Source: Heidelberg Materials

How is carbon captured?

There are various technological applications related to the capture of carbon dioxide (CO_2) for large industrial facilities, including pre- and post-combustion capture. Enbridge is involved in both applications as it advances world-class carbon capture and storage (CCS) projects across North America.

Post-combustion capture

With post-combustion capture, CO_2 from a smokestack or flue gas is sent through a CO_2 absorber containing chemicals called amines that absorb and attach themselves to the CO_2. This solution of amines and CO_2 then passes through a stripper, which uses heat to separate the two. Released CO_2 then passes through a dehydrator that removes water remaining in the solution after separation, and the amine is then washed to be recycled again through the capture process.

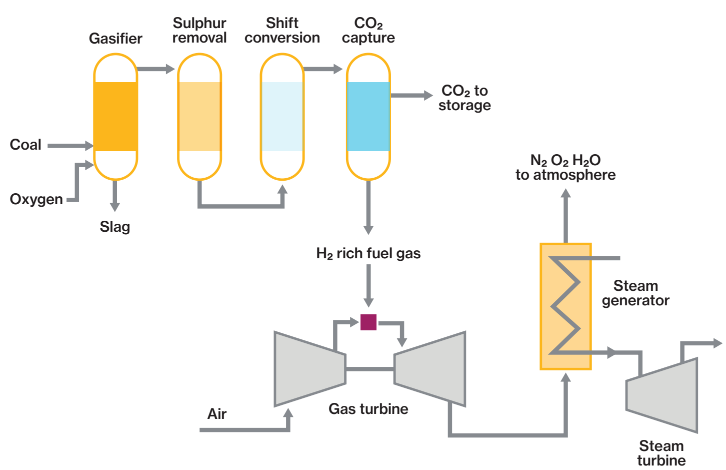
In a final stage, the CO_2 is compressed to a liquid-like state for pipeline transport *(see illustration on the back of this page).* Post-combustion capture is a popular and versatile CCS application because it can be used across many industries that have large set-points of emissions.

Post-combustion capture requires energy for the capturing process and to run compressors. Frequently, the CO_2 generated from this energy production is captured as well.

Post-combustion capture processes are evolving and improving over time. New amines that require less heat are being developed and post-combustion capture is expected to require less energy in the future.

Pre-combustion capture

With pre-combustion capture, CO_2 is removed from fuels like coal or natural gas before combustion occurs. For example, with pre-combustion of coal, this fuel is converted into a gas mixture of hydrogen and carbon monoxide (CO) known as syngas. The syngas is then reacted at high pressures with oxygen and water (H_2O) to create hydrogen (H_2) and a stream of fairly pure CO_2. The hydrogen is then either burned to generate electricity or transported for other energy uses, while the CO_2 is separated and captured for storage.



> Illustative process of pre-combustion capture

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An advantage of pre-combustion capture is it can achieve high capture rates using less energy. That said, it requires additional processing steps and can be expensive to implement. Pre-combustion capture is useful for newly-built industrial infrastructure, though it's not as easily incorporated into existing fuel burning plants.

Dehydration of CO_2 after capture

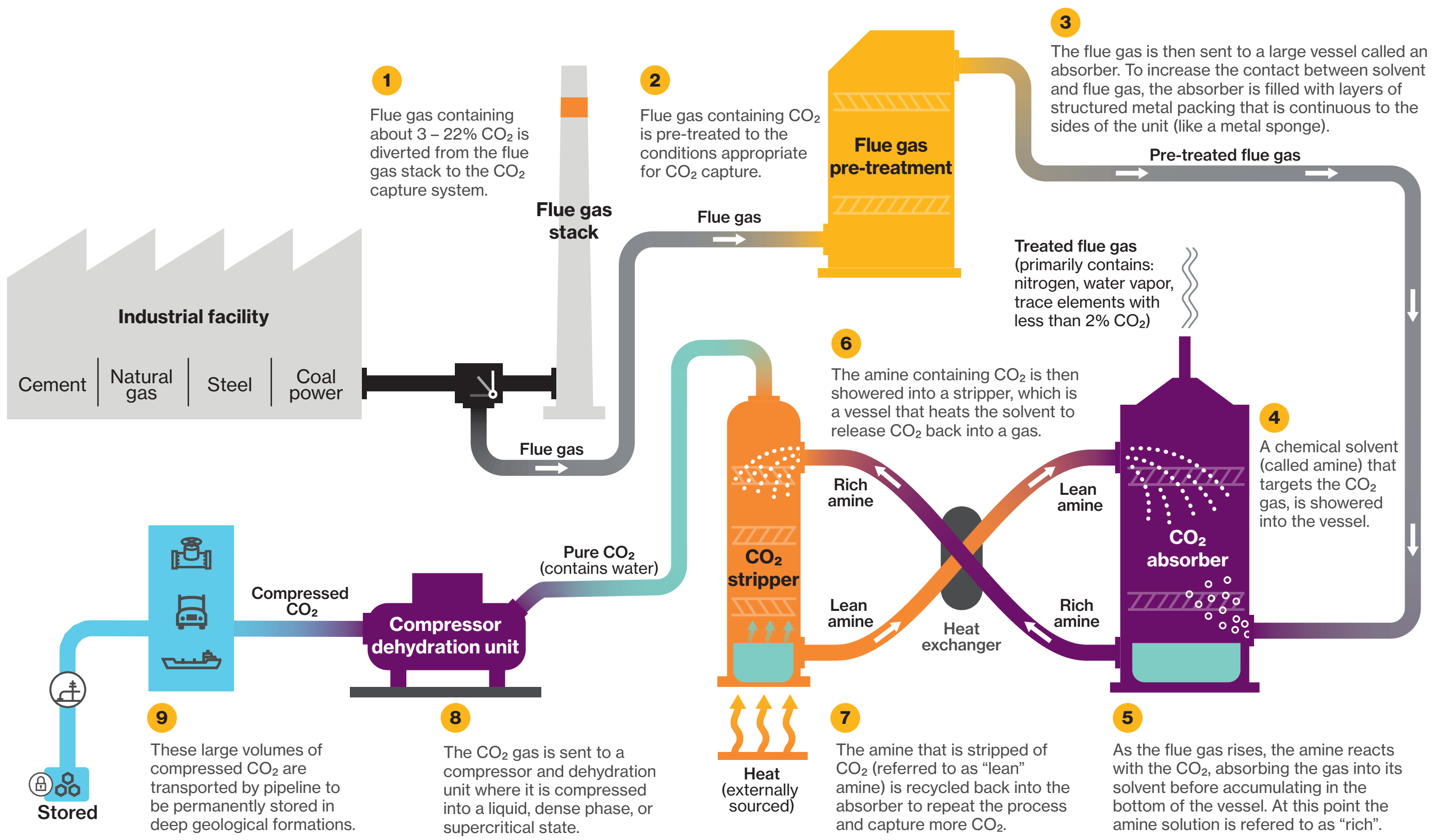
CO_2 that is separated for transportation via pipeline must have all moisture removed. Removing the water assures it can be easily compressed to a liquid-like state for transportation and to prevent corrosion of pipelines and other metals at the injection well. It's common for natural gas and other compounds transported by pipelines or by rail tanker cars to be similarly dehydrated to reduce risk of corrosion.

Compression of CO_2 after capture

Compressing CO_2 to around 1,100 pounds per square inch (psi) allows it to move and act like a liquid and ensures it takes up less space in deep storage formations. For our CCS projects, we're contemplating compression to around 2,200 psi. Once the CO_2 is compressed, it's ready to be transported to injection wells, to be permanently and safely stored deep underground.

Experts globally agree CCS is vital for meeting greenhouse gas reduction goals. That's why Enbridge is developing CCS solutions. CCS is a viable way to meaningfully reduce greenhouse gas emissions from critical industries like cement production, power generation, energy production and refining, along with fertilizer, plastics, chemicals and steel manufacturing.

Post-combustion capture: The path of CO_2 through the amine-based capture process



Enbridge is advancing CCS projects across North America as a key enabler to reaching national and international emissions reduction goals. This is one of a series of Enbridge fact sheets intended to provide an overview of the many facets of CCS.