

Economic Assessment of CO₂-Based Methane, Methanol and Polyoxymethylene Production

Authors : Wieland Hoppe, Nadine Wachter, Stefan Bringezu

Abstract : Carbon dioxide (CO₂) utilization might be a promising way to substitute fossil raw materials like coal, oil or natural gas as carbon source of chemical production. While first life cycle assessments indicate a positive environmental performance of CO₂-based process routes, a commercialization of CO₂ is limited by several economic obstacles up to now. We, therefore, analyzed the economic performance of the three CO₂-based chemicals methane and methanol as basic chemicals and polyoxymethylene as polymer on a cradle-to-gate basis. Our approach is oriented towards life cycle costing. The focus lies on the cost drivers of CO₂-based technologies and options to stimulate a CO₂-based economy by changing regulative factors. In this way, we analyze various modes of operation and give an outlook for the potentially cost-effective development in the next decades. Biogas, waste gases of a cement plant, and flue gases of a waste incineration plant are considered as CO₂-sources. The energy needed to convert CO₂ into hydrocarbons via electrolysis is assumed to be supplied by wind power, which is increasingly available in Germany. Economic data originates from both industrial processes and process simulations. The results indicate that CO₂-based production technologies are not competitive with conventional production methods under present conditions. This is mainly due to high electricity generation costs and regulative factors like the German Renewable Energy Act (EEG). While the decrease in production costs of CO₂-based chemicals might be limited in the next decades, a modification of relevant regulative factors could potentially promote an earlier commercialization.

Keywords : carbon capture and utilization (CCU), economic assessment, life cycle costing (LCC), power-to-X

Conference Title : ICCD 2017 : International Conference on Carbon Dioxide

Conference Location : Amsterdam, Netherlands

Conference Dates : May 14-15, 2017