

## **LIFE CYCLE ASSESSMENT OF MULTI-LOOP RECYCLING: OPPORTUNITIES AND CHALLENGES**

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Today, circular economy plays a prominent role in optimization of natural resource consumption, while also minimizing waste generation throughout the life cycle of a product. Both in relation to climate targets, the UN Sustainability Development Goals, as well as simply meeting recycling targets at national level. Keeping products, materials and resources in subsequent production cycles, for as long as possible, is one of the fundamental concepts of circular economy, and consistent strategies for how to improve resource utilization throughout the life cycle(s) of products are needed. Regarding the end-of-life waste stage of the product cycle, this can be achieved by reusing, repairing and recycling waste materials. However, within waste management most focus has been simply on recycling with little reflection of the material loops in a longer time perspective. Therefore, to avoid implementation of circular economy initiatives that may lead to net environmental impacts rather than benefits, comprehensive and systemic assessments are needed also involving subsequent recycling loops. While life cycle assessment (LCA) of repairing, reuse, recycling, and utilization options have been provided in literature, little attention has been placed on cascading and multiple recycling loops, although this is one of the primary intentions behind circular economy.

This study provides preliminary results evaluating LCA approaches from the perspective of multi-loop and cascading recycling with the aim of identifying opportunities, limitations and challenges based on current literature. Recommendations are provided based on evaluation of simple cases.