Implementing Hybrid LCA Routines in the Industrial Ecology Virtual Laboratory

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Hybrid life cycle assessment (LCA) â€“ combining conventional process-based LCA and environmentally-extended input-output analysis (EEIOA) in a variety of ways â€“ has been developed for almost 40 years. The most sophisticated form of hybridization is integrated hybrid LCA as it applies a consistent mathematical framework that combines complete sets of process and IO data. However, compiling the cut-off matrices that connect the two datasets is laborious and subject to limitations based on data availability and assumptions taken, impeding a wider uptake of hybrid LCA. This study intends to alleviate these limitations by automating hybrid LCA integration in the Industrial Ecology Virtual Laboratory (IElab), a cloud-computing research platform.
IElab compiles multi-region input-output data in the form of supply and use matrices, extended with several environmental accounts. It provides the most comprehensive breakdown of the Australian economy at a level of 2214 spatial areas and 1284 economic sectors, which has enabled various detailed environmental impact analyses. Since the automation of fully integrated hybrid LCA has not been attempted on this platform before, the core and novelty of this study is the automated procedure that links the full datasets from Ecoinvent and AusLCI process inventories to IO data. This is achieved by writing and applying an algorithm that fills in missing information in the upstream and downstream matrices of the integrated hybrid table.
Once the automation has been completed, it will be used to assess the life cycle environmental impacts of the construction sector in Australia. Construction plays a dominant role in contributing to greenhouse gas emissions and material consumption in Australia, manifesting far-reaching implications on energy use, natural resources depletion and waste generation. The results will be compared with the results obtained by other pure and hybrid LCA methods, and an uncertainty analysis based on Monte-Carlo simulation will be presented.