

Capturing Carbon Dioxide (CO₂)

In order to store CO₂, first we need to capture it. There is a lot of research being undertaken both into improving existing processes, and developing new methods of capture, but currently there are three main methods of CO₂ capture which capture the CO₂ either before combustion (burning) of the fuel, after it, or by combusting the fuel in a different environment, and these are described below.

Post-Combustion CO₂ Capture

Post combustion capture, as the name suggests, takes place after the normal combustion process has taken place, i.e. after the fuel has been burnt to produce electricity. Post combustion capture takes place in the chimney of a power station, also known as the 'flue'.

A chemical (or solvent) is washed through the exhaust gases, and this chemical effectively removes the CO₂ from the exhaust gases. This chemical, now containing the captured CO₂, is collected at the bottom of the flue and the CO₂ can be removed for transport and storage, while the chemical can be re-used.

First examples of this exhaust gas cleaning have been used since the 1930's, and because the capture takes place after combustion and after the electricity has been produced, no changes need to be made to the power station other than adding the capture system to the end of the process. This makes post combustion capture particularly suited to power stations that are not due to be replaced, and are still operating as relatively new power stations.

Pre-Combustion Capture

Again, the name of the process suggests where the capture takes place; pre-combustion capture takes place by removing the CO₂ from the raw fuel.

The fuel is subjected to a chemical reaction which converts the fuel into a gas mixture made up of hydrogen, carbon monoxide, and oxygen. A second stage reaction converts this into hydrogen and CO₂. The CO₂ is removed, and the hydrogen is combusted with air to produce electricity. The only waste product to come out of this process is water.

This is a very clean process, and also eliminates many other emissions. It is a more expensive option, and as the combustion process is significantly altered, it is less applicable to existing power stations, and is much better suited to new-build stations.

Oxyfuel Combustion

The third option is different in that instead of burning fossil fuels in air, which conventional power stations do, the fuels are burnt in oxygen. This means that the waste products are CO₂ and water which are easily separated.

Again, this process is more suited to new power stations, but can be fitted with minor changes to existing power stations. The main costs associated with this option are based around the supply of oxygen – this is done by removing the other components of air in a special process before the combustion process, and this is relatively expensive.

Summary

While all three options are viable, the choice remains dependant on the location, the need to fit the process to an existing power station or build a new one, and the availability of equipment and chemicals needed for each different process. All three are being tested, developed and demonstrated, and all have a part to play in emissions reductions.