

Life Cycle Assessment

Scientific publications

Applying material flow assessment-based system expansion with multiple functions to solve for multifunctionality of recycling in life cycle assessment

There are several LCA methods today that **solve for the multifunctionality of recycling** at the product level for determining the burden profiles of individual products. These product-level methods, however, often give varying environmental burden profiles and occasionally **different conclusions for determining whether recycling causes greater or lesser burdens than linear product strategies**. Such ambiguous results and findings across LCA methods confuse the public and decision-makers regarding the environmental implication of recycling compared to other material strategies. In this paper **system expansion with multiple functions (SEMF)** is investigated as a possible solution to the multifunctionality issue of recycling within LCA whilst also providing a product-level perspective.

Product-level LCA methods of recycling strategies lead to a wide range of global warming potential results for the same case scenario. This ambiguity prevents a uniform conclusion as to whether recycling causes lesser or greater burdens than linear material strategies. By contrast, it is demonstrated that SEMF finds one GWP for each recycling scenario, allowing for a less methodologically uncertain comparison with linear material strategies. It is also shown that **attributorial LCA (ALCA) in combination with MFA**, can be used to build the SEMF study, bridging the informational gap between the product level and SEMF scopes of recycling in LCA.

The sum of each product level **ALCA** can be used to assemble an **LCA with the SEMF perspective**. In this way, one can easily transition between the product level whilst comparing material strategies within a SEMF scope. To perform a SEMF-based LCA, it is necessary to **include the number of times a recycled material is used** and to **employ MFA to track resource use, mass flows, and check balances**.

From this research further investigation is recommended into existing methods for establishing how many times a recycled material is or can be used. The authors also recommend further testing and use of the SEMF LCA method through its application in real-life scenarios.

Quantifying uncertainties in absolute environmental sustainability assessment: a general framework applied to French electricity production

Assessing the environmental performance of products and systems from an **absolute perspective**, in relation to the Earth's carrying capacities, is **highly uncertain**. This is mainly due to **value-based choices** that must be made to downscale carrying capacities to the assessed activity, often making assessment results **highly dependent on one's interpretation of distributive justice**. In this work is presented a **framework for evaluating uncertainties in the downscaling of carrying capacities in absolute environmental sustainability assessment (AESA)** of products and systems.

The framework considers **19 possible approaches** to share carrying capacities, grounded in **four theories** of distributive justice (like egalitarianism and utilitarianism) and **seven enacting metrics**, such as final consumption expenditure or prior emissions.

Application to French power using the **PB-LCIA impact assessment method** showed that impact scores were statistically significantly higher than the downscaled carrying capacity (i.e., frequency of no-transgression ≤ 0.95) in **seven out of ten planetary boundaries**.

For example, the median biosphere integrity impact score with a 90 % uncertainty interval was 0.0081 (0.0047-0.012) % of biodiversity intactness index (BII) loss, as opposed to the median downscaled planetary boundary equal to 0.0032 (0.00032-0.017) % BII loss, corresponding to a frequency of no-transgression equal to 0.21.

This **highlights the need to consider uncertainty in AESA of products and systems for more robust quantification** of their performance, and setting better-grounded reduction targets.

New tool
available for



Life Cycle Assessment

Upcoming events

MCV 2025

We are pleased to inform you that your session 'The benefits of collaborative research in environmental analysis' has been pre-selected for the call for abstracts of the MCV 2025 Congress.

The final selection will be based on the interest generated by the call for abstracts, the number of abstracts submitted and their relevance.

→ We need your collaboration to propose abstracts related to SCORE LCA session (you can also propose abstracts for other sessions - see below - of course), so that our session can take place.

Call for abstracts deadline : from 24 February to 14 April

There are sessions about :

- **Challenges of training** for LCA, ecodesign, and criticality of materials,
- **Operational levers** to integrate Life Cycle Thinking,
- Deploying the life cycle approach to create a **competitive advantage** in the context of the CSRD and the Ecodesign Directive
- Environmental aspect when implementing **adaptation solutions**
- Decision support for **urban** development projects
- **Electronic equipment and digital services**: development and implementation of LCM
- LCA of **battery solutions** for mobility, stationary and industrial applications
- Energy transition and LCA: towards a **prospective, dynamic** and **spatialised** approach
- **Decarbonisation** and impact transfer: industrial processes, chemicals, steel and cement
- Implementation of the **Safe and Sustainable by Design** framework for materials and chemicals
- **Digital solutions, automation and AI** for the amplification of LCA studies
- Approaches for combining LCA with circularity and **planetary boundaries**

All the sessions can be consulted [here](#).

MCV 2025 is also offering [partnership](#) opportunities for those who would like to contribute to the long-term future of the MCV conference series.

First edition of conference on absolute sustainability : from less bad to good enough

🕒 **30 September to 2 October 2025: annual conference hosted by the Centre for Absolute Sustainability at DTU (Denmark)**

At this conference there will be focus on the concept of Absolute Sustainability. Discussion and contributions are guided by the three main pillars of the Centre of Absolute Sustainability:

1. **Systemic Modelling** (*focuses on quantitative and qualitative approaches to assess sustainability and the interconnectedness of systems*)
 - **Quantitative Sustainability Assessment (LCA):**
 - Developing advanced LCA methodologies.
 - Modelling environmental, social, and economic impacts of products and systems.
 - Allocation of carrying capacities to different activities.
 - **Dynamic Systems and Constraints**
 - **Circular Economy Systems**
2. **Systematic Engineering** (*aims to innovate, scale, and implement engineering solutions for sustainability challenges*)
 - Technology Innovation for Circularity
 - Engineering for Absolute Sustainability
 - Integration of Sustainability in Design
3. **Strategic Implementation** (*examines the pathways, policies, and business strategies to drive systemic change*)
 - Sustainability Transitions
 - Business Models and Economic Strategies
 - Collaboration Across Value Chains
 - Rebound Prevention and Policy Design

[Click here](#) to submit an abstract **until 30 March 2025**, to access the submission form and guidelines.



8 April

10-11 April

11-15
May 2025

9-12 sept

30 sept -
2 Oct18-19 Nov
2025

Eco-design & LCA expert day
(Lyon)

Open LCA
(Berlin,
Germany)

SETAC Europe 35th Annual Meeting
(Vienna, Austria)

LCM 2025
(Palermo, Italia)

From less bad to good enough
(Helsingor,
Denmark)

Second edition of MCV
(Bordeaux)