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Electricity production from anaerobic digestion of animal slurries in farm scale plants

Jacopo Bacenetti, Marco Fiala

Department of Agricultural and Environmental Sciences. Production, Landscape, Agroenergy. University of Milan

Via Giovanni Celoria 2, 20133, Milan, Italy

jacopo.bacenetti@unimi.it

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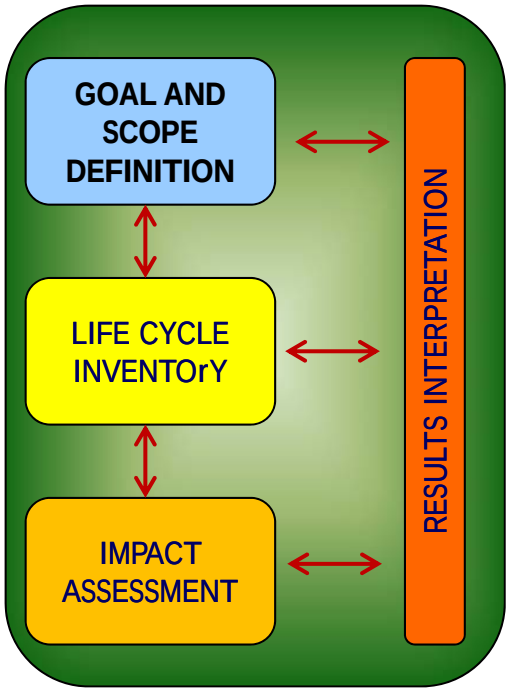
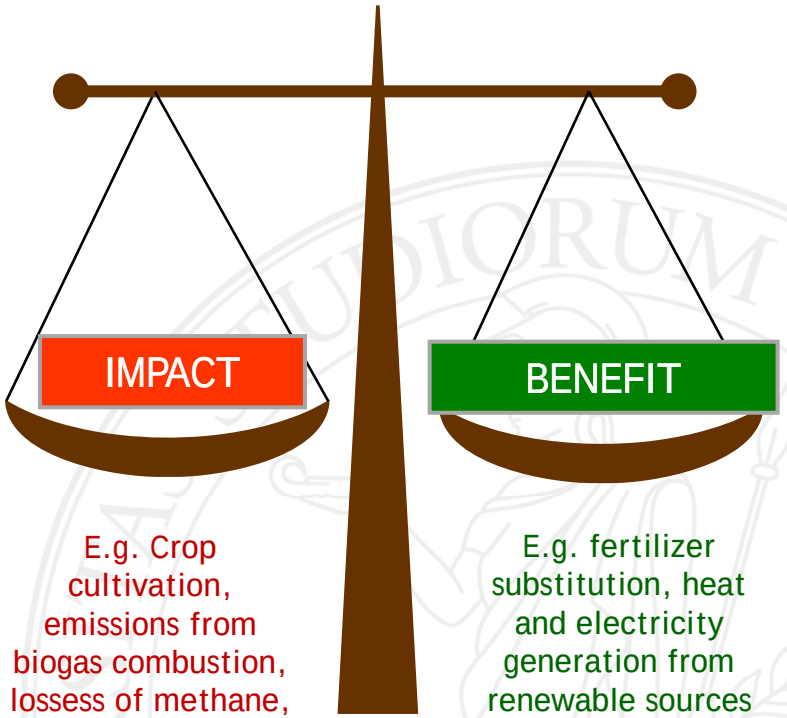
Life Cycle Assessment (LCA) is a methodology to assess the potential environmental impacts and resources' consumption associated with a production system (ISO 14040, 2006):

4 steps



BIOGAS & ENVITONMENT



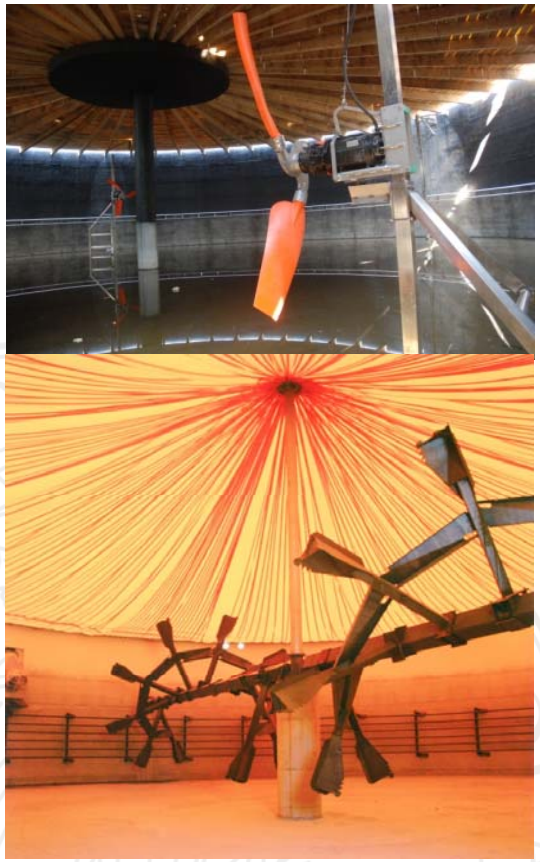
E.g. Crop cultivation, emissions from biogas combustion, lossess of methane,

E.g. fertilizer substitution, heat and electricity generation from renewable sources

AIM: to assess the environmental profile of electricity production from four different AD plants mainly fed with animal slurry and electrical power lower than 300 kW

Four biogas plant (LCA) located in Northern Italy and are fed mainly with animal slurry).

		Biogas plant			
		A	**B**	**C**	**D**
District	Unit	Cremona	Lodi	Pavia	Cremona
Electrical power	kW	100	250	300	300
Starting year	-	2013	2010	2013	2013
Feeding rate	t/day	Cow slurry 40 t/day	Pig slurry 180 t/day	Cow slurry 35 t/day Maize silage 13 t/day	Pig slurry 45 t/day Maize silage 14 t/day
Electric self consumption	%	7.0	7.6	9.2	8.4
Transport Distance	km	0.1	3.5	1.5 for Cow slurry 0.8 for Maize silage	1.3 for Pig slurry 0.7 for Maize silage
Surplus heat	-	Partially valorized	Wasted	Wasted	Wasted

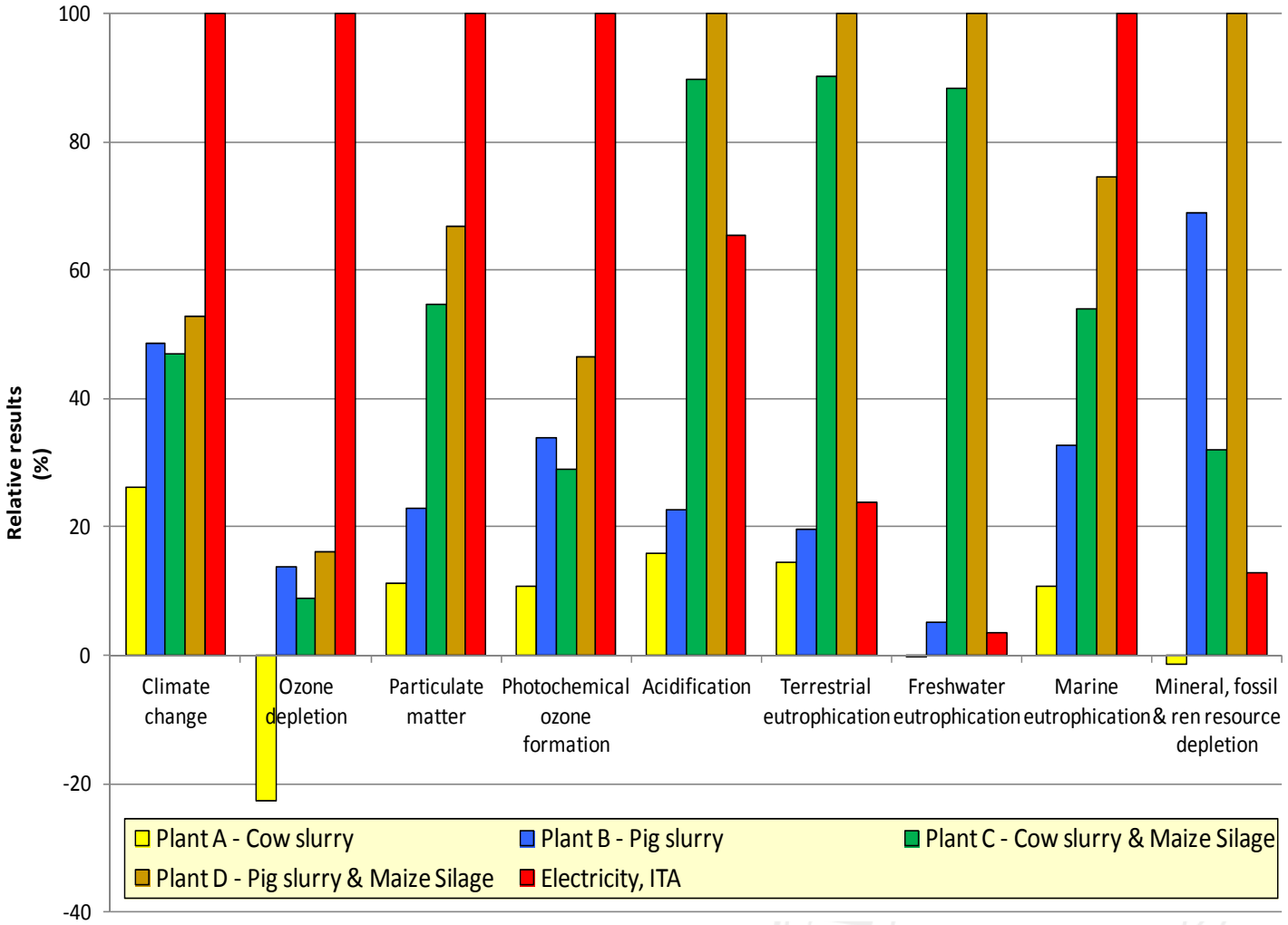


FUNCTIONAL UNIT: 1 kWh of electricity

ILCD method

Evaluated impact categories: climate change (CC), ozone depletion (OD), particulate matter (PM); photochemical oxidant formation (POF); acidification (TA), freshwater eutrophication (FE), terrestrial eutrophication (TE) marine eutrophication (ME), and mineral, fossil and renewable resource Depletion (MFRD)

RESULTS



For 5 impact categories (CC, OD, PM, POF and ME), the **Italian electricity has an higher environmental impact** than electric energy from AD plants.

For AC, TE, FE it has a **lower impact** than EE from the AD plants (C and D) fed with maize .

Plant A produces EE with the lowest impact: thanks to the heat-valorization credits, for 3 OD, FE and MFRD **environmental benefits** are achieved.

Plants (C and D) fed also with **maize silage** show a considerably **higher impact** for AC, TE, FE and ME: the fertilizer applications during maize cultivation involve emissions of ammonia in the air as well as nitrogen leaching and phosphate losses

The electricity produced from the AD plants fed with animal slurry has better **environmental performances** than electricity produced from fossil fuels, whereas for AD plants fed with maize silage this is true only for those impact categories not related to ammonia and dinitrogen monoxide emissions and to nitrate and phosphate leaching.

Recovery and valorization of **surplus heat** (Plant A) significantly reduce the environmental burdens.

The use of energy crops (**maize silage**) considerably increase the environmental impact of electricity from biogas

CAREFULLY ASSESS THE ENVIRONMENTAL SUSTAINABILITY FOR ELECTRICITY PRODUCED BY BIOGAS PLANT FED WITH ENERGY CROPS

LCA Group
AGRO-ENERGY and FOOD PROCESSING

Prof. Marco Fiala, PhD: marco.fiala@unimi.it - ☎ +39 503 16868
Dr. Jacopo Bacenetti, PhD: jacopo.bacenetti@unimi.it - ☎ +39 503 16869