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Life Cycle Assessment of biorefineries: how robust are the results?

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Life Cycle Assessment (LCA) studies that aim at supporting decisions usually compare a number of technologies (or technological systems) within a number of framework conditions in which they might operate. Both technologies and framework conditions are subject to uncertainty, due to the data used for the model and to the assumptions taken. LCA studies should quantify and communicate this uncertainty to decision-makers. In particular, when input- and process-specific models are used (e.g. EASETECH LCA model, Clavreul et al., 2014), knowledge of influence of data and model structure allow highlighting strengths and weaknesses of the assessed technologies. However, formal guidance on how to quantify and communicate the results of comparative LCAs subject to data and framework uncertainty is currently missing in the ISO standard (Gregory et al., 2013).

The aim of this presentation is to illustrate a method that combines uncertainty analysis on model data and scenario analysis on framework conditions. The method complements and extends existing step-wise uncertainty quantification methods (Bisinella et al., 2016; Clavreul et al., 2012) using discernibility analysis, Null Hypothesis Significance Testing (NHST) and modified NHST (Mendoza Beltran et al., 2018). The method aims at providing a quantitative indication of the most robust technology within the framework conditions assessed, in a manner simply conveyable to decision-makers. The presentation shows the application of the method to a hypothetical case study that compared waste biorefinery and anaerobic digestion. The study was carried out with the LCA model EASETECH, which allowed detailed input-specific and process-specific modelling of the technologies involved.

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