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DECISION MAKING WITHIN WASTE MANAGEMENT: COMBINED UNCERTAINTY AND SCENARIO ANALYSIS FOR THE LIFE CYCLE ASSESSMENT OF A DANISH CASE STUDY

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Life Cycle Assessment (LCA) is often employed in decision-support contexts for identifying optimal waste management solutions. However, very often LCA is asked to quantify the environmental performance of new technologies that will operate within potentially different and uncertain background conditions. So far, the potential evolution of these background conditions has been often critical for the identification of the most favourable waste management solution (*e.g*., Fruergaard and Astrup, 2011).

The present study provides the environmental assessment of three future waste management options for residual municipal solid waste for the case study of the city of Copenhagen in 2025. The assessed waste management options are: (S1) incineration in a future facility, or incineration in a future facility with prior (S2) treatment in a future waste refinery (Tonini et al., 2013), or (S3) source segregation of organic waste for anaerobic digestion. The technological scope of the LCA was highly uncertain due to the design stage of the considered options and the hypothetical future source segregation scheme. Moreover, the choice of the background energy framework contributed with further epistemological uncertainty, since the municipality aims at being carbon neutral by 2025. So far, uncertainty in waste LCA models has been systematically assessed on a parameter level by Bisinella et al., (2016), which provided a systematic a Global Sensitivity Analysis (GSA) approach. Epistemological uncertainty in LCA has been investigated by many authors as scenario analysis (*e.g.* Spielmann et al., 2005), but so far never combined with existing uncertainty assessment methods.

The present study combined parameter uncertainty and scenario analysis across future waste management solutions and energy frameworks with the aim to provide a reliable and transparent methodology for decision making within LCA. The study was carried out with the waste-LCA model EASETECH (Clavreul et al., 2014). The GSA approach was applied to the three waste management scenarios within four consistent energy framework contexts for Copenhagen in 2025. For each context, the GSA approach provided the features of each design-stage technology contributing the most to the uncertainty in the results. In combination with the scenario analysis, the study obtained a final hierarchy of the waste management solutions with the highest probability of representing the most sustainable solution across future background energy contexts.

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