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APPLICATIONS OF OXYGEN FOR NOX CONTROL AND CO2 CAPTURE IN COAL-FIRED POWER PLANTS

ABSTRACT

Two promising combustion modification approaches applicable to pulverized coal (PC) fired boilers are presented: "Oxygen-Enriched Combustion" (OEC) for NOx control and "Oxy-Combustion" (PC-OC) for CO2 capture. Oxygen-enriched air rather than air is used as an oxidizer in the OEC technology. Unlike flue gas treatment technologies, OEC directly impacts the NOx formation process by significantly reducing the conversion of coal bound nitrogen to NOx. Pilot-scale and full-scale tests have shown 20 to 30% NOx reduction from an optimized staged-air baseline. In addition to the overall cost competitiveness and the reduced capital requirements, other significant advantages of the O2-enriched technology versus existing low NOx technologies are presented. The PC-OC technology is shown as a cost-effective technology for CO2 capture from existing or new coal-fired power plants. Pure oxygen diluted in recycled flue gases is used as an oxidizer. The process has been successfully demonstrated and extensively characterized at pilot-scale level (1.5MWth). The tests have shown substantial benefits of the PC-OC technology, in terms of NOx reduction (60-70% from air-baseline), overall plant efficiency, etc. The cost effectiveness of this capture technology compared to competitive amine scrubbing technology was investigated. The cost of CO2 avoided was around $36/ton for the a new PC-OC cases, about $48/ton on a retrofit PC-OC case, which is about 25 to 40% cheaper than the amine scrubbing system. Those numbers were calculated for sub-critical units and include the cost of CO2 compression up to 80bars.

KEYWORDS

oxy-combustion, CO2 capture, NOx, acid rain, Green house effect

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