FACTSHEET CCS

INFORMATION ABOUT CCS – CARBON CAPTURE AND STORAGE

THE OXYFUEL PROCESS

Today, three technology options are available for the capture of carbon dioxide (CO_2) from the combustion process at a power plant and the Oxyfuel process is one of them. The aim of all three technologies is to produce a concentrated stream of CO_2 that can be transported to a suitable storage site.

In the Oxyfuel process, the fuel is combusted in a mixture of pure oxygen and recycled CO_2 instead of in air as in the case of conventional combustion. By excluding the nitrogen from the combustion process, the resulting flue gas will almost only consist of carbon dioxide and water vapour. The flue gas recycle, approximately 75% of the flue gas exiting the boiler, makes the combustion process similar to the well-known air firing.

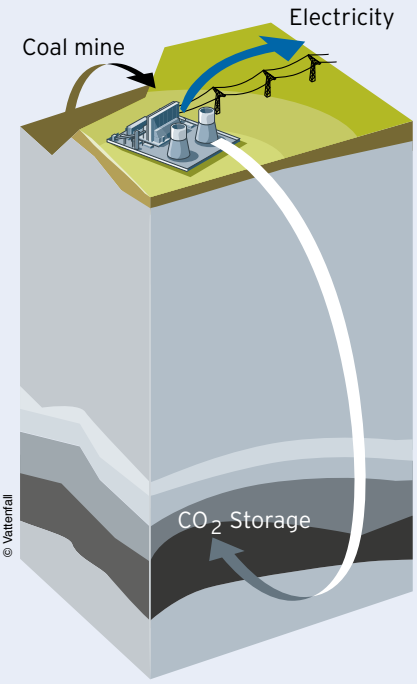
Subsequent treatment steps include dust separation and the desulphurisation of the flue gas as in a conventional power plant. The separated sulphur is used in gypsum production, as a by-product. Finally, the remaining water vapour is condensed out, leading to a flue gas with an up to 98% CO_2 concentration.

By lowering the temperature and raising the pressure, the resultant CO_2 can be liquefied for transport in trucks or by ship. If the CO_2 is transported in pipelines, a very high pressure is preferred.

Based on conventional technology

The Oxyfuel process is based on the conventional power plant process and uses additional components that are technically mature to a very large extent. The

CARBON CAPTURE AND STORAGE (CCS)



CCS stands for the technologies used to capture and store the carbon dioxide (CO_2) 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_2, compress it and then store it underground instead of releasing it into the atmosphere.

major additional components are the air separation unit and the CO_2 compression. This extra equipment 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.

The Oxyfuel process has the advantage of using established power plant components. One of the challenges is to achieve an optimal integration of the different process flows and components.

Dedicated work

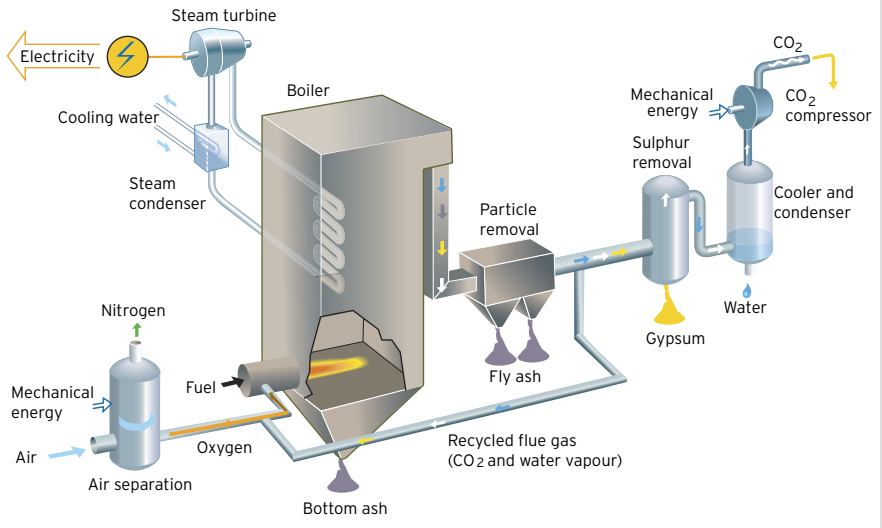
As Vattenfall identified the Oxyfuel technology as a promising option for CO_2 capture at an early stage, dedicated cooperation with universities in both Germany and Sweden on the topic has been established. At the Technical Universities in Cottbus, Dresden and Hamburg-Harburg, at IVD in Stuttgart and at Chalmers Technical University in Gothenburg, test-rigs for Oxyfuel firing have been constructed and advanced research, studying various parts and components of the Oxyfuel process, is being performed.

As present, the Oxyfuel technology is being validated on a large scale at Vattenfall's pilot plant in Schwarze Pumpe.

From 2015 at the latest, Oxyfuel will also be implemented in Vattenfall's demonstration plant at Jänschwalde. This plant will carry forward both the Oxyfuel and Postcombustion technologies.

Vattenfall is also involved in the British collaboration OxyCoal UK, which involves pilot scale tests of the Oxyfuel combustion of bituminous coal.

Oxyfuel (O_2/CO_2 recycle) combustion capture



As at: April 2010

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

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