On the importance of including a life cycle perspective in assessing the environmental performances of renewable energies

Niero, Monia; Olsen, Stig Irving; Laurent, Alexis

Published in:
Book of Abstracts Sustain 2017

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

On the importance of including a life cycle perspective in assessing the environmental performances of renewable energies

Monia Niero[1]*, Stig I. Olsen, Alexis Laurent[1]

1: Division for Quantitative Sustainability Assessment (QSA); DTU Management Engineering
*Corresponding author email: monni@dtu.dk

Cradle-to-Cradle® (C2C) is one of the key frameworks that lead to the development of the circular economy concept. The C2C design framework is based on three key principles: i) "Waste equals food", i.e. everything is a resource for something else; ii) "Using current solar income", i.e. energy should be renewable, and iii) "Celebrate diversity", i.e. there is no "one-size-fits-all" solution. To allow companies to monitor and market their progress towards the C2C vision, a certification program (Cradle to Cradle Certified™ Product Standard) was established. It includes a series of requirements divided into five quality criteria, being scored on a 5-grade scaling system (from basic to platinum). Most of the efforts in the implementation of the circular economy concept have focused on promoting the shift from a waste paradigm to a resource one (i.e. first C2C principle), and the role of energy systems in the circular economy debate has been largely overlooked. The second C2C principle is translated in the C2C certification program by the quality criterion "Renewable Energy and Carbon Management" (RE&CM), which includes a partial life cycle perspective. For all the grades but platinum in the scaling system, indeed energy use only at the manufacturing stage of a product is considered, thus leaving out the energy use during raw materials extraction, product use and end-of-life.

The aim of the present research was to provide decision-makers in industry with a demonstration of the benefits of introducing a life cycle perspective in the C2C certification program with respect to the "solar energy income" principle [1]. We considered the case of aluminium beverage cans in the UK market and compared different scenarios: 1) the current Al can system, (2) the Al can system with 50%, or 100% use of renewable energy in the manufacturing stage (reflecting C2C certification requirement for gold and platinum for the RE&CM criterion), and (3) the Al can system with consistent use of renewable energy throughout the life cycle, considering different aluminium-producing countries (China and Europe).

Our results show that compliance with the current RE&CM certification framework offers significant reduction for climate change, but negligible reductions for other environmental impacts (e.g., particulate matter and acidification). However, increasing the share of renewable energy in the primary Al production from a full life cycle perspective can greatly increase the environmental benefits brought up by the C2C certification not only for climate change, but also for the broader range of impact categories [1].

References

[1] Niero M., Olsen S.I., Laurent A. (2017) Renewable energy and carbon management in the Cradle-to-Cradle certification: Limitations and opportunities. Journal of Industrial Ecology DOI: 10.1111/jiec.12594