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Clean Coal Today

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

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

Advanced Power Generation Future Bright With Coal Gasification-Combined Cycle

Clean Coal Briefs

American Electric Power's (AEP) Tidd plant continues to break new ground in its performance as the Nation's first operating pressurized fluidized bed combustion (PFBC) power plant. In recent operations at **Ohio Power Company's Brilliant, Ohio** plant site, the unit reached a gross electric power output of 71 megawatts—its full power capacity. Two other milestones—a maximum bed height of 140 inches and a near-maximum bed temperature of 1575 degrees F—were also attained during the tests.

Since operations began a little more than a year ago, the $193 million project--from the Clean Coal Technology program's first round--has logged a total of about 1,350 operating hours.

The **National Energy Resources Organization** will award AEP one of its annual "outstanding achievement" awards to recognize its operation of the **Tidd plant**. The award will be

*See "**Briefs**" on page 11*

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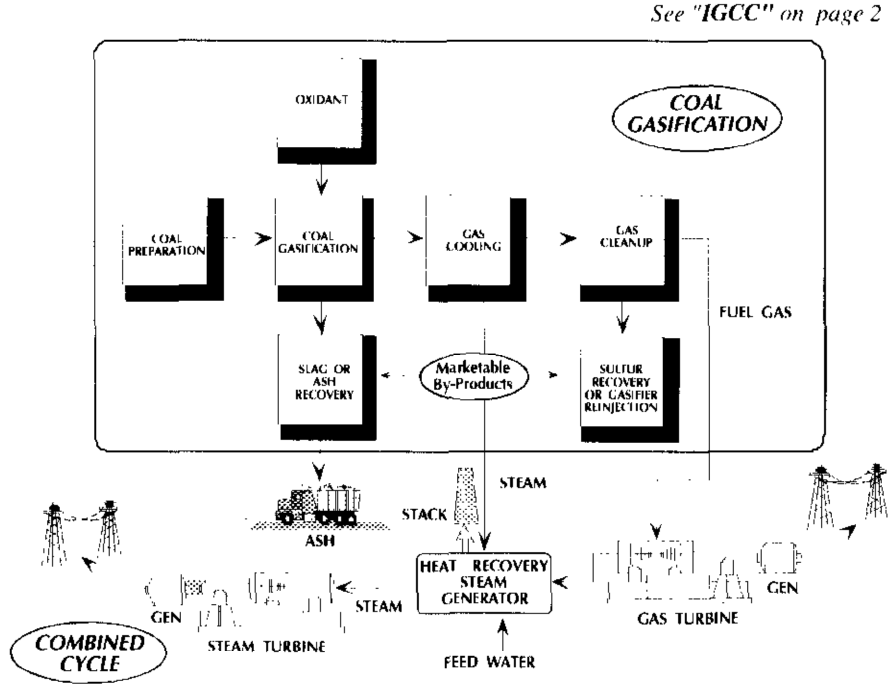
Six Major Projects in DOE's CCT Program

Power production in the U.S. is expected to increase rapidly during the next 20 years. Total consumption of electricity is expected to rise from 2.7 trillion kilowatt-hours (kWh) in 1990 to about 4 trillion kWh in 2010 and more than 5.3 trillion kWh in 2030. Even with aggressive conservation, and assuming that the existing 700,000 megawatts of electric generating capacity (MWe) now installed in the United States is maintained through refurbishment and replacement, the growth in electricity consumption between 1990 and 2030 translates into the need for an additional 200,000 MWe of capacity by 2010.

Today's technology will find it difficult to satisfy the rapidly changing environmental, economic, and technical performance requirements being imposed on power plants. The power plant of the future must be capable of meeting stringent siting and environmental demands while producing power efficiently and with a high level of reliability. And, the ability to rapidly add capacity in modules which closely match load growth will be an important factor in maintaining reasonable electricity costs.

Much of this Nation's 21st century electricity could be generated by a new breed

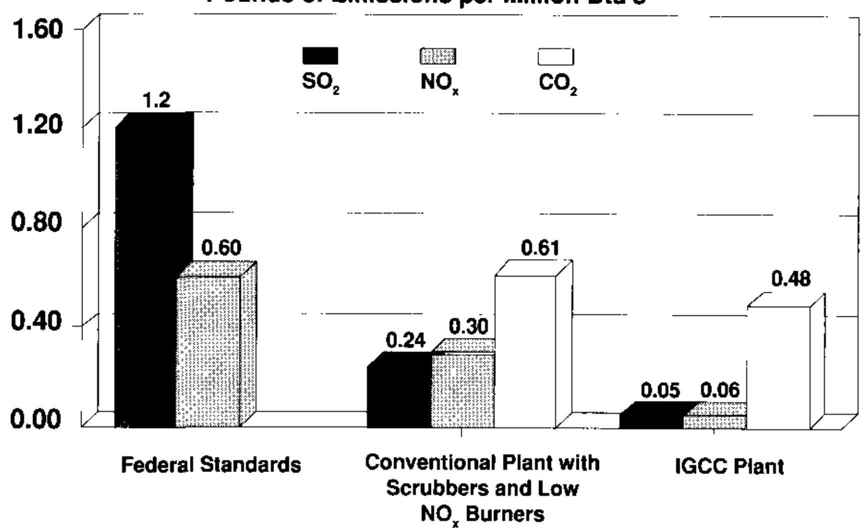
*See "**IGCC**" on page 2*



Integrated Coal Gasification Combined Cycle Process Schematic

IGCC...continued from pg. 1

IGCC Technology Outperforms Conventional Coal-Fired Plants in Reducing Acid Rain Emissions



Source: Industry data based on 450 megawatt power plant, 3% sulfur, 10% ash coal. Performance of specific design configurations may vary.

of affordable, highly efficient, and super clean power plants based on a process called integrated gasification combined cycle technology, or IGCC. Commercial acceptance of this advanced technology will depend to a great extent upon the success of several IGCC demonstrations in DOE's Clean Coal Technology Program.

Integrated gasification combined-cycle processes consist of four basic steps: (1) partial oxidation of coal with steam and oxygen (or air) under substoichiometric conditions to create a combustion gas; (2) gases undergo removal of pollutant species (sulfur, particulates); (3) gases are combusted and pass through a high efficiency gas turbine to produce electricity; (4) the residual heat in the turbine exhaust is used to create steam for a conventional steam turbine to produce additional electricity, thus the term "combined-cycle."

IGCC processes can be used for constructing completely new facilities, or can replace or repower existing units.

The gasifier can be one of three basic types: fixed bed, fluidized bed, or entrained flow. The fixed bed gasifier typically consists of a pressure vessel containing a grate which supports a coal charge that moves from the top of the vessel to the bottom. At the bottom, steam and oxidant are added and ash products are removed. In fluidized bed reactors, coal is fed into the bottom or side of the unit, and steam and oxidant are introduced at a velocity sufficient to fluidize the bed. Entrained flow gasifiers are characterized by higher velocities which transport the coal charge in a very hot reaction chamber at temperatures above the ash melting point. Entrained gasifiers can be single or two stage, with slurry or dry coal feed.

Either novel hot or conventional cold gas cleaning processes are employed downstream of the gasifier. Hot gas cleanup frequently includes feeding limestone to the gasifier to remove the bulk of the sulfur released during gasification, and requires filters, such as ceramic candle filters, to remove fine particulates.

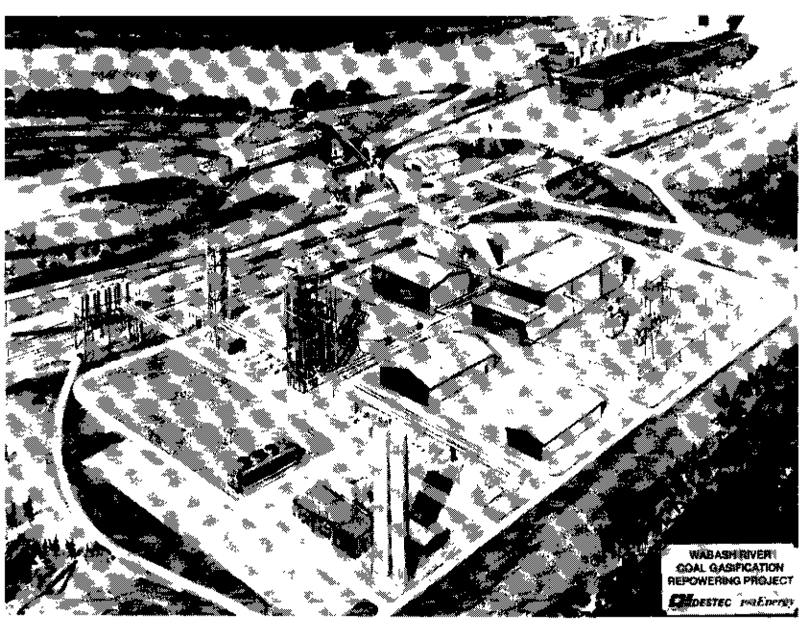
Compared with today's conventional coal burning methods, an IGCC plant can produce up to 25 percent more electricity from a given amount of coal.

Air pollutants can also be removed more efficiently from the gas produced in a pressurized IGCC system than from the flue gas which results when coal is burned directly.

For these reasons, IGCC plants are viewed as superior to today's conventional coal plants and are almost certain to be one of the lowest cost fossil fuel sources of electric power generation in the 21st century.

In repowering with IGCC, a gasifier, gas stream clean-up unit, gas turbine and waste heat recovery boiler are usually added. In most cases, these replace the existing coal boiler. The remaining equipment, including the steam turbine and electrical generator, is left in place.

See "IGCC" on page 3



Artist's Rendition-265 MWe Wabash River Coal Gasification Repowering Project, West Terre Haute, Indiana, Destec Entrained Flow Gasifier.

Clean Coal Technology IGCC Projects

Project	Technology	Status	Performance
Combustion Engineering IGCC Repowering Project. Lakeside Generating Station, City Water Light & Power, Springfield, IL, 60 MWe - 600 TPD Illinois coal.	ABB CE dry feed, air-blown, two stage, entrained flow gasifier with limestone injection and moving-bed zinc ferrite hot gas cleanup	Initiated preliminary design 1/92. Operations planned for 4/96 through 6/01. DOE awarded $129 million in assistance for $270 million project.	Goal:SO_2:>98.5%, NO_x:>90% Efficiency: near term: 39% n^{th} plant: 42-45%. Sulfur or sulfuric acid and slag saleable byproducts.
Tampa Electric IGCC Project. Lakeland, FL. 190 MWe gas turbine configured with steam turbine to produce 260 MWe - 2000 TPD bituminous coal.	Texaco slurry feed, oxygen-blown, single stage, entrained flow, gasification system. One commercial cold gas cleanup system at 100% capacity. Moving bed mixed metal oxide hot gas cleanup system at 50% capacity.	Preliminary design in progress. Redefining baseline to incorporate in larger $660 million Tampa Electric project. DOE award is $121 million, 50% of $241 million CCT Project.	Goal:SO_2>98.5%, NO_x>90%. Sulfur or sulfuric acid and slag saleable byproducts.
Sierra Pacific Power Corporation's Piñon Pine IGCC Power Project. Reno, NV. 56 MWe gas turbine configured with steam turbine to produce 80 MWe net - 800 TPD western bituminous coal.	MW Kellogg KRW, air-blown fluidized-bed gasifier with gasifier limestone injection and fixed bed zinc ferrite hot gas cleanup with ceramic candle filters for particulate removal.	Project selected for negotiation, September 1991. Proposed cost $341 million, 50% DOE share. 96 month schedule.	Goal: SO_2>98.5%, NO_x>90% Efficiency:near term 35% n^{th} plant:41-45%. Ash and lime sorbent disposal.
TAMCO Power Partner's Toms Creek IGCC Project. Coeburn, VA. 107 MWe net from two gas turbines (one natural gas fired), and one steam turbine. 55 MWe derived from coal gas. Export 20,000 lbs./hr steam to adjacent coal preparation facility.	IGT/Tampella U-Gas, air-blown, fluidized-bed with zinc titanite and ceramic candle filter hot gas cleanup	Project selected for negotiation, September 1991. Proposed cost $219 million, 50% DOE cost share. 81 month schedule.	Goal:SO_2>98.5%, NO_x>90% Efficiency: near term: 39% n^{th} plant: 42-48%. Ash and lime sorbent disposal.
Wabash River Coal Gasification Repowering Project. West Terre Haute, IN. 165% capacity increase at 21% lower heat rate, 265 MWe- 2500 TPD bituminous coal.	Destec, slurry feed, oxygen-blown, two stage entrained flow slagging first stage and non-slagging second stage gasifier. Amine based cold gas cleanup	Project selected for negotiation, September 1991. Proposed cost $592 million, 41% DOE cost share. 69 month schedule.	Goal:SO_2>98.5%, NO_x>90% Efficiency. near term:39% n^{th} plant:42-48%. Slag and elemental sulfur saleable byproducts.
Demonstration of the Liquid Phase Methanol Process. Daggett, CA. Production of 150 TPD of methanol utilizing the existing Cool Water Gasification Facility Nominal 1000 TPD coal feed, 50% of gas to MeOH.	Texaco slurry feed, oxygen-blown, single stage, entrained flow, gasification system. Cold gas cleanup system. Both synthesis gas and methanol will be used to fuel the gas turbine.	Cooperative Agreement should be signed in the near future. Proposed cost $214 million, 43% DOE share. 81 month schedule	Goal: SO_2>98.5%, NO_x>90% Saleable elemental sulfur

IGCC...continued from pg. 2

The result is an extension of plant life to essentially that of a new plant, an increase in efficiency from a nominal 35 percent to over 40 percent, and an increase in overall plant output of 50 to more than 150 percent with significantly reduced emissions. In general, additional land is not required making IGCC repowering attractive for facilities with limited space. The incremental costs of the additional capacity are low compared to the cost of a new conventional pulverized coal plant, especially with emission controls.

The six IGCC systems being demonstrated in the CCT Program are described above in the **Clean Coal Technology IGCC Project** Table. The projects range in size from 55-265 MWe capacity and include synthesis and combustion of methanol as a load balancing alternate.

The methanol synthesis project is considered an indirect liquefaction project under the CCT Program, but was included in the above table because the scope now includes the combined cycle power generation feature.

Four projects use entrained flow gasifiers, two use fluidized bed processes. Some projects use oxygen, others use air as the oxidant. Cold gas and hot gas cleanup processes are featured with process variations for each generic cleanup system. A variety of gas and steam turbines will also be demonstrated.

Thus, a wide matrix of conditions for evaluation of future commercial projects is being demonstrated under the CCT Program, including the effect of economy of scale with various size gasifier modules.

Emissions reductions mandated by the Clean Air Act Amendments of 1990 may help to accelerate deployment of advanced power generation technologies such as IGCC.

However, because U.S. utilities are regulated to generate electricity in a least expensive and lowest risk manner, the success of these environmentally-superior IGCC technologies will be largely dependent on their affordability and reliability in the commercial marketplace. The Clean Coal Technology Program will provide this important information. ■

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Gas Reburning Emerging as Cost-Effective Nitrogen Oxide Reduction Technique

Tests at Illinois Power's Hennepin Station Unit No. One, an 80-MWe tangentially-fired boiler, are showing that a combination of Gas Reburning and Sorbent Injection (GR-SI) can cut the costs of both NO_x and SO_2 reduction beyond original expectations (see *Clean Coal Today*, Issue #3, Summer 1991).

GR-SI equipment has also been installed at a companion site—City Water Light & Power's Lakeside Unit #7 cyclone boiler in Springfield, Illinois—and tests are ready to begin. Gas reburning has been combined with Low NO_x Burners at a third site, the Public Service Company of Colorado's Cherokee 172-MWe Unit Number Three located outside of Denver.

Progress for all three projects--each being carried out by Energy & Environmental Research (EER) Corp. as part of the CCT Program—was the topic of an Industry Panel meeting in Denver, Colorado, on March 31 and April 1.

A group of more than 50 potential users, representing utilities, sorbent manufacturers, architect engineers, burner manufacturers and related regulatory agencies attended the technical information exchange.

The group also toured both the Cherokee and Arapaho stations of Public Service of Colorado. The Arapaho site is the host of another Clean Coal Technology project. The group discussed the comparative benefits and constraints of adapting each EER system to particular boiler types.

Because of the early success of these projects, gas reburning—either alone or in combination with another technology—is emerging as a leading candidate for reducing NO_x emissions from all major types of boilers, especially those—like cyclones or wet bottoms—for which there is no commercially-available combustion modification technique. And better-than-expected performance means lower costs of pollution control, and lower costs of energy for consumers.

Gas reburning involves firing both natural gas and coal into the boiler. Natural gas is injected above the furnace's main coal combustion zone, where the NO_x formed from coal combustion is reduced to elemental nitrogen in the oxygen deficient reburn zone. Additional air is injected above the reburning zone to complete the combustion process.

GR-SI Test Results from Hennepin

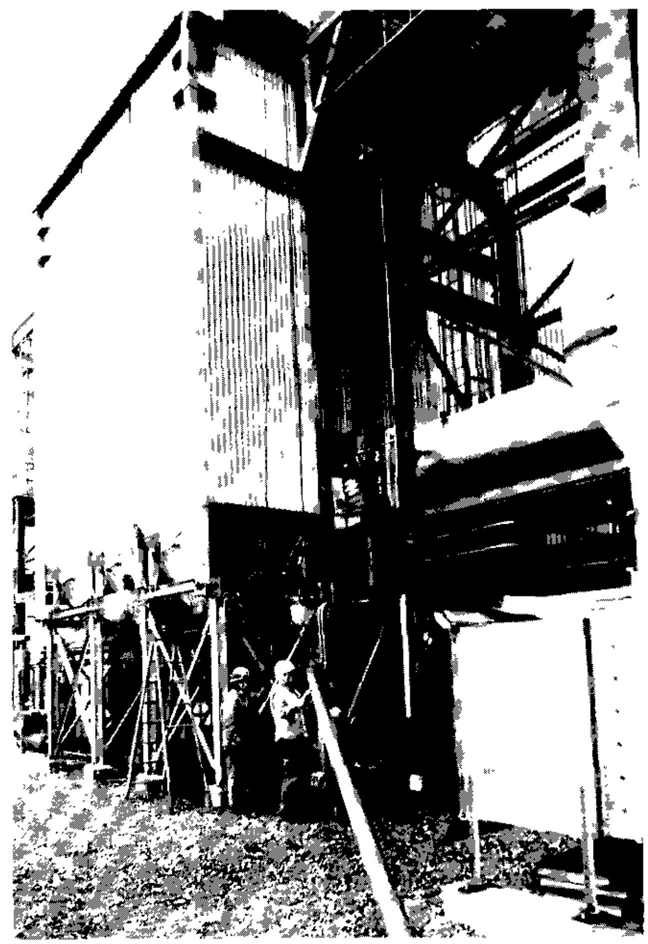
The goals of the GR-SI project were to lower NO_x and SO_2 emissions by 60 and 50 percent respectively. These goals were regularly exceeded in short-term tests at the Hennepin plant, reaching 77 percent for NO_x and 62 percent for SO_2 in one two-hour test while burning a combination of 82 percent pulverized coal with 18 percent natural gas fuel added to the reburning zone.

As was expected with the long-term tests, NO_x reduction fell slightly to 65 percent with SO_2 reduction of about 57 percent—still well above the project goals.

Eighteen percent of the SO_2 reduction in the long-term tests is attributed to the replacement of coal with sulfur-free natural gas. The remaining 39% reduction is due to the effectiveness of the fine calcium hydrate sorbent that is injected into the top of the boiler. This sorbent injection process takes advantage of the reaction between the sorbents and the SO_2 in the flue gases that form sulfur-containing solids that are subsequently collected in the electrostatic precipitator.

Humidification was used to decrease the flue gas volumetric flow rate so that the precipitator could handle the extra solids caused by sorbent injection. The gas stream was also redirected to prevent the wet solids from sticking to the duct work. After making these adjustments, routine day-to-day operation of the Hennepin GR-SI system by plant personnel is resulting in NO_x/SO_2 emission reductions of 65 and 57 percent respectively.

*See "**Reburn**" on page 11*



View of SNRB Baghouse, Located at Ohio Edison's R.E. Burger Plant, Dilles Bottom, Ohio

Success is in the Ceramic Bag B&W's SOx-NOx-Rox Box Starts Up

Babcock and Wilcox (B&W) is diverting a flue gas slip stream—equivalent to 5 MWe of power—from Ohio Edison's Unit 8, 158 MWe boiler at the R.E. Burger Plant, Dilles Bottom, Ohio, to demonstrate a unique post-combustion process for removing sulfur oxides (SO_x), nitrogen oxides (NO_x), and particulate matter ("Rox") from the emissions of coal-fired boilers.

B&W's SOx-NOx-Rox Box (SNRB) process utilizes a high-temperature baghouse (the Box) to combine removal of SO_x by injection of a dry alkaline sorbent, NO_x control by ammonia (NH_3) injection and selective catalytic reduction (SCR), and particulate matter capture with a high-temperature filter bag.

The SNRB project goals include demonstration of greater than 70 percent removal of SO_2, 90 percent removal of NO_x, and a greater than 99 percent removal of particulates. Construction and start-up activities are complete and the project has just entered the operations phase, which is scheduled to continue into early 1993.

To remove SO_2 using calcium-based sorbent, hydrated lime is pneumatically injected into the flue gas at a selected point between the upper part of the boiler combustion zone and the economizer outlet, where it reacts with SO_2 to form solid calcium sulfite and calcium sulfate particles. These particles are collected in the baghouse along with fly ash.

While lime will be the preferred sorbent in the eastern United States, sodium bicarbonate may be preferred in the West because it is a more active reagent at a lower operating temperature.

The NO_x removal process begins with NH_3 being injected into the flue gas upstream of the baghouse. A minor amount of the NH_3 and NO_x reacts immediately. When the gases enter the baghouse and pass over the non-promoted, zeolite-based SCR catalyst installed inside of the filter bags, the majority of the NO_x is converted to molecular nitrogen and water, normal clean components of our atmosphere.

The demonstration baghouse is composed of six separate modules, each containing forty-two 20-foot long by 6-1/8 inch diameter bags—the key to SNRB's success.

In the current demonstration, these particular bags, developed by Minnesota, Mining and Manufacturing Company (3M), consist of a proprietary ceramic fiber (Nextel) which can withstand temperatures up to 2,200 °F. Elevated temperatures of 800 to 850 °F are required to reach the project's goal of greater than 70 percent SO_2 removal. Moreover, the bag's tight weave allows it to catch the very small particulates of fly ash and sulfates/sulfites and also withstand the cyclical pulses of air which blow the collected solids into a hopper located at the bottom of the pulse-jet bag house. The fly ash is pneumatically transported from the hopper to a silo for storage until trucks can transfer it to a by-product utilization site or a solid waste landfill disposal facility.

SNRB is one of the few SO_2 removal processes offering the potential for a decrease in plant heat rate due to the removal of SO_2 and placement of the baghouse upstream of the air heater. Acid dew point concerns are virtually eliminated and more energy can be recovered in the air heater.

SNRB site area space requirements are much smaller than for some SO_2 stand alone removal systems, switching and blending of low sulfur coals requires multiple stock piles, and scrubbers often double utility space requirements.

The project participants anticipate that the SNRB operating and maintenance costs will be significantly competitive with respect to other multi-pollutant control systems.

In early 1993, when the $11 million dollar project (46 percent DOE cost shared) is complete, B&W feels there will be a large group of potential SNRB end users among the 700 candidate coal-fired power plants that could adopt this process. ■

Nextel Bag Assembly Containing SCR Catalyst is Lowered Into Baghouse Module Tubesheet

Cyclone Boiler Coal Reburn Technology Cuts NO_x by More Than 50 Percent

Along the Mississippi River in Grant County, Wisconsin, a 100 MWe coal-fired cyclone boiler helps power a rural farming community that cares about the natural life of the river and its corn and wheat crops. Bald eagles—a common sight along the river—and local residents are feeling better now that Wisconsin Power & Light Company has reduced its nitrogen oxide (NO_x) emissions from its Nelson Dewey Unit Two by more than 50 percent.

The Babcock & Wilcox Company designed and installed the innovative NO_x control equipment as part of their $13 million project from the Clean Coal program's second round.

Results from start-up tests conducted from December through early February 1992 exceeded expectations of a 50 percent NO_x reduction and indicate that coal reburning has the potential to be a major option for NO_x control from cyclone boilers.

Presently, there are no commercially proven technologies to control NO_x emissions from cyclone boilers except expensive post-combustion controls. However, if long-term operational tests at the Nelson Dewey plant, scheduled to begin this May, confirm these initial results, the technology could be applied to much of the cyclone boiler population of about 105 operating units.

Cyclone boilers were designed some fifty years ago to transfer heat in the most thermally efficient manner. At the time, engineers were mainly concerned with the economies of steam generation and gave little consideration to NO_x emissions. The system was designed to burn coal in a small cylindrical chamber located in the base of the furnace. Air enters the cylinder tangentially, creating a swirling motion that greatly increases the flame intensity and produces much higher temperatures—up to 3,000 °F—than are found with conventional burners.

NO_x is formed during combustion when nitrogen from both coal and combustion air is oxidized. NO_x formation is directly proportional to flame temperature, nitrogen content of the fuel, quality of escess air available for combustion, and residence time at high temperatures.

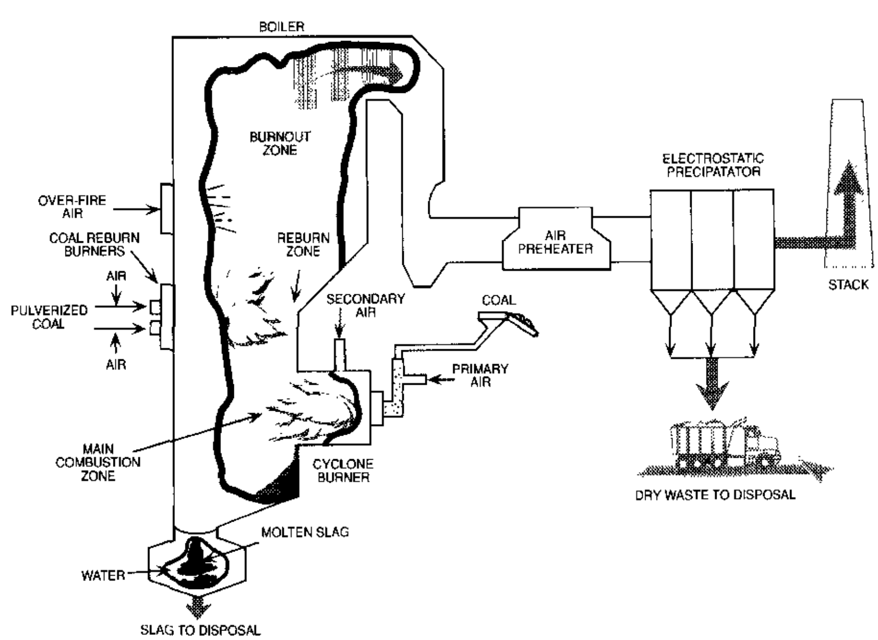
Low NO_x combustion techniques—such as lower flame temperature, short residence time and oxygen deprivation—can work in other boiler types but cause serious operational problems with cyclone boilers. These problems include high emissions of carbon monoxide, unburned carbon, partially-oxidized organic compounds which can be harmful to public health and the environment, and corrosion-causing oxygen deprivation.

The coal reburning process offers a comprehensive solution. It promises to reduce NO_x with only negligible boiler corrosion, and it requires minimal boiler modifications. The components—including burners, overfire air ports, coal feeders, pulverizers, and control systems—are all commercially available. And coal, as a reburn fuel, is cheaper than oil or natural gas, which may not be readily available at coal-burning power plants.

Coal reburning utilizes three zones within the boiler furnace. In the main combustion zone, approximately 70 percent of the coal is fed into the boiler along with sufficient air. After sufficient residence time to complete combustion, the combustion products enter the reburning zone where the balance of the coal is injected through four new reburn burners. In the oxygen deficient reburn zone, NO_x formed in the main combustion zone is chemically reduced to molecular nitrogen. Once again, sufficient residence time is provided to enable the reburning reaction to occur. To complete combustion, overfire air ports introduce combustion air into the boiler above the reburning zone.

On December 4, 1991, after instrument calibration was complete, Nelson Dewey personnel attempted the first system run at a boiler load of 90 MWe. During the course of operations, the burner flame remained stable, the flame

*See "**Cyclone**" on page 7*



B&W Coal Reburn Process Schematic

Cyclone...continued from pg. 6

scanners operated according to specifications, and NO_x was reduced by 40 percent.

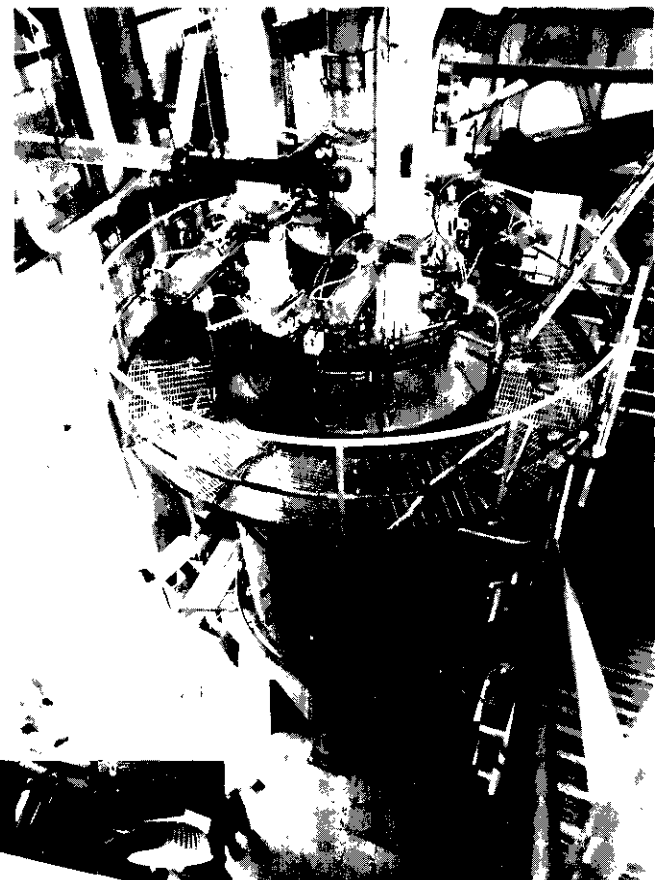
The reburn operation was stopped on December 16, 1991, for a scheduled outage. Maintenance involved the correction of routine start up problems including the elimination of hazardous conditions created by damper leaks that had allowed finely pulverized coal to back up into the primary air system. An early January test run demonstrated that a guillotine damper would be required to seal off all back flow between the pulverizer and the primary air fans. This damper was installed in a January reburn system outage.

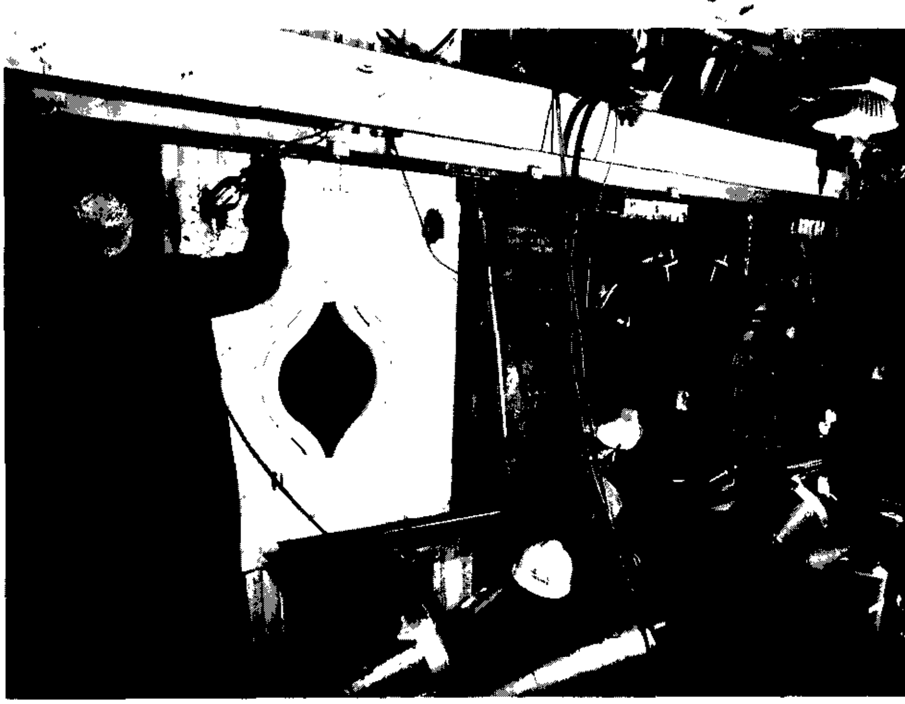
Monitoring equipment was put on line to determine the optimal operating conditions for long term performance testing. This included the B&W economizer outlet gas analysis grid system, which helped observe the impacts of parameter variations on reburn performance. Equipment calibration facilitated post retrofit testing by validating baseline measurements made in April-May 1990 on a number of variables. These included: NO_x, O_2, CO, and CO_2 at the economizer outlet, and measurements of in-furnace gas species and temperatures. Emission levels compared well with 1990 tests. Particulate measurements were also taken at the electrostatic precipitator inlet and outlet to determine unburned carbon loadings.

To measure the effects of reburning on corrosion, ultrasonic thickness tests were conducted on the boiler walls at five elevation levels. These points will be rechecked at the end of the project and compared with the initial measurements.

The coal reburn system had its scheduled spring outage in March 1992, and was brought back on the line March 23rd.

The boiler performance is currently being tested both parametrically and at optimum conditions. The electrostatic precipitator is also being checked at both its inlet and outlet. DOE anticipates that the long-term system tests, which will be conducted at different loadings beginning in May 1992, will demonstrate that coal reburning is an effective NO_x reduction process for cyclone boilers. ■





Left: Coal Reburn Burners Installed During Fall 1991 Outage. Photo shows One of the Four Burners Being Installed, and a Port to the Left Being Prepared for Burner Installation. Wisconsin Power & Light Nelson Dewey Station Unit No. 2, Cassville, WI. 100 MWe.

Above: View of New Pulverizer Which Produces Fine, Less Than 200 Mesh Coal Feedstock for the Reburn Burners.

Status of Clean Coal Technology Demonstration Projects

EER Corporation. Enhancing the Use of Coals by Gas Reburning and Sorbent Injection. (Hennepin and Springfield, IL)
Long-term load following testing of GR-SI began at Hennepin on January 9, 1992. Illinois Power personnel have completed training and are operating the system, which is exceeding the project goals of 60 percent NO_x reduction and 50 percent SO_2 reduction. Mechanical construction at the Springfield site was completed in February 1992. Checkout of all equipment preceded initial start-up of the system in March 1992.

Babcock & Wilcox. LIMB/Coolside Demonstration Project. (Lorain, OH)
This project is essentially complete. Up to 70 percent SO_2 removal has been achieved by both LIMB and Coolside processes. The final Coolside Topical Report has been delivered and is being reviewed by DOE. The LIMB Extension Final Report is scheduled to be issued by June 30, 1992.

Colorado-Ute Electric Assn. Nucla CFB Demonstration Project. (Nucla, CO)
All project activities have been completed for demonstration of an atmospheric circulating fluidized-bed combustion system at a commercial scale. Test results indicated strong correlations of CO_2, SO_2 and NO_x emissions levels with combustor operating temperatures. For temperatures below 1,620 °F, 70 percent sulfur retention was achieved with a 1.5 Ca/S ratio. The average level of NO_x emissions for all tests was 0.18 pounds per million Btu.

American Electric Power. Tidd PFBC Demonstration Project. (Brilliant, OH)
Approximately 1,350 hours of coal-burning have been logged, including runs of 155 hours and 108 hours. During February 1992 tests, the unit operated at a full 140 inches bed height and produced up to 71 MWe (gross) rating.

Rosebud Syncoal Partnership. Advanced Coal Conversion Process Demonstration. (Colstrip, MT)
Construction and equipment shakedown testing has been completed. Initial production of the "syn-coal" product is underway.

CQ, Inc. Coal Quality Expert. (Homer City, PA)
Utility scale combustion tests in combination with smaller scale tests to verify correlations, have been conducted on selected Wyoming, Montana, Oklahoma, Illinois, and Kentucky coals. Acid Rain Advisor BETA testing has been completed. Commercial release is expected in the near future.

The City of Tallahassee. Arvah B. Hopkins Circulating Fluidized Bed Repowering Project. (Tallahassee, FL)
An alternative site near York, PA with Air Products and Chemicals as host is being evaluted by DOE. A power sales agreement with Metropolitan Edison has been executed. Additionally, an adjacent industrial site would purchase steam.

Pure Air. Advanced Flue Gas Desulfurization Demonstration Project. (Gary, IN)
Construction is more than 95 percent complete with activities continuing in the waste water treatment area. Mechanical testing of various equipment sections has commenced. Operations should begin in June 1992.

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 II equipment (one of three basic air/coal feed configurations to be tested) indicated full load NO_x reductions up to 40 percent compared to the baseline emission data. This test ended in September 1991. Installation of the LNCFS Level III system was completed in November 1991. Through the end of February 1992, approximately 55 days of long-term data for Level III show that NO_x emissions have been reduced by as much as 48 percent compared to baseline values. Long-term testing continues.

Southern Co. Services. NO_x Reduction for Wall-Fired Boilers. (Coosa, GA)
Long-term testing of Advanced Overfire Air (AOFA) at Plant Hammond Unit NO. 4 has been completed with 80 days of data collected. Statistically reliable data indicate, depending upon load, a NO_x reduction of 24 percent. Long-term testing of the Low NO_x burners (LNB) was completed with 94 days of data collected. A 48 percent reduction of NO_x at full load was indicated. Long-term testing for the LNB plus AOFA configuration has started.

Passamaquoddy Tribe. Cement Kiln Flue Gas Recovery Scrubber. (Thomaston, ME)
Following an initial operating test period with promising results, the cement kiln was shut down in January 1992 for normal winter maintenance. Start-up has been delayed until May because of poor regional economic conditions.

Babcock & Wilcox Co. Coal Reburning for NO_x Control. (Cassville, WI)
Coal was fed to the reburn system and coal flames established on December 4, 1991. Prior to the planned spring outage in March, operation of the system gave preliminary results for NO_x reduction approaching, and in some cases exceeding the 50 percent goal.

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.

Southern Co. Services. Chiyoda Thoroughbred-121 FGD Process. (Newnan, GA)
Construction activities are nearing completion with current emphasis on the gypsum stacking site area.

ABB Combustion Engineering. IGCC Repowering Project. (Springfield, IL)
Plant process design evaluations confirmed project technical, cost, and schedule baselines. Preliminary design and basic engineering activities continue. The Environmental Assessment and Finding of No Significant Impact (FONSI) was approved

by the Office of Environment, Safety and Health.

American Electric Power Service Corp. PFBC Utility Demonstration Project. (New Haven, WV)
A revised project implementation plan has been approved. The project will proceed with a four year value engineering and preliminary design study for a greenfield plant. The site will shift from the Sporn Plant to the adjoining Mountaineer Plant.

Southern Co. Services. SCR for High-Sulfur Coal Boilers. (Pensacola, FL)
Design work continues on ductwork and reactors, with construction scheduled to start this spring. Seven suppliers of nine catalysts have been selected. Replacement of one of the catalyst suppliers that dropped out of the project is in progress.

Babcock & Wilcox Co. SNRB Flue Gas Clean-Up Project. (Dilles Bottom, OH)
Construction has been completed and operations began in April 1992.

ABB Combustion Engineering. SNO_x Flue Gas Cleanup Project. (Niles, OH)
Construction has been completed. Initial start-up commenced in February 1992 and operations began in April 1992.

Bethlehem Steel Corp. Blast Furnace Granulated Coal Injection. (Burns Harbor, IN)
Process design and detailed engineering are continuing, including work on the coal injection facilities and blast furnace injectors. Bethlehem Steel is continuing negotiations with British Steel Consultants, Ltd. to establish a formal license agreement for the BFGCI technology.

Bechtel Corp. Confined Zone Dispersion FGD Project. (Indiana County, PA)
Construction has been completed. Slurry injection tests conducted in early 1992 using dolomitic lime have indicated that the expected level of SO_2 emissions reduction of 50 percent can be reached and possibly exceeded.

AirPol, Inc. Gas Suspension Absorption Project. (Paducah, KY)
Design related activities are continuing. A new operations date of October 1992 has been established due to a one year delay in the availability of the TVA test site.

Alaska Industrial Development Authority. Healy Clean Coal Project. (Healy, AK)
Alaska coal has been successfully test-burned at the TRW slagging combustor facility in Cleveland, OH. Project design is about 20 percent complete.

Public Service Co. of CO. Integrated Dry NO_x/SO_2 Control System. (Denver, CO.)
Field construction activities continue on the flyash, boiler, dry sodium injection, and humidification systems. Baseline testing of the boiler without any modifications was completed in mid-December 1991. Baseline testing of the boiler with urea injection was completed in March 1992.

Clean Power Cogeneration, Inc. (now Tampa Electric) Air-Blown/Integrated Gasification Combined Cycle Project. (Tampa, FL)
The Cooperative Agreement was modified to provide for a restructured project including: Participant change to Tampa Electric Co.; gasifier change from air-blown, fixed bed to oxygen-blown, entrained flow; and project integration into Tampa Electric's 260 MWe facility in Polk County, Florida.

LIFAC N. America. LIFAC Sorbent Injection Desulfurization Demonstration Project. (Richmond, IN)
Construction continues. All foundations are complete, structural steel and ductwork fabrication is 80 percent complete, and field fabrication of the activation reactor pieces is 75 percent complete. The start of operations has been delayed to mid-1992 primarily due to additional design and permitting requirements, including redesign of the humidification section of the activation reactor to improve process performance.

Air Products and Chemicals, Inc. Liquid Phase Methanol Process. (Daggett, CA)
Negotiations are complete. DOE awaits submittal of several key documents.

Babcock & Wilcox, Inc. Low-NO_x Cell Burner Retrofit. (Aberdeen, OH)
Fabrication and installation of the 24 new burners was completed, and testing began November 1991. A review of the new system was done to seek methods to mitigate excessively high CO concentrations occurring in the lower furnace when operating to achieve high NO_x emissions reducton. An outage is planned for late April to make the necessary modifications.

ENCOAL Corp. Mild Gasification Project. (Gillette, WY)
Formal training sessions of the operating team were initiated. Start-up tests and plant commissioning are planned to begin in April.

MK-Ferguson Co. NOXSO Flue Gas Cleanup System. (Niles, OH)
Preliminary design activities are proceeding.

DMEC-1 Ltd. Partnership. Pressurized Circulating Fluidized Bed Demonstration Project. (Pleasant Hill, IA)
Preliminary design and process definition activities are continuing.

Energy and Environmental Research Corp. Gas Reburning and Low-NO_x Burners on Wall-Fired Boiler. (Denver, CO)
Construction activities near completion. Start-up activities began in late March 1992.

FIRST ANNUAL CLEAN COAL TECHNOLOGY CONFERENCE

September 22-24, 1992 - Cleveland, OH

PURPOSE:

The first public review of the entire U.S.DOE/Industry co-funded Clean Coal Technologiy (CCT) program to demonstrate the commercial readiness of CCTs.

OBJECTIVES:

Provide electric utilities, independent power producers,and potential foreign users information on the 42 CCT projects including status, results, and technology performance potential;

To further understanding of the institutional, financial, and technical considerations in applying CCTs to Clean Air Act compliance strategies;

To discuss the export market, financial and institutional assistance, and the roles of government and industry in pursuing exports of CCTs; and

To facilitate meetings between domestic and international attendees to maximize export opportunities.

DATE:

September 22-24, 1992

LOCATION:

Sheraton Cleveland City Centre Hotel
777 St. Clair Avenue
Cleveland, Ohio 44114
(216) 771-7600 or (800) 321-1090

REGISTRATION INFORMATION:

The registration fee for this conference is $125 for General Attendees, and $75 for Government Attendees/Presenters. Registration costs include all lunches, continental breakfasts, breaks, receptions, and proceedings. To register by phone please call Burns and Roe at 703-207-0800 or fax 703-207-8538.

Burns and Roe/CCT Conference
2812 Old Lee Highway, Suite 135
Fairfax, VA 22031

Cancellations will be accepted and refunds provided until September 7, 1992.

HOTEL INFORMATION:

All events will be held at the Sheraton Cleveland City Centre Hotel In Cleveland, Ohio (800) 321-1090 or (216) 771-7600. A group rate of $89 per night for a single and $99 per night for a double is available. To take advantage of the special rate, please contact the hotel directly and request the Department of Energy's room block. Reservations must be made by September 7, 1992. The Sheraton Cleveland City Centre Hotel is located approximately 13 miles from the airport in downtown Cleveland.

CONTACTS:

For further information regarding the conference please contact Ms. Denise H. Calore, U.S. Department of Energy's Clean Coal Technology Program, 703-235-2623, or Mr. Robert H. Robey, Burns and Roe Enterprises, 703-207-0800.

PRELIMINARY AGENDA

TUESDAY EVENING (SEPTEMBER 22, 1992)

Registration and Reception Cocktail Party

WEDNESDAY MORNING (SEPTEMBER 23, 1992)

Plenary Session

Moderator: Jack S. Siegel, Dep. Asst. Sec., Coal Technology, U.S.DOE
Opening Greeting: The Honorable George Voinovich, Gov., State of Ohio (Invited)
Introductory Remarks/NES Implementation:
The Hon. James G. Randolph, Asst. Sec. for Fossil Energy, U.S.DOE
State Regulatory View of Compliance Strategies:
Craig A. Glazer, Chairman, Public Utilities Commission of Ohio (Invited)
Perspective of Utility Investing in a Major CCT Repowering Technology: Girard F. Anderson, Pres. and Chief Operating Officer, Tampa Electric Co. (Invited)
Perspective of Utility Investing in a Major CCT Retrofit Technology: Gary L. Neale, Pres. and Chief Operating Officer, Northern Indiana Public Service Company (Invited)

Regulatory Panel Session

Moderator: Ashley C. Brown, Commissioner, PUC of Ohio (Invited)
Panel Members: TBD

Luncheon Speaker

General Richard L. Lawson, Pres., Nat'l. Coal Assoc. (Invited)

WEDNESDAY AFTERNOON (SEPTEMBER 23, 1992)

Concurrent Technical Sessions

Session 1: Advanced Power Generation Systems
Session 2: High Performance Pollution Control Systems

Government Export Panel Session

Moderator: Jack S. Siegel, Dep. Asst. Sec., Coal Technology, U.S.DOE
Panel Members:
U.S. Agency for International Development, U.S. Department of Commerce, Export-Import Bank of the U.S., U.S. Trade and Development Program, and Overseas Private Investment Corporation

WEDNESDAY AFTERNOON (cont.)

Industry Export Panel Session

Moderator: Ben N. Yamagata, Exec. Dir. Clean Coal Technology Coalition
Panel Members:
National Coal Association, Edison Electric Institute
Electric Power Research Institute, and an Independent Power Producer

THURSDAY MORNING (SEPTEMBER 24, 1992)

Utility Panel Discussions

Moderator: George T. Preston, V.P., Generation and Storage Div. Electric Power Research Institute (Invited)
Panel Members:
James J. Markowsky Ph.D., Sr. V.P. and Chief Engineer, American Electric Power (Invited)
Stephen C. Jenkins , V.P, Commercial Development, Destec Energy, Inc. (Invited)
Randall E. Rush, Director, Clean Air Compliance, Southern Company Services, Inc. (Invited)
George P. Green, Manager, ElectricSupply Resources, Public Service of Colorado (Invited)
Howard C. Couch, Manager, Environmental and Special Projects, Ohio Edison (Invited)

Concurrent Technical Sessions

Session 3: Advanced Power Generation Systems
Session 4: NO_x Control Systems
Session 5: Coal Processing Systems

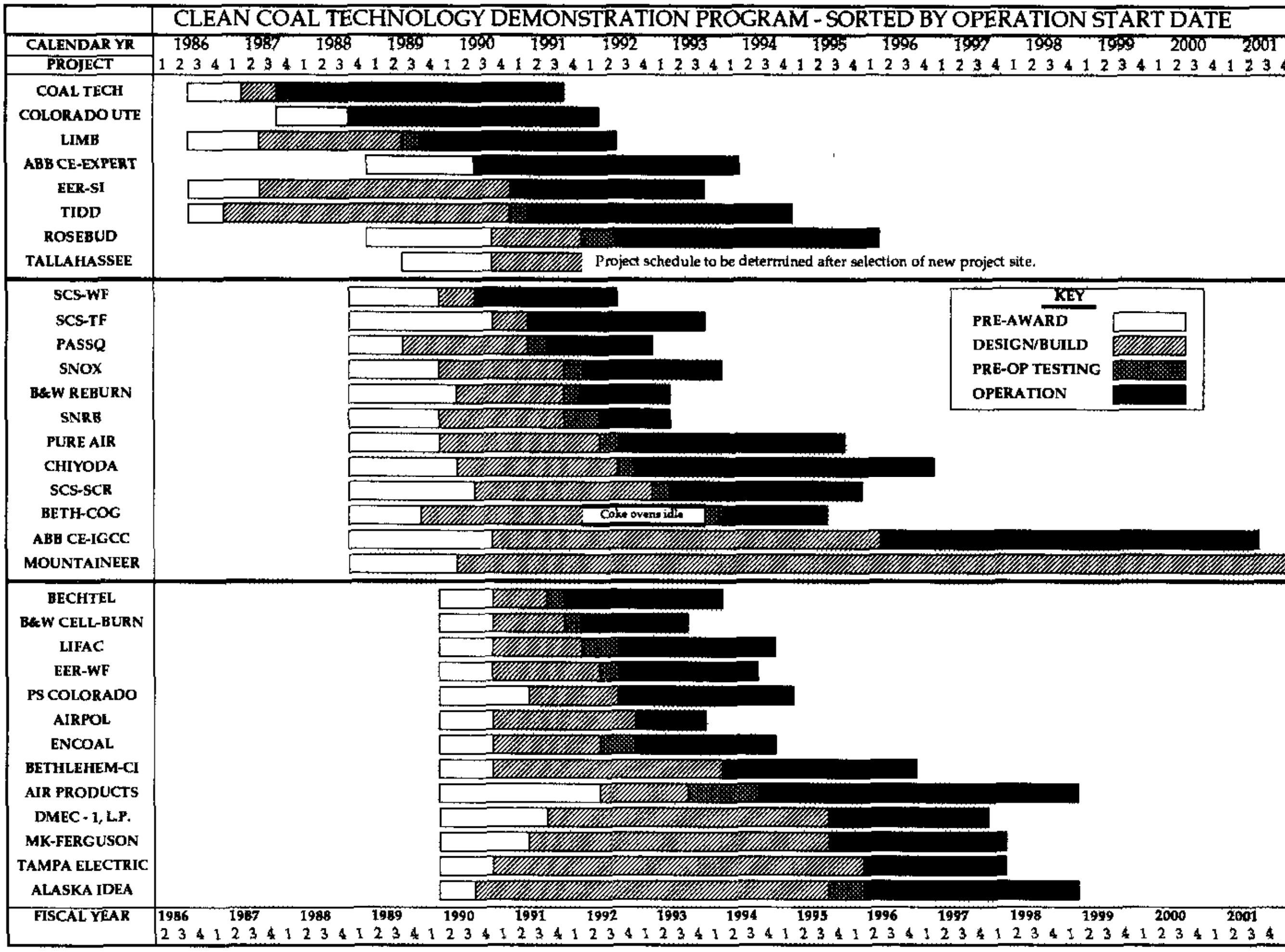
Luncheon Speaker, Clean Air Act Implementation: The Hon.William G. Rosenberg

Hon.William G. Rosenberg, Asst. Admin. for Air and Radiation, U.S.EPA (Invited)

THURSDAY AFTERNOON (SEPTEMBER 24, 1992)

Concurrent Technical Sessions

Session 6: Advanced Combustion/Coal Processing
Session 7: NO_x Control System
Session 8: Retrofit for SO_2 Control



Briefs...continued from pg. 1

presented at NERO's annual banquet on May 6. Other winners this year include former Deputy Energy Secretary W. Henson Moore, Senator Malcolm Wallop (WY), the National Association of Manufacturers, and Westinghouse Handford Company.

The Ohio Coal Development Office (OCDO) will join AEP and the Babcock & Wilcox Company in hosting a second open house and plant tour at the Brilliant, Ohio site. One-day tours will be held on June 5 and 8. For more information, contact Sheila Brown at OCDO (614) 466-3465.

Operations have begun at the **Rosebud Syncoal Partnership's** coal upgrading plant. The newly-built plant is located next to Western Energy's Rosebud Mine, one of the largest in the Nation. Construction of the showcase facility was completed in 10 months—a full 8 months ahead of schedule—despite winter weather. When fully operational, the plant will produce 1000 tons per day of upgraded solid fuels that will be test burned at utility sites. The project partners are planning a plant dedication ceremony to take place in the early summer .... Also beginning operations this quarter was the **Babcock & Wilcox Company's Coal Reburning** project on a 100 megawatt cyclone boiler in Cassville, Wisconsin (see article p. 6).

Several changes were approved in the IGCC project that was to be carried out jointly by CRSS Capital and TECO Power Services, a subsidiary of **Tampa Electric**.

As reconfigured, the Energy Department agreement will be solely with Tampa Electric, and the 260 MWe plant will be built in Polk County, outside of Tampa, Florida. The gasifier technology will now be an oxygen blown, entrained bed which more closely meets Tampa Electric's needs. ■

Reburn...continued from pg. 4

Other Projects

Work on EER's second (Springfield, Illinois) project site for GR-SI—a 40 megawatt cyclone boiler—is progressing as well. While inclement weather caused some construction delays, the project is now nearly ready to enter its initial testing phase and is expected to generate equally positive results as the Hennepin project.

While GR-SI can be effectively integrated and retrofitted to all types of coal boilers, EER is demonstrating an alternative NO_x emission control strategy at the Cherokee Station. This project—from the third round of the Clean Coal Program--involves the retrofit of a Gas Reburning-Low NO_x Burner system onto a wall-fired boiler. The new burners and much of the gas reburning equipment were installed during a scheduled plant outage last fall. Start-up tests have commenced.■

Upcoming Events

Date	Event	Contact
July 26-31, 1992	Coal Preparation, Utilization, and Environmental Control Conference, Westin William Penn, Pittsburgh, PA	R.E. Hucko 412-892-6133
September 15-17,1992	Twelfth Annual Gasification and Gas Stream Cleanup Systems Contractors Review Meeting, Morgantown Energy Technology Center, Morgantown, WV	METC Conf. Svcs. 304-291-4108
September 22-24, 1992	First Annual Clean Coal Technology Conference, Sheraton Cleveland City Centre Hotel, Cleveland, OH	D. Calore 703-235-2623
October 12-16, 1992	Pittsburgh Coal Conference, Green Tree Marriott, Pittsburgh, PA	G. Elia 412-892-5862
October 18-22, 1992	ASME Internatioanl Joint Power Generation Conference, Hyatt Regency, Atlanta, Georgia	G. Elia 412-892-5862

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 Service, U.S. Department of Commerce, Springfield, VA 22161.

Feb 92 DOE/FE-0247P	Clean Coal Technology Demonstration Program (Program Update 1991)
NTIS/DE92002587 & DE92002588-T7	The Demonstration of an Advanced Cyclone Coal Combustor with Internal Sulfur, Nitrogen and Ash Control for the Conversion of a 23 MM Btu/hour Oil-Fired Boiler to Pulverized Coal (Coal Tech Project Final Technical Report and Appendices I, II, III, IV, V, and VI).
NTIS/DE92001122	Colorado-Ute Nucla Station CFB Demonstration Program (Colorado-Ute Electric Associaton Circulating Atmospheric Fluidized Bed Project Final Technical 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 703-235-2628.

"Results From LIMB Extension Testing." T.R. Goots, et al., The Babcock & Wilcox Co.; March 1992.

"Micronized Coal Reburning for NO_x Control on a 175 MWe Unit." D.T. Bradshaw, et al., Tennessee Valley Authority; *POWER-GEN '91,* Tampa, FL, December 1991.

""Impact of Clean Coal Technologies in the Post-2000 Electricity Generation Markets." L. Graham, F. Gmeindl, W.T. Langan, and B.J. Tomer, Morgantown Energy Technology Center; *American Power Conference*, Chicago, IL, April 1992.

"The Piñon Pine Power Project." J.D. Pitcher, Foster Wheeler Energy Corporation; and J.W. Motter, Sierra Pacific Power Company; *American Power Conference*, Chicago, IL, April 1992.

"How and Why Tampa Electric Company Selected IGCC For Its Next Generating Capacity Addition." Donald E. Pless, TECO Power Services, Inc.; *American Power Conference*, Chicago, IL, April 1992.