



Requirements of an Overall Strategy Combining CCS, CCU and CDR

What is carbon management?

Carbon management seeks to

- keep greenhouse gas emissions out of the atmosphere or remove them so that they don't contribute to global warming, and
- recycle carbon in order to reduce dependence on fossil carbon.

It is made up of three pillars:

- With **Carbon Capture and Storage (CCS)**, CO₂ produced in a cement works, for example, is captured and then injected underground for permanent storage there.
- **Carbon Dioxide Removal (CDR)** offsets greenhouse gas emissions that cannot be captured directly at source (because they are spread over a large area, for instance, as is the case in agriculture). CDR can also be used to go further and lower CO₂ levels in the atmosphere. The carbon is stored in different ways, depending on the method used – e.g. underground (CCS) or in vegetation and the soil.
- In the case of **Carbon Capture and Utilisation (CCU)**, carbon dioxide captured from industrial facilities or the atmosphere is used for manufacturing carbon-based products (e.g. plastics).

The three pillars require similar process steps and infrastructures in part and overlap in terms of their contribution to climate action. This is why an **overarching strategy** is needed for carbon management.

No climate neutrality without CCS

Attempting to attain climate neutrality without CCS is likely to fail. Indeed, without CCS, emissions would have to be cut by even more than they need to be anyway.

- This would require particularly far-reaching **changes in behaviour**, e.g. in terms of nutrition – and public support for this is very uncertain.
- **Residual emissions** would primarily need to be offset by means of carbon storage in vegetation and soil, which is hampered by the limited availability of land. The permanence of this method is also far from assured.
- To achieve even **net-negative emissions** in future seems all the more implausible without the use of CCS.

The climate footprint of CCU

Fossil carbon cannot be used in a climate-neutral industry. This makes CCU indispensable as a source of carbon for manufacturing many different products. In most cases, however, it does not represent an alternative to CCS and CDR:

- CCU only results in **permanent storage** of the CO₂ in the case of very **du-rable goods** such as building materials.
- Manufacture of goods with a short life can only be considered **climate neutral** if the CO₂ used **comes from the atmosphere or biomass** and the production process itself is climate neutral.

Avoid greenhouse gases wherever possible, manage them where needed

Compared to measures avoiding the production of greenhouse gas emissions, carbon management can only make a small contribution to climate action.

This is because the potential sustainably to use is limited and ramping up the technology is a challenge, even if carbon management is targeted only at hard-to-abate emissions.

- This means it is important to **make systematic use of and keep developing all the different ways of avoiding greenhouse gases** – from developing renewables and the hydrogen infrastructure via energy-saving measures to lower-emission production techniques in industry and agriculture.