

Quantifying uncertainty in sustainability assessments: from feedstock to end-of-life

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Life Cycle Assessments (LCAs) are increasingly being used to quantify the sustainability of technological solutions in decision-making contexts, for product and waste management systems. Uncertainty in LCAs is widespread, from modelling decisions (methodological uncertainties) and data quality and appropriateness (technical uncertainty) to model representativeness of the system being studied (epistemic uncertainty). However, even if practitioners are primarily aware of uncertain inputs in their models and critical modelling choices, results are rarely accompanied with uncertainty quantifications (Laurent 2014b, Lloyd and Ries).

Uncertainty quantification has been addressed in the literature by many authors, mainly suggesting tiered approaches characterized by increasing levels of complexity, where the basic steps are usually contribution, sensitivity, uncertainty analyses (Clavreul, Heijungs). Yet, due to differences and the often high complexity of formulations for uncertainty propagation in the literature, practitioners most often relegate uncertainty quantification to an early sensitivity analysis stage, and to a technology or scenario level (Laurent 2014b, Lloyd and Ries).

Sensitivity represents the evaluation of the robustness of the model only, while uncertainty of parameters and processes represents the connection from the modelled system with reality. Moreover, only rarely LCA softwares allow input-specificity, and the importance of substances and chemicals related to the input material is most often not represented. In this way, the modelled systems are further far away from reality. Lack of guidance on how to represent uncertainty.

The aim of the presentation is to provide a clear understanding of how uncertainty propagates in sustainability assessments, especially on the connection between sensitivity and uncertainty. A higher transparency would provide higher knowledge, therefore fair representation and communication of results for decision making.
