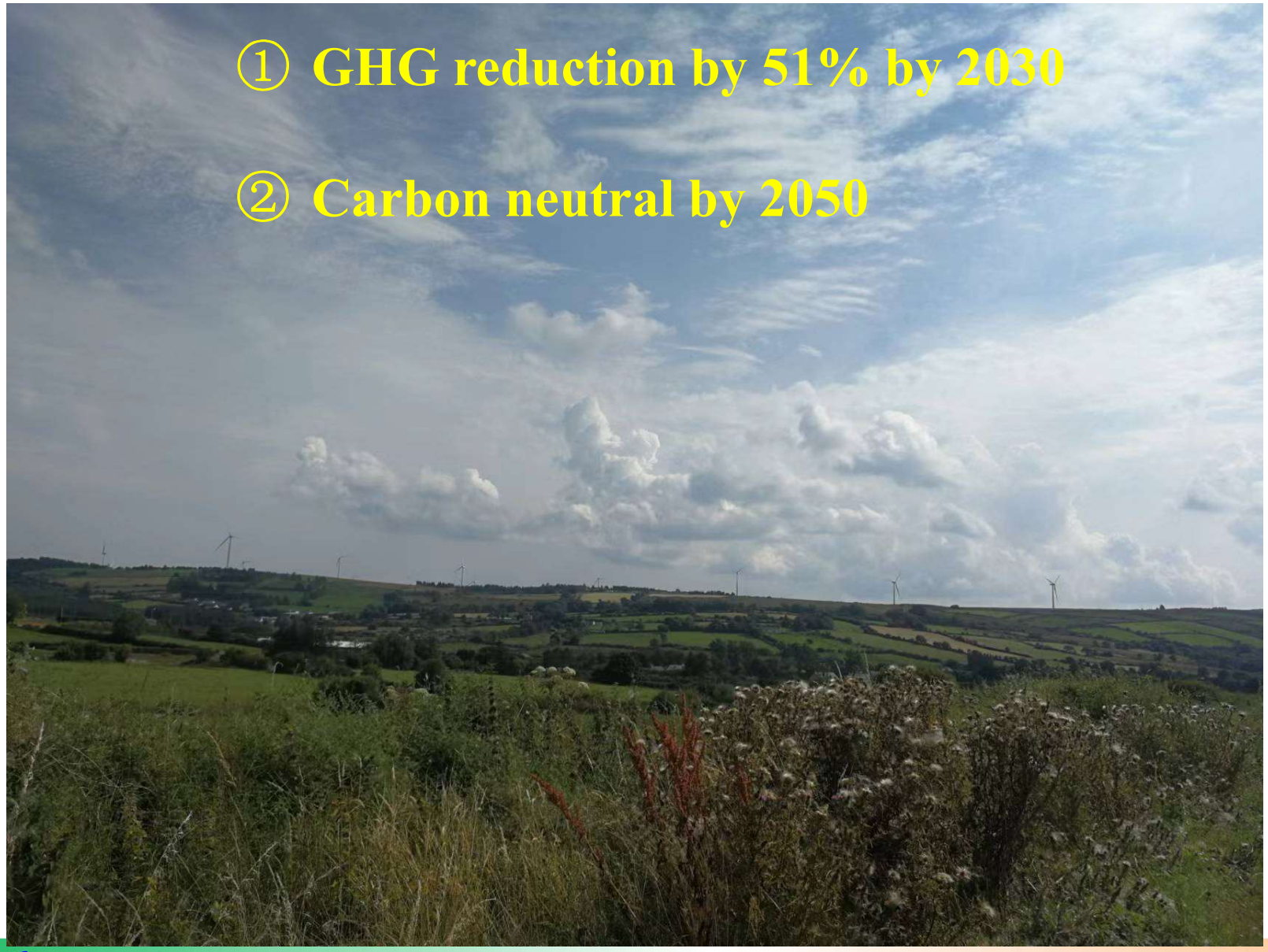
National University of Ireland Galway

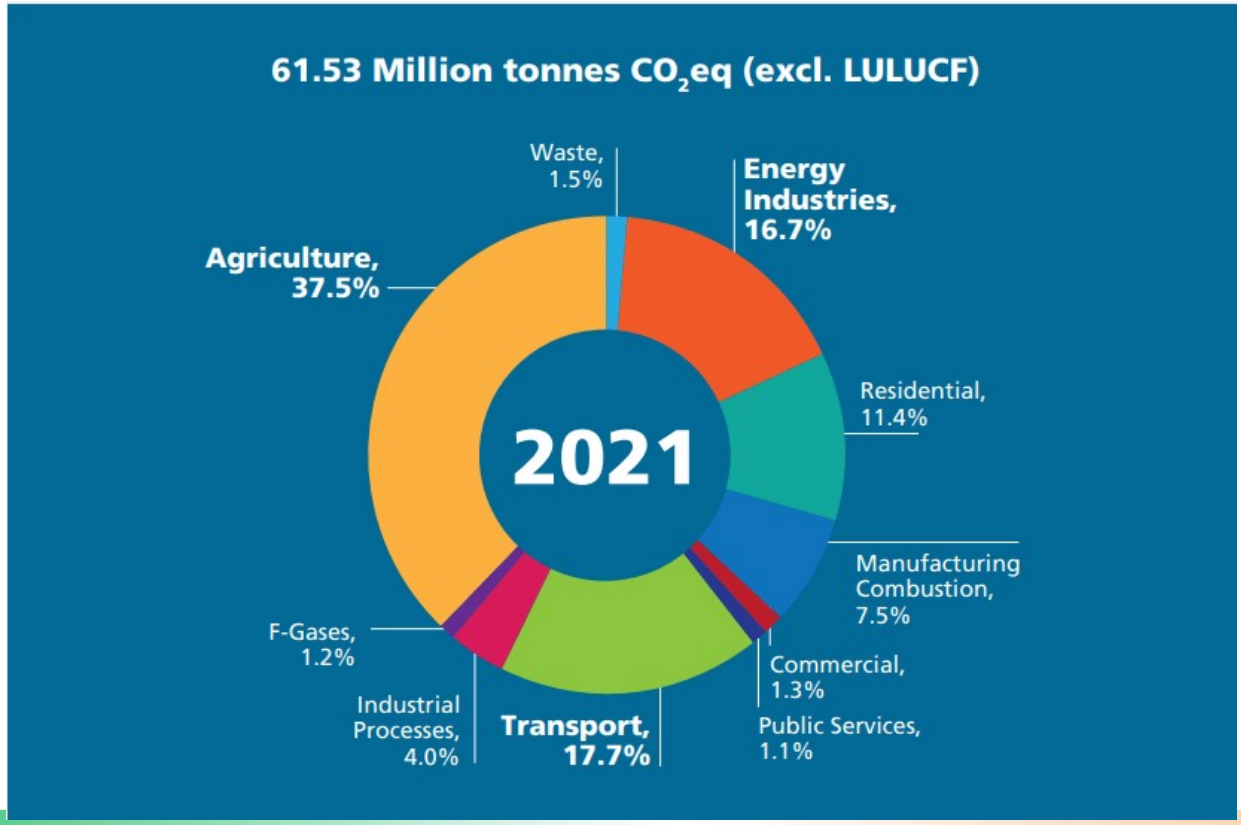
- Established 1845; 14,000 full time students ; 20% foreign students
- Lonely Planet names Galway as fourth best city in the world in 2019

Climate action targets in Ireland



However……

Ireland's greenhouse gas emissions increased by 4.7% in 2021 compared to 2020 and are now 1.1% above 2019 pre-COVID restriction levels.



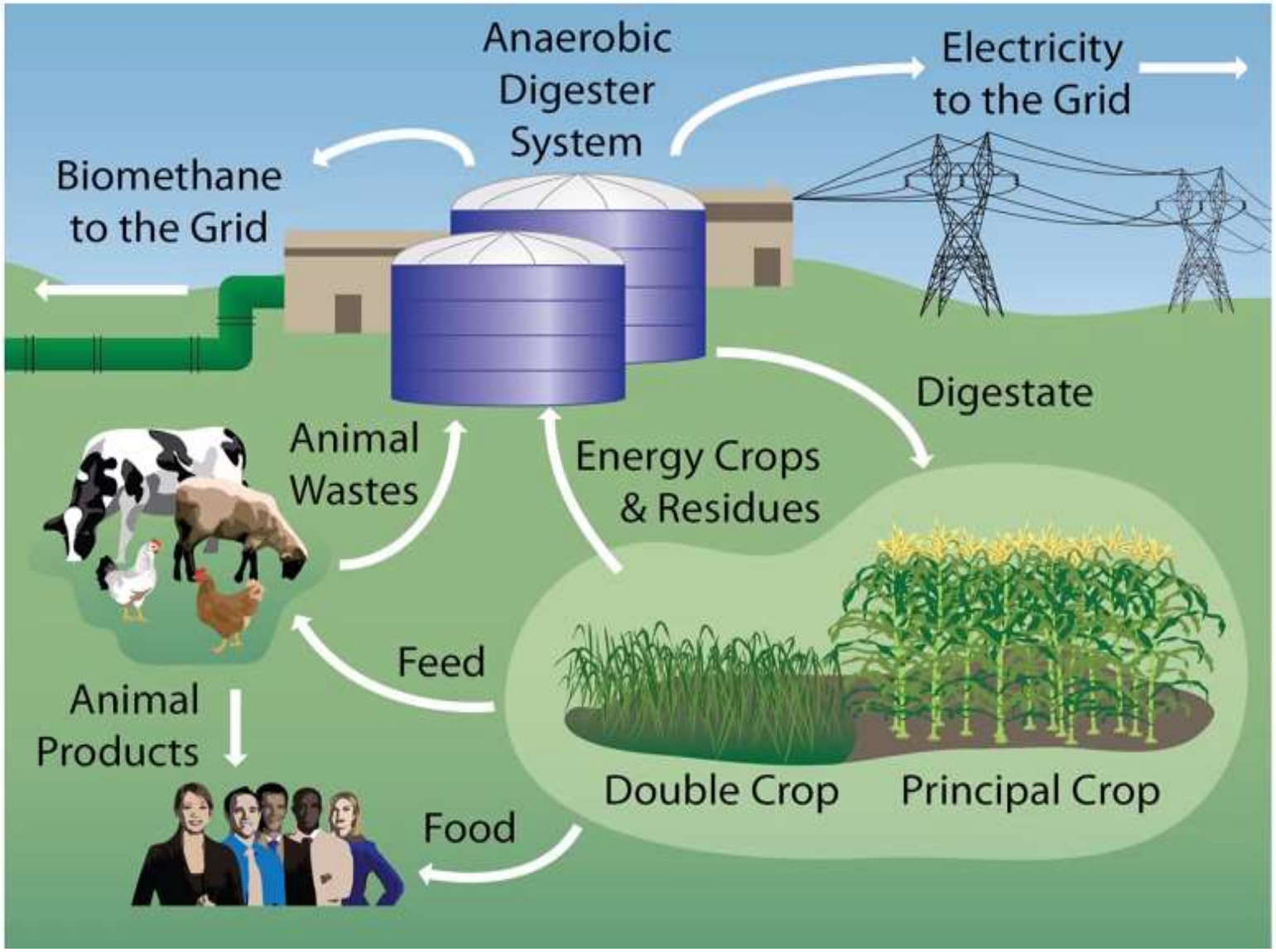
Government's new target by 2030:
25% reduction in agricultural emissions

"The government will also be assisting in the development of biomethane from Anaerobic Digestion (AD), which will provide opportunity for farmers who wish to consider additional income sources while also contributing significantly to decarbonising the energy system."

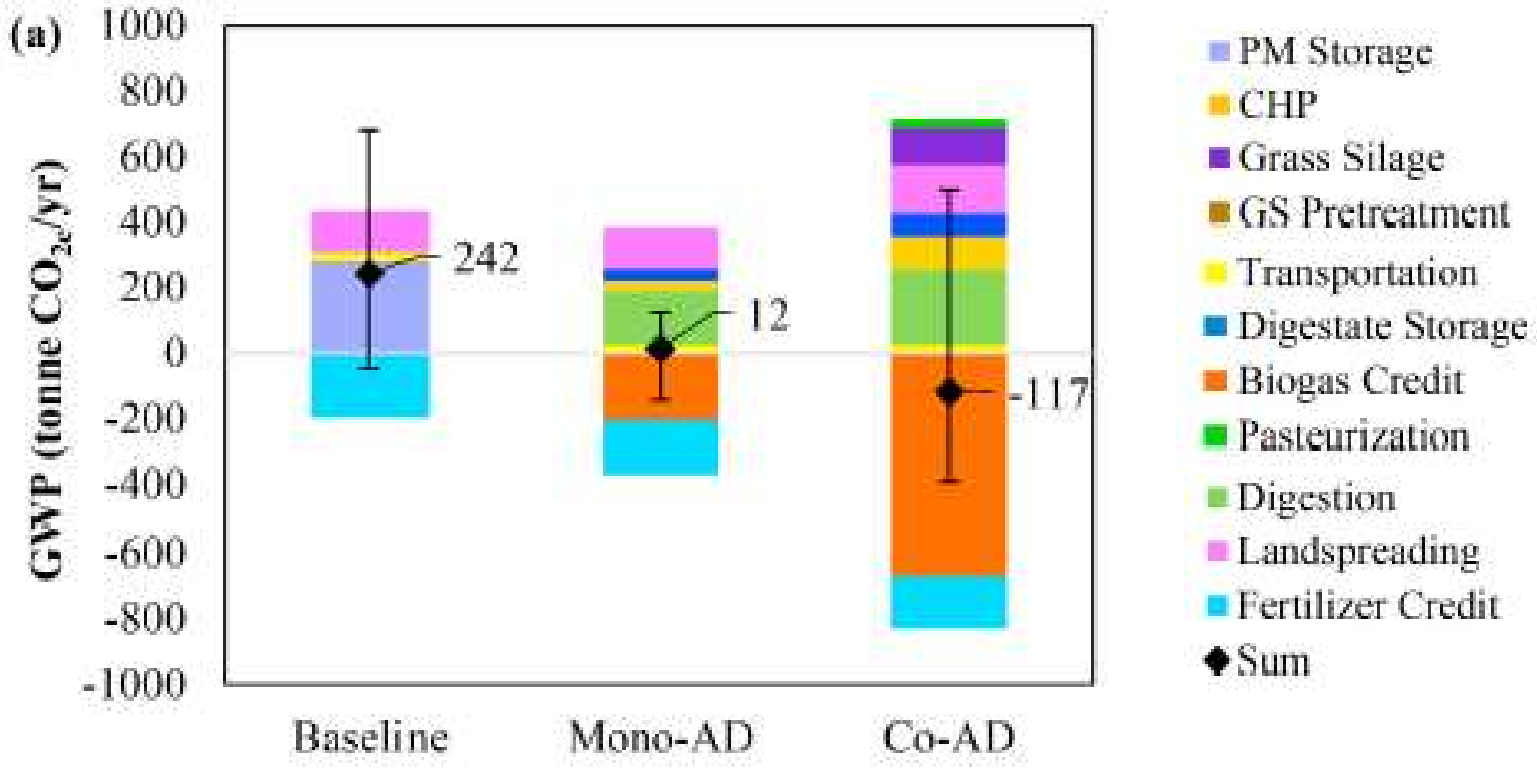
Pig Industry in Ireland

Survey of 11 Irish pig farms	
DM (%)	4.80%
N (kg/m³)	2.4
P (kg/m³)	1.3
K (kg/m³)	2.3

Can anaerobic digestion help to achieve GHG emission mitigation?



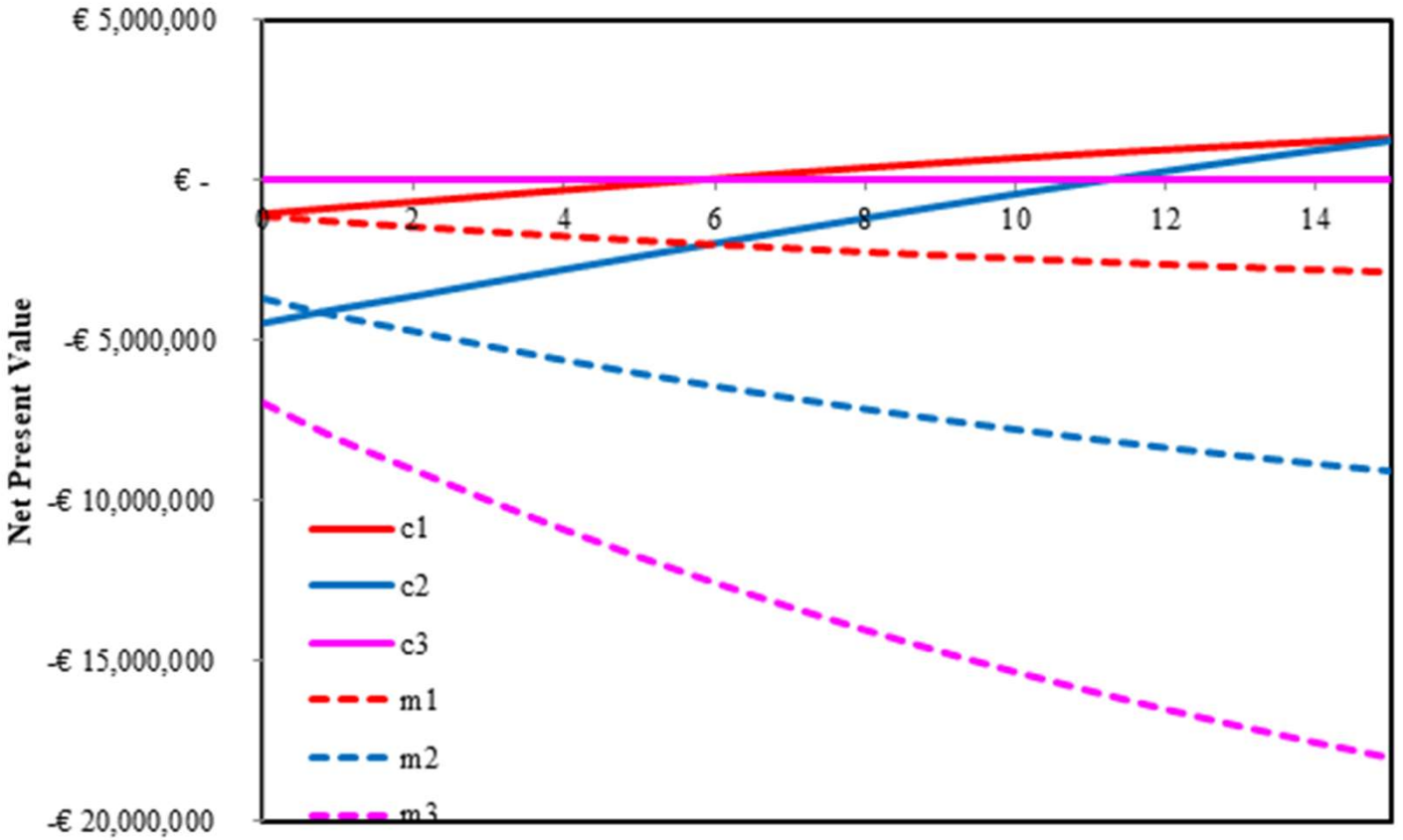
AD can achieve GHG emissions reduction



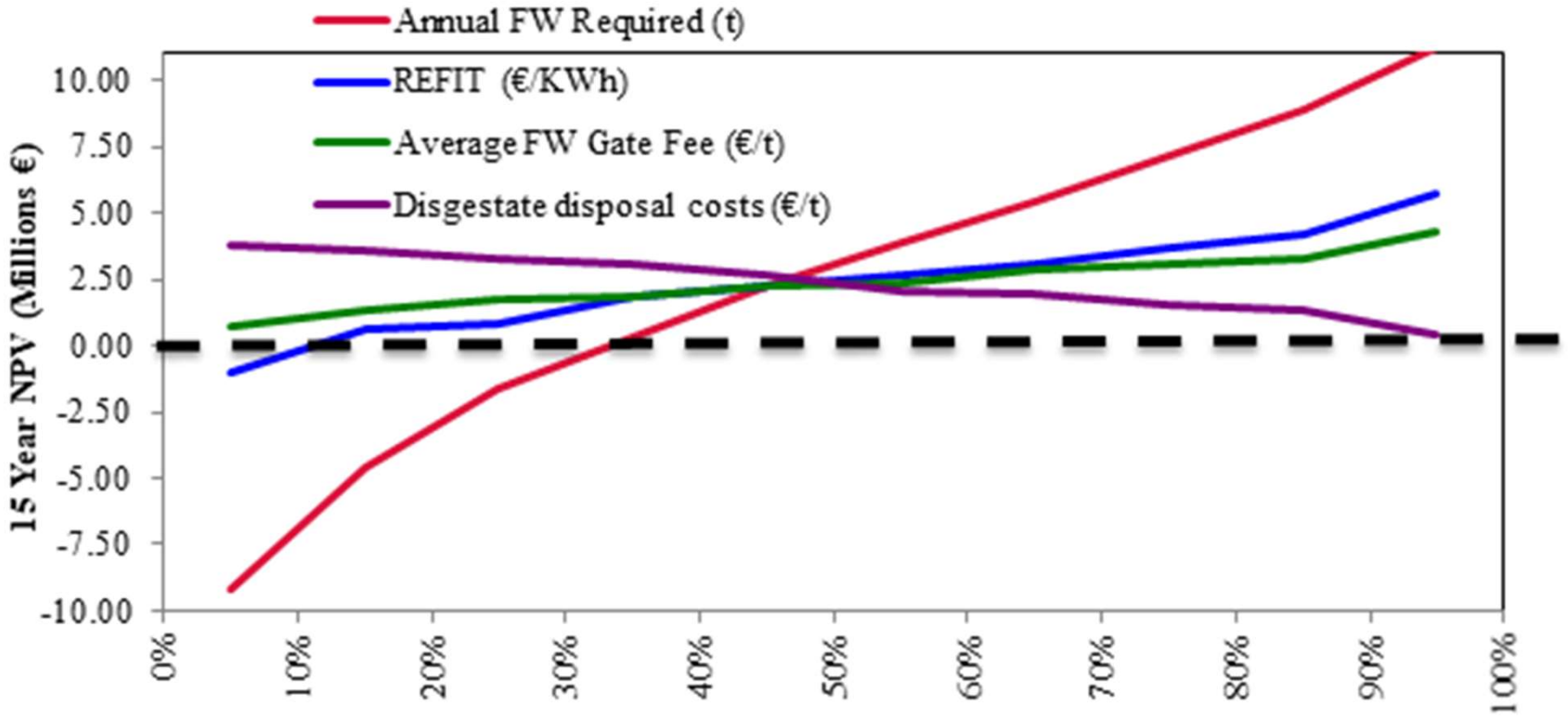
Process-based global warming potential of three pig manure management systems (manure spreading; mono-digestion of pig manure followed by land application; co-digestion of pig manure and grass silage followed by land application

Zhang et al. ***Renewable and Sustainable Energy Reviews***, 10.1016/j.rser.2020.110476, 2020

Co-digestion



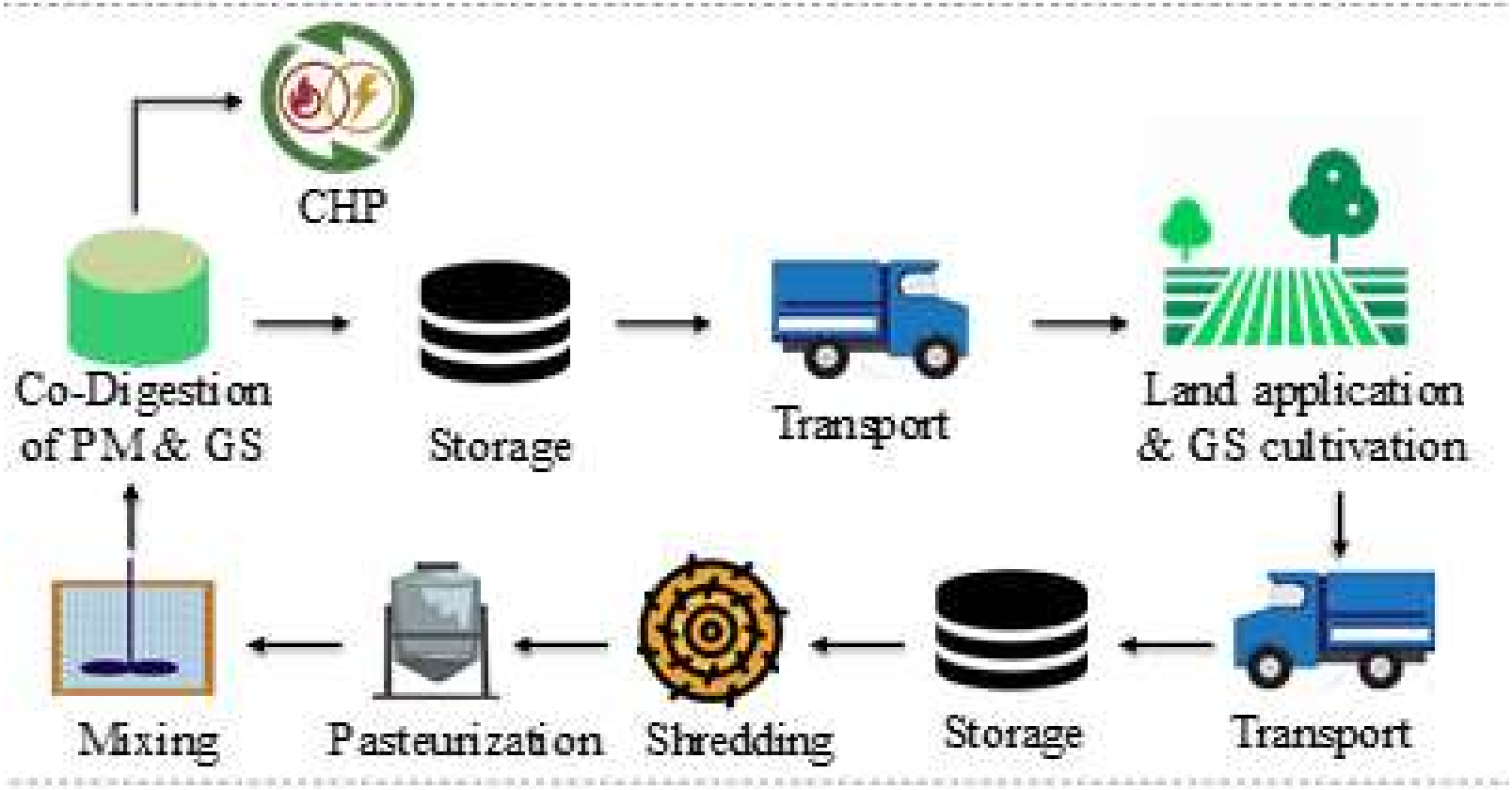
Net present values of each scenario under baseline scenario conditions



Impact of annual FW required, REFIT, FW gate fees and digestate disposal costs on net present values under baseline scenario conditions.

Nolan et al. *Bioresource Technology,* 105, 15–23, 2012
Dennehy et al. *Applied Energy, 205*, 1528-1537, 2017

Co-digestion of pig manure and grass silage



Xie et al., *Bioresource Technology*, 102, 5728–5733, 2011; *Bioresource Technology*, 102, 8748–8755, 2011; *Bioresource Technology*, 104, 289–297, 2012; *Bioresource Technology*, 114, 406-413, 2012; *International Biodeterioration & Biodegradation*, 123, 244-250, 2017

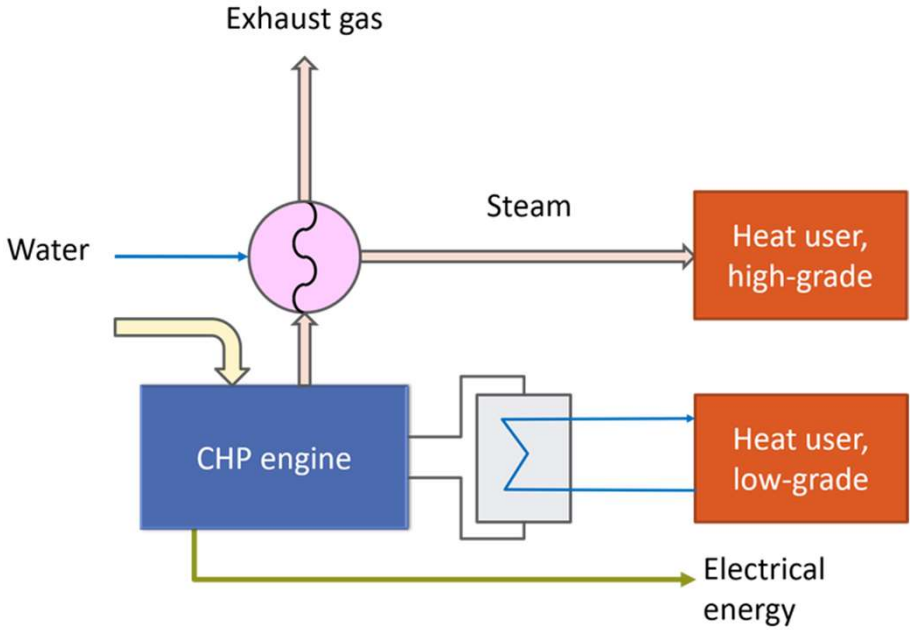
C/N

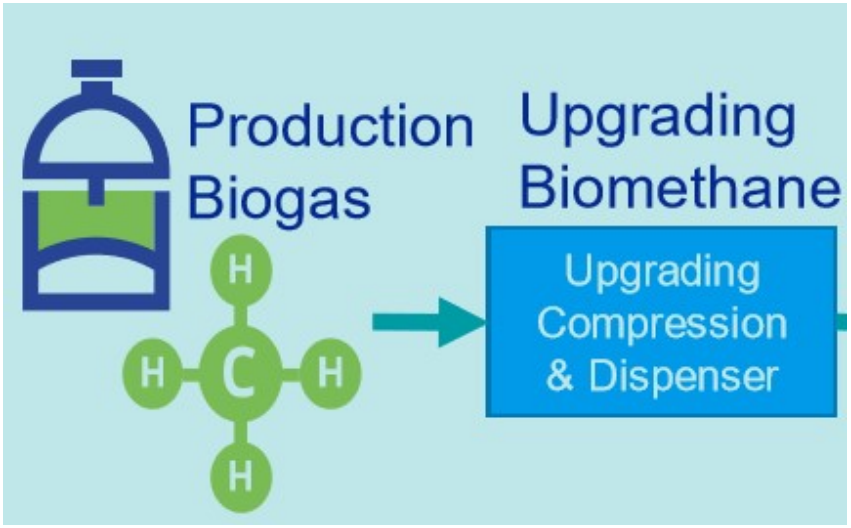
	Grass Silage	Pig Manure
Advantages	Higher methane yields	High in alkalinity, trace metals-stable
Issues	Low alkalinity and trace metals-instability	Low methane yields

Farm-scale AD co-digesting grass silage and cattle manure in Grange, Teagasc, Ireland

HAVING A BREAK: (From left) Dr Xinmin Zhan, NUI Galway; Peter Frost, AFBI; Peadar Lawlor, Teagasc; and Kathy Carney, Moorepark; take some time out at the dissemination day for research results on alternative uses for pig manure in Teagasc Moorepark O'GORMAN PHOTOGRAPHY

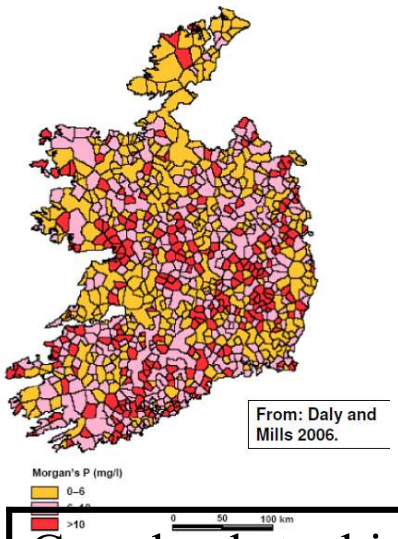
Use of methane gas





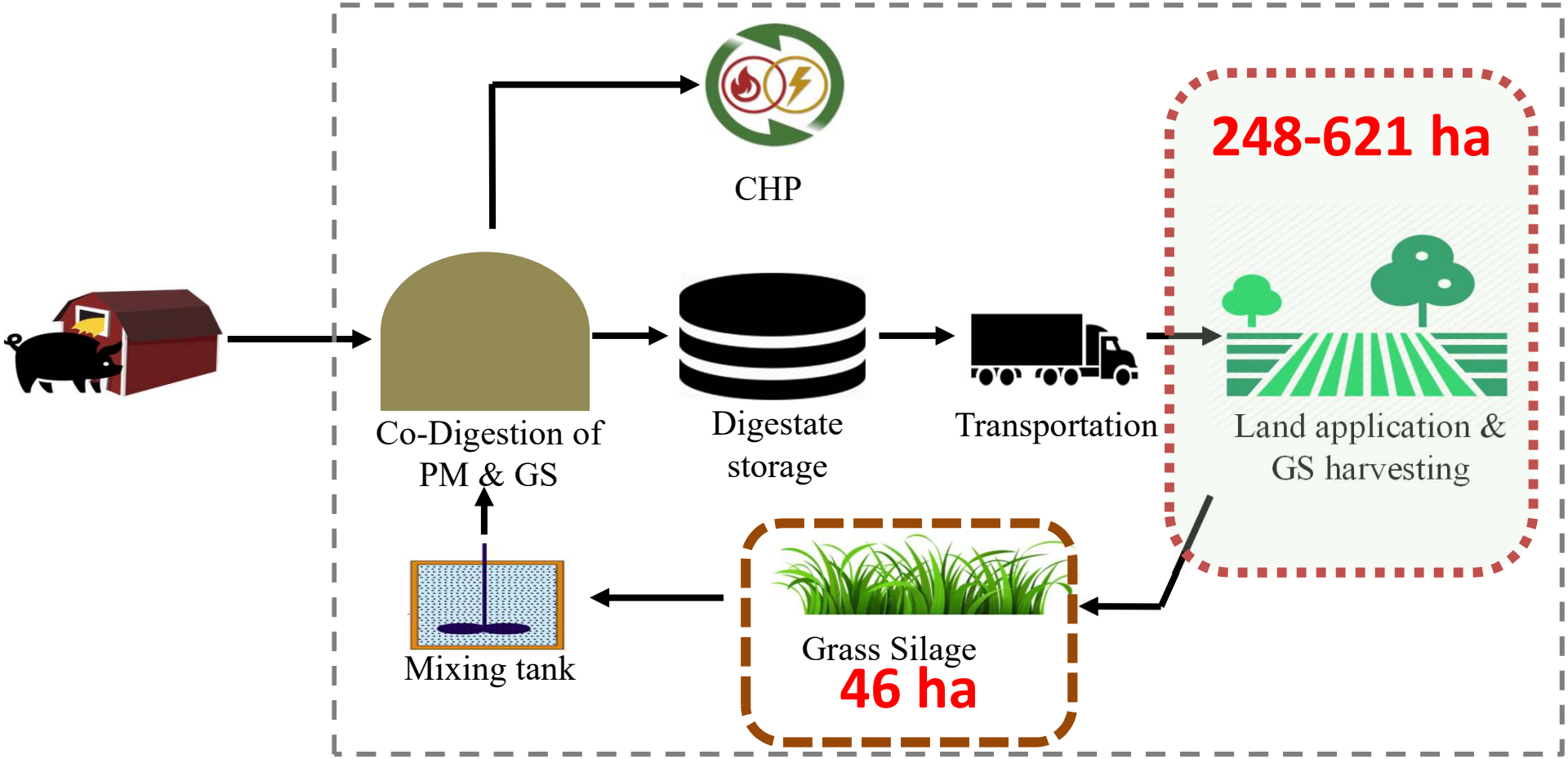
Digestate management

Land spreading of digestate is regulated!



Soil Phosphorus Index	Soil Phosphorus ranges (mg/L)	
	Grassland	Other crops
1	0-3.0	0-3
2	3.1-5.0	3.1-6.0
3	5.1-8.0	6.1-10.0
4	>8.0	>10.0

Grassland stocking rate (kg/ha/yr)	Phosphorus Index			
	1	2	3	4
	Available Phosphorus (kg/ha)			
< 130	35	25	15	0
131-170	39	29	19	0



What will happen for soil index of 4?

Zhang et al., *Renewable and Sustainable Energy Reviews*, 10.1016/j.rser.2020.110476

"The identification of high P levels in digestates and the issues of spreading on high P agricultural land in N. Ireland were only considered in 2019 by which time most of our AD plants were well established. Our Environment Agency introduced legislation which is now problematic for biogas plant operators and in some cases has added additional costs to digestate management. "

Conclusion

Farm-scale digesters can play a vital role in achieving zero-carbon livestock farming, but economic viability needs to be assessed carefully in the planning stage.

Government incentive is very critical.

Environmentally friendly use of digestate is a critical factor for a successful farm-scale digestion.

Acknowledgement

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