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Issue No. 10, Spring 1993

Clean Coal Today

An Update of the U.S. Clean Coal Technology Demonstration Program

Office of Fossil Energy, U.S. Department of Energy

Clean Coal Briefs

A new round of project selections—each representing a novel approach to power generation from coal that will be more than able to meet the strict environmental focus of the 21st century—highlighted this quarter's activity in the Clean Coal Technology Program (see story, p.1). While the five projects selected are the fewest in number of any Clean Coal round to date, the total value of the expected government and industry investment in these projects, at nearly $2 billion, breaks all records.

Also, be sure to mark your calendars for the **Second Annual Clean Coal Technology Conference** in Atlanta, Georgia, September 7-9. Look for details in the enclosed insert.

In the meantime, significant progress continued at many of the 41 ongoing projects in the program. It was again standing room only at a Technology Transfer Open House sponsored by the **Ohio Coal Development Office**. This time, hundreds gathered for one of two days (April 16 and 19) at **Dayton Power & Light's** Stuart Station near Aberdeen, OH to see the success of **Babcock & Wilcox's** Low NO_x Cell™ Burner project. These burners are successfully

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21st Century Options for Coal

Five New Clean Coal Projects

The Department of Energy (DOE) has selected five new clean coal technology projects it believes can help usher in a 21st century era of higher efficiency, environmentally clean, electric power generation from coal.

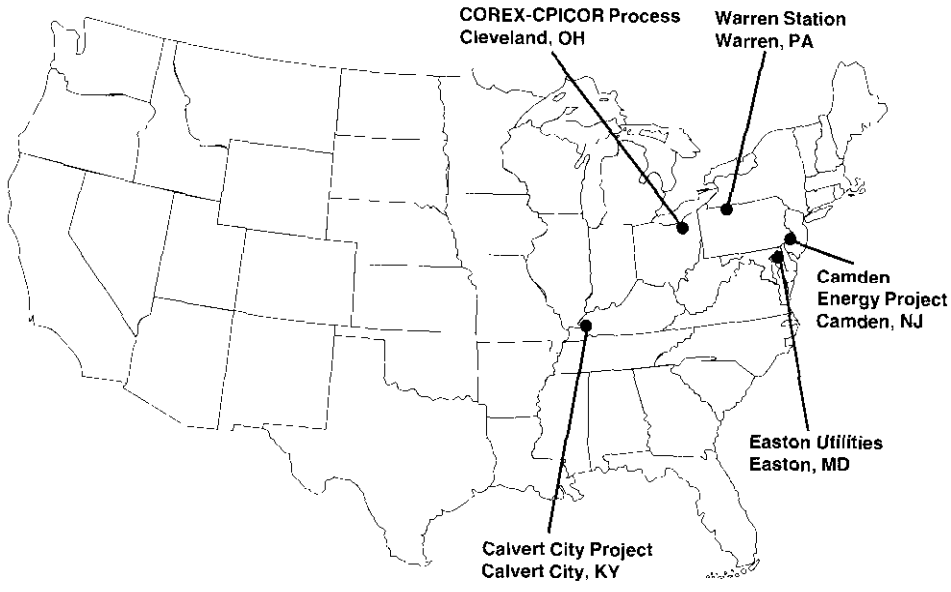
Four of the demonstration projects are principally intended for producing electricity cleanly from coal. The fifth project will demonstrate an advanced coal-based, blast furnace/power cogeneration technology that could offer a competitive boost to America's steel industry.

Together the five selected projects total more than $2 billion, the largest amount selected in any round of the Clean Coal Technology Program. Pending successful completion of negotiations, the winning companies would provide nearly $3 in cost-sharing for every $1 supplied by the Federal Government, the most private cost-sharing offered to date.

The selections culminate Round V of the Clean Coal Technology Program, a joint government/industry effort begun in 1986 to demonstrate a new generation of highly advanced coal processes that release extremely low levels of air emissions. DOE received 24 proposals by last December's deadline, and a 7-member panel of government reviewers, assisted by more than 80 technical experts, spent the last five months examining and ranking the technical, environmental, management and other merits of the proposals.

Selection of the projects was announced by Energy Secretary Hazel O'Leary at a news conference in Washington on May 4, 1993.

See "New" on page 2 . . .



The Five New Clean Coal Projects

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O'Leary said the projects represent the Clinton Administration's belief that the twin goals of "a cleaner world and expanding opportunities for economic growth" can be achieved by advanced, innovative technology. She also stated that the projects not only offer cleaner and more efficient energy for the United States, but will also demonstrate systems that could become valuable export commodities, particularly for developing nations.

DOE determined that, on average, the four selected power plant technologies, when commercially deployed, will be capable of reducing carbon dioxide, a greenhouse gas, by as much as 25 percent.

Where a conventional, modern-day coal power station in the United States converts about 33-35 percent of the coal's energy into usable electricity, the Round V winning technologies will be capable of extracting an average of 45 percent of the energy. With more electricity being generated from a given amount of coal, less carbon dioxide is emitted for every megawatt produced. The advantages of high efficiency become even more apparent when compared to the power stations of less developed nations which typically have efficiencies of 25 percent or less.

DOE oriented its selection criteria for Round V to encourage higher efficiency technologies.

The technologies chosen also emit very low levels of sulfur and nitrogen pollutants, making them particularly important in the post-2000 timeframe when U.S. power generators will be required to operate under stricter clean air standards.

The fifth round of the Clean Coal Technology Program completes the originally scheduled series of competitions begun in 1986 as an outgrowth of concern over acid rain. Each competition was geared to attract industry proposals for advanced projects that would bridge the gap between pilot scale development and commercial deployment.

When the program was expanded in response to recommendations from the U.S. and Canadian Envoys on Acid Rain, it was expected to total $5 billion in government/industry co-funding. Higher-than-expected cost-sharing from private industry is likely to push the funding level to about $6.8 billion, making the program one of the largest energy and environmental initiatives ever undertaken by the U.S. Government.

Secretary O'Leary has directed Energy Department staff to review the progress made to date in the Clean Coal Technology Program and report to the Administration and Congress on whether future competitions should be undertaken. DOE is also planning in FY 1995 to begin an international clean coal technology transfer initiative called for by the Energy Policy Act of 1992.

The Round V selections bring the total number of projects in the Clean Coal Technology Program to 46 in 21 states.

The following is a more detailed description of each winning project. A compilation of project abstracts prepared by the proposers as part of their project submissions is available from the Office of Fossil Energy Communications (FE-5), U.S. Department of Energy, Washington, D.C. 20585, (202) 586-6503.

Clean Coal Technology Program Round V Project Descriptions

The five new projects are described below. Both DOE proposed cost share and project costs are "as proposed" and subject to negotiation.

Camden Clean Energy Project, Camden, NJ, $780 million, 25% DOE share.

The Camden Clean Energy Partners Limited Partnership, made up of Duke Energy Corp., General Electric Co., and Air Products and Chemicals, Inc., will design and build an independently owned 480-megawatt advanced integrated gasification combined cycle power plant in an industrial redevelopment area in Camden, NJ. The project will demonstrate the British Gas/Lurgi fixed-bed oxygen-blown coal gasification technology in which the ash is removed in the form of slag. The project will use high-sulfur coal from West Virginia to produce a clean gas that is combusted in advanced gas turbines. Turbine exhaust will be used to produce steam to drive steam turbines in a second cycle. These "combined" cycles will make the IGCC plant up to 20 percent more efficient than a conventional coal plant, while minimizing levels of SO_2, NO_x, and particulates to levels well below the most stringent environmental standards. The project will also include a first-time demonstration of a molten carbonate fuel cell developed by Fuel Cell Engineering, a subsidiary of Energy Research Corporation. The fuel cell will use a portion of the clean coal gases to produce 2.5 megawatts of power.

Calvert City Advanced Energy Project, Calvert City, KY, $375 million, 40% DOE share.

Air Products and Chemicals, Inc., has teamed with Foster Wheeler, Deutsche Babcock Energie Umwelttechnik AG, and Westinghouse to build a second generation pressurized circulating fluidized-bed power plant at Air Products' chemical manufacturing facility in Calvert City, KY. The plant will burn Kentucky bituminous coal to produce 95 megawatts of power. Steam from the cogeneration power plant will be supplied to the chemical manufacturing plant and power will be sold to the Tennessee Valley Authority on a long-term basis. The advanced system will employ a topping combustor and advanced hot gas cleanup system.

See "Projects" on page 3 . . .

. . . "Projects" from page 2

Clean Power from Integrated COREX-CPICOR Process, Cleveland, OH, $825 million, 18% DOE share.

Centerior Energy Corporation will lead a team made up of LTV Steel Company, Inc., Air Products and Chemicals Inc., Deutsche Voest-Alpine Industrieanlagenbau, and Electric Power Research Institute, to demonstrate the production of hot iron via the COREX process and power from a combined-cycle plant fueled by the export gas. While COREX plants have operated internationally, none have been designed to integrate the steel and power producing processes. The plant will be commercial size (producing 1,170,000 tons of hot metal per year) while producing 181 megawatts of power. Compared to conventional coke oven/blast furnace steel plants, COREX offers several advantages: elimination of the coke-making plant and associated environmental problems, coal desulfurization integrated into plant operations, and high operational flexibility. The addition of a power-generating capability further enhances the overall system's efficiency. The proposed plant will be built at LTV Steel Company's Cleveland Works where it will be integrated into the existing steel-making facility.

Warren Station EFCC Demonstration Project, Warren, PA, $146 million, 50% DOE share.

Pennsylvania Electric Company will repower its Warren Station with the addition of an externally fired gas turbine, resulting in a combined cycle power plant. The system is centered around a ceramic heat exchanger capable of withstanding the high firing temperatures of modern gas turbines, and an atmospheric combustor which replaces the conventional combustion system. Because the gas turbine operates on indirectly heated clean air, the gas path is never exposed to corrosive elements in the fuel. Other team members include Black & Veatch and Hague International. One of the existing 47 megawatt steam turbines at the Warren station will be converted to EFCC, while the other will continue to operate in its present mode. The new gas turbine will generate 18.3 megawatts, for a combined total net plant output of 62.4 megawatts. The repowered unit's heat rate will be a 28.6 percent improvement over the existing unit.

Demonstration of Clean Coal Diesel Technology at Easton Utilities, Easton, MD, $37.3 million, 50% DOE share.

Easton Utilities, Cooper Bessemer and Arthur D. Little have teamed to build a two-stationary diesel engine power system that will add 14 megawatts of power to Easton's Plant Number Two in Easton, MD. The diesels will be operated as part of a combined-cycle power plant, with exhaust from the engines passing through a heat recovery boiler to produce steam for a steam turbine. The diesel system is expected to achieve 45 percent efficiency in this demonstration with larger 10-15 MW diesels expected to attain 48 percent efficiencies. NO_x emissions will be controlled by a selective catalytic reduction unit. A dry flue gas scrubber and baghouse will control SO_2 and particulates, respectively. The system will use coal-water slurry produced from Ohio coal by a two-stage coal cleaning and slurrying process. Power from the project will serve the Town of Easton and the Delmarva power grid. CCT

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cutting NO_x emissions on a 605 megawatt commercially operating boiler by more than 50 percent (see story, p. 8).

The technical community was also given an opportunity to preview another clean coal technology—the **NOXSO** system—at an open house at the company's pilot plant at **Ohio Edison's** Toronto Station in Toronto, OH (see story, p. 8).

The Ohio Coal Development Office's **next Technology Transfer Open House** is scheduled for June 25 and 28, 1993, at the ABB **SNOX** project in Niles, OH. Space is limited and is made available on a first-call, first-served basis. Call Sheila Brown, Ohio Coal Development Office, 1-800-374-SNOX for more details.

Congratulations are again in order for **Northern Indiana Public Service Co.** and **Pure Air**. Their advanced generation scrubber project, making NIPSCO the first utility in the nation to meet the Clean Air Act Amendment's Phase One requirements for sulfur dioxide, was again recognized with a prestigious award. This time the Bailly Station was named a **Powerplant of the Year** by McGraw Hill's **Power** magazine. Earlier this year, the project received an award from the **National Society of Professional Engineers.**

Also in the award category, **Dr. James Markowsky** of **American Electric Power Service Corporation** was named **Man of the Year** by the International Conference on Fluidized Bed Combustion. The award was presented in a ceremony on May 12, 1993, and recognized Dr. Markowsky's dedication and success in introducing pressurized fluidized bed combustion technology to the United States.

A pat on the back also goes to Combustion Systems Inc., Tri-State Generation and Transmission Association, Inc., and DOE/METC, the authors of a "Best Paper in Topic Area" at the **12th International Conference on Fluidized Bed Combustion** held in San Diego from May 9-13. The paper described the

See "Briefs" on page 5 . . .

Major Greenfield IGCC Plant

Florida Project Demonstrates Key Technologies

Tampa Electric Company will be the owner and operator of the Clean Coal Technology Program's first "greenfield" Integrated Gasification Combined Cycle (IGCC) plant when its 260-MWe demonstration goes on line in Polk County, FL, early in 1996. The Round 3 project was selected in 1991.

The project will be the first increment of the planned build-out to 1,150 MWe at the new site. DOE is providing approximately $120 million of the nearly $500 million total cost estimated for the 260-MWe IGCC demonstration.

The project is currently undergoing the review process required by the National Environmental Policy Act (NEPA). Preliminary design activities are progressing rapidly. Pending the results of the NEPA process and receipt of the various required permits, construction is expected to start in Spring 1994. A two-year operational period to demonstrate the IGCC technology is scheduled to start in January 1996. Following project completion, Tampa Electric will continue to operate the plant as a baseload unit on its power grid.

Tampa Electric is a wholly owned subsidiary of TECO Energy, Inc., an energy-related holding company with over 3,200 MW of generating capacity, of which 97 percent is coal-fired. TECO Power Services, another subsidiary of TECO Energy Inc., is responsible to Tampa Electric for overall project management of the Polk County IGCC project.

Process Technology

Several key technologies will be demonstrated. A Texaco pressurized, oxygen-blown, entrained-flow coal gasifier will convert approximately 2,000 tons per day of coal into a medium-Btu fuel gas with a heat content of about 250 Btu/scf (LHV). Coal-water slurry is combined with oxygen in the gasifier to produce a high-temperature (2,500°F), high-pressure syngas. Molten coal ash flows out of the bottom of the vessel into a water-filled quench tank where it freezes into a solid inert slag. Syngas produced in the gasifier flows through a high-temperature heat recovery unit which cools the gases prior to entering two parallel gas cleanup areas.

A portion (up to 50 percent) of the hot syngas is cooled to 1,000 °F and passed through a moving bed of zinc titanate sorbent which removes sulfur-containing components of the fuel gas. The project will be the first in the world to demonstrate the GE Environmental Services advanced metal oxide hot gas desulfurization technology at a commercial scale.

The remaining portion of the syngas is cooled to 400 °F for conventional acid gas removal. This portion of the plant is capable of processing between 50 percent and 100 percent of the dirty syngas.

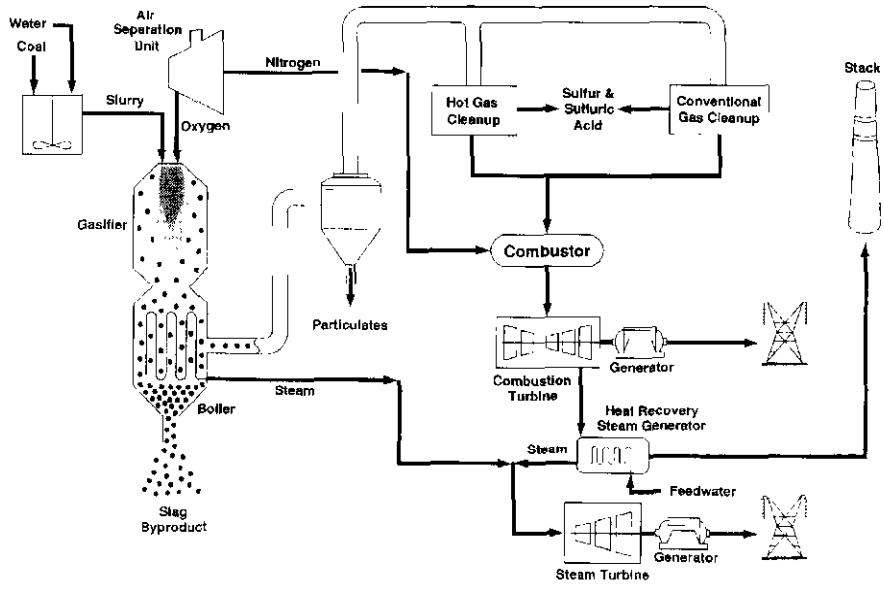
The cleaned syngas is routed to the combined cycle power generation system where it is mixed with air and burned in the gas turbine combustor. Nitrogen from the air separation unit (ASU) is also injected into the combustor. The hot exhaust gases are expanded through the turbine to generate about 192 MWe.

Heat is extracted from the expanded exhaust gases by a heat recovery steam generator to produce high-pressure steam. This steam, along with the steam generated in the gasification process, drives a steam turbine to generate an additional 132 MWe of power. Internal process power consumption is approximately 64 MWe, and includes power for coal grinding, air separation, and feed pumps. Net output from the IGCC demonstration plant will be about 260 MWe.

Hot particulate removal and sulfur cleanup, and integration of the ASU with the gas turbine represent first-time or early applications of these technologies both domestically and worldwide.

Tampa Electric has contracted with Air Products & Chemicals, Inc., to supply an ASU that will deliver nearly 2,100 tons/day of oxygen at 95 percent

See "Florida" on page 5 . . .



Simplified Integrated Gasification Combined Cycle Power Generation Process Schematic

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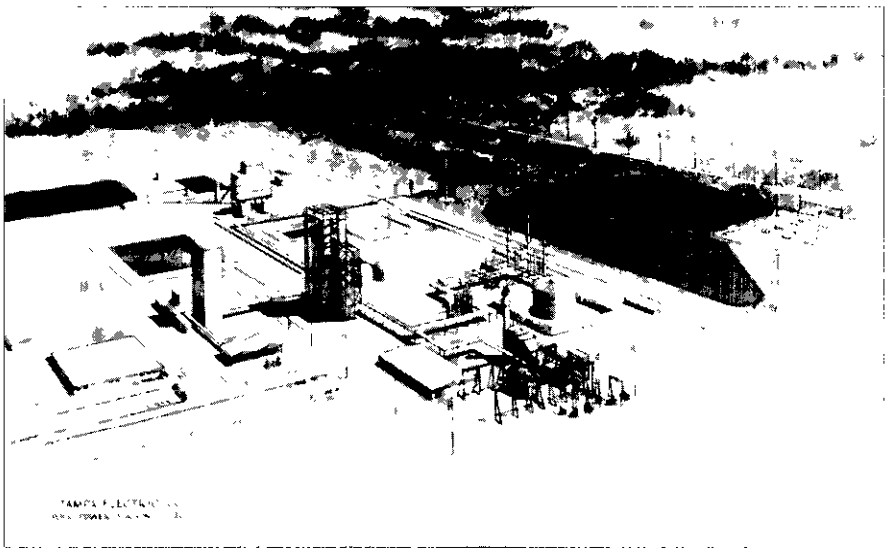


Artist's conception of new Polk County, Florida, 260 MWe IGCC Electric Generation Facility

purity, producing 6,300 tons/day of nitrogen in the process. Earlier system studies had identified that injection of the waste nitrogen from the ASU would improve the overall IGCC efficiency, reduce NO_x emissions, and provide power augmentation at Florida's high ambient temperatures by increasing the mass flow through the turbine. Tampa also considered a fully integrated system in which inlet air to the ASU would be supplied by the gas turbine compressor. However, it did not elect to go that route because the technology is not yet ready.

Tampa has contracted with General Electric Company (GE) to supply an advanced combined cycle system based on a Frame-7 gas turbine. GE has performed several combustor tests to verify the improved performance characteristics and lower emissions expected from combining the fuel gas with nitrogen diluent. Additional tests are planned as part of the qualification testing of the engine prior to start-up in early 1995.

Environmental Status

Tampa Electric has also been on the leading edge when it comes to citizen participation in the site selection process. In 1989, the company assembled a 17-member Community Siting Task Force, made up of environmentalists, educators, economists, and community leaders, to advise on protecting the environment since this was to be a top priority in selecting the plant's technology and site. With assistance from an environmental consulting firm, the task force conducted a year-long study of more than 35 sites in six counties. Ultimately deciding that it would be better to use sites that had already been disturbed by industry, the task force recommended three former phosphate mining tracts in southwest Polk County. Many acres of the previously spoiled land will be reclaimed by placing mined-out phosphate land into productive use.

Extensive environmental documents have been prepared. In August 1992, DOE conducted a Public Scoping Meeting to solicit comments from the general public and to learn of any special concerns which should be addressed in the Environmental Impact Statement (EIS). Because the demonstration project represents only the initial portion of the planned 1,150-MW power plant, the Environmental Protection Agency (EPA) has agreed to be the lead agency for preparing the EIS. Permits from the State of Florida and Records of Decision from both EPA and DOE are expected to be in hand by early 1994. Assuming they are all favorable, Tampa Electric will proceed with construction.

CCT

. . . "Briefs" from page 3

success of the 110 megawatt CFB at the Nucla plant conducted under the CCT program.

In a major milestone, **ENCOAL** has recently completed a 16-day run of its mild gasification demonstration plant in Gillette, WY, setting a new operations record for the pioneering facility. The 400-hour run, originally scheduled for only 250 hours, ran from April 13 to April 29 when it was brought down for inspection. The run confirmed that the plant had been able to overcome several mechanical problems that had previously prevented sustained operations beyond seven days. The run processed more than 5,000 tons of low rank Powder River Basin coals to produce more than 125,000 gallons of high quality liquid fuel and several thousand tons of clean solid product.

In February 1993, as part of the **Healy Clean Coal Project** design effort, **TRW** completed a series of design verification tests on two critical components of its advanced slagging coal combustion system; the precombustor module, and direct coal feed system. These successful tests are considered a key milestone in the scale-up of this novel Clean Coal Technology for utility application. The 160 tons of pulverized coal supplied by the Usibelli Coal Mine from Healy, AK were utilized in a series of 28 tests. The total run time on coal was approximately 43 hours. TRW's system burns coal with staged combustion air to reduce NO_x emissions. Combustion is completed in the Foster Wheeler boiler by the addition of air through NO_x ports and an overfire air zone. To reduce SO_2 emissions, pulverized limestone is injected at the exit of the slagging combustor.

The Healy project is a planned nominal 50 MWe electrical generation plant which will integrate two TRW Advanced Entrained (slagging) Combustion Systems in a bottom-fired configuration to a Foster Wheeler designed boiler. The systems are designed for NO_x and first-stage SO_2 control. A Joy

See "Briefs" on page 7 . . .

Coal Reburn Exceeds Expected NO_x Reductions

Control Option for High NO_x Emitting Cyclone Boilers Demonstrated

Through several projects in the Clean Coal Technology Program, natural gas reburning technology has emerged as a highly effective and economical way to reduce NO_x emissions from a variety of major boiler types.

Now, Babcock & Wilcox (B&W) has successfully demonstrated another option. Instead of natural gas, coal is used as the reburn fuel. In the full-scale demonstration, B&W has used the coal reburning technique on a cyclone boiler to cut NO_x emissions by more than 50 percent. The pioneering demonstration took place at Wisconsin Power & Light's (WP&L) Nelson Dewey Station in Cassville, WI. Testing has been completed, and the coal reburning retrofitted boiler is now routinely being operated by WP&L in a load-following manner.

The success of the technology will be especially helpful to operators of cyclone boilers, notoriously high NO_x emitters for which there is no known commercial combustion modification NO_x reduction option. The boiler-independent coal reburning technique is expected to be effective on other boiler types, as well.

Results Exceed Expectations

The project began start-up operations in December 1991, and the final reports are now being prepared. During the testing period, the boiler and reburn systems were operated by computer control over a range of one half to full load.

Overall test results were better than expected, exceeding the initial project goals of at least 50 percent NO_x reduction with acceptable boiler operation. Both parametric and optimization tests demonstrated NO_x reductions of more than 50 percent at full load. The unit operated well, although with slightly less NO_x reduction, down to about one third load with bituminous coal. Reductions in NO_x greater than 50 percent were achieved over the same range of loads with western low rank coal. At lower loads, the NO_x reduction fell off to about 35 percent.

Long-term testing of the reburn system, when operated by plant personnel, demonstrated reliable consistent performance. Unexpected bonuses from the reburning retrofit included improved boiler operability, cleanliness, and the capability of firing low-sulfur, low rank coal without boiler derating.

High NO_x Emitting Boilers

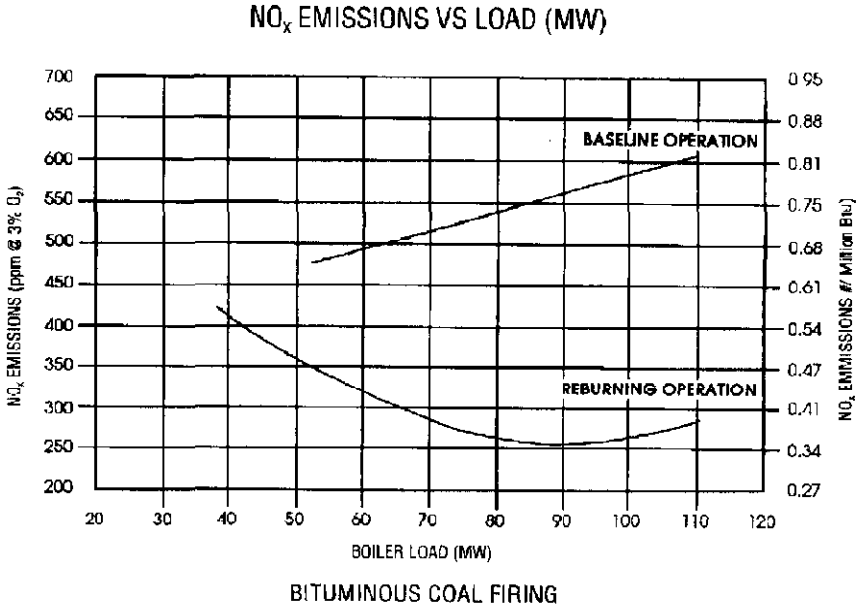
The more than 100 cyclone boilers operating today representing more than 25,000 megawatts of electricity were designed nearly 50 years ago at a time when the overriding concern in the utility industry was to transfer heat as efficiently as possible. Little or no attention was paid to nitrogen oxide emissions. Estimates indicate that although cyclone boilers represent only 14 percent of the pre-NSPS boiler population, they represent 23 percent of the NO_x emissions.

In a cyclone-fired boiler, crushed coal is fed to the cyclone furnace axially, while secondary air enters the cyclone cylinder tangentially. This creates a swirling motion that greatly increases the intensity of the flame, producing much higher temperatures than those found with conventional burners. Because flame temperature is one of the key factors affecting NO_x formation (along with the nitrogen concentration in the fuel, the level of excess air, and the residence time at high temperatures), NO_x emissions tend to be high.

Techniques developed to limit NO_x formation in some existing boilers include lower flame temperature, shortened residence time and oxygen deprivation. Such techniques, however, cannot be used in cyclone boilers because they also cause operational problems, such as high carbon monoxide emissions, unburned carbon, corrosion from lack of oxygen, and formation of partially oxidized organic compounds that can be harmful to public health and the environment.

As a result, there are no acceptable commercially available technologies to

See "Reburn" on page 7 . . .



BITUMINOUS COAL FIRING

SECOND ANNUAL CLEAN COAL TECHNOLOGY CONFERENCE

Co-Sponsored by U.S. Department of Energy and Southern States Energy Board
Atlanta, Georgia
September 7-9, 1993

TUESDAY EVENING (September 7)

- *Registration* (12:00 p.m. - 8:00 p.m.)
- *Plant Yates Tour*, Southern Company Services, CT-121 FGD Project; dinner at Plant site (3:00 p.m. - 8:00 p.m.)

WEDNESDAY MORNING (September 8)

Plenary Session 1

- ***Moderator*: Jack S. Siegel**, Acting Assistant Secretary for Fossil Energy, U.S. Department of Energy
- ***Opening Greeting:*** **Kenneth J. Nemeth**, Executive Director, Southern States Energy Board
- ***Welcoming Remarks.*** **Invited Speaker, The Honorable Zell Miller**, Governor of Georgia
- ***Keynote. The Domestic and International Environmental Role for Clean Coal Technologies.*** **Invited Speaker, The Honorable Hazel O'Leary**, Secretary, U.S. Department of Energy
- ***What's After the Clean Air Act Amendments.*** **Invited Speaker, Eileen Claussen,** Special Assistant to the President and Senior Director for Global Environmental Affairs, National Security Council
- ***Utility Market - Perspective for Economy and Jobs to 2010.*** **Kurt Yeager**, Senior Vice President, Electric Power Research Institute
- ***Regulatory Climate for Clean Coal Technologies into the Next Century.*** **Invited Speaker, The Honorable Lynn Shishido-Topel,** Commissioner, Illinois Commerce Commission
- ***Power Generation Market - Coal Producers' Perspective:*** **Speaker, TBD**

WEDNESDAY AFTERNOON (September 8)

Luncheon

- ***Coal: Fuel of Choice, Fuel of Necessity:*** **Michael Reilly**, Chairman, National Coal Association

Clean Coal Technology Markets Session

- ***Panel Chairman:*** **Herbert Wheary**, Chairman, Utility Advisory Committee, Southern States Energy Board
- ***Panel Members:***
  George T. Preston, Vice President, Generation and Storage, Electric Power Research Institute
  Barry K. Worthington, Executive Director, U.S. Energy Association (invited)
  S.A. Fluevog, Project Engineer, Systems Planning, Georgia Power Company
  Kent Fickett, Vice President, Environmental and Regulatory Affairs, U.S. Generating Company
  Roger Naill, Vice President, Applied Energy Services, Inc.
  Robert Conley, President, Pure Air
  David K. Owens, Sr. Vice President, Finance, Regulation, and Power Supply Policy, Edison Electric Institute

Concurrent Technical Sessions

Session 1: *NO_x Control Technologies*
Session 2: *Advanced Electric Power Generation Systems*
Session 3: *SO_2 Control Technologies*
Session 4: *Industrial Applications*

WEDNESDAY EVENING (September 8)

- *Reception* (6:00 p.m. - 8:00 p.m.)

THURSDAY MORNING (September 9)

Clean Coal Technology Deployment/ Technology Transfer/Outreach Session

- ***Panel Chairman:*** **Ben Yamagata**, Executive Director, Clean Coal Technology Coalition
- ***Panel Members:***
  Robert Porter, Director, Office of Communications, Fossil Energy, U.S. Department of Energy
  Stuart Dalton, Program Manager, SO_2 Control, Electric Power Research Institute
  Ben Yamagata, Executive Director, Clean Coal Technology Coalition
  David South, Economist/Program Manager, Argonne National Laboratory (invited)
  Ted Atwood, Office of Clean Coal Technology, U.S. Department of Energy

Concurrent Technical Sessions

Session 5: *Coal Combustion/Coal Processing*
Session 6: *Advanced Electric Power Generation Systems*
Session 7: *Combined NO_x/SO_2 Control Technologies*

THURSDAY AFTERNOON (September 9)

Luncheon

- ***What Clean Coal Brings to the International Market:*** **Invited Speaker, Robert Driscoll**, President, U.S. ASEAN Council

Plenary Session 2
Emerging Issues/Environmental

- ***Moderator:*** **Dr. C. Lowell Miller**, Associate Deputy Assistant Secretary for Clean Coal, U.S. Department of Energy
- ***Panel Members:***
  Stephen Jenkins, Manager, Advanced Technology, TECO Power Services
  David Eskinazi, Manager, Air Quality Control Projects, Electric Power Research Institute
  Dr. Ian Torrens, Director, Environmental Control Systems Department, Electric Power Research Institute
  Joseph Vandenburg, Director, Technical Services, Edison Electric Institute
  Robert Long, Chairman, Global Climate Coalition (invited)
  Craig Harrison, Esq., Utility Air Regulatory Group, Hunton & Williams

REGISTRATION INFORMATION:

The fee for this Conference is $300 for General Registration, $175 for Government Registration/Presenters, and $360 for on-site registration. Registration fees cover speakers/continental breakfasts, lunches, breaks, and plant tour/dinner. To register, please complete the attached Registration Form with checks made payable in USD to ***Southern States Energy Board*** and send to the address listed on the Form. Payment should be received no later than ***August 1, 1993.***

HOTEL INFORMATION:

All events are scheduled at The Atlanta Hilton and Towers, 255 Courtland Street, N.E., Atlanta, GA, 30302 USA. The following rates are available for hotel rooms.

Government rate: (70 rooms available)	**General Audience:**	**In the Towers:**
$69.00/single	$78.00/single	$125.00/single
$94.00/double	$106.00/double	$145.00/double

Reservations can be made by calling 1-800-HILTONS, or 1-404-222-2800 and asking for Southern States Energy Board under which the rooms are reserved. Reservations must be made by **August 9, 1993**. After that date, reservations are subject to availability.

TRANSPORTATION:

The Atlanta Hilton and Towers is one block from Interstate 75/85 and 15 minutes north of Atlanta's Hartsfield International Airport. Parking is available in an underground garage.

Located at the ground transportation area of Hartsfield International, The Atlanta Airport Shuttle offers transportation to and from all major downtown hotels. Taxi service is also available. Additionally, all major car rental agencies are represented at the airport. Atlanta's public transportation system, MARTA, provides a rail line from the airport that stops at Peachtree Center (Station N1), which is one block from The Hilton.

CONTACTS:

For further information on the Conference, please contact **Mr. Arvid Strom**, U.S. Department of Energy, Office of Clean Coal Technology, (301) 903-2790, Fax (301) 903-9438, or **Ms. Regina Monsour**, Technology & Management Services, Inc., (301) 670-6390, Fax (301) 670-1942.

REGISTRATION FORM

Please complete this registration form and return by August 1, 1993, to:
Southern States Energy Board - Registration
P.O. Box 883
Germantown, MD 20875-0883 USA

(Please Print)

Name:

Title:

Company:

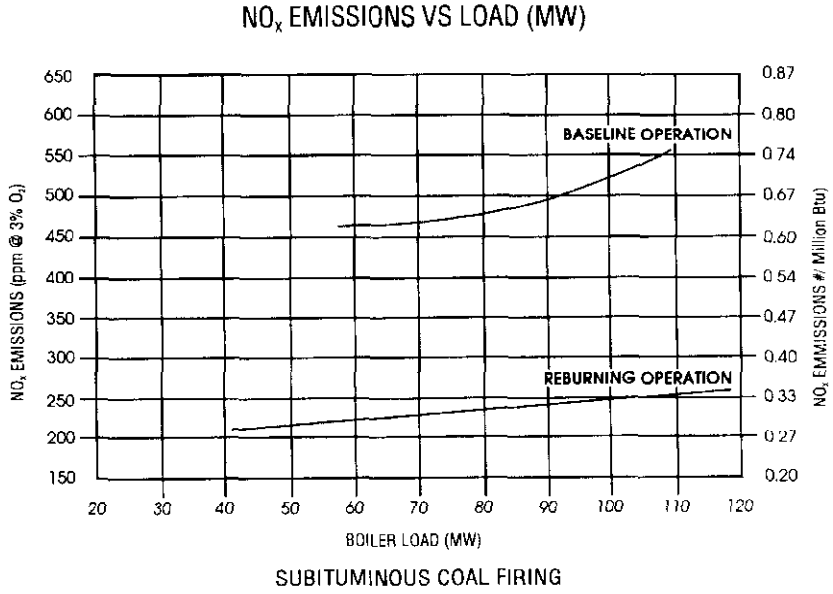
Address:

Phone:

I have enclosed a check payable to **Southern States Energy Board** in the amount of $_____ for the Conference Registration Fee.

I **will**____ **will not**_____ be attending the site visit and dinner at *Plant Yates* on September 7, 1993, 3:00 p.m. - 8:00 p.m.

. . . "Reburn" from page 6



SUBITUMINOUS COAL FIRING

modify cyclone burners in ways that will result in lower NO_x emissions. Although most of today's operating cyclone boilers are 20 to 30 years old, they still have an additional 10 to 30 years of remaining lives. And with deadlines of the Clean Air Act Amendments fast approaching, along with the ongoing threat of even stricter standards from the state level, it is fairly certain that these boilers will be targeted for NO_x emission reductions before the end of the decade. For these, and other cyclone boiler types, reburning may be the answer.

Three Combustion Zones

Coal reburning takes place in three combustion zones within the boiler furnace: the main combustion zone, the reburning zone, and an overfire air zone. About 70 percent of the coal is fed into the main combustion zone of the boiler along with a slightly reduced quantity of excess air. After allowing sufficient residence time to complete combustion, the combustion products enter the reburning zone where the balance of the coal is injected through retrofitted reburn burners along with a minimal amount of air. This deficiency of oxygen in the reburn zone creates a reducing environment where NO_x formed in the main combustion zone is chemically reduced to molecular nitrogen.

The combustion gases leaving the reburning zone are oxygen deficient and contain unburned carbon, carbon monoxide, and hydrogen. Therefore, to complete combustion, retrofitted overfire air ports introduce additional combustion air into the boiler above the reburning zone. Again, adequate residence time is required for the oxygen to thoroughly mix and react with the furnace combustibles before the gases enter the convective heat transfer section of the boiler.

An Unexpected Benefit

An added benefit of using coal reburn technology was discovered during the demonstration trials, namely, that it allows use of lower sulfur subbituminous coal while maintaining the unit's full load capability. While low in sulfur, these coals also have lower heating values per pound than bituminous coals. For the cyclone to maintain full load using the lower heating value coal, it must burn a larger volume of coal—something not possible because of the cyclone's physical operating restraints. It is not uncommon to have a loss of 15 to 20 percent of full load capacity when switching a cyclone boiler to western fuel.

Reburn technology uses additional fuel through the reburn burners to make up the difference in lost capacity. Seen in this light, reburning can be viewed as a combined SO_x/NO_x reduction technology, with SO_2 reduced by switching to a low sulfur coal. B&W is exploring the possibility of marketing this approach to the entire U.S. cyclone burner utility market.

The demonstration project is being performed over a 43-month period at a total estimated cost of $13.6 million. In addition to DOE, funding has been provided by Wisconsin Power & Light Co., the Illinois Department of Energy and Natural Resources, the Electric Power Research Institute, and 14 utility sponsors who operate cyclone boilers. Based on these demonstration results, B&W intends to offer coal reburning as a commercial technology. CCT

. . . "Briefs" from page 5

Technologies' spray dryer absorber and baghouse system capture additional SO_2. The project is proposed to be built in Healy, AK about 200 miles north of Anchorage at a site adjacent to an existing 25 MWe pulverized-coal power plant owned by Golden Valley Electric Association. DOE is cost sharing the Healy project with the **Alaska Industrial Development and Export Authority**. Construction of the power plant is scheduled to be completed in 1996 and will be followed by a one-year test program. Afterwards, the plant will be operated commercially by **Golden Valley Electric Association.**

Custom Coals International announced in April that it had received Letters of Intent from three of Poland's largest coal mines to build coal preparation plants using its advanced clean coal technology. Design, construction and operation of the plants will be worth about $120 million to the Pennsylvania firm and is the first step in what Custom Coals projects will be a 10-year, $1.2 billion effort. Custom Coals officials attribute the deal to contacts made through a DOE-administered joint U.S./Poland program to use U.S. technology

See "Briefs" on page 8 . . .

Two CCT Projects "Get the Word Out"

Getting up-to-date information to decision makers is what the Low-NO_x Cell™ Burner and NOXSO project team members accomplished through Open Houses. The two-day events were successful in attracting the interest of those within the utility industry who will have a significant influence in determining the future commercial potential of these promising coal technologies.

Low-No_x Cell Burner Project

The Round 3 project, "Full-Scale Demonstration of Low-NO_x Cell™ Burner Retrofit," completed 12 months of online testing and was on a scheduled maintenance outage in April for inspection of the boiler. In conjunction with this activity, on April 16 and 19, 1993, the Ohio Coal Development Office (OCDO), with Dayton Power & Light Company (DP&L) and Babcock & Wilcox, held a Technology Transfer Open House for the project.

The open house was scheduled coincident with the open boiler to give attendees the opportunity to closely inspect the low-NO_x cell burner system both from inside and outside the boiler. The event was attended each day by about 100 people, drawn primarily from the electric utility industry. In addition to the tour of the boiler, guests were given a technical presentation on the low-NO_x cell burner system and its performance results during the test period.

This $11 million demonstration project, 48 percent DOE funded, is being conducted by Babcock & Wilcox on DP&L's J.M. Stuart Plant, Unit No. 4 (605-MWe boiler) located near Aberdeen, OH. The Ohio Coal Development office is a co-funder for the project and has participated with the Department of Energy in many Ohio clean coal technology projects. Other funding sponsors include the Electric Power Research Institute and five utility companies which operate cell burner boilers.

The goal for this demonstration project is to economically replace the existing circular burners with the Low-NO_x cell burner system in order to reduce the NO_x emissions by more than 50 percent without adversely affecting the operation or performance of the boiler. This goal was exceeded with emissions in the range of 0.526 lb/million Btu (55 percent reduction).

The final data are now being examined by Babcock & Wilcox and expectations are high that this technology will have a bright commercial future in the retrofit market.

NOXSO SO_2/NO_x Removal Project

NOXSO Corporation's Open House on April 7 and 8, 1993, was held at Ohio Edison's Toronto Station in Toronto, OH. Approximately 180 people from industry, government and business attended.

The NOXSO technology is a post-combustion process designed to simultaneously remove NO_x and SO_2 from a coal-fired boiler's flue gas stream. The Open House included a technical program and tour of the NOXSO Pilot Plant which treats a 5-MW slip stream from the power station boiler.

The NOXSO process is a dry, regenerable system in which the flue gas passes through a fluidized-bed adsorber downstream of the precipitator where the SO_2 and NO_x are adsorbed by the sorbent. The sorbent consists of spherical beads of high surface area alumina impregnated with sodium carbonate. The cleaned flue gas then passes to the stack.

The pilot effort was declared a success in meeting and exceeding the project's objectives. The system has operated for over 6,500 hours and demonstrated up to 99 percent SO_2 removal and up to 95 percent NO_x removal.

The Pilot Plant was used to gather the technical and operational information required for the Clean Coal Technology Program under the $66 million, 50 percent DOE cost share Cooperative Agreement.

The commercial-scale system was to have been built at Ohio Edison's Niles Station with the utility purchasing the facility after the demonstration. However, plant closings and fuel switching remove the need for the allowances the NOXSO plant would have generated. Also, Ohio Edison will not raise rates to cover capital expenditures before the year 2000. NOXSO is currently considering other site options. CCT

. . . "Briefs" from page 7

to help improve air quality in Poland.

Also on the international front, **Jack Siegel**, now serving as DOE's Acting Assistant Secretary for Fossil Energy, led the U.S. electric power industry on a trade mission to China from June 1-12. The delegation included representatives of 22 U.S. technology vendors, the largest group of domestic industry officials ever to participate in a U.S. energy technology trade mission. The trip is expected to open doors to a growing Chinese market for upgraded power generation technologies in what is likely to be the world's fastest growing market for new coal and other utility technologies over the next two decades.

The 1992 edition of the **Clean Coal Technology Program Update** is now available. If you have not received your copy, call the Office of Clean Coal Technology at (301) 903-2790 to add your name to our mailing list.

(If you know of an event, award, or milestone related to one of the 46 ongoing Clean Coal Technology demonstrations that could be included in an upcoming *Clean Coal Today*, send the information to Associate Editor, FE-5, 1000 Independence Avenue, SW, Washington, D.C. 20585.) CCT

Status of Clean Coal Technology Demonstration Projects

American Electric Power. Tidd PFBC Demonstration Project. (Brilliant, OH)
The plant is in an outage period caused by blade failures in a low-pressure turbine. Repairs are on schedule and operations are projected to resume in late July.

Babcock & Wilcox. LIMB/Coolside Demonstration Project. (Lorain, OH)
The Final Coolside Topical Report is available to the public through NTIS [Ref. DOE/PC/79798-T26 (DE93001722)]. The LIMB Extension Final Report is also available through NTIS [Ref. DOE/PC/79798-T27 (DE93005979)].

CQ, Inc. Coal Quality Expert. (Homer City, PA)
More than half of the planned six full-scale field tests and pilot and bench scale correlation tests have been completed. Over 100 algorithms based on the data generated from the tests are under development. The Acid Rain Advisor software package is now commercially available. Two new host sites have been selected for field test sites #5 and #6.

EER Corporation. Enhancing the Use of Coal by Gas Reburning and Sorbent Injection. (Hennepin and Springfield, IL)
A summary of GR-SI performance, Boiler Impacts and Operational Economics was completed for the Illinois Power Hennepin Plant in April 1993. Illinois Power is reviewing the summary to determine how GR-SI can best fit into its long-term emission compliance strategy. Work on the report of the results of long term testing started and will continue through the quarter. At the Lakeside Station of City Water, Light & Power in Springfield, IL, all calibration, construction modifications and checkout work was completed.

Rosebud Syncoal Partnership. Advanced Coal Conversion Process Demonstration (Colstrip, MT)
Phase III Operations that started in June 1992, are continuing. Modifications made to the demonstration facility are now being tested; these changes are expected to overcome the operating difficulties that have been experienced to date.

York County Energy Partners. Circulating Fluidized Bed Cogeneration Project. (York, PA)
YCEP has requested that DOE approve a change in the project site to a location some 6 miles away. The request was prompted by YCEP's attempts to meet commitments to offset SO_2 emissions 2 to 1 in the community. If approved, the relocated project would provide steam to an existing P.H. Glatfelter paper mill and power to the electric grid.

ABB Combustion Engineering. IGCC Repowering Project. (Springfield, IL)
Activities remain focused on refining the project cost estimate to substantially reduce the capital cost projection.

ABB Combustion Engineering. SNOX Flue Gas Cleanup Project. (Niles, OH)
The SNOX plant is operating at full capacity, producing 93 percent pure sulfuric acid, and achieving SO_2 and NO_x removals of 96 and 94 percent respectively. This SNOX project has also been selected to participate in the Air Toxics Testing Program.

American Electric Power Service Corp. PFBC Utility Demonstration Project. (New Haven, WV)
Value engineering activities are continuing, including development of system descriptions, definition of component requirements and trade-off studies, to refine the preliminary design for a 340-MW greenfield plant.

Babcock & Wilcox. Coal Reburning for NO_x Control. (Cassville, WI)
Results of parametric and optimization testing with bituminous coal indicate that NO_x emissions are reduced by about 55 percent between full load (110 MW) and 70 MW. From 70 to 40 MW the NO_x reductions range from 50 to 35 percent. Air Toxics emissions monitoring and reburn testing on western coal appear to be better than those obtained on bituminous coal. Testing is now complete on this project.

Babcock & Wilcox. SNRB Flue Gas Clean-Up Project. (Dilles Bottom, OH)
Operations at Ohio Edison's R.E. Burger demonstration facility are complete and show NO_x and SO_2 reductions above 90 percent and 80 percent respectively. Test hours of 1,800 and 800 hours were completed on the Nextel and S Glass filter fabric bags, respectively. About 3,800 hours of testing have been accumulated on three different fabrics at the Colorado Springs test facility. Tests are completed and the facility is being dismantled.

Bethlehem Steel Corp. Blast Furnace Granulated Coal Injection. (Burns Harbor, IN)
DOE has approved continuation of the project into the second budget period. Planned activities during the new 25-month budget period include completion of both plant design and construction.

Bethlehem Steel Corp. Coke Oven Gas Cleaning System. (Sparrows Point, MD)
The coke ovens were placed on "cold idle" on January 24, 1992. The project has been postponed for at least two years to allow for rehabilitation of the coke ovens.

Passamaquoddy Tribe. Cement Kiln Flue Gas Recovery Scrubber. (Thomaston, ME)
Installation of new chevron-style mist eliminator system has been completed and the scrubber is operating. Early indications are that the scrubber is operating well with the new system. The project has been extended through September 30, 1993, to provide additional operational data.

Pure Air. Advanced Flue Gas Desulfurization Demonstration Project. (Chesterton, IN)
The FGD scrubber is operating and has demonstrated the capability to reduce SO_2 emissions by greater than 95 percent, thereby removing some 60,000 tons of SO_2 from the air on an annual basis. Byproduct gypsum is 97 percent pure and is being sold to U.S. Gypsum. Tests with the standard NIPSCO coal (3-3.5 percent S) have been completed, and tests with 3.5-4 percent S coal began in May 1993.

Southern Co. Services. Chiyoda Thoroughbred 121 FGD Process. (Newnan, GA)
Plant testing started in January and was completed in March 1993. Approximately 32 separate tests were completed covering the normal range of boiler operations, with SO_2 removals of 68-98 percent. The CT-121 system can routinely remove 93-98 percent of

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the SO_2 contained in the boiler flue gas. In separate testing, it was learned that the CT-121 process could remove 90 percent of the particulate contained in the flue gas, even after the gas had previously been cleaned by the electrostatic precipitator.

Southern Co. Services. NO_x Reduction for Tangential-Fired Boilers. (Lynn Haven, FL)

Long-term test data from operating the Low NO_x Concentric Firing System (LNCFS) Level I, II, and III equipment (three basic air/coal feed configurations tested) indicated full load NO_x reductions up to 37, 40, and 48 percent, respectively, compared to the baseline emission data. Air toxics and fuel fineness data continue to be evaluated.

Southern Co. Services. NO_x Reduction for Wall-Fired Boilers. (Coosa, GA)

Long-term testing of the Advanced Over Fire Air (AOFA) and for the Low-NO_x Burners (LNB) has been completed. Testing of the LNB plus AOFA configuration is underway. Chemical emissions testing is scheduled to be complete by the end of May, and the low-NO_x digital control system preliminary engineering is complete.

Southern Co. Services. SCR for High-Sulfur Coal Boilers. (Pensacola, FL)

The nine reactor SCR facility design is complete, and construction, which began on March 23, 1992, was completed on February 28, 1993. Facility start-up and shakedown began during the first week of March 1993, and continued through the first quarter of 1993. Parametric and long-term testing are underway.

Air Products and Chemicals, Inc. Liquid Phase Methanol Process. (Daggett, CA)

Texaco Syngas Inc.'s negotiation of a power purchase agreement for the Texaco Cool Water Project is delayed. As a result of the current economy and forecasts for natural gas price and availability in California, the Texaco Cool Water Project with the Liquid Phase Methanol (LPMEOH™) unit add-on can not compete economically in California without restructuring the project's financing. Efforts to restructure the project's financing and to explore relocating the LPMEOH™ project add-on to an alternative site are underway.

AirPol, Inc. Gas Suspension Absorption Project. (Paducah, KY)

Preliminary test results of the Gas Suspension Absorption (GSA) system concluded that the GSA is capable of achieving 99+ percent SO_2 removal, and that the performance is not limited by operating parameters such as approach-to-saturation temperature or the lime recirculation rate. The first half of the factorial factor test program has been completed. The second half of the test program is expected to be complete in July 1993. Testing of the 1 MWe pulse jet baghouse is being conducted concurrently with the GSA tests.

Alaska Industrial Development Authority. Healy Clean Coal Project. (Healy, AK)

Engineering and permitting efforts are proceeding on schedule. Operation of a new TRW combustor design verification test facility began in December 1992. DOE issued its Draft Environmental Impact Statement (DEIS) in November 1992, and conducted public hearings in Alaska in December 1992. The public comment period for the DEIS closed on January 20, 1993.

Babcock & Wilcox. Low-NO_x Cell Burner Retrofit. (Aberdeen, OH)

Every other lower burner and NO_x port was inverted and shallow angled replacement impellers were installed by May 1992. These changes were made to mitigate high CO concentrations in the lower furnace that occurred when operating to achieve high NO_x emission reductions. Optimization testing was completed in July 1992; long term baseline testing is complete. NO_x emission reductions exceeded the 50 percent target level.

Bechtel Corp. Confined Zone Dispersion FGD Project. (Indiana County, PA)

Slurry injection tests using dolomitic lime have indicated that the expected level of SO_2 emissions reduction of 50 percent can be achieved and possibly exceeded. Parametric testing has been completed. The six-month continuous demonstration run was initiated in August 1992, and although there have been delays, is nearing completion.

DMEC-1 Ltd. Partnership. Pressurized Circulating Fluidized Bed Demonstration Project. (Pleasant Hill, IA)

Preliminary design is continuing. An Implementation Plan for completion of the Environmental Impact Statement has been approved and a draft Environmental Impact Statement has been prepared and is undergoing review.

EER Corp. Gas Reburning and Low-NO_x Burners on a Wall-Fired Boiler. (Denver, CO)

During the first quarter, the Unit #3 boiler experienced a series of reheater tube failures and the loss of a feedwater pump. The problems have since been resolved: none were associated with the Gas Reburning Low-NO_x Burner demonstration. The one-year-long term baseline test program started the last week of April 1993.

ENCOAL Corp. Mild Gasification Project. (Gillette, WY)

A very successful 16-day test run was recently completed, demonstrating excellent performance of the plant equipment and the process control system. More than 5,000 tons of Powder River Basin coal were processed during the run, which produced in excess of 125,000 gallons of liquid fuel and several thousand tons of solid product.

LIFAC N. America. LIFAC Sorbent Injection Desulfurization Demonstration Project. (Richmond, IN)

Construction and baseline testing are complete. Parametric testing began in February 1993.

MK-Ferguson Co. NOXSO Flue Gas Cleanup System. (Niles, OH)

Preliminary design activities are proceeding into 1993. The design is now incorporating the results of pilot testing.

Public Service Co. of CO. Integrated Dry NO_x/SO_2 Emissions Control System. (Denver, CO)

Low NO_x burner and overfire air testing was completed on October 30, 1992. Results indicate NO_x removals between 60 and 69 percent. On-site testing for Baseline Air Toxics Monitoring was completed the week of November 16, 1992. Testing of the urea and aqueous ammonia injection system began on January 4, 1993, and was completed on April 9, 1993. At full load, 43 percent reduction was achieved with a 10 ppm ammonia slip. A second phase of Air Toxics Monitoring with the urea injection system operating was completed the week of March 15, 1993. Calcium injection testing is being conducted in May and June 1993. The overall testing schedule will be completed in mid-1994.

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Tampa Electric. Integrated Gasification Combined Cycle Project. (Tampa, FL)

Final bids have been received for all major equipment items. The Environmental Protection Agency has agreed to serve as "Lead Agency" for preparation of the Environmental Impact Statement required under the National Environmental Policy Act. DOE is a "Cooperating Agency" for the 260-MW Clean Coal Technology portion of the 1,150-MW planned buildout at the Polk Power Plant.

Custom Coals International. Self Scrubbing Coal: An Integrated Approach to Clean Air. (Greensboro, PA; Springdale, PA; Richmond, IN)

Project definition activities are continuing. Preliminary design of the coal cleaning plant is more than 50 percent complete.

New York State Electric and Gas (NYSEG). Milliken Clean Coal Technology Demonstration Project. (Lansing, NY)

Design activities are underway. The Environmental Assessment activities continue and are expected to be completed in the near future.

TAMCO Power Partners. Toms Creek IGCC Demonstration Project. (Coeburn, VA)

Project definition and preliminary design activities are under way. A power purchase agreement is being sought.

Tennessee Valley Authority. Micronized Coal Reburning for NO_x Control. (Paducah, KY)

The Cooperative Agreement was awarded on July 28, 1992. The Fuller Company purchased Micro Fuel Corporation in September 1992, and will assume Micro Fuel's obligations in this project. TVA signed a contract with Fuller in April 1993.

ThermoChem, Inc. Demonstration of Pulse Combustion in an Application for Steam Gasification of Coal. (Gillette, WY)

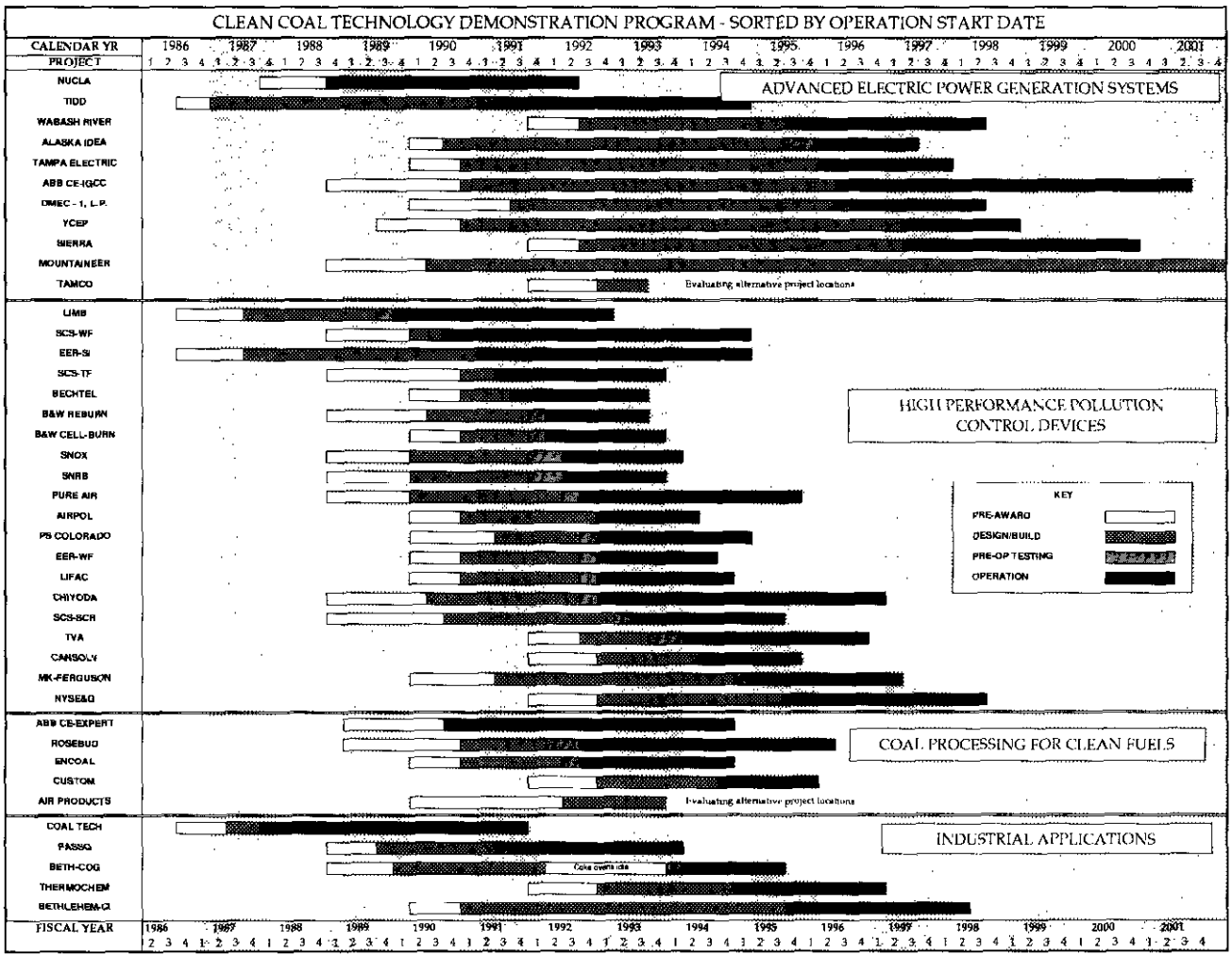
Preliminary design work is now fully underway.

Sierra Pacific Power. Piñon Pine IGCC Project. (Reno, NV)

Design activities are proceeding. Environmental engineering activities are being conducted in support of project permitting requirements and the Environmental Impact Statement preparation.

Wabash River Joint Venture. Wabash River Coal Gasification Repowering Project. (W. Terre Haute, IN)

Detailed equipment design specifications and bid packages have been prepared for the major equipment items, and purchase commitments have been made for most of them. DOE has approved continuation of the project into the second budget period. Planned work during this new 25-month budget period includes completion of plant design, construction and startup. An Environmental Assessment and Finding of No Significant Impact has been issued by DOE, and an air emissions permit has been received from the Indiana Department of Environmental Management.



Upcoming Events

Date	Event	Contact
June 25-28, 1993	***SNOX Project Open House,*** Ohio Edison Niles Station, Niles, OH	Reservations Required (800) 374-SNOX
June 28-30, 1993	***Coal-Fired Power Systems '93—Advances in IGCC and PFBC,*** Morgantown Energy Technology Center, Morgantown, WV	METC Conf. Svcs. (304) 291-4108
August 3-5, 1993	***Joint Contractors Review Meeting,*** (Advanced Turbine Systems, Heat Engines, and Fuel Cells), Morgantown Energy Technology Center, Morgantown, WV	METC Conf. Svcs. (304) 291-4108
September 7-9, 1993	***Second Annual Clean Coal Technology Conference,*** The Atlanta Hilton and Towers, Atlanta, GA	A. Strom (301) 903-2790

CCT Reports Update

The following Clean Coal Technology Program Reports and Comprehensive Reports to Congress have been released since the last issue of *Clean Coal Today*. Copies of the reports are available from the National Technical Information Services, U.S. Department of Commerce, Springfield, VA 22161.

October 1992	DOE/MC/24132-3195	*Tidd PFBC Demonstration Project Public Final Design Report*
November 1992	DOE/MC/26304-3194	*PFBC Utility Demonstration Project 1991 Annual Report*

The following papers, authored by DOE employees or CCT participants, have been delivered at recent conferences. Copies are available from the authors. For further information, contact Doug Archer, Office of Clean Coal Technology at (301) 903-9443.

"Application of an Advanced Power System in the Tampa Electric Polk Power IGCC Project." Donald E. Pless, TECO Power Services, and Gregory J. Starheim, GE Power Generation; *PowerGen'93 Conference,* Paris, France, May 1993.

"Combining Low-NOx Burners, Overfire Air, and SNCR for High Efficiency NOx Removal," T. Hunt and R. Smith, *Air & Waste Management Association's 86th Annual Meeting & Exhibition,* Denver, CO, June 1993.

"Integrated SO_x/NO_x Emissions Control System (IS/NECS) - Update," T. Hunt and J. Doyle, *International Power Generation Conference,* Atlanta, GA, October 1992.

"Low-NO_x Combustion Modifications for Top-Fired Boilers," T. Hunt and others, *1993 Joint Symposium on Stationary Combustion NO_x Control,* Miami FL, May 1993.

"Reducing Stack Emissions by Gas Firing in Coal-Designed Boilers—Field Evaluation Results," Presented at the *EPRI/EPA Joint Symposium on Stationary Combustion NO_x Control,* Miami Beach, FL, May 1993.

"Selective Non-Catalytic Operating Experience Using Both Urea and Ammonia," T. Hunt and others, *1993 Joint Symposium on Stationary Combustion NO_x Control,* Miami, FL, May 1993.

"Tidd PFBC Demonstration Plant Operation and Testing," M. Marrocco and D.R. Hafer, American Electric Power Service Corporation; *Symposium on Energy and Environmental Management,* New Orleans, LA, March 1993.

The following papers were presented at the *American Power Conference*, Chicago, IL, April 1993.

"ABB Combustion Engineering's Coal Gasification System for Combined Cycle Power Generation." L.J. Peletz, P.R. Thibeault, and H. Andrus, Jr., ABB Combustion Engineering.

"AEP's Program for Enhanced Environmental Performance of PFBC Plants." D.R. Hafer and D.A. Bauer, American Electric Power.

"Environmental Considerations of Coal Gasification Technology and the Wabash River Repowering Project." W.S. Lessig, Destec Energy, Inc.; and M. Judd, PSI Energy.

"Integration of Coal Gasification and Combined Cycle Facilities on the Wabash River Coal Gasification Repowering Project." P. Amick, Destec Energy, Inc.; D.M. Zupan, PSI Energy; and R.E. Herbster, Sargent & Lundy.

"Low-NO_x Combustion Modifications for Down-Fired Pulverized Coal Boilers," E. Mali and others.

"The Midwest Power PCFB Demonstration Projects/AHLSTROM PYROFLOW First and Second Generation Pressurized Circulating Fluidized Bed (PCFB) Technology." S. Ambrose, Midwest Power; and Clifford L. Green, Richard Dryden, and S.J. Provol, Pyropower Inc.

"The Piñon Pine IGCC Project/Design and Permitting Issues." John W. Motter, Sierra Pacific Power Company; Jon D. Pitcher, Foster Wheeler USA Corporation; and William M. Campbell, The M.W. Kellogg Company.

"Tampa Electric Company Polk Power Station Unit #1 IGCC Project." S.D. Jenkins, TECO Power Services.