

# FACTSHEET CCS

INFORMATION ABOUT CCS – CARBON CAPTURE AND STORAGE

## THE PRECOMBUSTION PROCESS

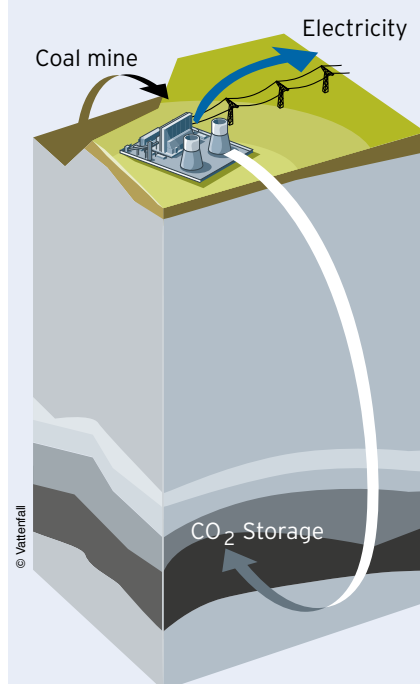
**Today, three technology options are available for the capture of carbon dioxide (CO<sub>2</sub>) at a power plant and the Precombustion process is one of them. The aim of all three technologies is to produce a concentrated stream of CO<sub>2</sub> that can be transported to a suitable storage site.**

It is likely that the Precombustion capture process will be applied only in combination with gasification technology. In gasification, coal and biomass are first transformed into a combustible gas known as synthesis gas, syngas for short, which is cleaned and desulphurised. This cleaned syngas mainly comprises the combustible components Hydrogen (H<sub>2</sub>) and CO. It is relatively easy and efficient to remove CO<sub>2</sub> from the syngas by means of a so-called "CO shift". Steam (H<sub>2</sub>O) is added to the syngas, causing a chemical reaction ( $H_2O + CO \rightarrow H_2 + CO_2$ ) in a catalytic converter and giving rise to a syngas with more hydrogen, H<sub>2</sub>, and carbon dioxide, CO<sub>2</sub>.

About 90% of the CO<sub>2</sub> is then separated by means of a washing solvent and the H<sub>2</sub> is combusted in a gas turbine that generates electricity.

Some residual products remain at the end of the gasification process and these are captured and reused. Slag and fly ash are used in road construction and the production of concrete. Sulphur can be sold to the chemical industry for refinement.

### CARBON CAPTURE AND STORAGE (CCS)



CCS stands for the technologies used to capture and store the carbon dioxide (CO<sub>2</sub>) 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 CO<sub>2</sub>, compress it and then store it underground instead of releasing it into the atmosphere.

Before the captured CO<sub>2</sub> can be transported, it is first compressed. The compressed CO<sub>2</sub> is then transported via a pipeline to the storage location.

### Based on gasification technology

In comparison with conventional coal-fired power plants, gasification has the advantage that the air pollution is much less. As the coal gas is thoroughly cleaned, emissions of dust, sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>) and metals are minimal. Furthermore, by replacing some of the coal with biomass the emissions of fossil CO<sub>2</sub> can be reduced as well.

The extra equipment needed for the CO<sub>2</sub> capture does need additional energy from the power plant, which will result in a decrease in the net efficiency of the power plant. This is the reality for all currently known carbon capture technologies.

### Precombustion pilot programme

To make Precombustion truly viable for commercial use in power plants, further

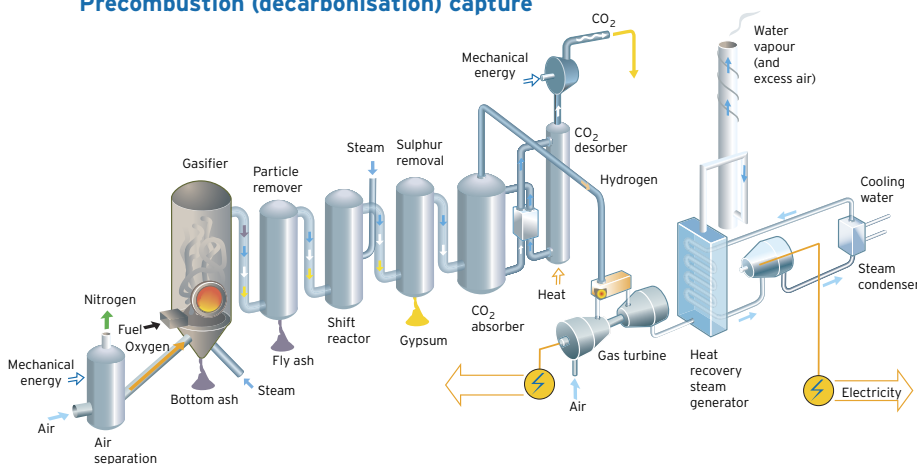
development of the gas turbine and the gasifier is required.

### Considerations for commercial viability

Most of the process equipment required for Precombustion is readily available and commonly used in ammonia plants, refineries and other industrial processes. An advantage of gasification in combination with Precombustion is that it could be optimized for generating electricity or producing hydrogen or chemicals, or even a combination of all three.

A pilot programme for CO<sub>2</sub> capture using the Precombustion process is due to take place at the Willem-Alexander power plant in Buggenum, the Netherlands. The aim of the pilot programme is to make the Precombustion capture of CO<sub>2</sub> suitable for the energy sector and to optimise the process. The knowledge and experience gained will be applied at the Magnum power plant which is under construction in the north of the Netherlands.

### Precombustion (decarbonisation) capture



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Read more about Vattenfall's project on CCS at [www.vattenfall.com/ccs](http://www.vattenfall.com/ccs)