

The capture of carbon dioxide (CO₂) from a stationary source, such as a power plant, involves trapping, or capturing, the CO₂ rather than allowing it to be released to the atmosphere.

The main sources potentially suitable for CO₂ capture are industrial processes, electricity generation and possibly in the future, hydrogen production.

Industrial processes that may lend themselves to CO₂ capture now include natural-gas processing; ammonia production; and cement manufacture, but the total quantity of CO₂ produced by these processes is limited. A far larger source of CO₂, accounting for approximately half of all CO₂ emissions in Australia, is fossil-fuelled electricity generation, whether that be from coal, oil or natural gas. While the basic building block technologies exist for capture from these sources, and such a plant could be built today, more research is required on these capture technologies to reduce the power cost increases to the community.

Technologies for capturing CO₂ from electricity generation fall into three categories: post-combustion, pre-combustion and oxy-firing.

In post-combustion capture CO₂ is separated from the flue gas after fuel is burnt from conventional power stations, either coal or natural gas.

During pre-combustion capture the fossil fuel is brought into contact with steam and oxygen, producing a synthetic gas (syngas), largely comprising carbon monoxide (CO), carbon dioxide and hydrogen (H₂).

This syngas can then be combusted in power gas turbines to produce electricity – such plants exist today. The CO₂ is removed from the syngas before combustion in the power gas turbines.

However, for maximum CO₂ removal an additional reaction (water gas shift) is used to convert the residual carbon monoxide to CO₂ and additional hydrogen with water.

This process can be applied to all fossil fuels, but in the case of coal, the solid fuel is gasified in either an oxygen or air-blown gasifier. Examples of this process are Integrated Gasification Combined Cycle (IGCC) or Integrated Drying Gasification Combined Cycle (IDGCC) – an Australian-developed technology.

Oxy-firing combustion capture is where fuel is combusted in pure oxygen. The process produces about 75 per cent less flue gas than air-fueled combustion and the exhaust consists of between 80 and 90 per cent CO₂. The remaining gas is water vapour, which simplifies the CO₂ separation step. An air separation plant is required to produce pure oxygen for the process from air.

CO₂ capture practised commercially for many years

While the capture of CO₂ for geosequestration is a relatively new concept, CO₂ capture for commercial markets has been practised in Australia and overseas for many years.

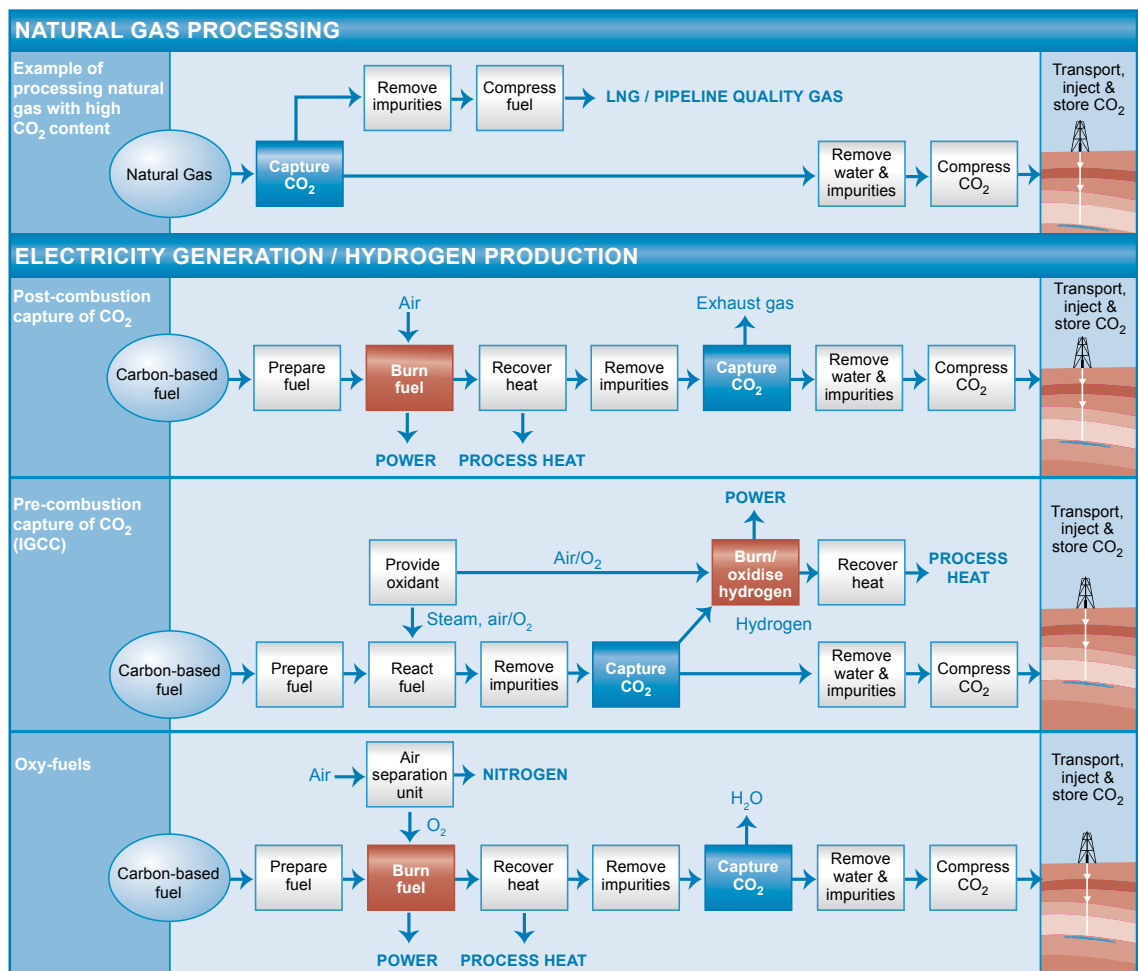
CO₂ is captured from natural gas wells in South Australia, near Mt Gambier and in southern Victoria, near Port Campbell. The CO₂ is then used for various commercial processes including carbonation of beverages and dry-ice production.

In the United States, CO₂ capture at power plants using chemical absorption based on the monoethanolamine solvent has been practised since the late 1970s, with the captured CO₂ being used for enhanced oil recovery as well as smaller scale CO₂ beverage manufacture.

CO₂ capture and geosequestration

Following capture, CO₂ is usually transported from a source, such as a power station, to the geological storage site in a compressed form via a pipeline (though other forms of transportation such as road, rail or ship are feasible and may well be economic in certain situations).

CO₂ is then injected deep underground into porous and permeable rocks within geological reservoirs between one and three kilometres beneath the surface. (See fact sheets: What is Geosequestration, and Storing CO₂ for further information.)



Further CO₂ capture fact sheets include: CO₂ Capture Costs (fact sheet 3), CO₂CRC Capture Research (fact sheet 4).