CAPTURING CARBON DIOXIDE

Capturing carbon dioxide (CO_2) from a stationary source such as a power plant involves separating it from the flue gas stream to prevent the gas from being released to the atmosphere.

The main sources for CO_2 capture are natural gas processing, industrial processes, electricity generation and, potentially in the future, hydrogen production.

Natural gas production often involves separating naturally occurring CO_2 mixed with the gas in its natural state before the gas can be sold. As Australia's natural gas industry expands this will be an increasing source of emissions that will need to be dealt with.

Other industrial processes where CO_2 capture is applicable include fertiliser and ammonia production, and cement manufacture; however the total quantity of CO_2 produced by these processes is relatively small.

A far larger source of CO_2, accounting for approximately half of all CO_2 emissions in Australia, is fossil fuel electricity generation from coal, oil or natural gas. The technology for capturing CO_2 from these sources is currently available, and research is underway to make the process more efficient and cost-effective.

There are three categories of CO_2 capture systems that could be used at power stations: post-combustion, pre-combustion and oxy-firing.

In **post-combustion capture** CO_2 is separated from the flue gas after fuel is burnt. This process can be added, or retro-fitted, to existing power stations, either coal or natural gas-fired.

During **pre-combustion capture** the fossil fuel is reacted with steam and oxygen, producing a synthetic gas (syngas) which is made up of mostly carbon monoxide (CO), carbon dioxide and hydrogen (H_2). An additional reaction with water (known as a water gas shift) can be used to convert the residual carbon monoxide to CO_2 and additional hydrogen. The CO_2 is removed and the hydrogen can then be burned in gas turbines to produce electricity. Such plants exist today.

This process, where the solid fuel is gasified in either an oxygen or air-blown gasifier, can be applied to all fossil fuels. 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 involves the combustion of fuel (coal or gas) in pure oxygen or oxygen-enriched air. The process can produce about 75 per cent less flue gas than air-fueled combustion and the exhaust consists of between 80 and 90 per cent CO_2. The remaining gas is water vapour, which simplifies the CO_2 separation step. An air separation plant is required to produce pure oxygen for the process from air.

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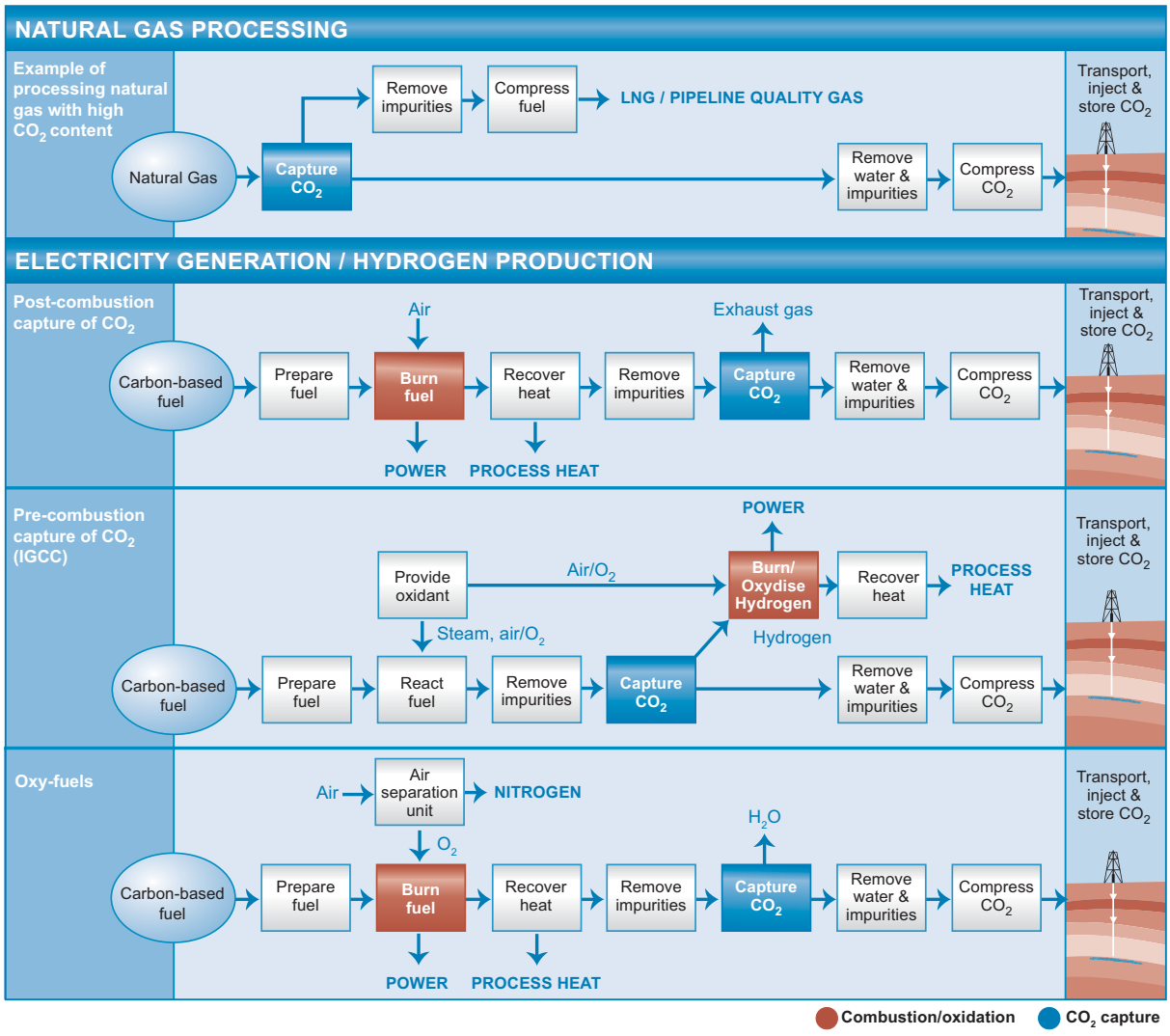
CO_2 capture has been practised commercially for many years

While the capture of CO_2 for geological storage is a relatively new concept, CO_2 capture for commercial markets has been practised in Australia and overseas for many years.

CO_2 is captured from natural gas wells in South Australia, near Mt Gambier and in southern Victoria, near Port Campbell. The CO_2 is then used for various commercial processes including carbonation of beverages and dry-ice production.

In the United States, CO_2 capture at power plants using chemical absorption based on the monoethanolamine solvent has been practised since the late 1970s, with the captured CO_2 being used for enhanced oil recovery as well as smaller scale CO_2 beverage manufacture.



Processes for carbon dioxide capture

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