

# Methodological issues of LCA application to building sector: challenges, risks and opportunities

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## 1. Introduction

Sustainability criteria application must be understood as the essential procedure for the necessary restructuring of the construction sector, which mobilizes 10% of the world economy, accounting for more than one third of the consumption of the world's resources, around 30 - 40% of energy consumption and emissions of greenhouse gases, 30-40% of waste generation and 12% of all the fresh water use in the world.

Nowadays there is a wide range of initiatives and instruments for sustainable construction, innovation, rethinking the value chain and international competition. However, initiatives pursue different objectives; there are large disparities between countries and still significant room for improvements. Internationally and specifically in Europe there is an intensive standardisation process going on aiming at structuring building environmental assessment as well as the contents of building product information. In this sense, it is remarkable the work of CEN/TC 350, which is providing a reference framework and developing voluntary horizontal standardised methods for the assessment of the environmental performance of new and existing buildings.

In a previous work, more than 80 case studies have been reviewed in order to describe and classify the results of the LCA studies regarding their goal and scope and their practical methodology implications, by discussing the variability associated to main hypotheses such as the functional equivalent selected and the choice of impact categories [1]. This review allowed to establish conclusions about the degree of consistency with the future regulatory environment and to identify two priority needs for action:

-The need for harmonization, given the strong methodological inconsistencies detected that prevent the comparison of results obtained in assessment works.

-The need for simplification, given the inherent complexity of the assessment, so that, while maintaining the utmost rigor, make the practical application feasible in the different contexts.

## 2. Methodology

The thread of the present research sets out from the need to establish a description of the basic features and limitations of the methodology of Life Cycle Assessment (LCA) applied to building sector. As a next step, the research focuses on the analysis of the work of CEN/TC 350 and Joint Research Centre - Institute for Environment and Sustainability (JRC-IES), which has the mission is to provide scientific-technical support to the European Union's Policies. A critical review of the works that have been developed in recent years is conducted, proceeding to deepen the state of the art of LCA applied to the building sector. Finally, the main aspects related to future prospects and lines of action that have been identified as priorities are outlined.

## 3. Results and discussion

### 3.1. Framework for the assessment of environmental performance

The first objective of the CEN/TC 350 is to develop common rules for the assessment of the environmental performance of new and existing buildings within the framework of integrated performance of buildings. Comparisons between the results of assessments of buildings or assembled systems (part of works) shall only be made on the basis of their functional equivalency. This requires that the major functional requirements shall be described together with intended use, and the relevant specific technical requirements. Remarkably, the building climate context is a determining factor on which guidelines of classification should be established in order to analyze the environmental performance: valuation of the environmental of performance of the building can not be done in isolation without regard to specific geographical context. It should be noted that the standards developed under CEN 350 framework do not set the rules for how different building assessment schemes may provide valuation methods; nor do they prescribe levels, classes

or benchmarks for measuring performance. Providing guidelines and normalization factors that allow the identification of the relevance of the environmental impacts calculated in the assessment is a priority task to be performed by the scientific community towards a tangible reduction in overall environmental impact.

### **3.2. Recommendations for Life Cycle Impact Assessment (LCIA)**

The ILCD Handbook is supposed to be in line with international standards, but in terms of recommendations on models and characterisation factors that should be used, there was a discrepancy between "ILCD Handbook - Recommendations for LCIA in the European context" [2] and the EN 15804 standard [3], which created confusion. The main change introduced by JRC is to recommend a methodology which allows describing Acidification and Eutrophication Potentials on a regional level. The solution adopted by WG3 was to delete the requirement of always following the updated versions of JRC /ILCD handbook and use a dated version of the CML characterisation factors (CFs). In this sense, it is remarkable that CML CFs are well integrated in LCA calculation tools and data is easily provided. Moreover, a change in LCIA methodology and subsequently in the standard's requirements could confuse the industry and delay EPD provision (an overall delay in implementing green building assessment may result). On the other hand, it is important to be aware that the methodology is not based on the latest established scientific results so a future revision should be addressed.

### **3.3. Environmental Product Declaration (EPD)**

The work of CEN/TC 350 will be used when mandates to cover the Basic Requirements for Construction Works (BRW) will be issued. Manufacturers are requested to give environmental information in a form of Environmental Product Declaration (EPD) according to the unified European method by CEN/TC350. Environmental product characteristics derived from BWR3 and BWR7 should become "essential product characteristics" and part of Declaration of Performance as soon as any Member State or the European Commission (e.g. caused by other directives) have requirements to declare the defined environmental indicators or they set actual limit values to the buildings on the life cycle basis, or on the products in its intended use (as part of the works). Guidance should be developed by the CEN Construction Sector Network, in conjunction with CEN/TC 350, to ensure consistency between product standards and the standards for assessment of sustainable construction. Technical Committees (TCs) have been urged to develop their own Product Category Rules, as defined in EN 15804, so that EPD can be implemented consistently.

## **4. Conclusions and final remarks**

LCA has been traditionally concerned with product design, but by limiting the functional unit of an LCA to a building material or component, a number of functions that should be provided by buildings cannot be properly taken into account: decisions based on isolated LCA for materials or components might lead to erroneous conclusions. The value of an EPD can only be assessed properly in the context of the performance of a whole construction work.

More than ever, it can be stated that the application of LCA is fundamental to sustainability and improvement in building and construction. The definition of methodological issues must integrate general principles of LCA methodology with the protocol established in the European standard, also considering the regulatory standards to construction practices in the different contexts in order to make its implementation possible. Adapting "real life" to the new normative environment is a challenge we are facing nowadays. By systematically directing environmental issues towards standardization, the environmental impacts of products and services could therefore be reduced. There is no need for development of new indicators or methodologies for measuring and communicating environmental performances of construction products and works. There is a strong need for coordination and joint efforts for better synergies.

## **5. References**

- [1] Rivela B, Bedoya C, García-Santos A. The need of harmonization: From building product information to the whole process of the construction. In: Proceedings BSA 2012 - 1st International Conference on Building Sustainability Assessment; 23-25 May; Porto, Portugal: Green Lines Institute for sustainable Development. p 471-480.
- [2] European Commission -JRC-IES. 2011. International Reference Life Cycle Data System (ILCD) Handbook- Recommendations for Life Cycle Impact Assessment in the European context. EUR 24571 EN.
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