Decarbonization
Status, Challenges, and Policy Options for Carbon Capture, Utilization, and Storage

What GAO found

Many technologies for carbon capture, utilization, and storage (CCUS) are ready for wider demonstration or deployment, but multiple challenges limit their use. Carbon capture includes technologies that separate and purify carbon dioxide (CO₂) from a source, which could be an industrial facility (point-source capture) or the atmosphere (direct air capture). Applications of capture technologies at point sources are mature in some sectors (e.g., natural gas processing) but require further demonstration in some of the highest-emitting sectors (e.g., power generation). Direct air capture is not as mature, but has been implemented at pilot scale. Lengthy time to deployment and high costs hinder widespread deployment of both types of carbon capture in the near term.

Technologies for transporting, storing, and directly using captured CO₂ are mature. Companies are beginning to commercialize utilization technologies that convert captured CO₂ into valuable products such as ethanol, sustainable aviation fuel, and mineral aggregates. However, many CO₂-based products are not competitive with conventional products, may be excluded from the market by industry standards, and lack a standardized method for ensuring they effectively reduce CO₂ emissions.

Components of carbon capture, utilization, and storage

GAO identified three aspects of CCUS deployment where challenges may arise:

- **Cost.** Deploying CCUS is an added cost to doing business but currently offers few opportunities to generate revenue. Incentives such as federal tax credits help offset the high cost of CCUS for some but not all emitters.

- **Infrastructure development.** More widespread deployment of CCUS would require a build-out of infrastructure for each of its components, including transport and storage. Timing of development, negotiating land access, and proximity of facilities are all challenges affecting this build-out.

- **Community engagement.** Deploying CCUS projects relies on acceptance by and effective engagement with local communities. In the past, unsuccessful community engagement and local opposition have contributed to cancellation or relocation of some CCUS projects, while others were well received.
GAO identified seven policy options that could help address these challenges or enhance the benefits of CCUS technologies. The policy options are possible actions by policymakers, which may include Congress, federal agencies, state and local governments, academic and research institutions, and industry. In addition, policymakers could choose to maintain the status quo, whereby they would not take additional action beyond current efforts. See below for details of the policy options and selected opportunities and considerations.

### Policy options to help address challenges or enhance benefits of CCUS technologies, with selected opportunities and considerations

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| **Research, development, and demonstration (report p. 20)**                  | • Research and development could reduce cost, resolve issues, mitigate risks, and advance emerging technologies.  
• Demonstrations could reduce cost and establish the viability of carbon capture by promoting learning-by-doing. | • Stakeholders have different ideas for research and development priorities.  
• Requires careful oversight of large-scale demonstrations. |
| **Technology-neutral standards (report p. 34)**                              | • Could incentivize the development or use of products with the best CO₂ benefits.  
• Could incentivize manufacture in the U.S. | • Standards development is a resource-intensive and lengthy process.  
• Could be difficult to compare CO₂ benefits of different products without standardized life cycle assessment. |
| **Standardized life cycle assessment guidelines (report p. 34)**             | • Could improve accuracy of comparisons between various CO₂ utilization pathways or products. | • Standards development and life cycle assessment are resource-intensive and lengthy processes.  
• Coordination of many stakeholders to establish standardized life cycle assessment guidelines may be challenging. |
| **Framework for land access (report p. 44)**                                 | • Legal or regulatory clarity could facilitate deployment of CO₂ storage infrastructure.  
• Pore-space unitization processes could reduce the time and cost of negotiating land access for storage. | • Individual landowners may oppose losing certain property rights due to pore-space unitization.  
• CO₂ storage projects may cross state boundaries, requiring coordination. |
| **Strategic siting (report p. 44)**                                          | • Could minimize financial and logistical barriers to CCUS development.  
• Carbon capture and utilization industries may accelerate deployment if access to infrastructure increases. | • Certain geographic regions that are inherently more suited for CCUS could benefit more than others from infrastructure investments.  
• Some communities may not want CCUS infrastructure for several reasons, including perceptions of environmental and safety risks. |
| **Modify incentives (report p. 55)**                                         | • Could increase the number or kinds of facilities that deploy CCUS.  
• Could incentivize new technology development to reduce costs of capture. | • Modifying tax credits could reduce government tax revenues or increase use of fossil fuels.  
• Modifying market-based approaches could be subject to uncertainty in carbon prices. |
| **Community engagement (report p. 62)**                                      | • Better understanding of public opinion could guide community engagement and decision-making.  
• Could build local support and reduce delays. | • Well-designed education and public awareness campaigns could be resource-intensive.  
• May require new funding or reallocation of existing resources to support new efforts. |

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