

Quantifying regionalised embodied carbon emissions of buildings using an integrated hybrid life cycle inventory model of Australia

Topic: Life-cycle analysis

Author: Man Yu

Co-Authors: Thomas O. WIEDMANN

Although hybrid life cycle assessment (hLCA) is developed with the intention to harness the merits of both process-based LCA and environmentally-extended input-output analysis (EEIOA) to enable a specific as well as complete LCA, it has not been routinely employed to quantify embodied carbon emissions due to limitations remaining around data availability and uncertainty. This study intends to alleviate these limitations by developing, verifying and applying a hybridised life cycle inventory database in an Input-Output Virtual Laboratory (IO-VL).

The Australian Industrial Ecology Virtual Laboratory (Australian IELab) is one of the IO-VLs, which compiles the most comprehensive Australian multi-regional input-output databases based on a high-performance computing infrastructure. By merging Australian IELab with the Australian National Life Cycle Inventory database (AusLCI) in an integrated way, a virtual lab hLCA framework is established and applied to deliver a fully hybridised and regionalised LCI database covering all 4463 AusLCI processes with quantitative uncertainty information included.

With this newly developed hybridised LCI database, a streamlined hybrid analysis will be conducted to quantify the embodied carbon emissions of typical Australian buildings in different regions to demonstrate whether the accuracy of results will be significantly influenced by geographical and technological representativeness within the national boundary. These hybridised results will also be compared with the results generated out of pure process-based analysis to illustrate the comprehensiveness of hybrid LCA.

Keywords: integrated hybrid life cycle assessment, input-output virtual laboratory, embodied carbon emissions, buildings, Australia