Carbon Management in the Industrial Sector

Industrial Innovation Initiative

What is CCUS?

Carbon capture, utilization, and storage (CCUS) is a portfolio of safe, effective, and increasingly cost-effective technologies used to manage, abate, and remove carbon dioxide (CO_2) emissions from industrial facilities and power plants. Carbon capture equipment can be retrofitted onto existing facilities to capture their carbon emissions, which can then be injected underground for permanent geologic storage, either onsite or transported to another location. Captured CO_2 emissions may also be reused to produce low-carbon materials like building materials, alternative fuels, and chemicals.

Where is it applicable for industry?

HIGHER EMISSIONS ↕ LOWER EMISSIONS

Sector	Potential for Carbon Capture
Pulp and Paper	The pulp and paper industry can utilize bioenergy with carbon capture and storage (BECCS) to reduce its emissions, as about 75-100% of carbon emissions from a pulp mill come from biomass.
Gas Processing	Some of the first CCUS projects were in natural gas processing, and this industry provides lowe-cost opportunities for CCUS application. This is due to industry's inherent processes, which require impurities (e.g., CO_2 or sulfur dioxide) to be separated out from the gas before it can be transported by pipeline or turned into liquefied natural gas. This separation results in a concentrated stream of CO_2 that is easy to transport and store.
Cement and Concrete	Carbon capture can play a critical role in addressing unavoidable process emissions in concrete and cement production. Cement production facilities can be retrofitted with equipment that captures CO_2 from the precalciner or the kiln.
Iron and Steel	There are two primary ways carbon capture can help decarbonize the iron and steel sector. First, post-combustion carbon capture can be retrofitted onto blast furnaces, which are represented in many existing steel plants globally. Second, carbon capture can play a role in the developing hydrogen-based ironmaking industry.
Ammonia	Carbon capture holds great potential for decarbonizing the ammonia industry. Ammonia needs hydrogen as a feedstock, and a byproduct of hydrogen production is a high-concentration stream of CO_2. Some of this CO_2 can be used on-site at the facility to produce urea. With carbon capture technology, the rest can be purified and compressed, then transported and stored instead of being released into the atmosphere.
Ethanol	Carbon capture has demonstrated significant potential to decarbonize the ethanol industry. The technology has been used commercially in the ethanol industry since 2009, and large-scale projects to capture, transport, and store captured CO_2 from the ethanol industry are currently under development.
Chemicals	Carbon capture can be used at chemical production facilities to capture unavoidable process emissions. Additionally, captured CO_2 can sometimes be utilized and converted into chemicals and chemical intermediates, including methane, methanol, and plastic. However, not all captured or removed CO_2 can be utilized for the production of chemicals.

Source: EPA GHGRP, 2024

How would a facility pay for CCUS?

Section 45Q of the US tax code is the key economic driver for CCUS projects in the United States. 45Q provides a performance-based tax credit for carbon management projects that capture CO_2 from eligible industry and power facilities, as well as facilities that capture CO_2 directly from the atmosphere.

For industrial facilities to be eligible for the 45Q tax credit, they must own the carbon capture equipment and capture at least 12,500 metric tons of CO_2 annually. To claim the credit, **operators must successfully demonstrate permanent geologic storage or reuse of the captured carbon dioxide**. Eligible projects that begin construction before January 1, 2033 can claim the credit for up to 12 years after being placed in service.

45Q CREDIT AMOUNT

For dedicated secure geologic store of CO_2 in saline or other geologic formations:

$85/metric ton

For carbon reuse projects to convert CO_2 into useful products:

$60/metric ton

For secure geologic storage in oil and gas fields:

$60/metric ton

Why is CCUS beneficial for the economy and communities?

CCUS can bring high-quality jobs to communities and spur significant private investment in states. CCUS projects require both project jobs (jobs associated with the equipment, materials, engineering, and labor required to install technology and build infrastructure) and ongoing operations jobs (jobs to operate and maintain retrofits).

STATE SNAPSHOT: Pennsylvania

According to an analysis from Rhodium Group, Pennsylvania has the opportunity to create up to **8,557 project jobs annually** over a 15-year period and **5,504 ongoing operations jobs** by adding carbon capture to 33 industrial and power facilities. Around 1,600 of these project and operations jobs would be at industrial facilities. Developing CO_2 capture, transport, and storage infrastructure at all eligible facilities could generate up to **$34 billion in private investment** and **capture 64 million tons of CO_2 every year**.

Who is doing it?

ETHANOL CASE STUDY:

Gevo - Richardton, North Dakota

Gevo operates a low-carbon ethanol facility. They capture CO_2 from the ethanol production process and store it in a nearby geologic storage well with an annual capacity of one million metric tons of CO_2.

CEMENT CASE STUDY:

Heidelberg Materials – Mitchell, Indiana

Heidelberg is working to integrate full-scale carbon capture, transport, and storage into their cement plant. In early 2025, Heidelberg drilled a geologic CO_2 storage test well at the site to study its geologic suitability.

AMMONIA CASE STUDY:

CF Industries – Ascension Parish, Louisiana

CF Industries is developing a low-carbon ammonia facility. Once operational, approximately 2.3 million metric tons of CO_2 will be captured from the facility annually, then transported and stored to 1PointFive's Pelican Sequestration Hub.