The Babcock & Wilcox Company

Generating Powerful Solutions℠

a McDermott company

Oxy-Coal Combustion Overview

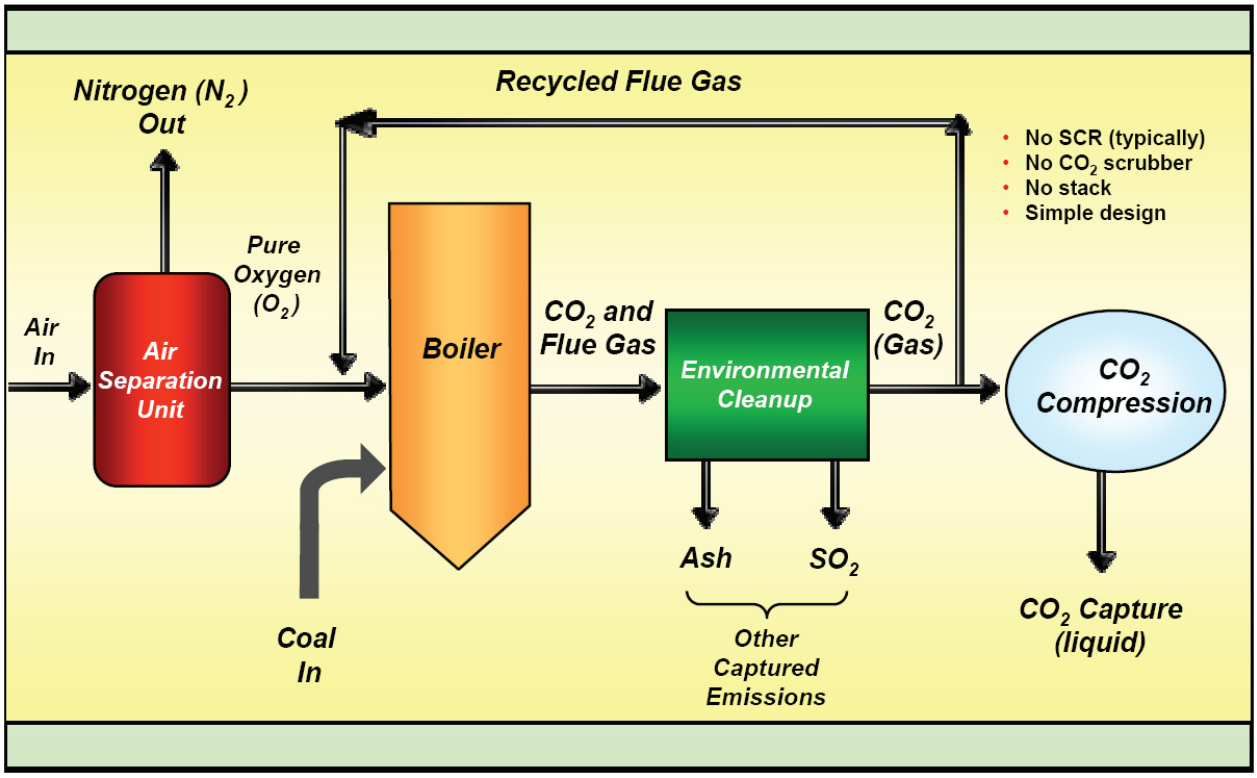
Conventional Combustion

In conventional coal combustion power plants, air and coal are supplied to the furnace. The oxygen in the combustion air burns the carbon (in coal), producing carbon dioxide (CO_2). The heat from combustion is transferred to make high temperature, high pressure steam. The steam energy spins the turbine of a turbine-generator set, producing electricity. Burning coal with air creates a combustion products flue gas stream in which the CO_2 is diluted to about 15 percent. The majority of the flue gas is nitrogen, the major constituent (78 percent) in the air provided to the furnace. The relatively inert nitrogen moderates the furnace temperatures and facilitates heat transfer for steam production. However, the dilution of the flue gas with nitrogen is also the primary technical impediment to capture of the CO_2. The CO_2 needs to be concentrated to be economically used for enhanced oil recovery (EOR), enhanced coal bed methane (ECBM) or stored in deep saline aquifers.

Oxy-Coal Combustion Concept

A variety of advanced combustion systems hold promise for producing concentrated streams of carbon dioxide from coal combustion systems. In the oxygen-fuel fired boiler concept, combustion air is replaced with relatively pure oxygen. The oxygen is supplied by an on-site air separation unit. The nitrogen that would normally be conveyed with the air through conventional air-fuel firing is excluded. Instead, a portion of the CO_2-rich flue gas is returned back to the burners, essentially substituting CO_2 for the nitrogen in the furnace. The CO_2 in oxygen combustion affects furnace operation and heat transfer in ways similar to the nitrogen in the air-fired system. Oxycombustion creates a flue gas that is primarily a concentrated stream of CO_2, rather than nitrogen, and other products of coal combustion. The fraction of the flue gas that is not recirculated to the burners leaves the plant, and would then be available for subsequent use or storage.

Near Zero Emissions Using Oxy-Coal Combustion Technology



(Continued on reverse side)

Beyond carbon management, an important secondary benefit of oxy-fuel firing is the reduction of nitrogen oxides (NO_X) emissions. By using relatively pure oxygen and replacing the nitrogen with the CO_2-rich recirculated flue gas, much less NO_X is produced since there is much less nitrogen available. Furthermore, some of the fuel NO_X (derived from nitrogen provided in the coal) in the recycled flue gas will be reduced by reactions within the flame to elemental nitrogen.

Oxy-Coal Combustion Commercialization Trajectory

The Babcock & Wilcox Company (B&W) has been actively engaged in oxy-fuel combustion research and development since the late 1990s. During the summer of 2007, B&W will complete a pilot demonstration of the technology at its 30 MW_{th} combustion test facility. An Oxy-Coal Combustion Advisory Group has been established to help bring potential users of the technology into the development process. One of the advisory group participants, American Electric Power (AEP), will work jointly with B&W on a feasibility study aimed at retrofitting an existing AEP plant for commercial-scale CO_2 capture and storage. The oxy-coal combustion technology is expected to be in service on an AEP plant around 2012-2015.

In a parallel initiative, SaskPower (Saskatchewan Power Corporation Inc.) is examining the feasibility of building a new plant in Estevan, Saskatchewan. Utilizing B&W's oxycombustion technology, this plant would supply 300 MW_e to the grid while simultaneously supplying 8,000 metric tons per day of CO_2 for enhanced oil recovery. This will likely be the first commercial-scale near-zero emissions coal power plant (NZEP) with carbon capture and storage (CCS) in North America.

Oxy-fuel combustion potential:

- **applicable for new power plants**
- **can be retrofit to some plants of the existing fleet**
- **commercially available in the near- to mid-term**
- **relatively simple system that looks and acts like a conventional power plant**
- **captures essentially all of the CO_2**
- **plant efficiencies and costs of electricity are comparable to those projected, but not yet attained, for gasification capture systems.**

March 2007

The Babcock & Wilcox Company
20 S. Van Buren Avenue
Barberton, OH 44203
Phone: (330) 753-4511 • Fax: (330) 860-1886

B&W Washington Office
511 Second Street, N.E.
Washington, DC 20002
Phone: (202) 756-7205 • Fax: (202) 756-7204