SINGLE-IMPACT FICHE
MANURE PROCESSING TECHNIQUES

IMPACT: ENERGY USE (LCA)

Data extracted in July 2021
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Note to the reader: This fiche summarises the effects of Manure processing techniques on ENERGY USE (LCA). It is based on 1 synthesis paper[1] containing 23 primary studies.

1. WEIGHT OF THE EVIDENCE

CONSISTENCY OF THE IMPACT

The effect of manure processing techniques, namely anaerobic digestion, on energy use (as calculated in LCA-modelling studies) is lacking of statistically-tested results, in the reviewed synthesis paper (**Table 1**).

The table below shows the number of synthesis papers with statistical tests reporting i) a significant difference between the Intervention and the Comparator, that is to say, a significant statistical effect, which can be positive or negative; or ii) a non-statistically significant difference between the Intervention and the Comparator. In addition, we include, if any, the number of synthesis papers reporting relevant results but without statistical test of the effects. Details on the quality assessment of the synthesis papers can be found in the methodology section of this WIKI.

- Available LCA-studies were insufficient to achieve statistically-significant results, for all considered combinations: anaerobic digestion of manure alone (mono-digestion), anaerobic co-digestion of manure and other substrates, and anaerobic digestion combined with other integrated treatment techniques (including filtration, reverse osmosis, microalgae, drying, stripping).

The selected synthesis paper included studies conducted in Europe (see **Table 2**).

Table 1: Summary of effects. Number of synthesis papers reporting positive, negative or non-statistically significant effects on environmental and climate impacts. The number of synthesis papers reporting relevant results but without statistical test of the effects are also provided. When not all the synthesis papers reporting an effect are of high quality, the number of synthesis papers with a quality score of at least 50% is indicated in parentheses. The reference numbers of the synthesis papers reporting each of the effects are provided in **Table 3**.

				Statistically tested			Non-statistically tested
Impact	Metric	Intervention	Comparator	Significantly positive	Significantly negative	Non-significant	
Decrease energy use (lca)	Energy use (LCA approach)	Anaerobic digestion	Conventional management	0	0	0	1

QUALITY OF THE SYNTHESIS PAPERS

The quality of each synthesis paper was assessed based on 16 criteria regarding three main aspects: 1) the literature search strategy and primary studies selection; 2) the statistical analysis conducted; and 3) the evaluation of potential bias. We assessed whether authors addressed and reported these criteria. Then, a quality score was calculated as the percentage of these 16 criteria properly addressed and reported in each synthesis paper. Details on quality criteria can be found in the methodology section of this WIKI.

2. IMPACTS

The main characteristics and results of the 1 synthesis paper is reported in **Table 2** with the terminology used in those papers, while **Table 3** shows the reference numbers of the synthesis papers reporting for each of the results shown in **Table 1**. Comprehensive information about the results reported in each synthesis paper, in particular about the modulation of effects by factors related to soil, climate and management practices, are provided in the **summaries of the synthesis papers** available in this WIKI.

Table 2: Main characteristics of the synthesis paper reporting effects on Energy use (LCA).

Reference number	Population	Scale	Num. papers	Intervention	Comparator	Metric	Conclusion	Quality score
Ref1	Dairy farm manure	Global	23	1) Anaerobic digestion (general); 2) Anaerobic monodigestion (only manure); 3) Anaerobic mono-digestion (only manure) + integrated treatment techniques (including filtration, reverse osmosis, microalgae, drying, stripping); 4) Anaerobic co-digestion (manure + other substrates)	No treatment	Energy use	All waste-to-energy (anaerobic digestion) pathways have uncertain effects on energy use, due to lack of data.	62%

Table 3: Reference numbers of the synthesis papers reporting for each of the results shown in **Table 1**.

[1] Synthesis research papers include either meta-analysis or systematic reviews with quantitative results. Details can be found in the methodology section of the WIKI.

				Statistically tested			Non-statistically tested
Impact	Metric	Intervention	Comparator	Significantly positive	Significantly negative	Non-significant	
Decrease energy use (lca)	Energy use (LCA approach)	Anaerobic digestion	Conventional management				Ref1

3. FACTORS INFLUENCING THE EFFECTS ON ENERGY USE (LCA)

Table 4: List of factors reported to significantly affect the size and/or direction of the effects on Energy use (LCA), according to the synthesis papers reviewed.

Factor	Reference number
NA	Ref1, Ref1, Ref1, Ref1, Ref1, Ref1, Ref1 and Ref1

4. KNOWLEDGE GAPS

Table 5: Knowledge gap(s) reported by the authors of the synthesis papers included in this review.

Ref Num	Gap
Ref1	It was not possible for the present study on account of huge differences among publications and the lack of key information. Regarding Energy use, not sufficient data were available for a proper statistical analysis for all types of anaerobic digestion, including monodigestion (only manure), anaerobic co-digestion, anaerobic mono-digestion + integrated treatment techniques (including filtration, reverse osmosis, microalgae, drying, stripping).

5. SYNTHESIS PAPERS INCLUDED IN THE REVIEW

Table 6: List of synthesis papers included in this review. More details can be found in the summaries of the meta-analyses.

Ref Num	Author(s)	Year	Title	Journal	DOI
Ref1	Zhang J., Wang M., Yin C., Dogot T.	2021	The potential of dairy manure and sewage management pathways towards a circular economy: A meta-analysis from the life cycle perspective	Sci. Total Environ. 779, 146396.	10.1016/j.scitotenv.2021.146396

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