Limitations of EPDs for product comparisons

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EPDs are an exciting trend but be careful not to overestimate their utility. This briefing note explains the limitations of EPDs for product comparisons or whole-building LCA.

The publication of environmental product declarations (EPDs) is a relatively new trend in North America that has been escalating rapidly. This is likely motivated by a general interest in “transparency” in the sustainability community, and by market incentives like a credit in LEED® for building design projects that accumulate enough EPDs. More recently, the Buy Clean California Act¹ is providing additional impetus for EPDs in the marketplace.

The growth in EPDs is a promising trend, because this is a sign that industry is using life cycle assessment (LCA) more often. LCA is an important tool for discovering opportunities to reduce potential environmental impacts of products.

Market demand and policy have resulted in thousands of EPDs currently available globally², most of which are easily accessible from on-line sources. As a consequence, EPDs may be seen as a convenient source for LCA data. Can designers choose products by comparing EPDs, or even use EPDs as a short-cut route to LCA for a complex assembled product like a whole building? Probably not, as explained in this briefing note.

Understanding EPDs
An EPD is a simple summary of the life cycle assessment results for a product, intended for public release. Underpinning this typically short document is an extensive LCA study and a lengthy report with all the technical details. Full LCA reports are less frequently made available to the public.

The limitation of EPDs for product-to-product comparisons or as a data source for whole-building LCA modeling stems from the fact that EPDs are static documents: they represent a fixed snapshot for the product at a particular time, for a particular declared or functional unit, electricity grid, location and LCA method. Each EPD is based on a specific methodology and scope as defined in its respective product category rules (PCR). EPDs do not report life cycle inventory (LCI) flow data and therefore are not adjustable for regional differences, differing data quality and sources, or varying product compositions.

The core issue here is comparability. If we want to compare two different product EPDs, or if we want to use EPDs to calculate whole-building impacts, the EPDs need to be consistent. Using EPDs in this way is possible only if a large number of criteria are met. These criteria are defined in ISO and EN standards

¹ This legislation requests facility-specific EPDs for certain products used on state-funded infrastructure projects. In 2020, EPDs will be required for those products, and in 2021 products must not exceed a to-be-established limit on global warming potential (carbon footprint). https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act
and other relevant documents 3,4,5,6,7. According to one review of the criteria, they are currently “extremely difficult to achieve...this means it is virtually impossible to create a database of construction products that can be said to be comparable according to the standards. This has considerable implications for the assessment of buildings from EPD data.” 8

Consider for a moment two EPDs for the same product completed using the same product category rules (PCR). The PCR will set out the required LCA scope (typically here in North America, the system boundary is only the product stage, that is, modules A1 to A3). The PCR will also specify what foreground gate-to-gate data need to be accounted for, but the PCR rarely sets out rules for the background data other than its vintage (i.e., less than 10 years old). And that creates a big opportunity for variability. Differing vintage and source background data sets can lead to very different results even for the same product. For example, was the study based on a regional or national electricity grid, is it representative of a 2019 or 2009 electricity profile, is it derived from the USLCI database or based on commercial LCA databases such as GaBi or ecoinvent, and so on.

All of these background data assumptions will lead to differing outcomes and in some instances significantly different results for the same product – and this is just one component of the background data (the electricity grid). There are sometimes hundreds of upstream data sets needed to complete even a simple product LCA (raw material extraction and processing, inbound transportation, waste treatment, etc.).

Without a consistent background dataset, even intra-industry EPDs are difficult to compare, let alone comparisons across competing industries. This is why optimal whole-building LCA does not rely on EPDs, but rather goes back to the underlying LCI data. Here’s an example. Recently, the Cement Association of Canada (CAC) received a request from thinkstep to have their cement EPD included in Tally. But Tally’s datasets are built on GaBi background data, while the CAC’s cement EPD uses ecoinvent datasets in the background. Gabi and ecoinvent apply different assumptions and use different methods when constructing their respective datasets, which means CAC’s EPD data isn’t compatible with Tally. So, thinkstep requested the underlying LCA report and LCI datasets so they could properly model and emulate the CAC cement EPD results such that they were consistent with other product LCAs supported in Tally. We do the same when importing Gabi-based data into our own Impact Estimator software.

Consider another example from the world of pavements. Both concrete and asphalt have their own PCRs, which differ in declared unit, scope and methods. This means concrete and asphalt EPDs cannot be compared to each other. Both PCRs are similarly limited to the production of each material type and therefore are truncated LCAs offering an incomplete LCA. In addition, the National Asphalt Pavement

3 ISO 21930:17, Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services (see section 5.5).
4 EN 15804:2012+A2 2019, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products (see section 5.3).
5 ISO 14025:2006, Environmental labels and declarations — Type III environmental declarations — Principles and procedures (see section 5.6).
8 For details, see: Assessing the environmental impacts of construction – understanding European Standards and their implications. Building Research Establishment (BRE) (no date – possibly 2016).
The Association’s PCR⁹ explicitly complies with EN 15804:2012+A1:2013, while the NSF’s PCR¹⁰ for concrete complies with ISO 21930:2017. Such diverging PCRs makes comparability more difficult as they require different reporting metrics and impact characterization methodologies¹¹. Until PCRs are harmonized, the value of EPDs will be limited to intra-industry analysis, i.e., procurement within a specific product type or category. But, as noted above, this too may still be problematic.

Comparability issues are being studied and reported, which will ideally lead to improvements. For example, a 2017 study¹² found that over 60% of the time EPD comparisons within the same PCR were invalid due to scope and methodology issues not addressed in the PCR.

**Implications for whole-building LCA**

The non-comparability of EPDs introduces a degree of uncertainty that gets magnified when multiple EPDs are combined for a whole-building LCA. In that case, an attempt is made to add up a collection of EPDs from various sectors or manufacturers based on varying PCRs using varying background data sources and vintages. Clearly, this will yield whole-building LCA results of questionable accuracy and perhaps lead to the unintended consequence of a building that is worse than business-as-usual.

In addition, most EPDs only cover the manufacturing stage in the life cycle (modules A1 to A3). Whole-building LCA requires consideration of the remaining life cycle stages: the downstream scenario modules (A4-A5, B1 to B7, C1 to C4 and D). This includes, for example, maintenance, replacement and end-of-life potential impacts for products. The standard EN 15804 clearly states that products cannot be compared outside of a whole building life cycle context¹³.

A full cradle-to-grave LCA model requires a consistent overarching methodology with an equally consistent background, foreground and downstream scenario database for it to provide meaningful results. This kind of consistency is provided by whole-building LCA software tools that rely on life cycle inventory data, such as the Athena Impact Estimator and Tally. In addition, whole-building LCA tools enable material considerations within the holistic context of the whole building, so that trade-offs are visible, burden-shifting is avoided, and materials are gauged at the proper scale.

Some whole-building LCA software tools might incorporate EPDs in the background, in spite of the issues discussed in this briefing note. In that case, it is incumbent upon those tool providers to transparently communicate in detail their method for validating, harmonizing and regionalizing EPDs, and their method for incorporating cradle-to-gate EPDs within their cradle-to-grave LCA method. Users of whole-building LCA tools that rely on EPDs should look for clear documentation on method and validation and should consider seeking third-party LCA expertise in assessing reliability of results.

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¹¹ Note that some metrics are consistent, like GWP.


¹³ “Comparison of the environmental performance of construction products using the EPD information shall be based on the product’s use in and its impacts on the building, and shall consider the complete life cycle (all information modules). EPDs that are not in a building context are not tools to compare construction products and construction services.” EN 15804:2012+A2 2019, Section 5.3.
In summary, EPDs are currently too inconsistent for reliable side-by-side product comparisons (although comparability is theoretically possible if criteria are met, as previously discussed). The inconsistencies across EPDs are potentially magnified when multiple EPDs are added together for a short-cut whole-building LCA result. Plus, the missing life cycle phases in EPDs add further uncertainty. Until there is better harmonization in EPDs, evaluating the environmental impact of material decisions in a building design project is best done within a whole-building LCA software tool that relies on LCI data and consistent LCA methodology and scenarios.

Glossary

**Environmental Product Declaration** (EPD) is document that summarizes the results of an LCA study. It is created according to the instructions in a relevant PCR, and it is typically third-party verified.

**Life cycle assessment** (LCA) is a multi-step procedure for calculating the lifetime environmental impact of a product or service. The complete process of LCA includes goal and scope definition, inventory analysis, impact assessment, and interpretation. The process is naturally iterative as the quality and completeness of information and its plausibility is constantly being tested.

**Life cycle inventory (LCI)** is the data collection portion of LCA. LCI is the straight-forward accounting of everything involved in the “system” of interest. It consists of detailed tracking of all the flows in and out of the product system, including raw resources or materials, energy by type, water, and emissions to air, water and land by specific substance. This kind of analysis can be extremely complex and may involve dozens of individual unit processes in a supply chain (e.g., the extraction of raw resources, various primary and secondary production processes, transportation, etc.) as well as hundreds of tracked substances.

**Product Category Rules** (PCR) is a document containing requirements and guidelines for conducting LCA and creating EPDs for products within a specific category (e.g., structural lumber, carpet, etc.).

**About the Athena Institute**
The Athena Sustainable Materials Institute is a non-profit research group that advocates for environmental performance measurement and accountability in the built environment. The Athena Institute is the North American leader in LCA for construction and its materials and has been providing ground-breaking research and free resources since 1997. Visit our website to learn more about us and how you can help.

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