



# What is Direct Air Capture?

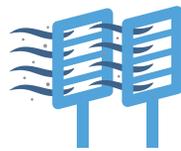
There is a growing global appetite for clean technologies and products with reduced emissions, which present market opportunities where American businesses can get ahead. The recent expansion of the 45Q tax credit will accelerate [investment](#) in and deployment of carbon capture and utilization projects. As Congress examines additional legislative efforts to complement the tax credit, this explainer aims to describe carbon dioxide removal and direct air capture and their importance to the American energy portfolio.

**Carbon dioxide removal** refers to efforts to remove carbon dioxide, or CO<sub>2</sub>, from the atmosphere and store it long-term. There are two approaches:



**Land-Based** – CO<sub>2</sub> storage in plants and soils

- Afforestation
- Reforestation
- Soil Carbon Sequestration
- Accelerated Weathering



**Technological** – Uses technology to separate CO<sub>2</sub> from air for storage in rocks or materials

- Direct Air Capture and Storage
- CO<sub>2</sub> Mineralization
- Bioenergy with Carbon Capture and Storage

**Direct air capture and storage** is an emerging carbon dioxide removal strategy that uses advanced technology to capture and store or utilize carbon dioxide directly from the ambient air. Direct air capture is distinct from carbon capture and utilization, which uses similar processes to capture CO<sub>2</sub> from point sources, such as power plants, that contain higher concentrations of CO<sub>2</sub> than the air.

**Direct air capture technology works.** Commercial projects are already drawing CO<sub>2</sub> from the air today for sale and use. Examples of current direct air capture technology include three companies operating facilities and successfully ramping up operations:



**Global Thermostat**

- A U.S. company with pilot plants in California and Alabama with plans to build a demonstration plant in Oklahoma and a technology center in Colorado
- Uses waste heat to capture CO<sub>2</sub> and sells pure CO<sub>2</sub> for use in building materials, fuels, etc.
- 35 patents awarded to date



**Carbon Engineering**

- Operating an “air-to-fuels” pilot plant in British Columbia producing diesel and gasoline
- In 2019, the company, along with Occidental Petroleum, announced plans to build the world’s largest direct air capture and sequestration facility in the Permian Basin in West Texas
- Uses captured CO<sub>2</sub> to produce up to one barrel of synthetic fuel per day and is scaling up operations



**Climeworks**

- Commercial and demonstration plants in Switzerland, Italy, and Iceland, with contracts for CO<sub>2</sub> supply and removal services
- Injects captured CO<sub>2</sub> in the ground, where it becomes rock
- Working on an “air-to-fuels” approach to sell captured CO<sub>2</sub> as renewable diesel and jet fuel

**A CO<sub>2</sub> market exists and direct air capture can help fill the need.** The market for CO<sub>2</sub> is growing and will incentivize investment in and improvement of carbon extraction and utilization technology, including direct air capture. The global market for CO<sub>2</sub> was valued at [\\$6 billion](#) in 2015 and is expected to [double in size](#) in just five years. Direct air capture technology will help meet these needs. The ability to sell or convert CO<sub>2</sub> into useful products also provides a commercialization pathway for direct air capture.

Below are examples of commercial entities that are using captured CO<sub>2</sub> today:



**Concrete and Cement:** CO<sub>2</sub> is injected in concrete to produce stronger and lower cost building materials

- Solidia Technologies – New Jersey
- Blue Planet – California
- CarbonCure – Canada
- Calera – California



**Raw Materials:** CO<sub>2</sub> is used to produce precursors for plastics, chemicals, feedstocks, and more

- Novomer – Massachusetts
- New Sky Energy – Colorado
- Carbonfree Chemicals – Texas
- Covestro – Germany



**Synthetic Fuels:** CO<sub>2</sub> is processed to produce gasoline and biofuels

- Opus 12 – California
- Carbon Recycling International – Iceland
- Greyrock Energy – California
- Dioxide Materials – Florida



**Oil Production:** CO<sub>2</sub> is used to improve yield from mature fields through enhanced oil recovery

- Denbury Resources Inc. – Texas & North Dakota
- Occidental Petroleum – New Mexico & Texas

### **More federal research funding is needed to unleash innovations in direct air capture technology.**

- Private sector investment in direct air capture research in the United States has primarily been through angel investments by high-net worth individuals and limited federal funding from the Department of Energy's Office of Fossil Energy.
- The private sector tends to underinvest in breakthrough energy research because energy technologies are often capital-intensive and take years to develop before they can be deployed broadly.
- Decades of federal energy research has filled a crucial investment [gap](#) and helped improve technology cost and performance for many of today's energy technologies, including advanced combustion engines, lithium-ion batteries, and solar panels, that have generated billions in economic returns and energy savings for consumers. Federal support will be just as crucial for direct air capture and storage.

## **BOTTOM LINE:**

More federal research investment is needed in direct air capture and storage technology, which can operate at large scale, spur further advances in materials science and manufacturing, and facilitate business growth as market opportunities for CO<sub>2</sub> expand.