

THE BOTTOM LINE



How does Carbon Capture work?

Carbon capture is the process of capturing carbon dioxide (CO₂) emissions from large point sources, like fossil fuel power plants, and storing it instead of releasing it into the atmosphere. Capturing and storing CO₂ can stop it from adding to global warming.

There are a few ways to capture CO₂: pre-combustion, post-combustion, and oxyfuel combustion. In pre-combustion

capture, fuel is converted into CO₂ and water vapor before it's burned. In post-combustion capture, exhaust gases are cooled and treated so the CO₂ can be separated out. Oxyfuel combustion burns fuel in oxygen instead of air, creating an exhaust stream that's mostly made up of CO₂ and water vapor. There are a number of ways to store carbon dioxide, including underground injection, ocean storage, and agricultural sequestration. Each method has its own benefits and challenges.

UNDERGROUND INJECTION

Underground injection involves injecting CO₂ into deep geological formations, such as saline aquifers or depleted oil and gas reservoirs. The CO₂ is typically injected thousands of meters below the surface, where it is permanently trapped by the surrounding rock formations.

Benefits

Underground injection is one of the most widely-used methods of carbon storage. It is relatively simple and low-cost and can be used with existing infrastructure (such as oil and gas wells). In addition, it offers a high storage capacity and can be used to store large volumes of CO₂.

Challenges

There are a number of potential risks associated with underground injection, including leakage of CO₂ into groundwater or surface waters, and seismic activity. These risks must be carefully managed to ensure the safety of both people and the environment.



OCEAN STORAGE

Carbon dioxide can also be stored in the ocean, where it reacts with seawater to form carbonic acid. This process is called ocean acidification, and it can have a number of negative impacts on marine ecosystems.

Benefits

Ocean storage is a relatively simple and low-cost method of carbon storage. It offers a high storage capacity and can be used to store large volumes of CO₂. In addition, the ocean is already absorbing a significant amount of anthropogenic CO₂, so this method could help to mitigate climate change.

Challenges

There are a number of potential risks associated with ocean storage, including ocean acidification and the release of stored CO₂ into the atmosphere. These risks must be carefully managed to ensure the safety of both people and the environment.

AGRICULTURAL SEQUESTRATION

Agricultural sequestration is the capture of CO₂ by plants and soils. Plants take in CO₂ during photosynthesis, and some of this carbon is stored in the soil. Agricultural sequestration can be used to offset greenhouse gas emissions from agriculture and other land-use activities.

Benefits

Agricultural sequestration is a natural process that can help to mitigate climate change. It offers a high storage capacity and can be used to store large volumes of CO₂. In addition, it can provide other benefits, such as improved soil fertility and water retention.

Challenges

There are a number of potential risks associated with agricultural sequestration, including leakage of stored CO₂ into the atmosphere and the potential for agricultural land to be converted to other uses. These risks must be carefully managed to ensure the safety of both people and the environment. Carbon storage is a promising tool for mitigating climate change. However, it is important to carefully consider the risks and benefits of each storage method before implementing any large-scale projects.

THE COSTS AND RISKS ASSOCIATED WITH CARBON CAPTURE & STORAGE

The costs of carbon capture and storage (CCS) technology can be divided into three main categories: capital costs, operating costs, and climate change mitigation costs. Capital costs are the upfront investments required to build a CCS system, while operating costs are the ongoing costs associated with running the system. Climate change mitigation costs are the benefits achieved by reducing greenhouse gas emissions through CCS.

The largest component of CCS costs is typically the capital cost of building the infrastructure required for capture, transport, and storage of carbon dioxide (CO₂). Estimates of these capital costs range from \$30-\$80 per ton of CO₂ captured, depending on the specific CCS technology and project location. In addition to these upfront investment costs, CCS systems also incur significant operating costs. For example, the power plant efficiency penalty associated with post-combustion CO₂ capture is estimated to be between 2-6%. This means that a power plant equipped with CCS would require 2-6% more fuel to generate the same amount of electricity as a power plant without CCS.

CCS technology also carries some risk of leakage, which could offset the climate change mitigation benefits achieved through reduced emissions. Estimates of potential leakage rates from CCS projects range from 0.1% to over 10%, although most are in the 1-2% range. The likelihood and consequences of leakage depend on a number of factors, including geologic storage formation, well integrity, and injected CO₂ volume.

Despite the costs and risks associated with CCS, the technology remains an important tool in the fight against climate change. When used in conjunction with other greenhouse gas reduction strategies, such as renewable energy and energy efficiency, CCS can help to significantly reduce emissions of CO₂ and other greenhouse gases.