A Primer on Environmental Product Declarations and Life Cycle Assessment of Buildings

OVERVIEW

The number of green building rating standards available to building developers and owners today is evidence of a significant movement to reduce environmental impacts associated with buildings. While the objective of creating “green buildings” is laudable, the current standards for evaluating these projects fail to quantitatively account for impacts over an entire lifetime and, therefore, offer an incomplete picture.

Quantitative evaluations of a building’s environmental impacts must be done using life cycle assessment (LCA), which is a method that quantifies the impacts of resources and emissions associated with construction and operation of buildings. It can be challenging to compare the results of building LCAs because of differences in scope and analysis methodologies. This primer is intended to clarify the scope of different LCAs, their purposes, and when they can be used for comparisons.

DEFINITIONS

- **Environmental product declaration (EPD):** a life cycle assessment of a building product that has been conducted by a manufacturer in accordance with a product category rule (PCR). The scope includes the materials used and the manufacturing of the product. Results are usually made publicly available.
- **Whole building LCA:** a life cycle assessment of the building products and the construction of the building. Also referred to as the embodied impact of the building. It does not include building operation.
- **Whole building and whole life LCA:** a complete life cycle assessment of the building, including building products, construction, operation, and end-of-life.

Phases of the building life cycle and the scope of building product EPDs, whole building LCAs, and whole building and whole life LCAs.

Building product EPD	✓			
Whole building LCA	✓	✓		✓
Whole building & whole life LCA	✓	✓	✓	✓

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COMPARISONS

It is tempting to compare the results of EPDs and LCAs conducted by different entities. However, there are several challenges associated with comparing results due to differences in approaches[1]. **Comparisons among EPDs and LCAs can only be made when they are conducted for products or buildings that serve the same function using the same approach[2].**

The current system for EPDs is geared towards compliance with the Leadership in Energy and Environmental Design (LEED) building rating system, which offers points for buildings that use products that have an EPD. The points are intended to encourage manufacturers to measure the environmental footprint of their products. There is no requirement for manufacturers to lower their footprint, nor is there a requirement for a footprint threshold. This is because the current system does not require EPDs to be based on the same PCR or approach.

If a system were in place to ensure that EPDs used the same approach (e.g., using a single software tool and data), EPDs could be used to make *vendor decisions*. That is, selection of vendors for products that have already been specified in the design. Similarly, if an LCA is conducted that includes multiple design alternatives using a single approach, the LCA can be used to make *design decisions.* That is, selection of different product types (e.g., materials or energy systems) for use in the design.

Acceptable uses for comparative EPDs and LCAs depending on the approach used.
Red text indicates approach not currently in place.

Approach for Analysis of Alternatives	Building Product EPD	Whole Building LCA	Whole Building & Whole Life LCA
Different	LEED points	None	None
Same	LEED points and *vendor* decisions	LEED points and *design* decisions*	LEED points and *design* decisions

*Design decisions can only be made using whole building LCA if design alternatives have equivalent operational requirements (e.g., energy consumption)

SUPPORTING PUBLICATIONS

A complete set of publications may be found at: http://cshub.mit.edu/buildings/lca

Miller, T. Reed; Gregory, Jeremy; and Kirchain, Randolph. "Critical Issues When Comparing Whole Building & Building Product Environmental Performance." MIT Concrete Sustainability Hub, 2016.

Ghattas, Randa; Gregory, Jeremy; Noori, Mehdi; Miller, T. Reed; Olivetti, Elsa; and Greene, Suzanne. "Life Cycle Assessment for Residential Buildings: A Literature Review and Gap Analysis." MIT Concrete Sustainability Hub, Revised 2016.

Ghattas, Randa; Gregory, Jeremy; Miller, T. Reed.; and Kirchain, Randolph. "The decision-making process in the design of residential structures," MIT Concrete Sustainability Hub, March 2015.

Ochsendorf, John; Keith Norford, L; Brown, D; Durschlag, H; Hsu, S.L; Love, A; Santero, N; Swei, O; Webb, A; and Wildnauer, M. "Methods, Impacts, and Opportunities in the Concrete Building Life Cycle." MIT Concrete Sustainability Hub, 2011.

[1] See the CSHub report on *Critical Issues When Comparing Whole Building & Building Product Environmental Performance* for further details.
[2] In this case, the *approach* is about more than following the same product category rule. It includes scope, data, models, and assumptions, not all of which are defined in a PCR.

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