An overview of CO₂ storage and utilization

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This study aims to understand the integration of two different approaches for the use of carbon dioxide (CO₂). The close link between economic growth, energy consumption, carbon dioxide emissions and depletion of fossil resources demands new strategies able to dramatically reduce atmospheric greenhouse gas concentration.

The Carbon Capture and Storage (CCS) is a technique that allows the geologic sequestration of the CO₂ that is separated and captured as a by-product from industrial processes. Another complementary strategy is the Carbon dioxide Capture and utilization (CCU), which allows (quasi) circular material flows by considering the CO₂ as valuable feedstock (Meylan et al., 2015). This is aligned with the industrial ecology strategies, taking into consideration material and energy constraints, enabling the industrial utilization of the carbon dioxide to provide various final products as shown in the figure 1.

The geological sequestration is an important option that can be economically interesting when using CO₂ for enhanced oil recovery (EOR), a technique between sequestration and utilization. Currently, the proportion of CO₂ used by industrial activities (approximately 0.2 Gt/yr) is considerably small comparing to the anthropogenic emissions (more than 30 Gt/yr). However, new processes are being developed to increase this proportion and reduce the environmental impact.

This approach faces challenges in multiple domains. With regard to the legal aspects, the European Union has recently shown interest in CO₂ recycling as an alternative and complementary approach for CO₂ geological sequestration, which is already regulated by the Carbon Storage Directive 2009/31/ EU (CSD) (Piguet et al., 2017).

In this context, the CCS and the CCU can be combined (Carbon Capture, Utilization and Storage, CCUS) to respond to environmental concerns (Oldenburg, 2012). This combination can potentially close carbon cycles according to industrial ecology and circular economy principles. A way to merge this is to re-think and re-design business models able to deliver economic, environmental and social values, considering financial resilience and long-term viability and stability.
Figure 1. Integration of CCS and CCU processes (based on Meylan et al., 2015).

REFERENCES