

## Life Cycle Assessment for sustainable circular models of the economy: Theoretical aspects and practical applications

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### Abstract

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One of the key objectives of Sustainable Development and related goals is to care for environmental integrity, through combatting climate change and protecting the oceans and land ecosystems. Circular Economy (CE) can make a relevant contribution in this sense, by making material flows more efficient and maintaining the utility and value of materials and products for as long as possible. Improving circularity and increasing the efficiency of materials management can be achieved through: extending product lifetimes; reducing material losses; recirculating materials and products; preventing downcycling; and substituting greenhouse gas-intensive materials with those with lower emissions.

Over the years CE has been documented as an approach to promote the responsible and cyclical use of resources. It is increasingly considered as the remedy to the global problem that is associated with the increasing consumption of resources; a remedy that decouples demand satisfaction from the raw material requirement and facilitates the transitions to equitable, sustainable, post fossil-carbon societies.

When deciding, however, which CE-based actions to prioritise and integrate into policies and measures oriented to climate change prevention and to environmental protection, countries and companies need to be able to compare the relative benefits — and emission reductions — of the individual circular economy actions. Tools like Life Cycle Assessment (LCA) can make a relevant contribution to find the most sustainable of those actions

LCA can be used to complement the CE in the following three steps: assessment of both advantages or disadvantages of CE principles and strategies on a hypothetical product or service level; identification and assessment of the feasible improvements along the life cycle, and rethinking; and determination of the increased values along the business strategy, by which to transition to CE [1-3]

The literature is full of LCAs of CE-based systems that, overall, have contributed to the understanding that the material commodities produced from those systems are environmentally competitive. Apart from being more sustainable than the virgin counterparts, they are often more sustainable than 100%-natural materials.

In this context, product and process innovation must be developed and tested from an environmental and socio-economic perspective to contribute to implement holistically sustainable circular models of the economy

**Keywords:** Sustainable Development, Circular Economy, Life Cycle Assessment

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