

FACTSHEET CCS

INFORMATION ABOUT CCS – CARBON CAPTURE AND STORAGE

TRANSPORT OF CARBON DIOXIDE

The infrastructure for transporting carbon dioxide (CO₂) is the key component that ties the capture of CO₂ at power plants to storage at suitable sites.

A large-scale CO₂ capture and storage system would have to handle CO₂ from several power plants. A single 1,800 MW lignite power plant produces around 10 million tonnes of CO₂ each year. For transporting the vast amounts of CO₂ produced in large power plants, pipelines and ships are the most attractive options.

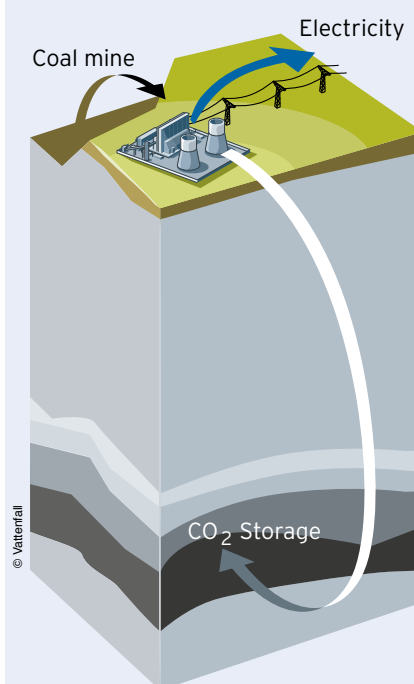
Pipelines

Large volumes of CO₂ are already transported over long distances in high-pressure pipelines in the US, where pipelines for CO₂ transport have existed since the early 1970s. The pipelines today extend over 5000 km and the transported CO₂ is used to enhance oil production in mature oil fields. When transporting the gas in pipelines it is preferred to keep it under very high pressure, up to 150 bar. At this pressure, the gas is in a physical state called super-critical, which means that it is as dense as if it were in the liquid phase but flows as easily as a gas. This makes this supercritical phase ideal for pipeline transport.

Shipping

Ship transport is the logical choice for offshore storage sites, but it might also be a sustainable alternative to pipeline transport. Moreover, ship transport could be a temporary and more flexible solution while a pipeline infrastructure is being built, or a complement in the

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.

logistic chains involving both pipelines and ships.

CO₂ transport in ships today

The ship transport of very large amounts of gas is currently used for liquid petroleum and natural gas (LPG and LNG), with a typical payload of up to 100000 m³ of liquefied gas or more. For the transport of commercial CO₂ today, mainly for the food industry, there are a few small ships with a payload of about 1000 m³. The CO₂ is transported in its liquid phase at about -28°C and 15 bar.

Because of the large volumes, the transport of CO₂ from power plants would require larger ships, which in turn would need to be developed technically due to the different physical behaviour of CO₂ compared to LNG and LPG.

In the future

Another ship concept has been presented, where the idea is to transport compressed CO₂ at a somewhat lower pressure, about 70 bar. In this "floating pipeline" solution, the CO₂ would be contained in packages made of standard pipeline pieces. The idea is to avoid energy losses in the processing of CO₂ by changing the pressure and physical state. In spite of the lower amount of CO₂ transported per ship, the full logistic chain may prove advantageous.

No standard solution

No optimal, standard solution for the logistics of CO₂ in the CCS chain can currently be identified, and will probably not be identified at a later stage either. The logistics to be preferred depend on a number of parameters such as the geographical prerequisites, amounts to be transported, timing, choice of technology, ship sizes, etc. Sets of logistic cases need to be formulated and studied in greater depth to improve our understanding of the technical and financial characteristics of possible transports of CO₂ for Vattenfall.



Photo: IM Skaugen

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