

Decision-Support with LCA: Consequences for the Design and Usage of Generic Life Cycle Inventory Databases

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Life cycle assessment (LCA), specifically if the guidance of ISO 14040 is respected, is a tool of high value for improving the environmental performance of products. In order to facilitate the widespread use of LCA, the existence of reliable generic life cycle inventory (LCI) datasets is essential. Therefore, generic LCI databases, which provide data on base materials, energy, and also product groups and components, play an important role. Special care, however, has to be taken to ensure the appropriate use of the data and to minimize the risks of data misuse (accidentally or on purpose), since generic databases, by their very nature, are not specifically tailored to the concrete life cycle scenario(s) to be assessed.

Especially the modeling of recycling and other end-of-life processes, which is directly influenced by the datasets selected for the standard production and recycling of materials, can highly affect the results and implications of an LCA. Therefore, any generic database should be able to provide the appropriate data needed for the specific life cycle of a product or (homogeneous) product group, in alignment with the goal and scope of the study according to ISO 14040. In this context it is of utmost importance that the database supports the selection of those models that most appropriately represent reality, i.e. that a product life cycle can be modeled according to the specific relevant recycling conditions. However, in generic databases different approaches for addressing recycling activities exist: the consideration of the (average) recycled content of a generic material (input parameter), directly integrated into the production model, and the consideration of the specific recycling processes at the end-of-life of a product (output parameter), the latter modeled based on the individual product life cycle of a product or product group via the selection of the user of the database. While the former corresponds to the so-called attributional (historical) LCA and gives only average data for today's (or yesterday's) relation of primary production and recycling activities, the latter is relevant for consequential (change-oriented, prospective) modeling. For metal products, such as aluminum components for the building sector, if environmental improvements are the goal,

it is evident that only the consequential approach is relevant, because it is not a question of how much scrap has been used for a product (rather than using this material for another product), but rather if a product is recycled or not. Using a recycled-content approach would only make sense if a higher market demand for the recycled content of a product would divert materials from incineration or landfilling to recycling. For metal products this is usually not the case, since all secondary material (scrap) that is collected is also recycled, due to its economic value. Using more recycled material for one specific product would automatically lead to the use of less recycled material for another product, in most cases resulting in an economically adverse and often environmentally negative situation (due to additional transport or sorting processes). This is specifically true in growing and global markets such as the aluminum sector, where even a 100% recycling of all end-of-life products could never satisfy the demand. This effect is intensified in sectors with a long life span of products, such as the building sector.

The presentation will show how generic data, nevertheless, can be employed to model appropriate LCAs of aluminum products for the building sector. A modular LCA approach, using generic data and with a cradle-to-cradle life cycle model, will be presented, where the focus is on the aluminum lost in the life cycle of a product. This modeling principle, which also resembles the implementation of the requirements of ISO 14040 (systems expansion) will be compared to the recycled-content approach. It will be shown that the integration of end-of-life recycling and thus the consequential LCA approach is feasible and essential in modeling LCAs of metal and other products if the LCA has the goal to support decisions that move our society towards environmental improvements and sustainability.