



Newsletter #2

Life Cycle Assessment (LCA)



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Life Cycle Assessment (LCA):

The Life Cycle Assessment (LCA) is a standardized and widely applied methodology to account for the environmental impacts of products and services along their entire life cycle.

This approach (Figure 1) is divided into four main steps that are interconnected with each other, *i.e.*, Goal and Scope Definition, Life Cycle Inventory (LCI), Life Cycle Impact Assessment (LCIA), and Interpretation of Results. LCA studies are very valuable giving partners feedback and raising awareness on the main environmental hotspots.

This is even more important when decisions must be made and there is more freedom available – *e.g.*, in an early stage of product development, or when trying to optimize different production processes. Thus, this framework may help environmental impacts to be minimized.

To estimate the potential environmental implications of metaFacturing developments, ISQ has been actively involved in applying sustainability assessment methodologies, namely LCA.

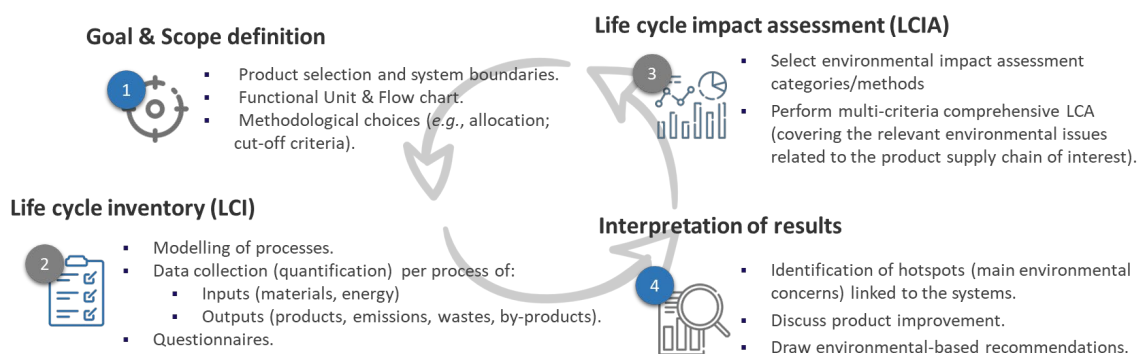


Figure 1. Main steps of the LCA methodology.

Within the scope of T4.5 – *Life cycle analysis and Life cycle costing*, ISQ has been collaborating with the partners responsible for the development of Use Cases (UCs). In total, four different UCs are being considered: two associated with casting, and two related to the welding of metal parts, both at lab and industrial scale. The preliminary LCA studies were conducted in accordance with ISO 14040 and ISO 14044 standards.

Focusing on the Casting UC (at lab scale), the environmental assessment aimed to assess the environmental impacts related to the casting process of a metal part. To do so, a “cradle-to-gate” approach was considered. Furthermore, a functional unit of 1 kg cast part was assumed to allow comparability between both UCs. The system boundaries considered, and the main results of the study are illustrated in Figures 2 and 3, respectively.

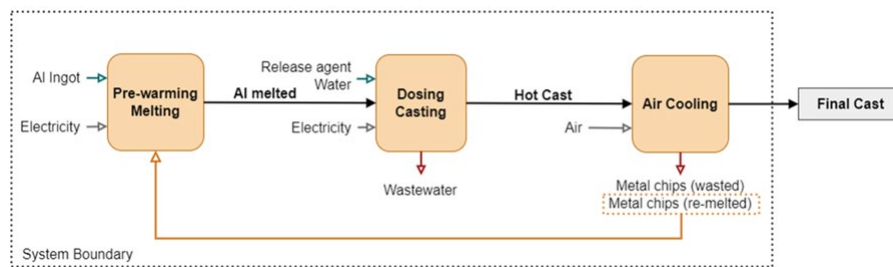


Figure 2. System under study for the Casting UC at the Lab scale.

The environmental results from lab scale casting UC (Figure 3) indicate that the melting process is the main hotspot, contributing to approximately 80% of the impacts mostly because of the Aluminum raw material used to produce the part. Also, the dosing casting step is responsible for significant impacts, accounting for about 18% of the environmental burdens due to the wastewater released during the process.

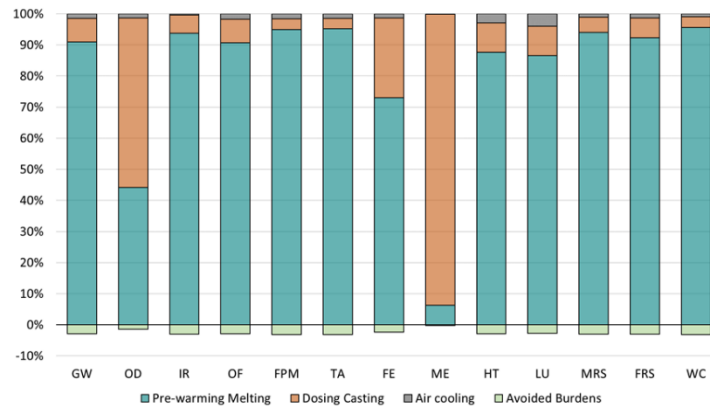


Figure 3. Preliminary relative environmental impacts obtained for Casting UC at the Lab scale.

Further developments considering the optimization of the UCs will be evaluated. This includes reducing production downtime, minimizing scrap rates, and increasing productivity to aid in the decision-making process during laboratory validation testing. So, the environmental impacts associated with optimized routes will be compared to support decision making and future developments.