Technologies and Cost Effectiveness of Post-Combustion NOx Controls

By

James E. Staudt, Ph.D.
Andover Technology Partners
112 Tucker Farm Road, North Andover, MA 01845
ph: (978) 683-9599; fax: (978) 683-3843; e-mail: staudt@andovertechnology.com
www.andovertechnology.com

SUMMARY

The SIP Call identified 23 jurisdictions (22 states and DC) that, according to EPA's determination, need to reduce emissions of NOx. According to the SIP call, reductions in most states will be substantial. Most of these reductions in NOx will be achieved through the use of high efficiency NOx reduction measures at utility plants. Although there is substantial experience with some of these technologies overseas (especially SCR), experience in the U.S. is less extensive. Utilities have, therefore, viewed these technologies with caution. Moreover, air pollution control technology is viewed generally as a non-productive asset. In a deregulated utility industry, this fact makes addition of air pollution control technology to a generation facility even more unattractive to many utility executives.

This paper reviews the status of NOx emission control technologies, drawing significant data from the NESCAUM and MARAMA "Status Report on NOx: Control Technologies and Cost Effectiveness" that was released in 1998 and bringing this material up-to-date in light of developments in the industry since that time. Recognizing that the NESCAUM study was primarily directed at the Northeast U.S., this paper also presents the data in the context of its relevance to the SIP call, which impacts a broader geographic area and wider range of facilities. Economic models are presented showing the impact of decisions the owner of a system might make in selecting control methods for their facilities.

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Range of Technology Options for Y2003 Compliance

- Nothing beyond Low NOx Burners
  - Purchasing Credits for the difference
- Moderate NOx reduction, low capital cost technologies
  - SNCR, FLGR, Conventional GR
- Higher reduction technology
  - Amine Enhanced FLGR, AGR, gas conversion
- Highest reduction technology
  - SCR

Commercial Coal-Fired Post-Combustion Experience in U.S. -Case Studies by/with End Users Provided Input to Report

- 9 Coal Fired Boilers with SNCR
- 7 Coal Fired Boilers with SCR
- 2 Coal Fired Boilers with Gas Reburning

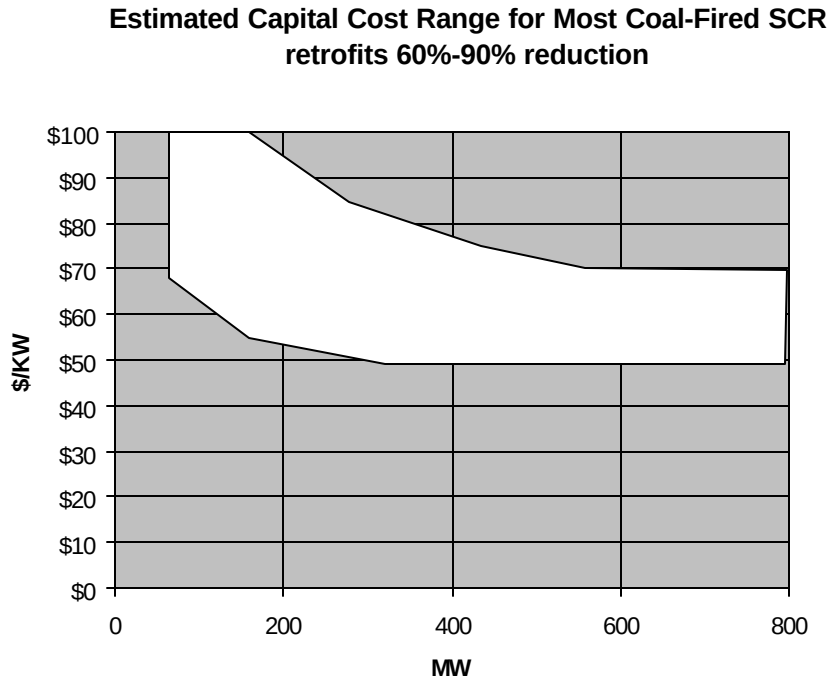
Cost of Post-RACT Technologies

- Cost Presented in Constant Dollars
  - Inflation Adjusted - best approach for evaluating/comparing long-term projects
  - Current Dollar approach is preferred for capital planning in short term (next five years)
- Analysis is sensitive to cost-of-capital and other assumptions

SNCR Lessons Learned

- Systems cost about $15/KW, sometimes less for larger systems, sometimes more for more complex systems
- Not necessarily limited to small units
- Good reliability - systems meeting their performance
- Urea seems to be more suitable than ammonia
- Slips are controllable, but higher than for SCR. NOx reductions are typically in the range of 30-40%
  - for high sulfur (≥ 2%) fuels and low economizer temperatures, need very low slip, possibly addition of catalyst
  - no fly ash sale/disposal problems

SCR Capital Cost



SCR - Lessons Learned

- Overall reliability very good
- Cost is dominated by initial capital
- Need to pay careful attention to coal mineral matter, as well as sulfur
  - arsenic and calcium, in particular (even for Group 1 boilers)
  - may limit fuel supply
- Catalyst may be used to follow SNCR
  - better reduction and ammonia slip than SNCR alone

Gas Reburn - Many Flavors

- Conventional Gas Reburn (CGR)
  - several commercial systems
- Advanced Gas Reburn (AGR)
  - one demonstration
- Fuel Lean Gas Reburn (FLGR)
  - Several demonstrations, one commercial
- Amine Enhanced FLGR (AE FLGR)
  - 2 commercial systems (Mercer)
  - 600+ MW demo this year

Reburn Experience

- Numerous demonstrations
- Years of U.S. Commercial Experience at Greenidge and Kodak
- Experience overseas on boilers up to 600 MW
- Several new commercial systems coming on line
- Natural Gas is the most common reburn fuel

Gas Reburn Economics

	Capital Cost, $/KW	Gas Use	NOx Reduction
Conv. Gas Reburn	~$15/KW	15%	50%-60%
FLGR	~$7/KW	4-7%	35%-45%
AE FLGR	~$20/KW	4-7%	60%-70%

Closing Comments

- More information available on the web site
  - **www.andovertechnology.com**
- Call NESCAUM for a copy of the complete Status Report on NOx: Control Technologies and Cost Effectiveness for Utility Boilers
  - (617) 367-8540