PROJECT facts

DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
FEDERAL ENERGY TECHNOLOGY CENTER

ADVANCED CLEAN/EFFICIENT **POWER** systems

PS021.0497

DEMONSTRATION OF AN ADVANCED INTEGRATED CONTROL SYSTEM FOR SIMULTANEOUS EMISSIONS REDUCTION

PRIMARY PROJECT PARTNERS

Carnegie Mellon University
Pittsburgh, PA

Praxis Engineers
Milpitas, CA

Rust College
Holly Springs, MS

Southern Company Services, Inc.
Birmingham, AL

MAIN SITES

Pittsburgh, PA

Milpitas, CA

Holly Springs, MS

Birmingham, AL

Wilsonville, AL

Coosa, GA

Genoa, WI

TOTAL ESTIMATED COST

$891,193

COST SHARING

DOE	**$—**
Non-DOE	**$—**

Project Description

Several active projects are using or developing computer software to assist managers, engineers and operators in selecting, improving and developing flue gas cleanup technologies.

One of these, being developed by researchers at Carnegie Mellon University, is a computer model which will allow engineers and managers to effectively evaluate how an advanced flue gas system will integrate into a specific power plant. This model will include the advanced technologies being demonstrated under DOE's Clean Coal Technology Program. When finished, the user-friendly model will provide decision makers the means to quickly and easily evaluate various cleanup technologies for use in a specific power plant from both financial and technical perspectives. The model will use a probabilistic approach which allows effective risk assessment of various options.

A second project, being conducted at Rust College, will use an existing model to aid in the development of improving and combining two existing NO_x control technologies—reburning and selective non-catalytic reduction (SNCR). This project is exploring different reburning fuels and NO_x reducing agents in various combinations and ratios using computer simulation with confirmation through laboratory tests. This work will ultimately lead to improved NO_x removal by optimizing the choice and ratios for the reburn fuel and the reducing agent. This project, via simulation and lab work will also improve our understanding of the mechanism of NO_x reduction.

The third project, conducted by Praxis Engineers, will develop a computerized power plant/FGC control system based on neural networks and fuzzy logic. This type of control system is capable of "learning" how altering various control parameters affects the operation and performance of the FGC system. It actually learns how various parameters interact and controls the system to optimize performance. After the software is developed it will be tested at the proof-of-concept scale at two commercial power plants—Dairyland Cooperative Power's Genoa plant and TransAlta's Keephill station.

The fourth project, being carried out by Southern Company Services, Inc. has developed a system similar to the one being developed by Praxis for FGC systems except that this project seeks to develop a computer-based NO_x control system that will optimize boiler performance while reducing NO_x emissions. The system is called a Generic NO_x Control Intelligent System (GNOCIS). Testing is being carried out at Georgia Power Company's Plant Hammond and Alabama Power Company's Gaston Station.

Program Goal

Fossil fuels provide the overwhelming majority of U.S. electricity, with coal alone supplying over half. Much of this fuel is domestically produced, which is why developing more economical and environmentally sound technologies for fossil-fired power generation will enhance energy self-sufficiency and industrial competitiveness for the U.S.

Demonstration of an Advanced Integrated Control System for Simultaneous Emissions Reduction

Project Benefits

The new Supervisory Optimization and Control System (SOCS) from Praxis Engineers provides the power-station operator with a mix of control set points that will meet NO_x, SO_x, opacity, and CO_2 emissions targets, produce the desired amount of power, and do so at the least cost. It will balance out the competing costs and income from fuel use, emissions credits, sale or disposal of bottom ash, flyash, gypsum, and other by-products, and tradeoffs between efficiency and equipment life. The use of SOCS will:

- Reduce the overall cost of electricity generation while achieving emissions compliance.
- Increase the competitiveness and flexibility of operations.
- Allow power generators to balance emissions credits, generation costs, and by-product sales.
- Increase the efficiency of power generation.
- Reduce plant derates.
- Increase the use of low-cost U.S. fuels.
- Increase the sales of by-products.
- Improve environmental compliance.

The benefits of using SOCS might be a high as 3% savings when expressed as equivalent fuel cost. For example, a 500-megawatt power plant using a 12,500 Btu-per-pound coal with a heat rate of 10,000 Btu-per-kilowatt-hour could save up to 50,000 tons of coal per year. Assuming a delivered price of $40 per ton, annual savings of $2 million would accrue—and emissions targets would still be met or exceeded.

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Cost Profile

(Dollars in Thousands)

	Prior Investment	FY95	FY96	FY97	Future Funds
Department of Energy*	$171	—	$325	$10	—
Private Sector Partners	—	—	$263	$122	—

* Appropriated Funding

Key Milestones

FY96	FY97
Data Collection	Installation

Final report