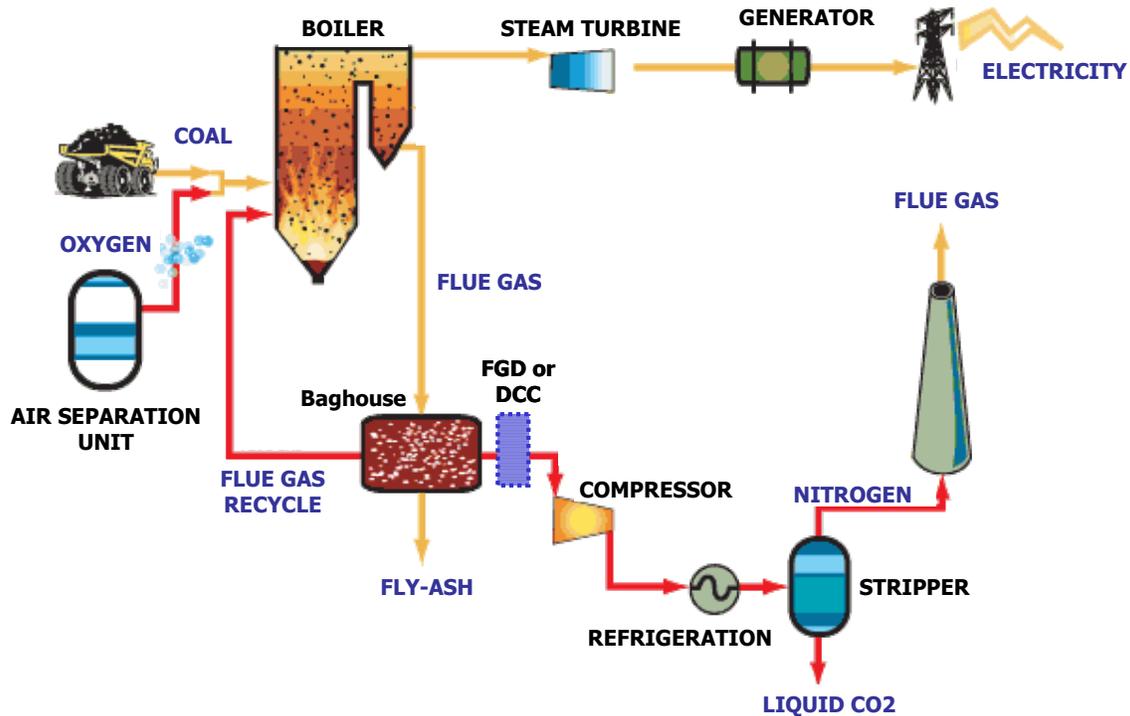


How an Oxyfuel Coal Plant Works

The following describes how to capture carbon dioxide from a coal plant by firing the plant with pure oxygen instead of air.



If the coal plant is fired with high purity oxygen, then the flue gas will contain about 63% carbon dioxide, 23% water, 8% nitrogen, 3% water and 3% argon. The flue gas coming from a traditional coal plant contains approximately 15% CO₂.

Once the flue gas is dried, the high concentration of carbon dioxide makes it easier to capture the carbon dioxide later in the process.

In order to produce the oxygen, very large air separation units are used to produce about 95 mole percent oxygen. Currently air separation technology relies on separating the oxygen as a liquid from the other constituents in the air at high pressure and low temperatures. A significant amount of electricity is required in this process.

Coal is burned in the boiler with oxygen to produce the energy required to make the steam used to drive steam turbines. However, coal boilers cannot operate on pure oxygen because the temperature in the boiler would become dangerously high. Therefore about two thirds of the flue gas exiting the boiler is recycled back

to the boiler to moderate the temperature. The ash in the flue gas is removed in a baghouse before the flue gas is sent back to the boiler. The other third of the flue gas is passed through a flue gas desulfurization process or a direct contact cooler to remove sulphur oxides.

Since there is very little nitrogen in the boiler, low concentrations of NO_x are formed compared to typical coal plants. Therefore processes to remove the NO_x may not be required.

The flue gas is dried to remove water and the CO₂ purified because it contains too much oxygen to be moved on a pipeline and the nitrogen in the flue gas may interfere with the ability of the carbon dioxide to enhance oil recovery.

To separate the CO₂, it is cooled to -55C and the pressure is increased to about 30 bara. At these conditions carbon dioxide can be separated in a series of vessels as a liquid. Most of the carbon dioxide is captured and the carbon dioxide has very few contaminants left in it. This liquid CO₂ is compressed to a higher pressure for delivery into a pipeline. The other constituents in the flue gas are sent up the stack.

There are a few demonstration scale oxyfuel plants operating. It will be several years before the first commercial scale oxyfuel plant is built. Foster Wheeler and Praxair, The Babcock and Wilcox Company & Air Liquide, and Alstom Power and Air Products are developing oxyfuel technologies.

For more information on oxyfuel plants please see the following sources.