

Uncertainty implications of hybridization in life cycle assessment

Topic: Life-cycle analysis

Author: Sangwon SUH

Co-Authors: Jessica Perkins

Hybrid Life Cycle Assessment (LCA) uses both process-level and sector-level input-output data in a mixed-unit setting. While it was argued that iterative hybrid LCA technique efficiently reduces the uncertainty in an LCA results, empirical analyses to support the argument have been sparse. We selected an existing process LCA on jacket manufacturing, and applied the hybrid technique. Using Monte Carlo Simulation, we analyzed the effect of hybridization, performed one flow at a time, on the shape and position of the distribution in the results. The results show that hybridization effectively moves the mean and the median of the result higher, while generally maintaining the breadth of the distribution. Analyzing the contribution of each input to the overall distribution of the results, we found that the major uncertainty contributors are not necessarily from the input-output side; both process and input-output side of inputs were identified as the major contributors to the overall uncertainty of the results. We simulated the potential effect of collecting higher quality data for those key uncertainty contributors. The simulation results show that the breadth of the distribution can be narrowed efficiently by targeting the top uncertainty contributors for additional data collection and refinement. Our results suggest that iterative hybrid has the potential to improve both precision and accuracy of the results in a cost-effective manner.