Environmental impacts of different options for the management of livestock waste in Cyprus

LIFE LIVE-WASTE

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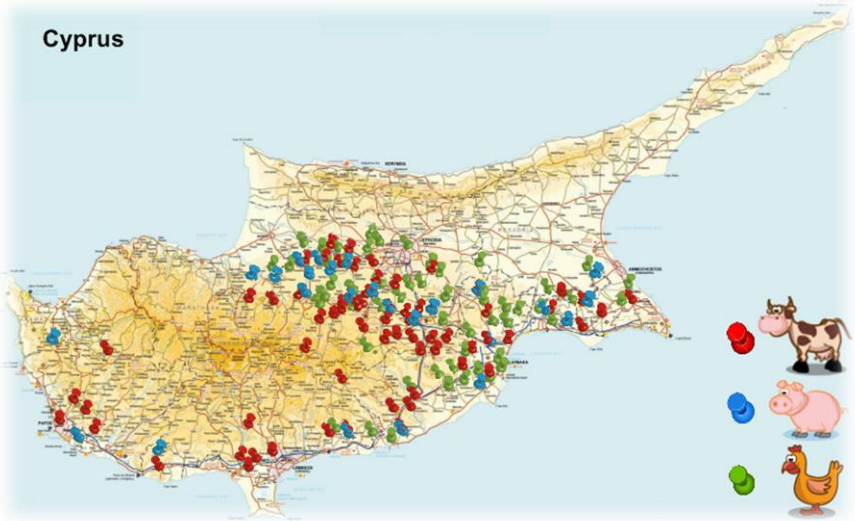
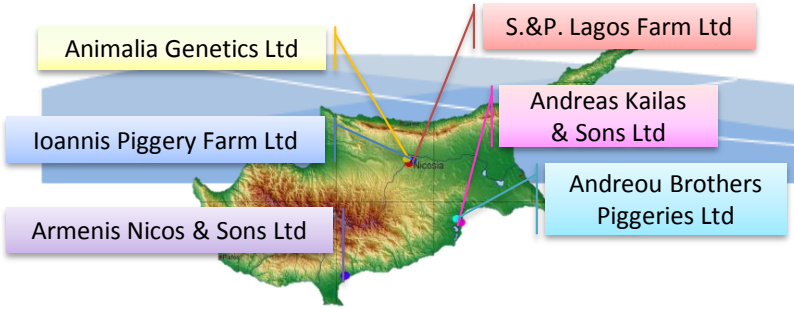
Introduction

- The estimated total livestock heads in Cyprus in 2011 were more than 4,400,000; which would means that around **1,850,000 tons of manure**.



- Cyprus faces **water shortage** problems → seasonal rainfall disparity, seawater penetration into the island's water table and lack of natural water retention areas.

- Cyprus has **few indigenous energy sources** → its power system depends on imported oil.



Introduction

	Number of animals	Manure production factor	Total manure production	Direct application	Anaerobic lagoons	Anaerobic digestion
	(head)	(t/head·year)	(t/year)	%	%	%
Cattle	55,975	10.8	604,530		93%	7%
Pigs	437,420	1.89	826,724		70%	30%
Sheep	255,540	0.64	163,546	100%		-
Goats	214,720	0.64	137,421	100%		-
Poultry	3,440,000	0.034	116,960		89%	11%

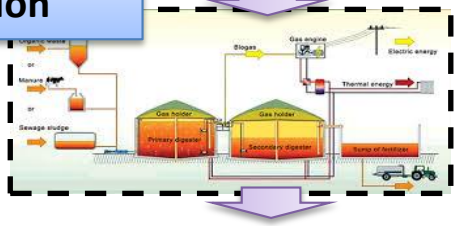
Objective: Comparison of the environmental profile of different options for the management of livestock waste in Cyprus

Materials and methods

Goal and scope definition

Inventory data collection

Raw materials, fossil fuels and water



Emissions to air, water and soil

Interpretation

Impact assessment

Conclusions
Recommendations
Improvement options

Inputs from technosphere	
Electricity	1000
Chemicals	50
Outputs to Environment	
CH_4	60
N_2O	0,1

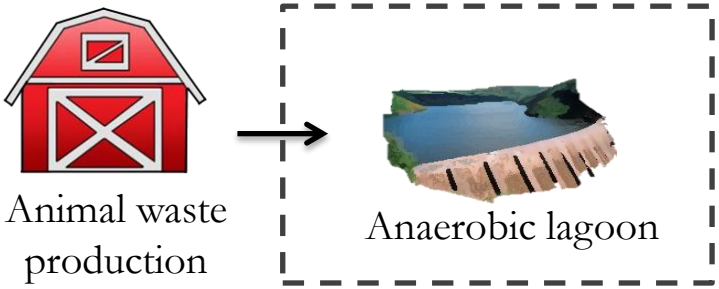
Environmental results			
Impact categories	A	B	C
Climate change	10	60	-1
Acidification	5	15	-5
Eutrophication	0,8	1	0

Identification of environmental hotspots

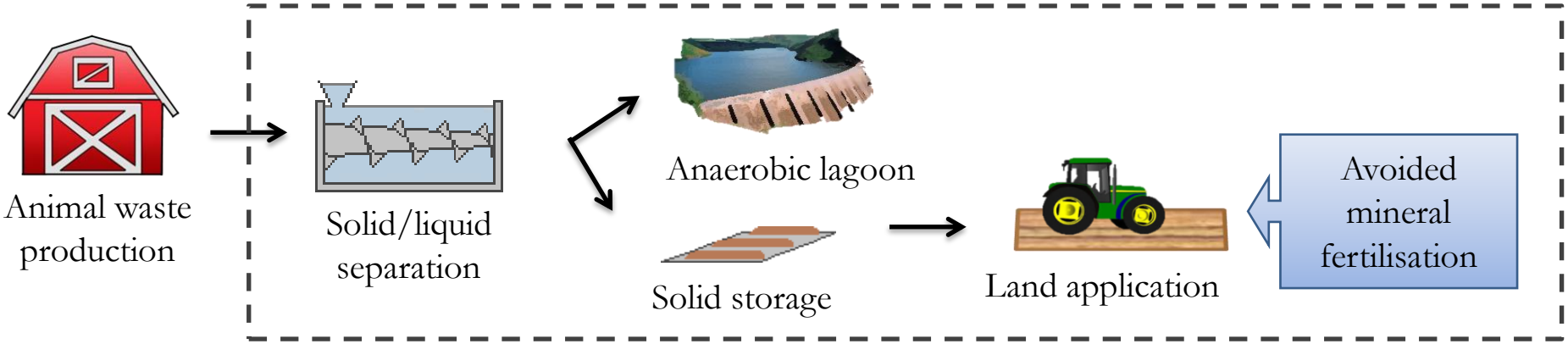
Environmental credits → resources recovery

Materials and methods

Scenario 1

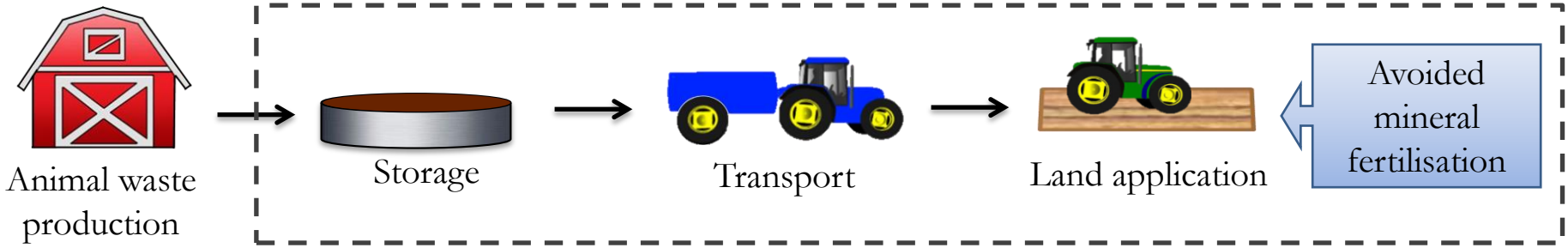


Scenario 2

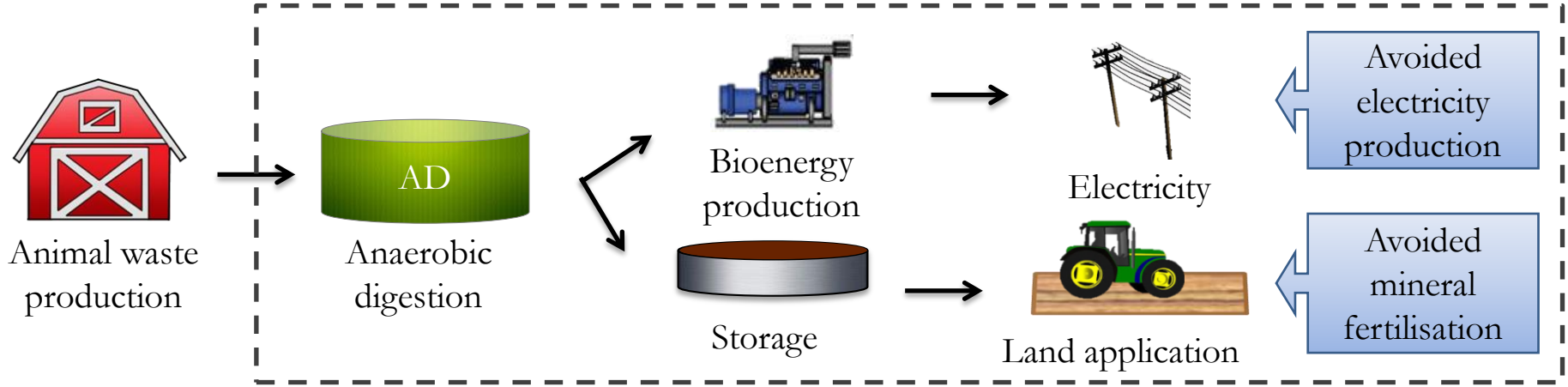


Materials and methods

Scenario 3

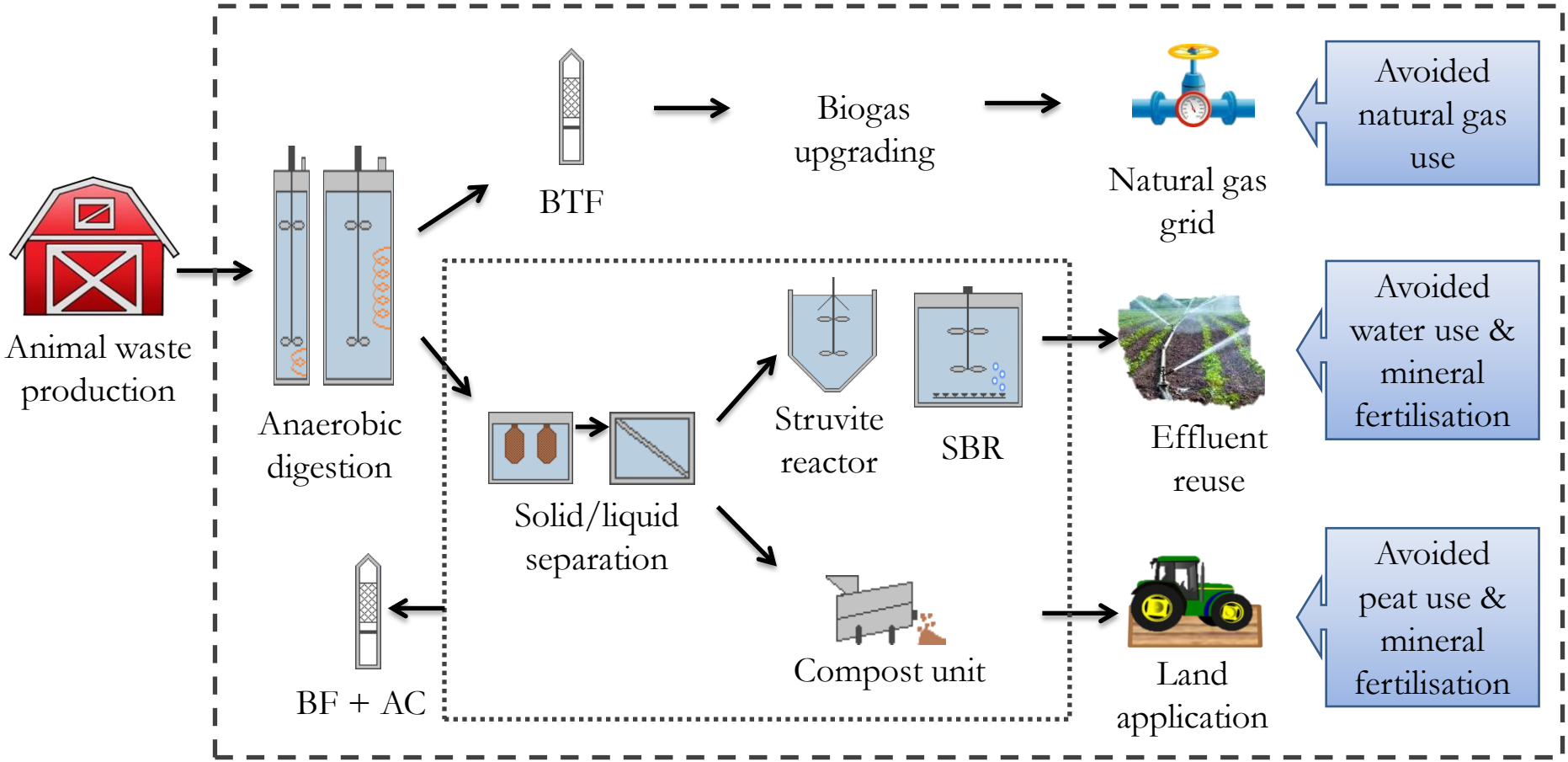


Scenario 4



Materials and methods

Scenario 5 – LiveWaste project



Materials and methods

Functional unit:

1 ton of livestock waste treated

System boundaries:

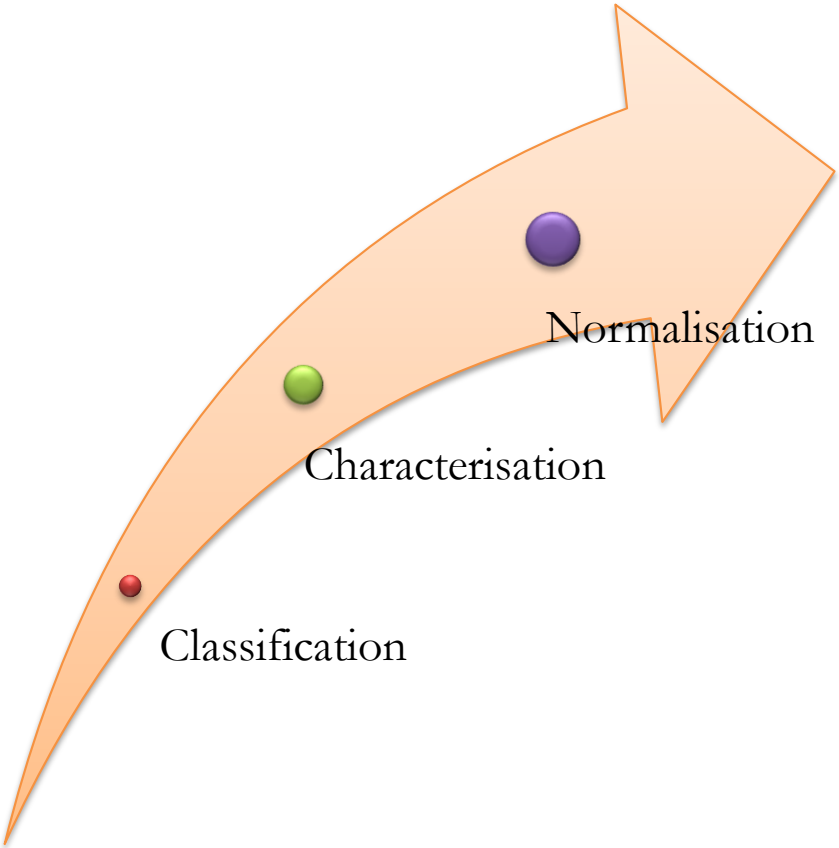
- **Production of inputs and energy**: electricity, transport, infrastructure and chemicals.
- **Direct emissions**: transport, CHP, storage, land application.
- **Environmental credits**: electricity production and manure and digestate applied on land can replace electricity from fossil fuels and mineral fertilisers.

Materials and methods

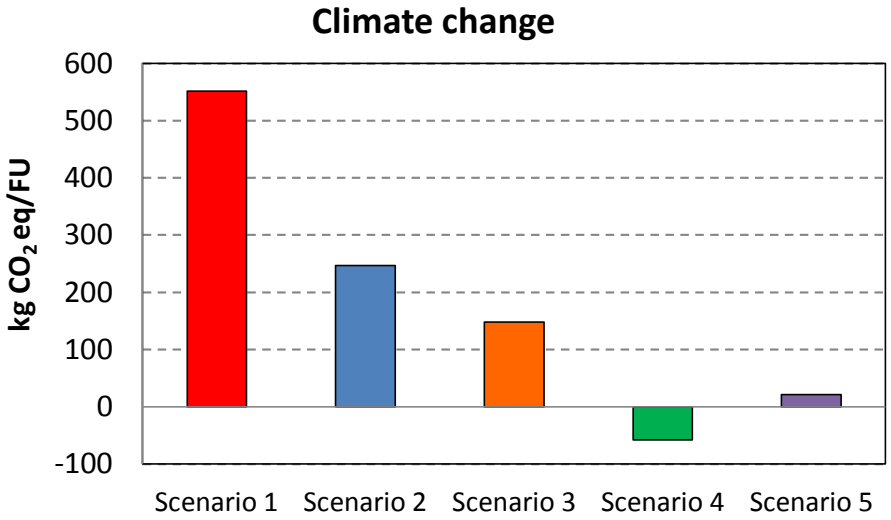
ReCiPe Midpoint Methodology

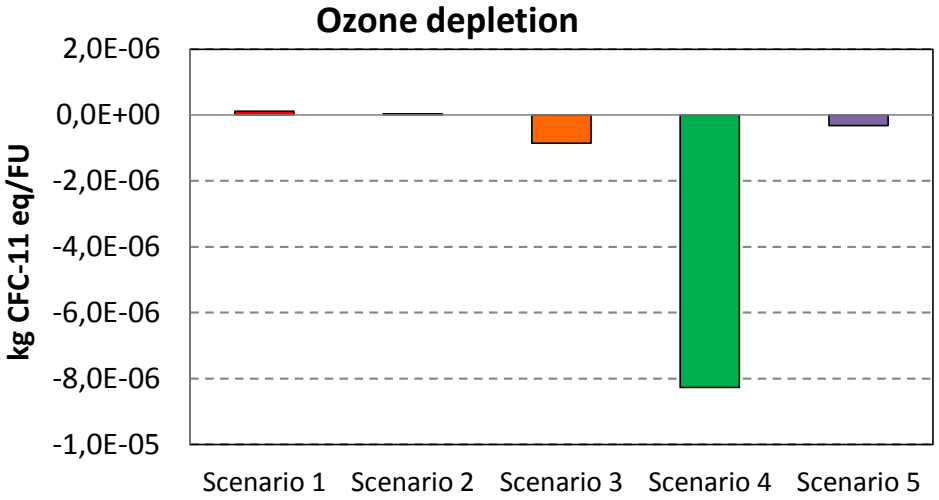
Characterisation results

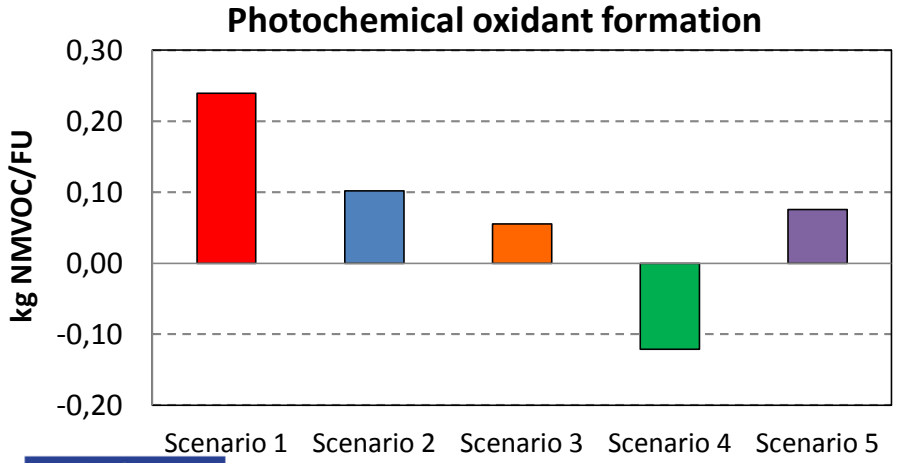
- Climate change (CC)
- Ozone depletion (OD)
- Photochemical oxidant formation (POF)
- Fossil depletion (FD)
- Water depletion (WD)
- Terrestrial acidification (TA)
- Freshwater eutrophication (FE)
- Marine eutrophication (ME)

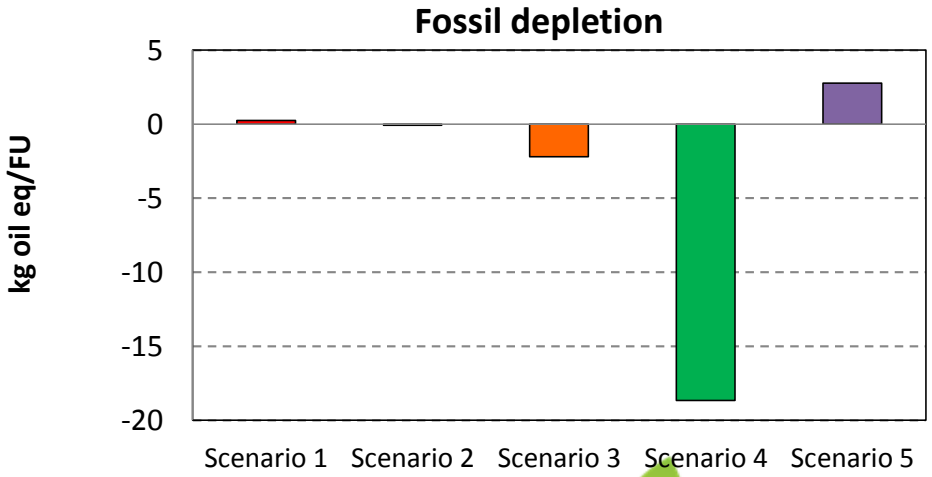


Comparative results - characterisation









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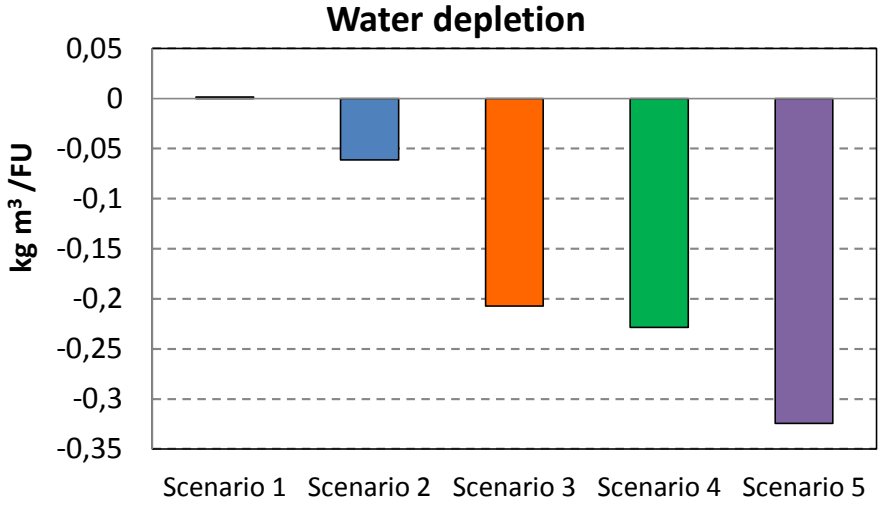
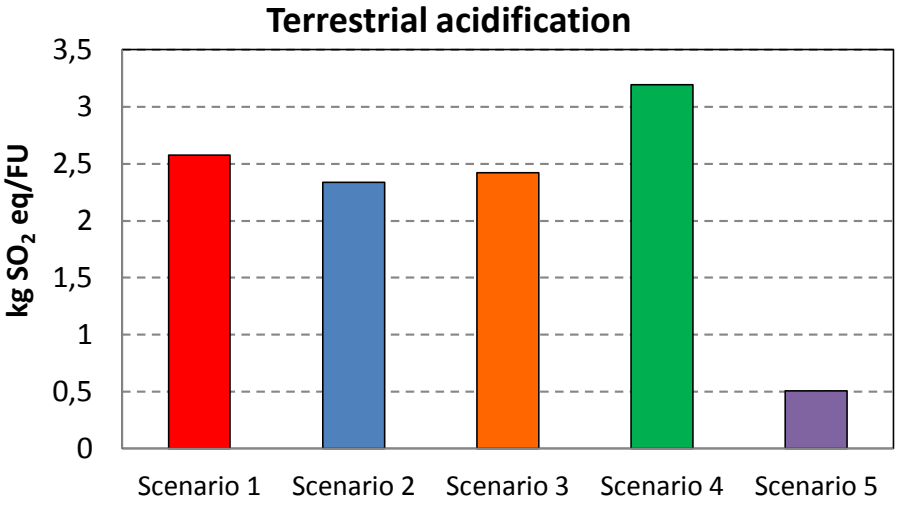
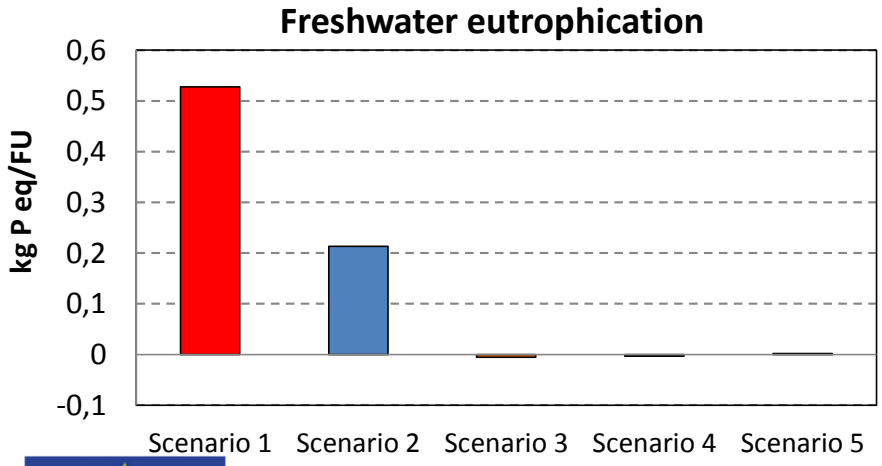
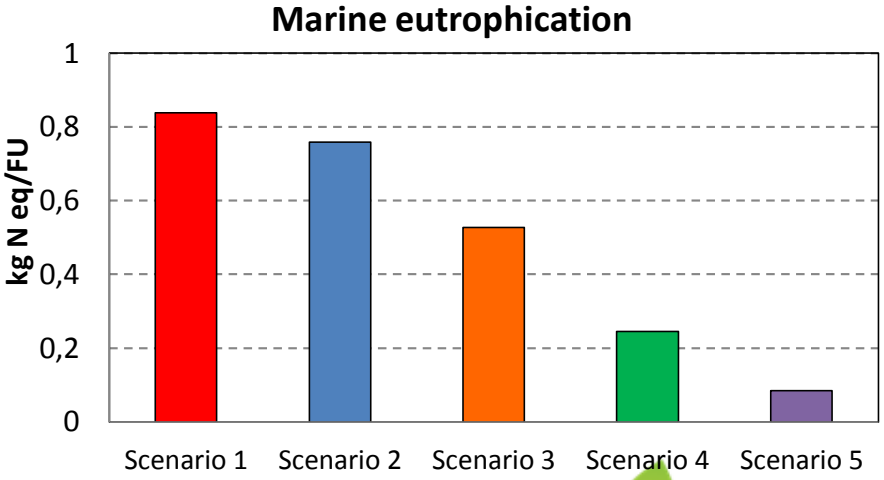
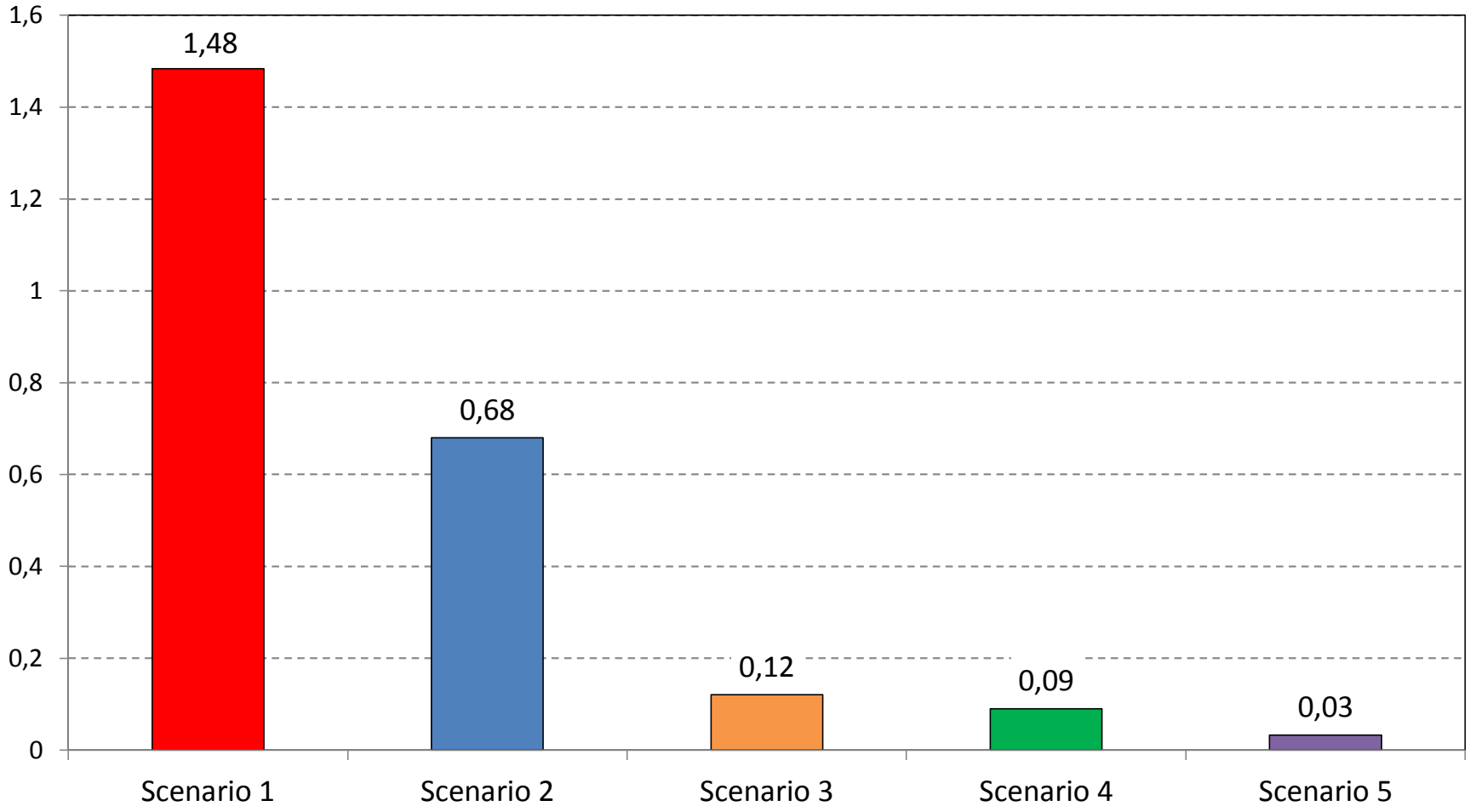








Comparative results – normalisation



Conclusions

Production of **valuable products** (bioenergy and organic fertilisers) helps to offset environmental burdens → replacement of potentially polluting processes.

- **Anaerobic lagoons** are a source of pollutants. In addition, this waste disposal process does not produce any valuable product.
- **Direct application** achieved intermediate results since a fraction of the nutrients present in the manure are uptaken by the plants and thus avoiding mineral fertilisers.
- **Biogas plant** exhibited the best environmental results in terms of energy-related categories since it avoids the production of electricity. However, environmental burdens were identified in TA due to the large content of ammonium in the digestate.
- **LiveWaste system** attained the best global environmental results since it reduces pollution and produces several valuable products from the gas, liquid and solid streams.

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