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CO_2 as a Raw Material
A building block of a climate-neutral carbon economy

CO_2 as a future carbon source

The chemical industry currently produces carbon-based products such as plastics and detergents primarily from crude oil. At the end of the product's useful life, the carbon from the crude oil is emitted into the atmosphere as CO_2.

In the future, **non-fossil carbon sources or closed carbon cycles** will be required for such products. Biogenic sources and recycling will probably not be sufficient for this, which is why the provision of carbon from CO_2 will also be important in the future. This is referred to as **Carbon Capture and Utilization (CCU)**. The CO_2 can come directly from the atmosphere or from bioenergy facilities. Emissions that are difficult to avoid from fossil or mineral sources could also play a role as a carbon source, especially during a transition period.

CCS and CCU complement each other

Capturing and geologically storing CO_2 **(Carbon Capture and Storage, CCS)** prevents hard-to-abate CO_2 created by industrial processes from being emitted into the atmosphere. Negative emissions are achieved if atmospheric or biogenic CO_2 is stored. **CCU has a different function** – it unlocks another source of carbon, thereby replacing fossil raw materials in industrial manufacturing.

It is likely that both will be needed if we are to achieve a carbon-neutral industry. Experts expect that CCS will be the main method used. However, CCS and CCU should be considered together when **planning the infrastructure** for CO_2 transportation.

Complex carbon footprint

CCU replaces fossil raw materials, meaning that under certain conditions it can contribute to climate change mitigation.
CCU is **not carbon-neutral per se** – if CO_2 captured from fossil or mineral sources is used, its release into the atmosphere is merely delayed for the duration of the product's useful life or for the amount of time it remains in closed recycling loops. In order to make the best possible use of various CCU solutions in the industrial transformation, their impact on the climate must be both assessed in a differentiated manner and controlled by economic incentives. This is challenging from a regulatory perspective, especially if the administrative burden is to be kept to a minimum.

High energy demand

In addition to CO_2, CCU requires hydrogen, for example, to produce methanol – a key raw material for the chemical industry.
Producing this in a carbon-neutral manner, using electrolysis, requires a lot of electricity. If atmospheric CO_2 is used, a high amount of energy is also needed to capture it. Experts view the availability of hydrogen and renewable electricity as the most significant limiting factors for CCU.
This therefore raises the questions as to **the extent to which CCU will be implemented in Germany**, the extent to which sections of the chemical industry will relocate to sites with low-cost renewable energies, and to which "green" raw materials will be imported into the country.

Enabling market ramp-up, avoiding a fossil fuel lock-in

A regulatory framework for CCU should be developed in the near future and should take the following points into account:

- The market ramp-up of CCU demands targeted funding.
- The extent to which fossil/mineral CO_2 can be useful for CCU applications in the interim should be investigated in more detail.
- CCU is necessary to a certain extent, but due to the high energy demand it is also an expensive option for climate change mitigation, even in the long term. This means that reducing the hydrocarbon demand, achieved by increased recycling and by using products that contain carbon more sparingly, for example, should definitely be prioritised.