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Developing a framework for LCA and TEA in carbon dioxide utilization

Peter Styring,[1]* Katy Armstrong,[1] Ana Villa Zaragoza,[1] Stavros Michalios,[1] Peter Sanderson,[1] Henriette Naims,[2] Andre Bardow,[3] Reinhard Schomäcker,[4] Arno Zimmerman,[4] Annika Marxen,[2] Andre Sternberg,[3] Leonard Müller,[3] Johannes Wunderlich,[4] Georg Buchner[4]

[1]*UK Centre for Carbon Dioxide Utilisation, Department of Chemistry and Department of Chemical & Biological Engineering, The University of Sheffield, Sir Robert Hadfield Buildig, Sheffield S7 2GA, United Kingdom*

[2]*Institute for Advanced Sustainability Studies e.V. (IASS), Berliner Straße 130, 14467 Potsdam, Germany*

[3]*RWTH Aachen University, Schinkelstraße 8, 52062 Aachen, Germany*

[4]*Technische Universität Berlin, Faculty II, Institute of Chemistry, Sec. TC 11, Straße des 17. Juni 124, 10623 Berlin, Germany*

**Corresponding author: E-mail address*

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In times of climate change, research on CO_2 utilisation is gaining momentum in industry, academia and policy circles. This is leading to a vast number of promising technologies in, for example, the production of CO_2 containing chemicals, fuels and minerals [1,2]. However, the term "promising technology" reflects a subjective opinion on commercial and environmental viability. It does not represent a systematic evaluation. Consequently, systematic and standardized Techno-Economic Analysis (TEA) and Life Cycle Assessment (LCA) are essential for guiding research and development towards commercialization. A better understanding of the feasibility is essential in designing processes, screening out those that would not survive in a commercial domain and allowing effort to be concentrated on down more fruitful routes.

Most CO_2 utilisation projects are currently in the research phase, Technology Readiness Levels (TRLs) 1-3, whilst relatively few have entered the demonstration and commercial phases (TRLs 7-8). There needs to be a concerted push in the transition between laboratory research and large scale roll out of technologies. This is often called the 'valley of death' for research spanning TRLs 4-6 as it requires enhanced investment in a proof of concept. This is often overlooked due to the costs involved. The investments necessary for research to process to the demonstration phase will need to increase. These funds, especially if public funds, will need to be allocated based on transparent, comparative and rational assessment methods. Therefore, there is an increasing need to adopt standardized guidelines for TEA and LCA in CO_2 utilization. This is especially true from the perspective of funding agencies but also for external stakeholders, industry and academia This should enable 'apples-to-apples' comparisons of different technologies, which is currently very difficult [3]. It also allows for fair comparisons to be made between processes and products.

Here, we present an overview of the first project to produce guidelines for conducting LCA and TEA specifically for CCU applications. Both LCA and TEA approaches will be discussed along with initial findings on how the techniques can be integrated. Common pitfalls that should be avoided and future challenges will be highlighted.

Acknowledgments

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