

## **CRITICAL REVIEW OF LCA – ESSENTIAL FOR QUALITY AND UNDERSTANDING**

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### **ABSTRACT**

The critical review provides quality assurance to life cycle assessments (LCAs) by providing an unbiased view on the subject, identifying potentials for improvement and hence contributing towards more scientifically robust and defensible results.

The DEKRA critical review process is designed to achieve these goals by working in close collaboration with LCA practitioners. In accordance with the specific standards used to carry out LCAs, DEKRA developed practical guidelines which provide the respective methodological framework for critical reviews. Experience has shown that this critical review process enhances the quality and credibility of the LCA and additionally contributes towards knowledge building on the side of the LCA practitioner and commissioner of the study while not exceeding target costs.

### **CRITICAL REVIEWS OF LIFE CYCLE ASSESSMENTS**

Ever since the life cycle assessment (LCA) methodology was described in a guiding document, this has been accompanied by a recommendation to undertake a critical review. In 1993 the Society of Environmental Toxicology and Chemistry (SETAC) guidelines proposed a ‘peer review’ to LCA studies in their “A Code of Practice” (SETAC, 1993). Next, the ISO Standards, which can still be considered the most important guiding document for LCA today, implemented the recommendation to carry out ‘critical reviews’ and even made it mandatory “...on LCA studies where the results are intended to be used to support a comparative assertion intended to be disclosed to the public. (ISO 14044, 2006, p.31)” The growing importance of critical reviews of LCAs is underlined by the fact that the European International Reference Life Cycle Data System (ILCD) describes the requirements and formal procedures of critical reviews as well as reviewer qualifications in detail (EC 2010a, b). Most recently, the Product Environmental Footprint (PEF) methodology made a critical review by “at least one independent and qualified external reviewer (or review team)” mandatory if an LCA study is to be called “in line with the PEF guide (EC 2013, p.69).” A more detailed overview of the historical development as well as the standard-specific requirements of critical reviews of LCAs can be found elsewhere (e.g. Klöpffer, 2012).

Both the PEF guide (2013) and the ISO Standard 14044 (2006) lay out the following basic requirements as to what the critical review shall ensure (ISO 14044, 2006)<sup>1</sup>:

- The methods used to carry out the LCA are consistent with this International Standard;
- The methods used to carry out the LCA are scientifically and technically valid;
- The data used are appropriate and reasonable in relation to the goal of the study,
- The interpretations reflect the limitations identified and the goal of the study; and
- The study report is transparent and consistent.

In the following, the “DEKRA way” of critical review is described, whereby particular attention is drawn to the preferred review process and the development of a review guideline.

### THE “DEKRA WAY” OF CRITICAL REVIEW

In general, the benefits of critical reviews of LCA studies are to enhance the scientific rigour and the technical quality of LCA studies and hence foster the reliability and credibility of LCA results and conclusions. More specifically, critical reviews help detect and avoid errors, provide the opportunity of “a fresh and unbiased pair of expert eyes” offering a different perspective (especially to goal and scope definition) and contribute to an increased comprehensibility and transparency of the LCA study. The authors see another key advantage of the critical review process that goes beyond the before mentioned quality assurance aspects: it contributes to life cycle thinking and knowledge building within organisations. In order to achieve this objective, the critical review process needs to follow a clearly outlined structure and foster interaction among the LCA practitioner, the commissioner of the study and the independent reviewer.

The critical review process can basically be carried out in two ways: 1) The reviewer can provide a critical review after the LCA and the auditable report are completed (“a posteriori”), or 2) the reviewer accompanies the LCA study from the onset of the project (“concurrent review”). The first approach entails the risk that errors or new aspects appear at the very end of the study when most of the work is already done, modelling and reporting are completed and often enough budgets have been exhausted. For these reasons, we favour the concurrent review approach (e.g. Klöpffer, 2012; ILCD, 2010a). Accordingly, the reviewer is typically involved during three phases of an LCA project as illustrated in Figure 1. The review concludes with the compilation of a detailed review report including a verification statement which provides a summary of the subject matter, can be attached to the LCA report and may be used for external communication purposes (e.g. presentations, marketing material, webpage, etc.).



Figure 1. Concurrent review process

<sup>1</sup>Slight differences to the PEF guide include a coherence to specific data quality requirements and the requirement that the study report shall be ‘accurate’ (EC, 2013).

The main advantage of the concurrent review approach is that potential problems can be identified and corrected at an early stage and before resources are expended on work which later turns out to be inadequate. Furthermore, a concurrent review approach should not be more expensive than an 'a posteriori' critical review process. Experience has shown that the increased rates of interaction with the LCA practitioner and/or commissioner are balanced out by the increased complexity to figure out how a complicated result has been influenced by debatable assumptions, or to reconstruct a missing calculation, which is often the situation in 'a posteriori' review processes. Finally, the more frequent exchanges provide greater opportunity to discuss, exchange ideas and consequently learn about methodological issues and the subject matter. This in turn fosters a greater understanding of LCA, contributes to knowledge and capacity building within organisations and can lead to knock-on effects of increased quality if, for example, future LCAs are produced.

Besides the basic requirements for critical reviews of LCAs as mentioned above, ISO 14044 (2006) outlines further general requirements that need to be addressed in the LCA report (Chapter 5.1 and 5.2).

Despite the fact that these requirements are listed and hence provide a general idea of which points should be evaluated in a critical review, they need to be interpreted further in order to develop more concrete critical review criteria which can be used to assess LCA studies. A review guideline was developed to provide a practical approach of carrying out critical reviews. It consists of concrete questions or checks, which consider the relevant Standards and ensure that the LCA study is fully compliant. The review guideline structures the review process and has the additional benefit of supporting more inexperienced colleagues in the field, but also LCA practitioners and commissioners of LCA studies in acquiring a better understanding and more detailed insights of the LCA method. In the following, an example is given in which excerpts of the review guideline are presented for a particular methodological LCA issue, i.e. allocation.

The reporting requirements according to ISO 14044 (2006) regarding allocation are that the allocation decision has to be described (Chapter 5.1.2) and that the allocation procedure has to be documented and justified as well as that its uniform application is ensured (Chapter 5.2). The review guideline includes the following checks regarding allocation:

- Have checks been carried out whether allocation could be avoided (e.g. more detailed data collection, system expansion)?
- If allocation is unavoidable, has the allocation principle used been explained and justified and are allocation factors and relevant references given (e.g. references for a similar allocation approach applied for a similar product; prices used in case of economic allocation)?
- Has allocation been carried out correctly: Checking questions include:
  - Do all inputs and outputs of a unit process need to be allocated or can some be attributed to only one product directly?
  - Is the sum of allocated inputs and outputs equal to the sum of unallocated inputs and outputs?
- In cases where several allocation procedures seem applicable, has a sensitivity analysis been conducted?

- Do all co-products actually have a market value or have waste outputs been accounted for as co-products?
- Has the same allocation procedure been applied to similar products leaving and entering the manufacturing site (also check background processes)?
- Were secondary input materials considered correctly (also check background process)?
- Were relevant allocation principles applied to reuse, recovery and recycling processes (e.g. check relevant product category rules; check application of conservative approach; check system boundaries; etc.)?

These checking questions and criteria can either be ticked off, or specific comments or questions can be entered in an MS Excel file. In addition, the particular checks and questions are complemented with illustrative examples of LCA studies drawn from the authors' past LCA experience. Where suitable, these examples can be used in review meeting discussions to illustrate the respective methodological LCA issue. Again, these practical examples are aimed at reinforcing the learning impact among LCA practitioners and commissioners of the study.

## CONCLUSIONS

Along with the growing importance of LCA and the stricter requirements to undertake critical reviews, organisations are well-advised to build up internal knowledge in this discipline. Besides the benefits of quality assurance and increased credibility of LCA results delivered by critical reviews, the "DEKRA way" of providing critical reviews offers the additional advantage of contributing towards internal knowledge building. This is achieved by a well-structured review process that includes in-depth interaction with the LCA practitioner and the commissioning organisation and a clear guideline with concrete review criteria, questions and checks enriched with relevant examples that increase learning about the LCA methodology.

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