

Variations in embodied energy and carbon emission intensities of construction materials

Abstract

Identification of parameter variation allows us to conduct more detailed life cycle assessment (LCA) of energy and carbon emission material over their lifecycle. Previous research studies have demonstrated that hybrid LCA (HLCA) can generally overcome the problems of incompleteness and accuracy of embodied energy (EE) and carbon (EC) emission assessment. Unfortunately, the current interpretation and quantification procedure has not been extensively and empirically studied in a qualitative manner, especially in hybridising between the process LCA and I-O LCA. To determine this weakness, this study empirically demonstrates the changes in EE and EC intensities caused by variations to key parameters in material production. Using Australia and Malaysia as a case study, the results are compared with previous hybrid models to identify key parameters and issues. The parameters considered in this study are technological changes, energy tariffs, primary energy factors, disaggregation constant, emission factors, and material price fluctuation. It was found that changes in technological efficiency, energy tariffs and material prices caused significant variations in the model. Finally, the comparison of hybrid models revealed that non-energy intensive materials greatly influence the variations due to high indirect energy and carbon emission in upstream boundary of material production, and as such, any decision related to these materials should be considered carefully.

Keywords

Australia; Carbon emission; Embodied energy; Malaysia; Parameter; Variation