

FACTSHEET CCS

INFORMATION ABOUT CCS – CARBON CAPTURE AND STORAGE

THE POSTCOMBUSTION PROCESS

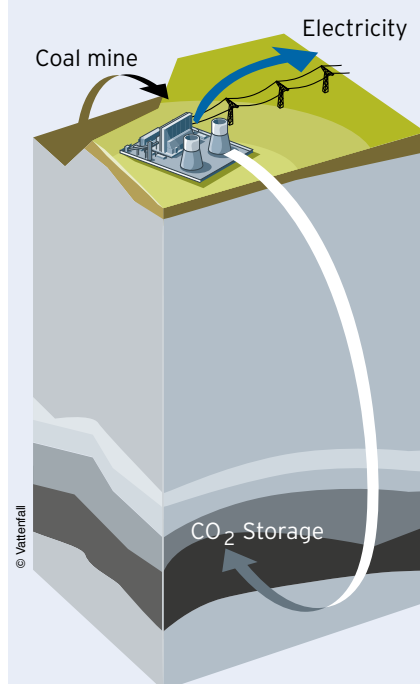
Three technology options are currently available for capturing carbon dioxide (CO₂) from the combustion process at a power plant. One of the three technologies is called Postcombustion capture. The aim of all three technologies is to produce a concentrated stream of CO₂ that can then be transported to a suitable underground storage site.

Postcombustion capture can be implemented at virtually any existing conventional power plant. In exactly the same way as at such plants, the flue gases resulting from fuel combustion are first purified to remove nitrogen oxide (NO_x), sulphur oxides (SO_x), particles and other environmentally-harmful substances.

In Postcombustion capture, CO₂ is then captured from the flue gases in an absorption column using an absorption process based on chemical solvents such as amines. The gases pass through the absorption column where the solvent reacts with CO₂, chemically binding it and removing it from the flue gas stream. After absorption, the purified flue gases primarily contain water vapour and nitrogen, a gas that is one of the main constituents of air and thus does not contribute to climate change.

Once the CO₂-rich solvent leaves the absorption column, it is heated in a separate stripper column to release the almost pure CO₂ and can then be reused in a loop for the absorption of CO₂. Heat from the power plant's steam turbines is used to raise the solvent's temperature

CARBON CAPTURE AND STORAGE (CCS)



CCS stands for the technologies used to capture and store the carbon dioxide (CO₂) generated in combustion processes, for example in a power plant. Essentially, three different processes are available: Oxyfuel, Postcombustion and Precombustion (IGCC). Today, all three technologies are available in the Vattenfall Group. The common aim of all these processes is to produce a concentrated stream of CO₂, compress it and then store it underground instead of releasing it into the atmosphere.

to its boiling point. The captured CO₂ can then be compressed and transported to a storage site.

Considerations for commercial viability

Gas scrubbing to remove unwanted constituents is a common unit operation in the chemical industry. However, the use of flue gases from fossil-fuel combustion in power generation does give rise to a number of specific challenges. Firstly, the low flue gas pressure requires a solvent that is chemically very active and that works fast enough to remove 90% or more of the CO₂ in the flue gas. This process would be much faster if the flue gases were pressurised. A second challenge is that the constituents of the flue gas, such as oxygen and sulphur oxides, cause degradation and loss in most types of solvent. Thirdly, it is still very unusual to find equipment large enough to treat the huge volumes of flue gas produced at power plants. In principle though, Postcombustion capture systems can be used for flue gases from the combustion of any type of fuel. The greatest challenge, however, is producing the energy needed to release the CO₂ from the solvent; as this reduces

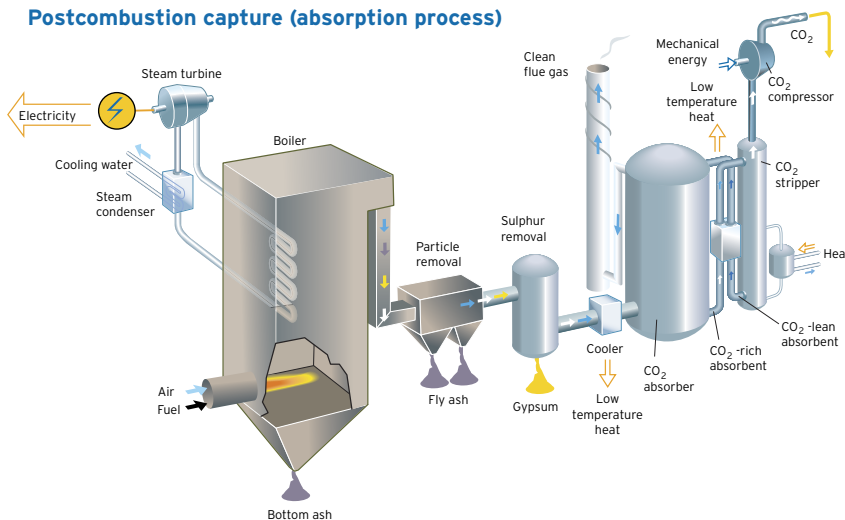
the overall efficiency of the power plant. On the other hand, the technology can be retrofitted at existing plants, making it the fastest and most adaptable solution.

Large-scale validation through pilot and demonstration projects

Vattenfall has announced that it will carry out a CO₂ capture and storage demonstration project to validate the Postcombustion processes and that this will be in operation in 2015. In the German project at the Jämschwalde power plant, 50% of the flue gas volume from a lignite-fired boiler will be purified to remove CO₂, equivalent to a 125 MW power plant. The demonstration project has received funding of EUR 180 million from the "European Energy Programme for Recovery" (EEPR).

Vattenfall is also participating in "CCpilot100+", a CCS project with Postcombustion technology at Ferrybridge Power Station in West Yorkshire, UK. The project is a collaboration with Scottish and Southern Energy (SSE) and Doosan Babcock. The pilot project will help Vattenfall to learn vital lessons before going large scale.

Postcombustion capture (absorption process)



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Read more about Vattenfall's CCS project at www.vattenfall.com/ccs