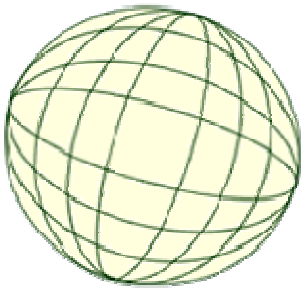
Carnegie Mellon

Greening Construction Processes Using an Input-Output-Based Hybrid LCA Model

Aurora L. Sharrard, H. Scott Matthews, Robert Ries[1], & Melissa Bilec[1]



http://gdi.ce.cmu.edu

Background

The design and construction industries have an increasing interest in and responsibility for a building's environmental impacts over its entire life cycle. Quantification of all building phases is important in life cycle assessments (LCAs), especially for the construction phase, which is often disregarded. Part of the reason previous LCAs have not advanced estimates of the construction industry's environmental impacts is the lack of data.

This research focused on creating better estimates of construction's environmental impacts by using an input-output-based hybrid LCA framework. A hybrid analysis such as this one builds on the best aspects of typical process and input-output (I-O) LCA approaches while minimizing weaknesses. The I-O-based hybrid method was chosen for the construction industry because it afforded a set framework with room for improvement. Additionally, due to open access to the Green Design Institute's Economic Input-Output Life Cycle Assessment model (EIO-LCA), creating an I-O-based hybrid LCA model was more accessible than many other hybrid options. Previous analysis of the EIO-LCA's construction sectors also provided insight into how an I-O-based hybrid model might best improve estimations of the construction industry's environmental impacts.

Statement Of Work

The major features of the I-O-based hybrid model included a new EIO-LCA hybrid tool and revised environmental vectors for the thirteen construction sectors in the 1997 EIO-LCA benchmark model. However, the primary focus of this research was new environmental impact estimates for a wide variety of construction industry case studies. The hybrid model results for these hypothetical and executed examples were compared to each other, earlier EIO-LCA estimates, and others' analyses. Implications for these and future case study results creating a more sustainable construction process are wide-ranging.

Results and Conclusions

Due to the process-level data required for each case study, results varied for each, but due to the reformulation of the environmental effects vectors, environmental impacts from each case study are generally larger than existing EIO-LCA estimates. When considering just the construction sectors, gasoline fuel use estimates, global warming potential, and particulate matter emissions increased most considerably, though carbon monoxide and volatile organic compound emissions were also amplified.

Consequently, the I-O-based hybrid LCA tool presents updated, revised, and more comprehensive estimates of the environmental impacts of construction projects than previous and existing construction LCAs. The results from the I-O-based hybrid LCA model move one step closer to modeling and understanding the environmental impacts of the construction industry in greater detail. These results can be utilized to help inform decision makers about the on-site and supply chain impacts of construction. Better comprehension will help encourage more accurate policy application regarding minimization of construction's environmental impacts, whether through the green building movement or local, state, and federal governments.

For more information contact:

Aurora Sharrard
aurorasharrard@yahoo.com

H. Scott Matthews
(412) 268-2940
hsm@cmu.edu

[1]Department of Civil and Environmental Engineering, University of Pittsburgh, Pittsburgh, PA