# PROJECT CONDOR: INVESTIGATION OF LOW NOx CONTROL TECHNOLOGY OPTIONS

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## SUMMARY

The existing fleet of coal-fired power plants is comprised of diverse technology designs spanning more than half a century. There has been a long-standing realization that pollution from power plants can have significant environmental impact on local, regional, national and even global scale. Coal-fired power plants in the United States require vast amounts of coal. The enormity of the fuel requirements and associated pollution raise the visibility of these plants as a target for improvement.

Given this situation, the National Energy Technology Laboratory (NETL) is actively assessing the potential for power plant improvements. The Coal Optimization Near-term Development Options and Response (CONDOR) Project is assessing and identifying the performance capability of coal-fired power generation and options that provide for cost effective solutions for clean and reliable energy supply. The project will identify research and development needs for maintaining and enhancing the performance of coal-fired power plants through the year 2020. Project CONDOR requires a fully functional suite of assessment tools that account for the current state of power plant configuration and associated emissions. Technology and strategies to maintain and improve the performance of each plant are evaluated through reasonable scenarios that target performance-based enhancements for existing power plants.

Up to this point, the regulatory standards for pollutants have principally focused on one pollutant at a time. The standards typically evoke control technologies that are incremental in nature. The benefit of reduced emissions may not be “judged” adequate throughout the life of the power plant. Since the life of the power plant may exceed the life of a standard, incremental ratcheting of standards for one pollutant after another may hamper cost effective control strategies. There exists an opportunity to consider multi-pollutant control approaches across the existing fleet of power plants throughout their life cycle. Through this process, marginal costs and marginal benefits can be evaluated for different strategic goals in time frames more representative of the useful life of a power plant.

NETL will examine the interactions of various pollution control strategies in a phased approach. Phase I will depict the current state of existing power plants and baseline pending emission requirements. Phase I is developing a prototype model to examine the differences between an incremental control strategy and a comprehensive multi-pollutant-control strategy. This model, the CONDOR-Enhanced Integrated Environmental Control Model (IECM), will be the platform for comprehensive studies.

Additionally, a spreadsheet model supporting Project CONDOR was developed and incorporates cost and performance algorithms of technologies to reduce emissions of $SO_2$, NOx, and Hg for time intervals up to 2020. An inventory of coal-fired power plants, including data on capacity, generation, and fuel characteristics, as well as information on pollution control equipment has been incorporated into the spreadsheet model. This model provides a flexible tool for assessing a variety of power plant improvement options and serves as a data feed system for the CONDOR-Enhanced IECM.

In the present work, results from analysis of NOx control technology options are discussed in the context of multi-pollutant control strategies. The impact on cost and performance of multi-pollutant control using combinations of Low NOx Burners (LNB) and Selective Catalytic Reduction (SCR) are investigated. The baseline configuration of control equipment at coal-fired power plants is fully characterized. Planned additions of control equipment are also incorporated into the model.

Scenarios are developed to assess the sensitivity of control strategies on emission reductions and ability to achieve targets that are more stringent. The system performance of each scenario is contrasted with system cost by classification of NOx control technology.

Major parameters examined in the analysis include coal switching and emission control equipment for NOx. Limitations of control technology applications are also examined for small power plants and plants having an age significantly above the mean age of the existing coal power fleet. Special attention is paid to the NOx SIP Call area.

The uncertainty of present and future performance expectations from NOx control options is examined in the context of multi-pollutant control. For instance, the uncertainty of SCR benefits from oxidation of mercury are incorporated into the model and a level of confidence for improving mercury control are evaluated for existing downstream pollution control equipment.

In summary, a robust analysis of multi-pollutant control options is performed in the context of NOx control technology options. This analysis is meant to stimulate interest in improving coal power plant performance from an integrated systems perspective. Alternative approaches for accomplishing one task (NOx control) is evaluated over a larger domain – multi-pollutant control. Important data gaps on technology performance are identified and the present level of confidence to meet performance targets is evaluated.