

Life cycle assessment of biogenic carbon capture and storage processes: review of life cycle inventories and recommendations

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Bioenergy with carbon capture and storage (BECCS) are part of the solution to reduce greenhouse gas emissions into the air. The idea is to capture biogenic carbon before it is emitted into the atmosphere and stored permanently. If biogenic carbon is stored indefinitely, it generates a flow of carbon from the atmosphere to a permanent sequestration. Thus, BECCS systems are considered as negative emission technologies (NET). However, in seeking to reduce the climate change impacts of BECCS systems, the technologies that comprise the BECCS system may impact other environmental phenomena. This may result in pollution displacement. Different technologies are available at each stage of the life cycle of a BECCS system. It is important to provide the decision maker with a clear understanding of the environmental impacts associated with the choice of these technologies. The objective of this study is to review the quality of the life cycle inventory data available in the literature and to provide recommendations to conduct a quality BECCS Life Cycle Inventory. An analysis of 35 LCA studies was conducted. These studies had to propose a BECCS life cycle inventory. The BECCS technologies considered start in the field with the cultivation of the biomass (depending on the type of biomass) and its harvesting. Several technologies can then be used to ensure the pre-treatment of this biomass, its combustion and gasification, and finally the capture of the biogenic CO₂ emitted. Afterwards, the CO₂ can be compressed for transport and then stored. Only 13 of the 35 articles reviewed provide life cycle inventory tables. Inventory data is often marked by a lack of reproducibility, of data. Nevertheless, this study provides LCI data and recommendations for conducting LCIs to facilitate harmonization between future LCAs on the BECCS. It is important that the inventory data be transparent with a clear display of boundaries and system assumptions. It would also be interesting for BECCS LCI to define the temporality of the data and their geographical representation. Each data quality criteria must be discussed as recommended by ISO 14 040/44.