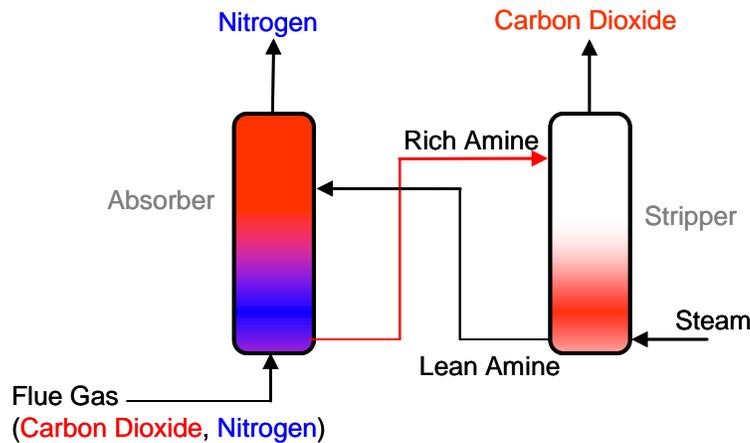


How Post Combustion Capture Works

Post combustion capture (PCC) refers to capturing carbon dioxide in a coal-fired power plant after a combustion process has been completed.

Amine scrubbing is a common form of PCC and is illustrated below. Cooled flue gas from the combustion process containing mostly nitrogen and carbon dioxide is sent to a vessel called an absorber. Amine liquid in the absorber flows down over packing and mixes with the flue gas from the combustion process. Carbon dioxide forms a weak chemical bond with the amine and is absorbed into the amine. Nitrogen exits through the top of the absorber and is sent to the stack.



Amine rich in carbon dioxide is sent to a vessel called as stripper. Steam is added to the stripper to provide the energy needed to break the chemical bond between the carbon dioxide and the amine. Once the carbon dioxide is stripped from the amine it flows out the top of the stripper where it is dried and compressed into a liquid prior to storage. The amine at the bottom of the stripper is lean in that it contains very little absorbed carbon dioxide. This lean amine is recycled back to the absorber to be used again.

Amines are typically degraded in the presence of SO_2 and NO_2 and therefore the flue gas must be cleaned to reduce these chemicals to very low concentrations before the flue gas enters the absorber.

About 50% of the steam entering the low pressure steam turbine in a coal plant is diverted to the stripper. About 1.5 tonnes of low pressure steam, contributing about 3.7 GJ, is required to capture 1 tonne of CO_2 . This use of steam typically reduces the power output of the coal plant by at least 20%.

Since amines are corrosive, they are usually diluted with water. This means that large amounts of liquid must be circulated through the system. The total energy requirement for this process and to compress the CO_2 typically reduces the power output of a coal plant by at least 25%.

Generally amine scrubbing systems are designed to capture about 90% of the carbon dioxide. The absorbers and strippers are very large vessels contain expensive packing. An amine scrubbing plant, required to capture carbon dioxide from a typical coal plant, will cover about 10 acres.

There are several suppliers of amines which could be potentially used for PCC on coal plants. Fluor and Mitsubishi Heavy Industries are leading suppliers. Saskpower has chosen the Cansolv technology owned by Shell to remove both SO₂ and CO₂ from their Boundary Dam project. Basin Electric has chosen to proceed with a FEED study on the HTC Pure Energy PCC technology for one of their plants. However, there are no commercial scale coal PCC plants.

Alstom and Power Span have developed chilled ammonia processes employing ammonium carbonate instead of amines. TransAlta and Capital Power have chosen the Alstom process for their Pioneer project. In the Alstom process flue gas is cooled to about 10 degrees C to reduce the amount of ammonia leaving the absorber with nitrogen. There is also a water wash system on top of the absorber to remove ammonia from the nitrogen. The ammonia collected in the water wash is sent to the stripper. The stripper operates >120 degrees C but at >20 bar. This higher temperature condition provides the energy to liberate the CO₂ from the carbonate. This high pressure environment helps keep ammonia in the liquid solution and out of the gaseous carbon dioxide product and serves to partially compress the carbon dioxide.

There are numerous other liquid and solid PCC processes being developed.

For more information please visit the following sources.