N°120
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Newsletter
Life Cycle Assessment

SCORE LCA

Scientific publications

Recent advancements in prospective life cycle assessment (pLCA): current practices, trends, and implications for future research

Prospective Life Cycle Assessment is gaining interest due to its inherent future-oriented feature, which is an essential component of every **decision-oriented life cycle assessment.** Previous studies have highlighted **challenges in conducting pLCA for emerging technologies**, categorizing them into issues of **comparability**, **data availability, scaling, and uncertainty** and propose general frameworks to address these challenges. Accordingly, the application of pLCA is rapidly growing in recent years, with **emerging methods addressing the limitations, and improving pLCA**.

This review study aims to compile and analyze emerging pLCA methods from scientific literature, identifying best practices and limitations to guide future research. It discusses **methodological advancements** in pLCA, including **prospective life cycle inventory (pLCI) database**, **foreground modeling**, **scenario development** and prospective life cycle impact assessment, offering insights for practitioners.

While changes in background systems are increasingly addressed in pLCA studies, some, particularly earlier or less systematic ones, fall short of fully integrating nuanced future scenarios. The reviewed studies highlight that incorporating **future scenarios related to the transformation of energy, material, transport, and industrial systems** can significantly **influence** LCA outcomes, reinforcing the importance of explicitly integrating such scenarios into pLCA to ensure reliable and meaningful results. To ensure robust LCA studies, it is important to consider the use of pLCI databases, accounting for varying technology maturity levels, their improvement and diffusion rate, and incorporating spatial considerations. Yet, integrating pLCI databases with standard LCA tools remains complex, with a **lack of practitioner guidance**. Moreover, the interlinkage between climate change and various impact categories is a key source of uncertainty in future assessments, highlighting the **need to improve both prospective inventory modeling and impact assessment**.

The findings call for future research to further explore the **spatiotemporal effect** of climate change on pLCA quantification, developing future-oriented characterization factors, expanding pLCI databases, as well as enhancing the applicability of pLCA studies through the integration of new analytical tools and models.

Absolute sustainability assessment of the Danish building sector through prospective LCA

How a combination of prospective life cycle assessment (**pLCA**) and absolute environmental sustainability assessment (**AESA**) can support **shaping environmental strategies** in the building sector? The paper highlights the benefits of pLCA as a forward-looking approach that integrates technological and socio-economic scenario projections. Through a **case study of the Danish building sector**, it investigates the potential of **technological advancements** to meet absolute sustainability targets and explores mitigation strategies to bridge the gap between current impacts and absolute targets. The study covers 16 environmental impact categories.

The study identifies which building materials have the **strongest potential to mitigate climate impacts** and reveals risks of burden shifts towards other impact categories. By modelling future construction in Denmark (2025-2050), the study finds a significant **divergence from current consumption patterns and exceedance of the planetary boundaries** suggesting that technological advancements cannot alone take construction in Denmark towards sustainable practices.

The study therefore suggests a shift towards **biobased materials and reduced construction activity** as viable mitigation strategies. The study highlights a **trade-off** between **climate change** and **land use** when conventional building materials (concrete, steel etc.) are replaced by biobased materials. Moreover, the study shows that anticipated changes in the background system rely on solutions that will increase some environmental impacts e.g. land use and resource use of metals and minerals. Overall, the findings underline the importance of **adjusting current LCA methods** to ensure relevant assessments that can **support decision making for achieving rapid climate mitigation** as expressed by the IPCC and ensure that burdens are not shifted unintentionally.

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Upcoming events

Contribution to the consideration of ecosystem services in the integrated assessment of nature-based solutions in urban environments (CSTB)

31 March 2025, at 2:00pm

Nature-based solutions (NBS) and the **ecosystem services** they provide have been identified as important levers for action in this joint **fight against climate change and the collapse of biodiversity**. Urban living conditions, which affect the majority of humanity, make this challenge even greater. In this context, it is vital to assess the impact of NBS. However, there is **still no evaluation method that takes into account both the positive impacts of NBS** (services rendered) and the **negative impacts** (environmental costs of implementing NBS).

In response to this shortcoming, the CSTB has been developing an integrated evaluation method, the **HIBOU 2030 method** - **H**ybrid Evaluation of **I**nteractions between Nature in the City, **BiO**diversity and the **U**rban System, based on LCA and aimed at an objective evaluation of NBS and the ecosystem services they provide.

The thesis, part of the HIBOU 2030 method, aims to contribute to the development of this **integrated method for evaluating NBS**, by **focusing on models for characterising the ecosystem services of stormwater management** (SWM) and **hosting biodiversity**, at the scale of a development project, and by using LCA to evaluate the environmental costs of NBS. Three NBS are considered: green roofs, urban trees and draining green soils.

The main contributions of the thesis are :

- The **development of a model for carrying out an integrated water balance on the scale of the project**, including different types of surface, including the three SFNs, and enabling the calculation of different GEP indicators (e.g. runoff, retention, etc.);
- The **development of a model for the biodiversity reception service enabling the calculation of a functional diversity indicator, the FAD** (Functional Attribute Diversity), in the urban context;
- The **construction of LCA impact sheets for urban trees and draining vegetated soils**

You can assist to this thesis here or in CSTB Grenoble (building L3).

Society and Materials Conference

6-7 May 2025 (Madrid)

2 days of conference, with 6 sessions :

1. **New methodologies**, beyond **LCA** and **MFA**
2. SSH and systems/materials **evaluation**
3. **Batteries** and sustainability issues
4. **New methodological developments** and original applications of **LCA**
5. **New methodological developments** and original applications **of MFA**
6. **Critical Raw Materials**

The program is available here.

One of our members (ArcelorMittal) is co-organizing this event.

8 April — Eco-design & LCA expert day (Lyon)

10-11 April — Open LCA (Berlin, Germany)

6-7 May 2025 — SAM (Madrid, Spain)

11-15 May 2025 — SETAC Europe 35th Annual Meeting (Vienna, Austria)

9-12 sept — LCM 2025 (Palermo, Italia)

30 sept - 2Oct — From less bad to good enough (Helsingor, Denmark)

18-19 Nov 2025 — Second edition of MCV (Bordeaux)