A Business Case for Chemical Recycling? – Recommendations for Techno-Economic Assessment of Chemical Recycling Technologies

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Abstract

Chemical recycling (CR) technologies – in enabling the conversion of carbonaceous waste into chemical feedstock before they are incinerated for energy or landfilled – could contribute to the transition of our society towards circularity and zero waste. However, as emerging technologies which are currently not yet well-established on the market, a lack of data and experiences with CR technologies have led to considerable uncertainty regarding its technological readiness, resource efficiency, environmental impacts, economic competitiveness as well as the possibility for easy integration in existing supply chains and chemical production lines. Such concerns – compiled with evolving policy and regulatory frameworks – have hindered the deployment of CR projects as decision-makers attempt to gather a well-founded data basis to evaluate the potential and feasibility of CR for their sustainability transition.

To address this gap, global interest in life-cycle assessment (LCA) is increasing to facilitate the evaluation of environmental and climate impacts of CR technologies. However, LCA could not provide commercial and market-oriented information regarding whether and under what conditions a business case could be made for CR investments. Techno-economical assessment (TEA) could provide such insights to support decision processes regarding investment and deployment of emerging CR technologies. Additionally, if applied according to standardized rules, TEA can support “meta assessments” to comparatively assess competing CR technologies or analyze the impact of individual framework conditions on a single CR technology.

Unlike LCA, there is currently no ISO-framework which can serve as a blueprint to structure TEA applications. Current applications of TEA for CR technologies thus exhibit: (1) ambiguity in methodological choices and reporting standards, (2) lack of comparability due to varying indicators, differing methodological principles, and (3) significant heterogeneity in reporting focus and structure. To support informative and robust TEA for the comparative evaluation of CR technologies, our study drew on available TEA literature to develop recommendations for TEA guidelines for the structured, comprehensive, and standardized economic assessments of CR technologies. Aspects specific to CR to be considered in TEA evaluations will be shared during the presentation. Additionally, the developed recommendations for TEA guidelines will be illustrated on two CR routes (i.e. waste pyrolysis & waste gasification).