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Insights on environmental product declaration use from Canada's first LEED® v4 platinum commercial project

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ABSTRACT

Industry adoption of environmental product declarations (EPDs, an internationally standardized document providing quantified environmental impacts over the life cycle of a product) is increasing as LEED® v4 material credits allow reliance on their content. This raises the question as to whether this reliance is appropriate, as well as larger questions about how it is affecting the wider construction industry. A case study is presented to investigate the use of EPDs in construction projects through the experience and perspective of members of three major stakeholder groups: Owner/Client, Designer, and Contractor. This includes the motivations for using EPDs, potential concerns with the methodology and creation of EPDs, the reliance of the information within EPDs and determining appropriateness of this reliance through the various stages of project delivery. Findings indicate that EPD impacts on the timeline is a key concern from the contractors while limited transparency of EPD development processes was a key concern for designers. Stakeholders noted that the integrative design process was critical to the success of this project, avoiding long lead-times and allowing for close review of specifications.

1. Introduction

As building operating energy intensity decreases, the initial and recurring embodied energy in buildings requires increased attention (de Klijn-Chevalerias and Javed, 2017; Means and Guggemos, 2015). The Leadership in Energy and Environmental Design rating system Version 4 (LEED® v4) (USGBC, 2014), responds to this by placing greater emphasis on the environmental impact of materials during construction and throughout the life-cycle of the building and includes a credit designed to encourage adoption of environmental product declarations (EPDs). Such inclusion in sustainability rating schemes has contributed to the increase in EPD adoption globally (Minkov et al., 2015).

This paper presents a case study showcasing the benefits and challenges of using materials with EPDs from the viewpoints of three stakeholders on a Canadian LEED® v4 project: the Owner/Client (Canada Green Building Council, CaGBC), the Designer (DIALOG), and the Contractor (Ledcor). The study includes the motivations for using EPDs, potential concerns with the methodology and creation of EPDs and the reliance on the information within EPDs, and evaluates the appropriateness of this reliance in design and construction.

2. Context

2.1. Materials and the built environment

The emissions stemming from the embodied and operational energy use of the built environment has a considerable effect on the natural environment. The residential and commercial building stock in Canada accounts for 33% of the country's energy use, 50% of the extracted natural resources, 25% of landfill waste, 10% of airborne particulates, and 35% of greenhouse gas emissions (ISED Canada, 2015), producing 87.2 megatons of CO_2 equivalent in 2014. This is a 20% increase from emissions reported in 1990 (ECC Canada, 2016). There is a pressing need to reverse the trend of emissions resulting from building construction and operation, and improving the performance of the building stock has been identified as one of the most cost-effective mitigation options of any sector (BPIE, 2011).

Materials used in building construction can help alleviate this situation in multiple ways. First, such materials are the most significant component of embodied energy in buildings (de Klijn-Chevalerias and Javed, 2017). Second, building products with lower environment impact can reduce material use and solid waste by using reclaimed, recycled, or reused material, and reduce greenhouse gas emissions

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Nomenclature

CaGBC	Canada Green Building Council
EPD	Environmental product declaration
IDP	Integrated design process
ID + C	Interior Design + Construction (LEED® rating system type)
ISO	International Organization for Standardization
LCA	Life cycle analysis
LEED®	Leadership in Energy and Environmental Design
PCR	Product category rules

through reductions directly at the manufacturing plant and/or through construction processes. One of the challenges the construction industry currently faces is to be able to identify construction products to assist with this, transparent information designers can trust.

2.2. Life cycle assessment

Life Cycle Assessment (LCA) is the process by which the global and regional environmental impacts of a product through its entire life cycle are quantified. An LCA study can be applied to building materials to decide whether it is preferable for the project or not, based on resource use, human health, and ecological consequences. Jönsson (2000) completed a comparative study of six environmental assessment approaches for flooring products: an LCA study, an eco-label; two eco-guides; a Type II environmental claim (product declaration); and an environmental concept. The study noted a need to balance between conflicting priorities in two areas: (1) high transparency vs. keeping trade secrets confidential, and (2) highly detailed and potentially difficult to interpret comprehensive results vs. highly aggregated results that could be misused due to limited background information. One of the main takeaways from this comparison is that LCA data and the environmental claims that use LCA data are the only types of assessments that provide quantitative data; all other assessment schemes or tools can only provide qualitative data. In this context, specific data provides much more useful results than generic data, but only when available and relevant to the specific context under consideration. Jönsson (2000) concluded that a standardized procedure would offer improved credibility but at the cost of low flexibility, which is a key issue in this discourse.

2.3. Definition of EPDs

Three types of environmental product labels based on LCA data exist within ISO's 14000-series:

a Type I: Governed by ISO 14024, these are for awarded by a third party claiming an environmental preference for a product based on a set of predetermined criteria (ISO, 1999). Examples of this are FSC Chain of Custody certification or the EU Ecolabel.
b Type II: Governed by ISO 14021, these are for self-declared environmental claims. This standard mandates the inclusion of certain information within the claim.
c Type III, often referred to as EPDs: Governed by ISO 14025, these are third-party verified transparent claims that provide quantified life-cycle information about a product. This article focuses on this specific version of environmental claims.

The latter are documents which provide quantified environmental information and are independently verified over the life cycle of a specific product. The impact categories and their values stated on EPDs are determined through a process of life cycle analysis (LCA), a methodology that determines the environmental impact of processes and ingredients through the cradle-to-grave product life cycle (Ortiz et al., 2008). To enable comparison between products, EPDs are written to product category rules (PCRs), which define the criteria for a specific product category and establish the requirements that must be achieved when creating an EPD for a product (Fet et al., 2009), including criteria to be used in the LCA of any product in the category. However, there is no limitation to who can operate as a program operator and create and develop PCRs (Schmincke and Grahl, 2007), causing significant variation between these rules. Ideally, EPDs enable fair comparison between similar products adhering to comparable PCRs and summarize third-party verified LCA results. A simplified version of the process for creating and publishing an EPD for a product is presented in Fig. 1.

2.4. ISO 14025 and other associated standards and documents

2.4.1. Product category rules

Product Category Rules (PCRs) are intended to clearly define quantification rules to ensure consistency across multiple claims (Wu et al., 2014) and are governed by the same international standards that govern EPDs, summarized in Table 1. The Guidance for Product Category Rule Development (Ingwersen and Subramanian, 2014) provides guidance, insight, and instruction to current and potential program operators on how to prepare, publish, and maintain PCRs, with the aim to develop PCRs in a consistent manner such that they can be used to support claims based on multiple standards (PCR GDI, 2013). This document is not an international standard and not does not attempt to pre-empt ISO 14025 or any other standard regarding environmental claims. Instead, its purpose is to fill knowledge and experience gaps in guidance on operating an EPD program and make the claims process easier, less costly, and less time-intensive. The guidance document does this by supporting the adaptation of PCRs and improving comparability of claims through the verbiage and content within the document. The first version of the document was published in 2013 and is described as a living document that will continue to improve as EPD use increases.

2.5. Environmental product declarations

There are no standards or guidance documents that focus solely on EPDs. Instead, standards and other related documents usually govern PCRs, and EPDs are governed by extension. Table 1 summarizes the most common relevant standards, their jurisdiction, and scope.

Additional standards are also relevant, such as PD CEN/TR 15941:2010 (CEN, 2010), which provides guidance for the selection and use of generic data within the LCA for an EPD and serves as a supporting document for EN 15804.

A North American standard of similar intent to EN 15804 is currently under development. It is a revision of ISO 21930, with a proposed renaming to "Sustainability in buildings and civil engineering works – Core rules for environmental declaration of construction products and services used in any type of construction works". The draft was published February 11th, 2016 and public release was anticipated in pril 2017 (ISO, 2017).

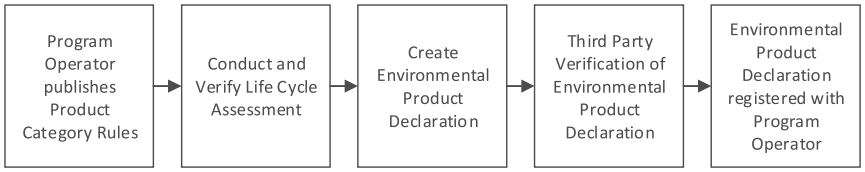

Fig. 1. Simplified EPD Process.