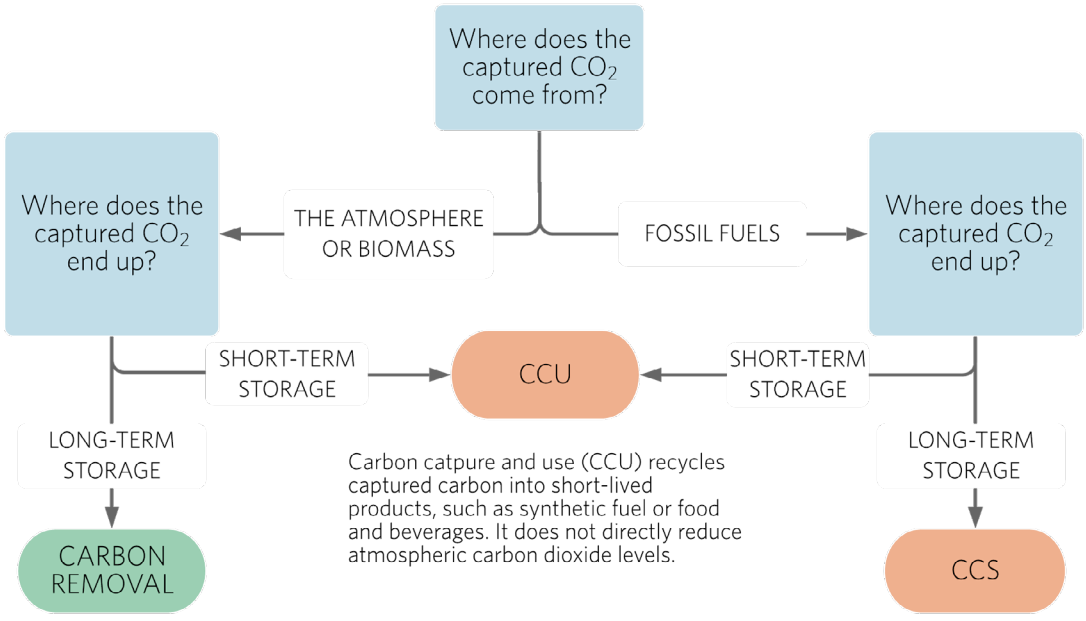
CARBON CAPTURE & USE

WHAT IS CARBON CAPTURE & USE?

Carbon capture & use (CCU), sometimes called carbon utilization or carbon-to-value, involves capturing carbon dioxide (CO_2) and using it in economically beneficial ways. This covers a wide range of activities, from converting CO_2 into useful products to injecting CO_2 into depleted oil reservoirs for enhanced oil recovery. CCU remains an area of active technological development, with companies experimenting with using captured CO_2 to create products as varied as synthetic jet fuel, fish food, and carbon-negative concrete, to name just a few.

IS CARBON CAPTURE & USE A TYPE OF CARBON REMOVAL?

Processes that capture CO_2 from the atmosphere and turn it in long-lived products, such as cement or building insulation, count as carbon removal because they reduce atmospheric CO_2 levels over the long run. Processes that capture CO_2 from the atmosphere and use it in short-lived products, such as beverages or biodegradable plastics or synthetic fuel, do not count as carbon removal because the carbon they capture soon returns to the atmosphere. They amount to "carbon recycling." Processes that only capture CO_2 from fossil fuel consumption do not count as carbon removal, regardless of what they do with the carbon, because they are not removing CO_2 that is already in the atmosphere. Enhanced oil recovery could, in theory, count as a form of carbon removal under very specific circumstances, but even when the CO_2 injected underground has been captured from the air, burning the oil that is pumped out of the well will usually create more CO_2 than the process initially sequestered.



Carbon catpure and use (CCU) recycles captured carbon into short-lived products, such as synthetic fuel or food and beverages. It does not directly reduce atmospheric carbon dioxide levels.

Genuine carbon removal lowers atmospheric levels of carbon dioxide by capturing carbon dioxide from the air and putting it in long-term storage. Long-term storage options include geological formations, the deep ocean, minerals, biochar, trees and soils, and long-lived products such as cement.

Conventional carbon capture and storage (CCS) captures carbon dioxide released by burning fossil fuels and puts it into long-term storage. This prevents that fossil carbon from entering the atmosphere, but it does not directly reduce atmospheric carbon dioxide levels.

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THE ROLE OF CARBON CAPTURE & USE IN CLIMATE POLICY

Different kinds of CCU can play very different roles in climate policy. Carbon-negative CCU, which takes carbon from the air and embeds it in long-lasting products, could compensate for emissions from harder-to-abate sectors or help reduce atmospheric concentrations of CO_2 by drawing CO_2 out of the atmosphere. Carbon recycling is carbon neutral, at best, but certain kinds could reduce emissions by displacing fossil fuels. Synthetic fuels, in particular, could play a role in decarbonizing sectors like aviation. "Fossil CCU," meaning CCU that captures and uses CO_2 from coal or gas power plants, could help finance carbon capture technology on such plants, which would significantly reduce their emissions. In all three cases, the challenge is scaling up CCU to capture and use millions or billions of tonnes of CO_2 per year. Unless and until that happens, CCU will not make a meaningful contribution to climate policy, though there may be other reasons to pursue certain types of CCU.

TECHNOLOGICAL READINESS

Point-source carbon capture, which could be attached to fossil fuel plants, bioenergy plants, or industrial facilities, is well-developed, but for financial reasons, it is not yet widely deployed. New methods of capturing carbon are emerging, including methods for capturing CO_2 from the air. While there are some mature technologies for using captured CO_2, such as enhanced oil recovery and greenhouse enrichment, many new technologies for using captured CO_2 are under active research and development. Of these, low-carbon and carbon-negative building materials currently appear to have the biggest carbon removal potential because of the scale of the building industry and the durability of carbon storage in building materials.

GOVERNANCE CONSIDERATIONS

- **Life cycle accounting:** sound methods of accounting for the life-cycle emissions of CCU processes are needed to identify genuinely carbon-neutral or carbon-negative CCU processes.
- **End-of-life handling of products:** institutions and processes need to be developed to ensure that the carbon in long-lived products is not released to the atmosphere at the end of the product's lifespan.
- **Monitoring, reporting, and verification:** robust mechanisms are needed for monitoring, reporting, and verifying that carbon has been captured and stored.

FURTHER READING

National Academies of Sciences, Engineering, and Medicine. 2019. *Gaseous Carbon Waste Streams Utilization: Status and Research Needs.* Washington, DC: National Academies Press.

Global CO_2 Initiative. 2016. *Global Roadmap for Implementing CO_2 Utilization.* University of Michigan.

McGlade, C. 2019. "Can CO_2-EOR really provide carbon-negative oil?" International Energy Agency. https://www.iea.org/commentaries/can-co2-eor-really-provide-carbon-negative-oil

For more fact sheets on carbon removal, visit https://carbonremoval.info/factsheets.

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