

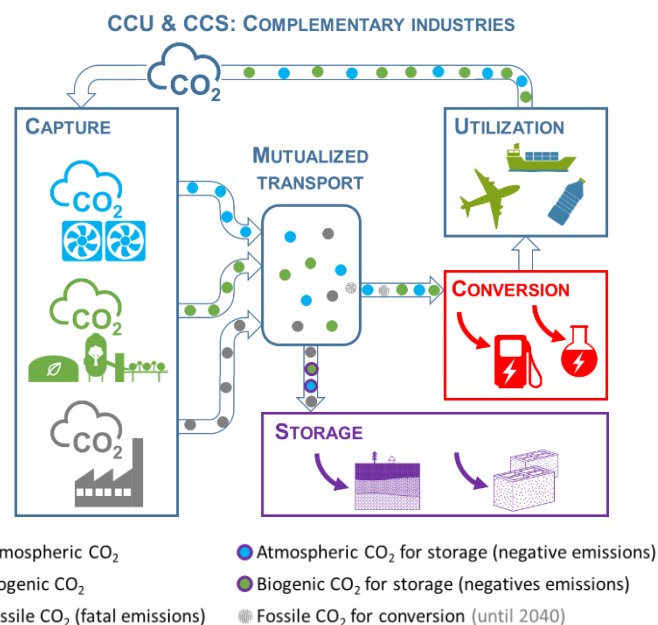
CCU AND CCS: TWO COMPLEMENTARY INDUSTRIES

The industrial carbon management strategy published by the European Commission in February 2024¹ is based on three pathways: carbon capture and storage (CCS), carbon capture and utilization (CCU), and carbon dioxide removal (CDR) (not addressed in this fact sheet). CCS aims to capture and permanently store CO₂ in a technological carbon sink approach. CCU aims to valorize the captured CO₂ in a circular carbon economy approach. And CDR aims to remove CO₂ from the atmosphere and store it permanently.

Both CCS and CCU industries are necessary and complementary with a common goal of carbon neutrality.

- They rely on a common technological building block: CO₂ capture. Transport infrastructure and the development of distribution hubs can also be shared, with a common CO₂ purity level to be defined. The downstream components (storage or conversion) are specific to each industry.
- The services provided by the two industries are different and include:
 - **A decarbonization goal** for fossil CO₂ emitters through CCS and the possibility of negative emissions by treating biogenic or atmospheric CO₂,
 - **A defossilization goal** for CCU through the production of synthetic fuels or molecules as substitutes for products derived from fossil resources.

The two industries are expected to develop in parallel, with a pace imposed by regulations and national and European roadmaps. These deployments can only be achieved through an integrated vision that relies on both efforts of sobriety and the intensification of net zero technologies (electrification, use of low-carbon hydrogen, energy efficiency, etc.). By 2050, the European Commission anticipates a need to capture 450 Mt of CO₂ in Europe, with 55% to be stored and 45% to be utilized. In France, as mentioned in [focus #1](#), with a need to convert about 15 Mt of CO₂ into e-SAF by 2050, the volumes of CO₂ required by the CCU industry are of the same order of magnitude as those targeted by the CCS industry (15–20 Mt of CO₂).



Trade-offs will certainly be necessary, particularly in terms of territorial and societal challenges:

- What will be the balance between CCS and CCU to meet the decarbonization trajectories within different industrial basins, for example, based on emission levels and the territorial infrastructure?
- What will be the social and societal appropriations of the CCU and CCS value chains?
- How the allocation and supply of critical resources will be structured (for example, electricity, CO₂, biomass)?
- What will be the geographical and temporal accessibility of storage areas?

The regulatory framework is thus expected to be precised in the coming years.

From the perspective of achieving carbon neutrality, the development and deployment of both industries must be based on **multi-criteria analysis** (including techno-economic and LCA) across the entire value chain to **ensure that solutions will be sized to the needs**. R&D activities of CEA and IFPEN contribute to the development of all the technological building blocks of these two industries at different maturity levels and their integration into complete value chains.