



The latest status of CO₂ utilisation technologies

Qian Zhu
IEA CCC

CO₂ has many potential uses and has already been used for decades with mature technologies in various industrial processes such as the food and beverage industry, CO₂-enhanced oil recovery (EOR), urea production and the production of fire retardants and coolants. There are also many new CO₂ capture and utilisation (CCU) technologies at various stages of development and commercialisation. These technologies have potential to convert CO₂ into a wide variety of marketable products using renewable energy. Depending on the technological routes used, the CO₂ utilisation technologies can be categorised into electrochemical, photocatalytic and photosynthetic, catalytic, biological (using microbes and enzymes) processes, copolymerisation and carbonation process. Several processes based on electrochemical and/or catalytic conversion of CO₂ to produce gaseous or liquid fuels or chemicals, such as CRI's ETL technology that convert CO₂ to methanol and Sunfire technology that produces syngas using H₂O and CO₂, have been developed and are emerging into the commercial market. Technology developments are more advanced in the field of CO₂ copolymerisation and mineralisation to produce polymers, construction and other materials. Some processes such as Carbon8 Systems' ACT process for treating industrial wastes using CO₂ to produce construction materials and CO₂-curing of concrete developed by CarbonCure and Solidia Technologies, are already in commercial operation and others are on the way. Interesting bioconversion routes are also under development, some (for instance, LanzaTech's gas fermentation process) at an industrial scale. There are extensive investigations worldwide in photocatalytic and photo-thermal catalytic conversion of CO₂, but they are mainly at early stage laboratory scales. This paper reviews the recent developments in CCU technologies that convert CO₂ to commercial products via chemical and biochemical reactions with a focus on front-running technologies that are at or close to industrial-scale demonstration or commercialisation. The environmental impact of CCU is also discussed in terms of life cycle analysis (LCA).

