Carbon180

Geologic Carbon Storage

Dedicated geologic storage involves injecting CO_2 into rock formations deep underground, where it remains stored for tens of thousands of years. It is a critical climate technology and will be essential to scaling technological carbon removal.

Geologic storage can be paired with a variety of processes, including industrial and power operations. It is estimated that the US currently has billions of tons of capacity for geologic storage, totaling more than 5,000x its 2018 CO_2 emissions. Current estimates for the costs of geologic storage range from $1 to $18 per ton of carbon dioxide.

How does geologic storage work?

Step 1: Site Selection

A geologic site is selected based on a set of criteria (see right) that will ensure storage is long term and secure.

Step 2: Capture

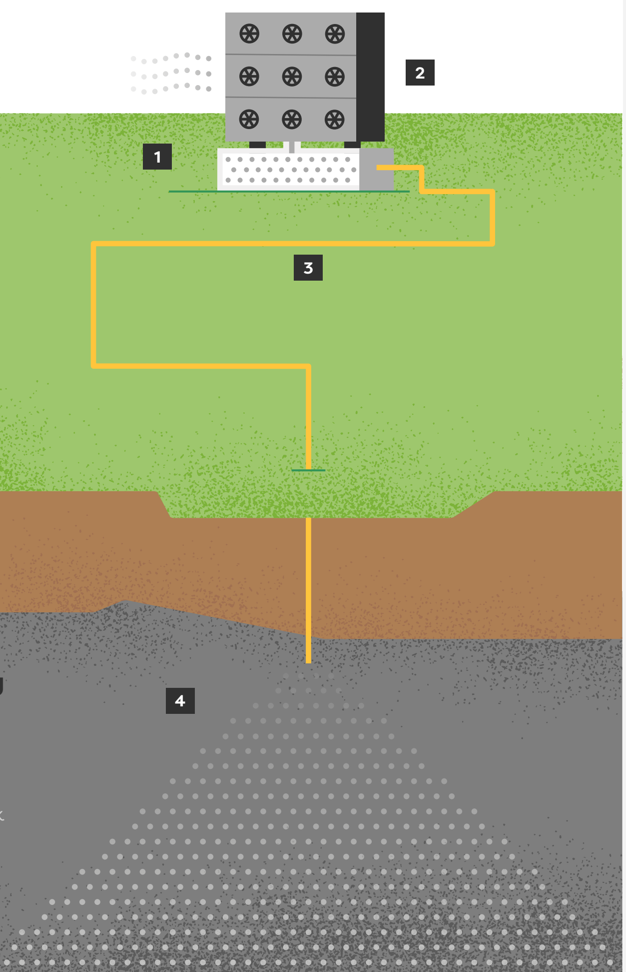
CO_2 is captured from the air by direct air capture plants.

Step 3: Transportation

Captured CO_2 is compressed and transported through pipelines to the selected geologic site.

Step 4: Storage and Monitoring

Captured carbon is injected deep underground. Post-injection monitoring, reporting, and verification (MRV) is important to ensure carbon does not leak into the air or nearby water systems.



SITING CONSIDERATIONS

Injectivity
Rate at which CO_2 can be injected underground

Storage resource
Amount of space a site has to hold CO_2

Integrity
Ability of a site to hold CO_2 safely without a leak

Depth
Distance downward a storage site must have to properly hold CO_2 at a certain pressure

REDUCING VS. REMOVING

Geologic storage can help reduce CO_2 emissions or result in permanent carbon removal. Whichever system it's applied to, geologic storage ensures carbon won't be released back into the atmosphere.

Carbon Capture
An emissions reduction technology that captures CO_2 from large point sources (like power plants), preventing it from entering the atmosphere.

Carbon Removal
A suite of climate mitigation practices and technologies, like direct air capture and carbon storage (DACCS), that remove CO_2 from the ambient air.

CONSIDERATIONS

Underground injection and geologic storage are not new — the process for geologic storage builds on practices and technologies that have been widely used for decades in oil and gas production.

However, there are potential risks to environmental and human health associated with geologic storage. The CO_2 injection process could potentially cause earthquakes, ground heaving, and effects on underground minerals while CO_2 leakage risks groundwater and drinking water contamination. These possibilities are all relatively low risk, but further research is needed to better understand them.

Increased investment in research and development (R&D) as well as the establishment of widely accepted oversight and regulations can protect public health and address safety considerations surrounding geologic storage.

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Current Policy Support

The US has spent decades researching and developing geologic storage technologies and infrastructure. The Department of Energy (DOE) leads federal R&D of geologic storage as part of the Carbon Storage Program. DOE also supports public-private partnerships surrounding geologic storage through its Regional Carbon Sequestration Partnerships (RCSP) Initiative. The Environmental Protection Agency (EPA) also plays an essential role in geologic storage oversight through the Underground Injection Control (UIC) program's Class VI permit system, established under the Safe Drinking Water Act.

Despite this early support, there remain a number of policy gaps that will need to be addressed as we move to deploy geologic storage at scale, including a need for additional research into potential social and environmental risks, cost-effective MRV for demonstration and deployment, strengthened interagency coordination, and financial support for associated infrastructure.

Several recently enacted and introduced bills include provisions on large-scale carbon sequestration infrastructure and R&D for commercial storage, verification, and piloting. Fiscal year 2021 appropriations allocated $3 million to the UIC Class VI program to expand expertise and capacity to improve the safe and secure geologic storage of carbon. The existing Class VI permit program is backlogged with numerous proposals from state governments and project developers; additional resources are needed to ensure timely, equitable, and safe storage.

H.R. 1512, the CLEAN Future Act, would support geologic carbon sequestration by providing the EPA with additional funding for the Class VI program and provide grants for states to establish their own geologic storage permitting programs. S. 799/H.R. 1992, the SCALE Act, would provide similar regulatory support to the EPA and states, and would also finance shared CO_2 transport infrastructure and provide grants for state and local governments to procure CO_2 utilization products, such as fuels and building materials.