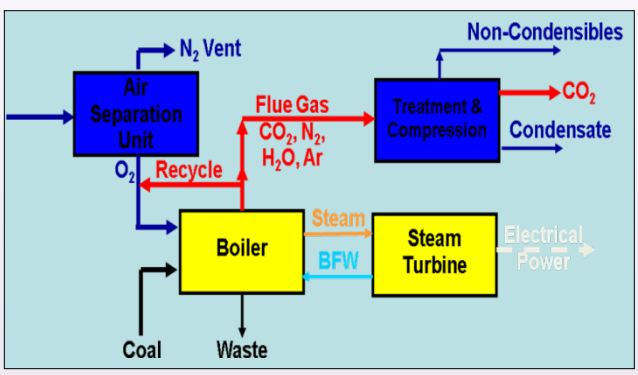
COAL FIRED OXY COMBUSTION BOILERS WITH CO_2 CAPTURE

OVERVIEW

As it becomes increasingly likely that CO_2 emissions in the future will be regulated not only from new sources but also from existing ones, possibly in the form of a "carbon tax," new processes are being developed to capture the CO_2 from flue gases of fossil fueled power plants. One family of processes involves contacting the flue gas with an aqueous amine solution to absorb the CO_2 and thermally stripping the loaded solvent to release a high purity CO_2 stream that may be compressed for sequestration. The oxy-combustion concept is an alternate approach and was first proposed by U. S. Department of Energy's Argonne National Laboratory in the late 1970s. It involves adding O_2 with recirculated flue gas instead of air to coal burners in order to generate a flue gas that has a high concentration of CO_2 that can be suitable for use or sequestering after further purification. Using recirculated flue gas allows control of nitrogen oxides (NO_x), flame and heat transfer characteristics within the boiler system. This technology concept may be suitable for deployment in greenfield coal fired boiler plants as well as existing boiler plants to mitigate CO_2 emissions.



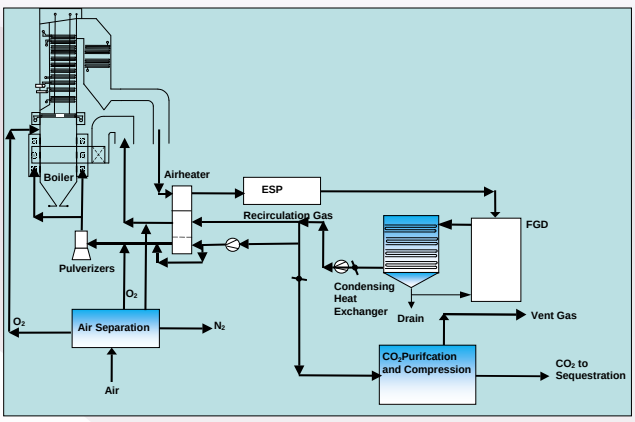
A COAL FIRED BOILER PLANT USING THE OXY COMBUSTION CONCEPT

GOALS

- Conduct a concept feasibility study to assess change in performance of an existing pulverized coal fired boiler plant retrofitted with oxy combustion while producing a CO_2 stream suitable for enhanced oil recovery
- Identify technical issues of retrofitting existing coal fired boilers
- Define the hardware needed to retrofit existing coal fired boilers and the impact on existing equipment

RESULTS

CO_2 capture significantly greater than 90% is technically feasible while the NO_x formation can be reduced in the boiler by 60% to 65%. The net electrical power output of the retrofitted plant decreases significantly, by as much as a 1/3rd, while the plant heat rate increases by the same



SYSTEM INTEGRATION IN A RETROFITTED OXY COMBUSTION BOILER POWER PLANT

RESULTS (continued)

amount due to the significantly higher in-plant power consumption. The main consumers are the air separation, the CO_2 purification and the CO_2 compression units. Flue gas recycle is required to makeup the missing N_2, and to maintain similar radiative and convective heat transfer within the boiler while staying within the O_2 concentration limits set by existing equipment, piping and seal materials. Typical flue gas recycle rates of 60% to 80% are required. Due to the very high concentration of CO_2 in the gas flowing through the boiler, the difference in physical properties of CO_2 (as compared to N_2) are to be taken into account in calculating the heat transfer and pressure profile through the various sections of the system. Performance of the other existing equipment also affected by this type of retrofit are the forced draft fan, induced draft fan and pulverizer blower. Buildup of trace components due to the high rate of recycle is a concern. Due to ingression of atmospheric air into the boiler, a downstream CO_2purification step (cryogenic) is required to meet the specifications for use in enhanced oil recovery or where the gas has to be pipelined over a significant distance for sequestration.

RECENT PUBLICATIONS/PAPERS

V. F. Francuz, "Oxy Fuel Scenario," *presented at the International Colloquium on Environmentally Preferred Advanced Power Generation - ICEPAG 2008,* Newport Beach, California, January 31, 2008

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