## Accepted Manuscript

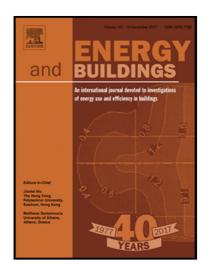
The Australian Industrial Ecology Virtual Laboratory and multi-scale assessment of buildings and construction

Timothy M. Baynes, Robert H. Crawford, Judith Schinabeck, Paul-Antoine Bontinck, André Stephan, Thomas Wiedmann, Manfred Lenzen, Steven Kenway, Man Yu, Soo Huey Teh, Joe Lane, Arne Geschke, Jacob Fry, Guangwu Chen

 PII:
 S0378-7788(17)32583-5

 DOI:
 10.1016/j.enbuild.2017.12.056

 Reference:
 ENB 8249



To appear in: *Energy & Buildings* 

Received date:31 July 2017Revised date:20 December 2017Accepted date:22 December 2017

Please cite this article as: Timothy M. Baynes, Robert H. Crawford, Judith Schinabeck, Paul-Antoine Bontinck, André Stephan, Thomas Wiedmann, Manfred Lenzen, Steven Kenway, Man Yu, Soo Huey Teh, Joe Lane, Arne Geschke, Jacob Fry, Guangwu Chen, The Australian Industrial Ecology Virtual Laboratory and multi-scale assessment of buildings and construction, *Energy & Buildings* (2018), doi: 10.1016/j.enbuild.2017.12.056

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

## The Australian Industrial Ecology Virtual Laboratory and multi-scale assessment of buildings and construction.

Timothy M. Baynes<sup>a</sup>\*, Robert H. Crawford<sup>b</sup>, Judith Schinabeck<sup>c</sup>, Paul-Antoine Bontinck<sup>b</sup>, André Stephan<sup>b</sup>, Thomas Wiedmann<sup>c</sup>, Manfred Lenzen<sup>d</sup>, Steven Kenway<sup>e</sup>, Man Yu<sup>c</sup>, Soo Huey Teh<sup>c</sup>, Joe Lane<sup>f</sup>, Arne Geschke<sup>d</sup>, Jacob Fry<sup>d</sup>, Guangwu Chen<sup>c</sup>

## Affiliations

a) Land and Water Division, Commonwealth Scientific and Industrial Research Organisation, Sydney, Australia

b) Melbourne School of Design, The University of Melbourne, Australia

c) Sustainability Assessment Program, School of Civil and Environmental Engineering, UNSW Sydney, Australia

d) Institute for Sustainability Analysis, School of Physics, The University of Sydney, Australia e) School of Chemical Engineering, The University of Queensland, Australia

f) Dow Centre for Sustainable Engineering Innovation, The University of Queensland, Australia

\* Corresponding author: <u>tim.baynes@csiro.au</u>, ph +61 (0)2 9490 8824 CSIRO, Land and Water PO Box 52 North Ryde, NSW 1670, Australia

## Abstract -

As global population and urbanization increase, so do the direct and indirect environmental impacts of construction around the world. Low-impact products, buildings, precincts and cities are needed to mitigate the effects of building construction and use. Analysis of embodied energy and greenhouse gas (GHG) emissions across these scales is becoming more important to support this direction. The calculation of embodied impacts requires rigorous, flexible and comprehensive assessment tools. Firstly, we present the Australian Industrial Ecology Virtual Laboratory (IELab) as one such tool discussing its structure, function and wide scope of application. Secondly, we demonstrate its potential high level of resolution in a case study: assessing embodied GHG emissions in an aluminium-framed window by combining productspecific life-cycle inventory data. The input-output analysis at the core of the IELab is mathematically comprehensive in the assessment of direct and indirect impacts and the tool can be applied at a range of scales from building component, to precincts and cities, or to the entire construction industry. IELab uses a flexible formalism that enables consistent harmonisation of diverse datasets and tractable updating of input data. The emissions and energy database supporting IELab has detailed data, aligning with economic accounts and data on labour, water, materials and waste that enrich assessment across other dimensions of sustainability. IELab is a comprehensive, flexible and robust assessment tool well positioned to respond to the challenge of assessing and aiding the design of a low-impact built environment.

Keywords: input-output analysis, embodied energy, embodied emissions, environmental footprint, low-impact buildings, building component

Download English Version:

https://daneshyari.com/en/article/6728761

Download Persian Version:

https://daneshyari.com/article/6728761

Daneshyari.com