

The Role of Uncertainty in the Integration of Environmental Parameters in Energy System Modeling

Authors : Alexander de Tomás, Miquel Sierra, Stefan Pfenninger, Francesco Lombardi, Ines Campos, Cristina Madrid

Abstract : Environmental parameters are key in the definition of sustainable energy systems yet excluded from most energy system optimization models. Still, decision-making may be misleading without considering them. Environmental analyses of the energy transition are a key part of industrial ecology but often are performed without any input from the users of the information. This work assesses the systemic impacts of energy transition pathways in Portugal. Using the Calliope energy modeling framework, 250+ optimized energy system pathways are generated. A Delphi study helps to identify the relevant criteria for the stakeholders as regards the environmental assessment, which is performed with ENBIOS, a python package that integrates life cycle assessment (LCA) with a metabolic analysis based on complex relations. Furthermore, this study focuses on how the uncertainty propagates through the model's consortium. With the aim of doing so, a soft link between the Calliope/ENBIOS cascade and Brightway's data capabilities is built to perform Monte Carlo simulations. These findings highlight the relevance of including uncertainty analysis as a range of values rather than informing energy transition results with a single value.

Keywords : energy transition, energy modeling, uncertainty, sustainability

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