

# CLEAN COAL TODAY

U.S. Clean Coal Technology Demonstration Program

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

## Wabash Plant Begins Operating

On November 8, 1995, more than 250 utility, energy, news media, and government representatives gathered at the campus of Indiana State University in Terre Haute, Indiana to formally dedicate and celebrate completion of construction and startup of the Wabash River Coal Gasification Plant, located near Terre Haute. Speaking at the dedication ceremony, Department of Energy Secretary Hazel O'Leary noted that the Wabash facility is showcasing an entirely new way to generate electricity from coal. "It is a preview of the 21st Century," she said.

The Wabash River Coal Gasification Repowering Project is a joint venture of PSI Energy, Inc., of Plainfield, Indiana, and Destec Energy Inc. of Houston, Texas. Destec and PSI Energy developed, designed, constructed, and will own and operate their respective portions of the integrated coal gasification combined-cycle (IGCC) power plant. Destec's coal gasification technology is being used to repower one of the six units at PSI's Wabash River Generating Station. The gasification process is integrated with a new combustion turbine generator and heat recovery steam generator to repower a 1950s-vintage steam turbine generator, using pre-existing coal handling facilities, interconnects, and other auxiliaries. The Wabash Plant will represent the world's largest single-train coal gasification combined cycle power plant to be operated in a fully commercial setting.



Department of Energy Secretary, Hazel O'Leary, toured the Wabash River Project, and spoke at the dedication ceremony.

The new IGCC plant will convey substantial benefits to PSI and its customers. It will process locally-mined Indiana high-sulfur coal (2.3-5.9 percent sulfur) to produce 262 MWe (net) of clean, low-cost, energy efficient baseload capacity. The new combustion turbine will generate 192 MWe (gross), and the existing steam turbine will generate an additional 104 MWe (gross), using 2,544 tons-per-day of coal. The increase to 262 MWe increases the unit capacity by more than 150 percent. Cinergy, PSI Energy's parent company, plans to dispatch the unit second behind its hydro facilities on the basis of both environmental and economic dispatch criteria. The Project not only meets, but operates well below the Phase II limits of the Clean Air Act.

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## Clean Coal Briefs

**The Ohio Power Company** recently submitted the Final Report for one of the nation's pioneering Clean Coal Technology Projects — the **Tidd Pressurized Fluidized Bed Combustion Demonstration Project**, in Brilliant, Ohio. After internal processing, the report will be available through the National Technical Information Service and the Office of Scientific and Technical Information.

During an 80 day period of operation, the **ENCOAL Mild Gasification Project** recently produced approximately 10,000 tons of marketable solid fuel for utility testing. **ENCOAL Corporation** also successfully tested another feedstock from a different part of the Wyoming Powder River Basin.

**Bethlehem Steel's Blast Furnace Granulated-Coal Injection System Demonstration Project** at the Burns Harbor plant in Indiana has completed startup and moved into

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The facility has a net plant heat rate of approximately 9,000 Btu/kWh (38 percent efficiency) and the ability to produce some of the lowest cost electricity on PSI's system. The heat rate of the re-powered unit is approximately 20 percent higher than the original plant. Since the original steam turbine was upgraded, the heat rate is comparable to that of a "greenfield" installation. The facility is expected to operate as part of PSI's baseload capacity for a period of at least 25 years, which will include a three-year demonstration period under the DOE Clean Coal Technology program.

The estimated total installed capital cost for the IGCC facility is approximately \$389 million. Repowering the #1 steam turbine and reusing available ancillaries saved some \$30-40 million. Repowering also saved a substantial amount of invested capital, and significantly reduced the environmental permitting time and the project schedule. The shorter schedule resulted in one to two years of earlier project revenues and a lower amount of "Interest During Construction."

The total cost of the Round IV Project is \$438 million, shared equally by DOE and the joint venture of Destec Energy Inc. and PSI Energy Inc.

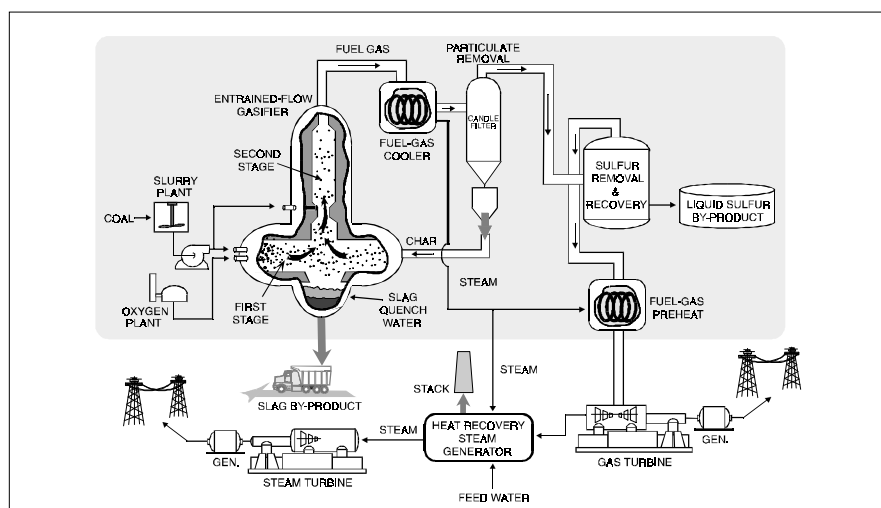
The plant is designed to substantially outperform the standards established in the Clean Air Act Amendments for the year 2000. The Destec gasification technology will remove at least 98 percent of the sulfur in the coal. Expected SO<sub>2</sub> emissions will be less than 0.02 pounds per MMBtu of fuel. NO<sub>x</sub> emissions from both the gasification block and the power

block are expected to be less than 0.1 pounds per MMBtu. CO<sub>2</sub> emissions will also be reduced approximately 20 percent on a per kilowatt-hour basis by virtue of the increased system efficiency.

At the Wabash Plant, coal is ground, slurried with water, and gasified in a pressurized, two-stage (slagging first stage and non-slagging entrained flow second stage), oxygen-blown, gasifier. The product gas is cooled through heat exchangers and passed through a cleanup system that removes particulates, ammonia, and sulfur. The clean, medium-Btu gas is then reheated and burned in an advanced gas turbine. Hot exhaust from the gas turbine is passed through a heat recovery steam generator to produce high-pressure steam. High-pressure steam is also produced from the gasification plant and superheated in the heat recovery steam generator. The combined high pressure steam flow is supplied to an existing steam turbine. The plant will produce sulfur as a by-product, minimizing the need for solid waste disposal of sulfur-bearing materials.

The two-year construction schedule for the Wabash Plant was ambitious and challenging. Construction contractors were mobilized in September 1993. Peak construction activity brought over 1,000 workers to the site daily.

Various construction challenges were met successfully. Construction of foundations and steel erection commenced in September of 1993. Major equipment began arriving in early 1994, and all significant pieces were on site by August. Steel erection and piping continued in parallel with equipment installation, which began in the fall of 1994. By late winter 1995, steelwork and major equipment installation was almost complete, and construction efforts were focused on piping, controls, and instrumentation. By mid-June, virtually all of the combined facilities' 157 subsystems were turned over to operations personnel, whose commissioning activities were in full swing. Commissioning was completed in July 1995 followed by commencement of coal operations in August. Commercial operations were achieved on November 18, 1995. Budget Period 3, the operating phase, officially began on December 1, 1995.



Process Schematic of Wabash River Coal Gasification Repowering Project showing the integrated combined-cycle using Destec's two-stage, entrained-flow gasification system.

To date, the initial facility operations have satisfied the performance requirements specified by the commercial agreements and also those specified by the lending institutions. The performance requirements include meeting specifications on syngas, steam, and emissions. Operational performance continues to improve, with both the gasifier and the combustion turbine posting increasingly lengthy continuous runs. The best operating run so far started in mid-February 1996, when the Wabash plant operated for over 12 consecutive days on coal with all parameters at acceptable levels. The gasifier achieved 100 percent of capacity for the first time and produced the most syngas ever from a single train coal gasification plant. The gas turbine also hit 100 percent on syngas and

generated 192 MW. Including the power generated from the steam turbine, about 245 MW (net) was sent to the grid. Average plant capacity for the period was over 80 percent.

The main objectives of the operational phase are to incorporate the Wabash Plant into the PSI system as a reliable and effective element of its baseload generating capacity, and to demonstrate the operability, effectiveness, and economic viability of the technology on a commercial scale and in a commercial utility environment.

The Wabash Project is expected to play a major role in the "new era of environmentally superior clean coal technologies," stated Secretary O'Leary. DOE will

provide continuing support in order to reduce risk and gain market acceptance of this new technology. IGCC plants may finally emerge as the leading technology for fossil power generation in both the U.S. and international marketplaces. ★



All major equipment, including the gasifiers, air separation unit, and gas turbine, has been installed in the Wabash River Plant. The plant became operational on December 1, 1995

## Award-Winning Clean Coal Technology Demonstration Projects

### Tidd PFBC Demonstration Project (The Ohio Power Company)

- 1992 National Energy Resource Organization award for demonstration of energy efficient technology.
- 1991 Powerplant Award presented by *Power Magazine* to American Electric Power Company's Tidd project "for demonstrating pressurized fluidized-bed-combustion combined-cycle technology." Co-recipient was The Babcock & Wilcox Company.

### Full-Scale Demonstration of Low-NO<sub>x</sub> Cell Burner Retrofit (The Babcock & Wilcox Company)

- 1994 R&D 100 Award presented by *R&D Magazine* to the U.S. Department of Energy for development of the low-NO<sub>x</sub> cell burner, selected as "one of the 100 most technologically significant new products of the year."

### Advanced Flue Gas Desulfurization Demonstration Project (Pure Air on the Lake, L.P.)

- 1993 Powerplant Award presented by *Power Magazine* to Northern Indiana Public Service Company's Bailly Generating Station "for demonstrating advanced wet limestone FGD technology with innovations in wastewater treatment and gypsum production reuse."
- 1992 Outstanding Engineering Achievement Award presented by the National Society of Professional Engineers.

### Innovative Application of Technology for the CT-121 FGD Process (Southern Company Services, Inc.)

- 1995 Society of Plastics Industries presented the project its Design Award in recognition of the mist eliminator.
- 1994 Powerplant Award presented by *Power Magazine* to Georgia Power's Plant Yates "for large-scale demonstration of an advanced scrubbing process . . . and commercial application of low-NO<sub>x</sub> burners." Co-recipient was the U.S. Department of Energy.
- 1994 Outstanding Achievement Award presented by the Georgia chapter of the Air and Waste Management Association for use of an innovative technology for air quality control.
- 1993 Environmental Award presented by the Georgia Chamber of Commerce in recognition of the success of the scrubber.

# Clean Coal Outlook In Brazil

The Department of Energy, Office of Fossil Energy (FE) co-sponsored a conference held December 13-15, 1995, in Rio de Janeiro, Brazil, which has resulted in a tentative agreement among DOE, the Brazilian States of Rio Grande do Sul and Santa Catarina, and the Brazilian Coal Mining Syndicate to share information to help Brazil improve its coal resource characterization and infrastructure, and employ clean coal technologies where possible. The information exchange, begun at the conference (Fossil Fuel Power Generation: Clean Applications for Brazil), may set the stage for a later trade mission to Brazil.

Conference sponsors included U.S. AID, the U.S. Embassy/Brazil, the U.S. Energy Association, the Brazilian Committee of the World Energy Council, and the Brazilian Ministry of Mines and Energy. The conference was attended by 165 participants from 19 U.S. firms and their international divisions as well as Brazilian industry and government officials. Barbara McKee, Director, International Program Coordination, Office of Fossil Energy, and Dr. Lowell Miller, Associate Deputy Assistant Secretary for Clean Coal, both spoke at the conference. The agenda included sessions on: (1) restructuring the Brazilian power sector with more privatization and independent power production, which is expected to provide opportunities for projects on a smaller scale than Brazil's traditional massive hydro; (2) relevant U.S. generating experiences; (3) international technical assistance; (4) the role of environmental technologies; (5) project financing opportunities; and (6) specialized panels by fuel types. A final unstructured day provided a unique and productive opportunity for one-on-one sessions between U.S. and Brazilian industrial and government representatives, members of academia, and technical experts.

FE participated in the conference as part of its international program to assure the use of U.S. technology, energy resources, and services abroad, thus expanding markets for U.S. firms, and promoting U.S. jobs. The program has a number of Memoranda of Understanding with foreign countries and has spearheaded participation by the coal industry in Secretarial missions to India and China, which resulted in \$1.85 billion in business to U.S. coal firms. FE has drawn up a draft regional plan with a market-driven approach, which recognizes Brazil as a Big Emerging Market and a regional "driver." The regional plan places DOE as a facilitator for marketing U.S. technologies in developing nations.

The Brazil conference followed the Secretary of Energy's Hemisphere Conference in October 1995, as well as the series of Fossil Energy International Program Stakeholder Meetings held across the country in 1994, which recommended a role for the U.S. Government in helping the private sector determine which types of clean coal (and other technologies) would be appropriate for each South American country and region.

Conference objectives, which FE feels were well realized, were to provide the Brazilian public and private sectors with information on fossil fuel power generation technologies and financing requirements; to identify reforms in

the Brazilian utility sector that may create a better climate for privatization; and to present information on coal investment opportunities in Brazil.

Such opportunities are now present in the State of Rio Grande do Sul, which is looking for investors to complete its 350-MW Candiota III coal-fired power plant. The Brazilian Coal Producers Union indicated interest in associating with independent power producers for power generation ventures. Brazil also is considering importing steam coal.

Brazil is Latin America's largest economy, with growth rates in electric power forecasted at 5-8 percent annually over the next 20 years, resulting in a possible 70,000 MW of capacity addition. Indigenous coal reserves are estimated at some 24 million tonnes. Brazil imports 50-60 percent of metallurgical coal from the



U.S. International Technical Assistance Program (U.S. and Brazilian officials), from left to right: Edward Kodunc, John Hammond, Barbara McKee, Alan Edwards, José Luiz, Peter Greiner, José Malhaes da Silva, and Jeff Seabright.

United States for its steel industry, and growing imports are expected for the cement industry. Hydroelectric power potential is estimated to be 220 GW, but cannot meet all future energy needs. Hydro also has the disadvantage of severe environmental disruption and high reserve margin requirements (overbuilding) to accommodate drought periods.

Hydro is expected to be the main energy source for the long term, and such projects will continue as exclusively government-owned. Conference participants agreed, however, that there is opportunity for coal in the short- and medium-term time frames. The utility market is being restructured, and is thought to provide opportunities for coal. New independent power producers will be looking for smaller and cheaper projects that do not have to be government subsidized. The current power market is being transformed from a government-operated one that discourages foreign investment to one that enjoys some privatization in the distribution sector, and will become increasingly privatized in the generation and transmission sectors. As further encouragement to CCTs, Brazil's environmental laws emphasize clean technologies for coal-fired plants.

Eletrobras is the major Brazilian power producer, and acts in the privatization process as corporate agent of the government. Eletrobras

explained to conference participants its strategy to encourage private/public sector partnerships, and its wishes to foster short- and medium-term private sector participation in early project stages. Financing needs are expected to amount to some \$2.4 billion per year.

One-on-one sessions on the last day of the conference reflected an overall theme of insufficient information on CCTs in this part of the world, and a lack of consideration of CCTs in the early stages of power planning. Many participants asked for general information on CCTs, comparative cost data on CCTs and pulverized coal, as well as specific data on such technologies as IGCC and reburning. They discussed the need for infrastructure, the applicability of CCTs to Brazilian coal fields, and the cost of environmental controls. Coal technologies of particular interest to Brazil include fluidized-bed combustion, beneficiation, and cogeneration. Mothballed gasification plants and other retired plants could be candidates for such moderniza-

tion. Coal, especially in the State of Rio Grande do Sul, is thought to have potential for high-load urban areas because of logistical considerations.

While conference participants noted that progress has been made, U. S. businesses noted important barriers:

- The privatization process is thought to be too unstructured; specifically, U.S. firms feel they can compete equally only if the bidding system is refined.
- Electric tariffs are too low, providing an inadequate return on investment.
- The business climate still is felt to be unfriendly to foreigners, and currency risk is another deterrent.
- There is a lack of "bankable" power purchase agreements.
- Decisionmaking lacks "transparency."

In all, the conference provided an important opportunity to advance CCT marketing efforts to the ever-expanding international market. ☆

## Financing and Opt-In Regulations Assist NOXSO

The NOXSO Corporation has found a friendly home for its Round III Clean Coal Technology Project, near Newburgh, Indiana. Governor Evan Bayh has signed into law a Clean Coal Technology Program that authorizes the Indiana Development Finance Authority to issue and guarantee revenue bonds to finance clean coal technologies. NOXSO received Indiana's guarantee early this year of \$40 million in revenue bonds for their SO<sub>2</sub>/NO<sub>x</sub> flue gas cleanup technology. The approval process required a technical evaluation by Indiana's Department of Commerce, and an economic evaluation by the State Budget Committee. The sale of revenue bonds for the NOXSO project was scheduled for March 1996, and construction is scheduled to begin this summer. It is expected that installation of the project at the 150-MWe Alcoa Generating Corporation Warrick Power Plant Unit 2, which provides power for aluminum smelting and fabricating, would allow the burning of 500,000 tons of high-sulfur, southern Indiana coal annually, and would save about 50 mining jobs in the area.

NOXSO also will take advantage of the Clean Air Act Amendments of 1990 (CAAA) "Opt-In Program." This program, administered by the U.S. Environmental Protection Agency (EPA), allows non-utilities such as Alcoa to generate and sell SO<sub>2</sub> allowances to utilities. Selling SO<sub>2</sub> allowances will provide the NOXSO project another stream of revenue. Recognizing that there are additional emission reduction opportunities in the industrial sector, Congress established the Opt-In Program under section 410 of the CAAA. The program allows sources not regulated by Acid Rain provisions the opportunity to enter Opt-In on a vol-

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untary basis, reduce their SO<sub>2</sub> emissions, and receive SO<sub>2</sub> allowances. The participation of these additional sources will reduce the overall cost of achieving the 10 million ton reduction in SO<sub>2</sub> emissions, mandated under the CAAA, by allowing non-regulated entities that can implement low-cost reduction technologies an opportunity to participate in the SO<sub>2</sub> allowance market. As participating sources reduce SO<sub>2</sub> emissions at a relatively low cost, their reductions in the form of allowances can be transferred to electric utilities where emission reductions can be more expensive. Opting-in will be profitable if the revenue from allowances exceeds the combined cost of the emissions reduction and the administrative cost of participating in the Opt-In Program.

NOXSO executed an agreement with Alcoa to build NOXSO's clean coal project at the Alcoa Warrick site on the Ohio River, near Newburgh, Indiana. The Warrick Power Plant is operated by Southern Indiana Gas & Electric Company. Unit 2 will burn 3.4 percent sulfur coal during the NOXSO treatment process. The recovered elemental sulfur from the project will be transported to a liquid SO<sub>2</sub> plant, which is being built at an Olin Corporation site in Charleston, Tennessee. The facility will have a 45,000 ton/year capacity, and is expected to generate commercial-grade liquid SO<sub>2</sub> from the elemental sulfur produced by the NOXSO plant. Total cost of the entire project, including two years of operation, is \$82.8 million.

The NOXSO process is a post-combustion technology that employs a dry, regenerable sorbent capable of absorbing both SO<sub>2</sub> and NO<sub>x</sub> from flue gas generated by coal-fired boilers. The process can remove up to 98 percent of the SO<sub>2</sub> and 75 percent of

the NO<sub>x</sub> from the flue gas, which is equivalent to removing over 90 percent of the combined weight of the two pollutants. Both pollutants are simultaneously removed from the flue gas by adsorption on a regenerable sorbent patented by NOXSO. The sorbent consists of spherical beads of high-surface-area alumina impregnated with sodium carbonate. Once the sorbent is saturated with the pollutants, it is regenerated using heat and a reducing gas such as methane. NO<sub>x</sub> is desorbed and recycled to the boiler with combustion air, where it is ultimately reduced to nitrogen and water in the flame. The sulfur compounds desorbed from the regenerated sorbent are ultimately converted to liquid SO<sub>2</sub>, one of the marketable by-products.

DOE awarded the cooperative agreement for the NOXSO project in March of 1991. The demonstration consists of a project definition phase, a design phase, and a construction and operation phase. The project definition phase was included to develop the preliminary design that incorporated the results from the NOXSO Proof-of-Concept 5-MWe pilot project, which was conducted under DOE's Flue Gas Cleanup R&D Program at Ohio Edison's Toronto power station.

NOXSO's Clean Coal Project is currently in the detailed design, construction, and operation phase, which includes a 16 month construction period and 24 months of operation and test periods. DOE issued a Finding of No Significant (environmental) Impact in June 1995. An environmental monitoring plan will be implemented when the project begins operation, which is scheduled for September of 1997.

The NOXSO process is applicable for retrofit or new facilities. The process is suitable for utility and

industrial coal-fired boilers of 75 MWe or larger. A high-sulfur coal will be used in the demonstration; however, the process is adaptable to coals with any sulfur content. The process can produce not only elemental sulfur and liquid sulfur dioxide, but also sulfuric acid. A readily available market exists for all of these products. The technology is expected to be particularly attractive to utilities that require high removal efficiencies for both SO<sub>2</sub> and NO<sub>x</sub> and/or need to eliminate wastes. This DOE Clean Coal Technology project is scheduled for completion in September of 1999. ☆

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full operation. The startup injection goal was 180 pounds of coal per net ton hot metal (#/NTHM). To date, injection levels of 235 #/NTHM have been achieved.

**Sierra Pacific Power Company** has completed all design work and nearly 40 percent of the construction of the **Piñon Pine Integrated Gasification Combined-Cycle Power Project**.

**Custom Coals International** introduced raw bituminous coal into their coal cleaning facility located near Central City, Pennsylvania in February 1996. The 500-ton-per-hour advanced coal cleaning facility, **Self Scrubbing Coal™: An Integrated Approach to Clean Air Project**, processed 156.3 tons of raw feed coal over about a one hour period. The operations produced 119.2 tons of clean coal product and 37.1 tons of refuse material. ☆

## LIFAC Nearing Marketability

An SO<sub>2</sub>-reduction technology designed for power plants with space limitations can provide a cost-effective answer for utility and industrial boilers that burn high-sulfur coal. A final report on the LIFAC process, which pneumatically injects pulverized limestone into an existing boiler, is due in a few months. It will chart the technology's success in removing up to 80 percent of SO<sub>2</sub> during a two-year testing period that included continuous operation from 500 to 800 hours. The technology was demonstrated by LIFAC-North America, a joint venture partnership between Tampella Power Corporation and ICF Kaiser Engineers, through DOE's Clean Coal Technology Program. The demonstration spanned 2,800 hours of operation.

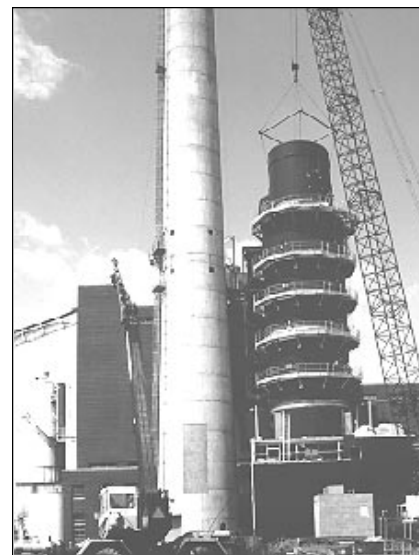
Successfully retrofitted to a power station's existing equipment, the technology is easy to operate because it has few moving parts and is easy to shut down and restart. The LIFAC process is automated by a programmable logic system, which regulates process control loops, interlocking, start-up, shutdowns, and data collection. When it was tested at Richmond Power & Light's Whitewater Valley Station in Richmond, Indiana, the entire process was easily managed by two IBM-compatible personal computers in the utility's control room.

Limestone is injected into the upper part of a boiler near the superheater, where it is calcined to lime (calcium oxide) and absorbs some of the SO<sub>2</sub> in the flue gas (about one-fourth of the total system SO<sub>2</sub> removal). Unreacted lime is then available for additional SO<sub>2</sub> capture downstream in the activation (or humidification) reactor. In the vertical chamber, sprays of water initiate a series of chemical reactions, including the hydration of lime to calcium hydroxide, which enhance SO<sub>2</sub> capture. After leaving the chamber, the sorbent is easily separated from the flue gas along with fly ash in the electrostatic precipitator (ESP). The sorbent then is recycled back through the reactor for increased sorbent utilization. A dry, solid waste is formed, which is more easily disposed of than the wet sludge produced by conventional limestone scrubbers.

The LIFAC process was demonstrated on a 60-MWe unit at the Whitewater Valley Station. Bituminous coal containing 2-2.8 percent of sulfur was burned, which marked the first time LIFAC was used to control emissions from high-sulfur coal. Sulfur removal was evaluated during parametric testing, with these factors having the greatest effect: limestone quality, Ca/S ratio, reactor bottom temperature, and ESP ash recycling rate. Overall SO<sub>2</sub> capture was 15 percent greater when fine limestone (80 percent minus 325 mesh) was used rather than a coarser limestone (80 percent minus 200 mesh), and an average 70 percent removal rate was achieved with a Ca/S ratio of 2.

The large amount of ash removed from the reactor bottom and the small size of the ESP hoppers combined to limit the ESP ash recycling rate during the demonstration. As a result, about 70 percent less ESP ash was recycled than originally anticipated. It is projected that if reactor bottom ash is recycled along with the ESP ash, while maintaining a reactor temperature of 5 degrees F above the adiabatic saturation temperature, an SO<sub>2</sub> reduction rate of 85 percent can be achieved.

During optimization testing in 1994, the boiler operated at a load of 60 MWe for long periods of time, although it fluctuated according to power demand.



The LIFAC system is highly operable because it has few moving parts and is managed via two personal computers located in the host utility's control room.

The LIFAC process automatically adjusted these boiler load changes. Other key process parameters that were held constant during long-term testing include the degree of humidification, the grind size of high-calcium-content limestone, and the recycle rate of spent sorbent from the ESP. Testing showed that stack opacity was low (10 percent) and ESP efficiency was high (99.2 percent). Solid waste, a mixture of fly ash and calcium compounds, was readily disposed of at a local landfill.

An economic evaluation of the system predicts that LIFAC is competitive with wet scrubbers and spray dryers. Capital costs range from \$99/kW for a 65-MWe unit to \$66/kW for a 300-MWe system. Crushed limestone accounts for roughly half of the process operating costs. LIFAC needs 4.3 tons of limestone to remove 1 ton of SO<sub>2</sub> — assuming that SO<sub>2</sub> removal is 75 percent, the Ca/S ratio is 2 and the limestone contains 95 percent calcium carbonate. If limestone costs \$15 per ton, it would cost \$65 per ton of SO<sub>2</sub> removed to operate LIFAC.

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The technology was developed in response to Finland's acid rain legislation, which requires that flue gas desulfurization remove 80 percent of SO<sub>2</sub>. Tampella Power began developing an economical alternative to sorbent injection involving lab-scale and pilot-scale tests, followed by full-scale tests injecting limestone. In 1986, the first large-scale test was performed at a power plant in Finland using a 70-MWe side-stream from a 250-MWe boiler burning 1.5 percent sulfur coal. The second LIFAC reactor was built to treat an additional 125-MWe side-stream. These initial demonstrations removed 70-80 percent of SO<sub>2</sub> using a Ca/S ratio of 2 to 2.5.

There are now at least 10 full-scale LIFAC units in operation or construction in Canada, China, Finland, Russia, and the United States. ★

## Clean Coal Outreach

As many projects in the Clean Coal Program move toward completion, a stronger emphasis on outreach is evolving to help ensure continuing the success of clean coal technology deployment and commercialization. Outreach activities in the coal office are growing to support this goal, and are keeping up with the latest information *and* the latest communication technologies. The Clean Coal program mailing list reaches close to 4,000 people around the globe from a variety of public and private sectors including industry, utility, academia, and environment. Publications provide information ranging from detailed technical data on clean coal technologies and projects, to broader topics such as commercialization and partnerships, and are available through a number of printed products. Now, for the first time, these timely publications will be available through the Fossil Energy Home Page, at URL: <http://www.fe.doe.gov>. Home Page offers general information and a gateway to more detailed information at field site Web servers.



The Fourth Annual Clean Coal Technology Conference, "The Global Opportunity," focused on the marketability of Clean Coal Projects domestically and abroad.

The message about clean coal technologies is being spread through a number of important avenues. In addition to the quarterly *Clean Coal Today* newsletter, the inventory of Headquarters publications expanded in 1995 to include the following:

- *The Clean Coal Technology Demonstration Program, 1994 Program Update* (April 1995);
- The first *Clean Coal Today Index* (September 1995), which provided a cross-reference of all articles published in the newsletter to date, presented by both "Project Title," and "Participant";
- *Report to Congress: Expressions of Interest in Commercial Clean Coal Technology Projects in Foreign Countries* (June 1995);
- To meet growing demand for project-specific information, DOE published the *Clean Coal Technology Demonstration Program Fact Sheet Book* (August 1995), the most sought after chapter from the *Program Update*, which includes important data on each project presented in the 1994 Program Update; and
- A revision to *The Investment Pays Off* (July 1995).

In addition, both METC and PETC produce fact sheets on their projects, which includes information on the status of each active project. The information is updated periodically, and is available through FE-22, as well as being distributed at numerous conferences and exhibits.

Another important means for getting the message out is through the use of exhibits designed for the Clean Coal program. With three fully equipped

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Editor: Phoebe Hamill

Comments are welcome and may be submitted to the Editor (FE-22)

- FAX: (301) 903-9438,
- Voice: Call through GSA Deaf Relay 1-800-877-8339, and ask for (301) 903-9436 (TDD)
- Internet: Phoebe.Hamill@HQ.DOE.GOV



exhibits managed by Headquarters, and others developed and managed by METC and PETC, conferences and exhibitions provide an important opportunity to display information about the program. Interchangeable panels provide an opportunity to display different messages, including a NEPA theme, government/industry partnership, and international opportunities, all as they relate to the Clean Coal Program and its projects and successes.

Throughout 1995, the CCT Program staff participated in over 16 domestic and international events involving users and vendors of technologies, regulators, financiers, environmental groups, and other public and private institutions. During the last quarter of 1995 alone, the clean coal exhibits were viewed by thousands at venues as diverse as the DOE Clean Coal Technology Conference (Denver, CO), NASA Technology 2005 (Chicago, IL), NARUC 107th Annual Convention & Regulatory Symposium (New Orleans, LA), and PowerGen Americas (Anaheim, CA). Papers were presented at each of these events as well.

Since then, staff have participated in the 14th Annual World Coal Conference in New Orleans in February, and the 21st International Technical Conference on Coal Utilization (Clearwater, FL, March 18-21). Upcoming events to which the exhibits are scheduled to travel include: the 58th Annual American Power Conference (Chicago, IL, April 9-11), Power Projects in Central & Eastern Europe (New York, NY, April 15-16), Air and Waste Management Association 89th Annual Meeting and Exhibition (Nashville, TN,

June 23-28), and NASA's Technology 2006 (Anaheim, CA, Oct. 29-31). Papers will be presented at many of these events. The next DOE Annual Clean Coal Technology Conference has been moved forward from September 1996 to January 1997, in Tampa, Florida, and will include a site tour of the Tampa Electric Clean Coal Demonstration Project, scheduled to begin operation in late 1996.

Building on the progress of the clean coal outreach program established in 1994, outreach activities continued to expand in 1995. A customer survey conducted in late 1994 was analyzed to assess the success of outreach products and users' understanding of how to obtain these products. Results indicated overall satisfaction with materials that have been produced and distributed. Analysis of the survey results identified several sectors where greater communication could be targeted, for example, the R&D program activities.

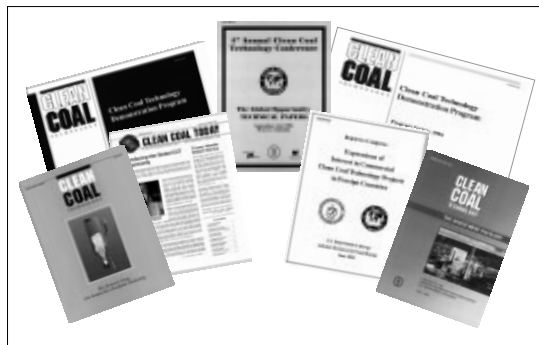
In June 1995, the Coal Outreach Steering Committee was reestablished, with the immediate mission of refining the definition of outreach, and defining, through a charter, the short- and long-term responsibilities and goals of the Committee. With representation from each of the groups within the Office of Coal

Technology, including Clean Coal, R&D, International, Communications, METC, and PETC, the Committee began drafting a charter, and developing evaluation criteria for deciding where to send exhibits and DOE staff. This Committee has undertaken assessments of outreach materials (publications, exhibits, photographs, and electronic information, among others), and is developing long-term plans to provide the most effective support to ensure continued success of clean coal technologies.

The Committee will discuss participating in the technical programs of future events; identify additional useful publications; plan, arrange, and convene public meetings and conferences; plan, prepare, and manage customer surveys and other means of measuring public feedback; and explore and evaluate emerging and developing means of engaging in outreach activities, including computer bulletin boards, internet access, local and wide area networks, computer disk, and compact disk media, among others.

Finally, and most importantly, the success of these outreach activities will rely heavily on input from the Clean Coal Program "customers and stakeholders," such as readers of *Clean Coal Today*. Only by addressing customer and stakeholder concerns can this outreach effort ensure that it is on the right course. It is through all of these interests that we can make the last word in energy be COAL!

For further information on Coal Outreach, contact Dr. Jerry Pell, Chairman of the Coal Outreach Steering Committee, at: U.S. Department of Energy, Office of Fossil Energy (FE-22), Washington, DC 20585; Phone: 301-903-9447, FAX: 301-903-9438; e-mail: jerry.pell@hq.doe.gov. ☆



Each year a number of key publications are produced to inform public and government audiences of advanced coal-using technologies.

# LPMEOH™ Demonstration to Start Up in the Fall

A first-of-a-kind facility will demonstrate a cost effective, environmentally friendly route for producing liquid fuels and chemical feedstocks from coal. Air Products and Chemicals, Inc.'s Liquid Phase Methanol (LPMEOH™) process demonstration at Kingsport, Tennessee, will produce methanol from coal-derived synthesis gas and is scheduled to begin demonstration operations this fall. DOE has signed a \$213.7 million cooperative agreement, as part of its Clean Coal Technology (CCT) Program, with Air Products Liquid Phase Conversion Company, L.P. (a limited partnership between Air Products and Eastman Chemical Company). The project is located at Eastman's complex in Kingsport, Tennessee. The LPMEOH™ process was developed by Air Products during more than 10 years of federally sponsored research.

Managed by DOE's Pittsburgh Energy Technology Center as part of the CCT Program, the project will demonstrate on a commercial scale the LPMEOH™ process, which enhances the economics and efficiency of integrated gasification combined-cycle (IGCC) electric power generation. IGCC technology, being demonstrated at several sites under the CCT Program, will provide one of the cleanest and most efficient of 21<sup>st</sup> century power generating options that can be combined with LPMEOH™ the technology. As developed under the CCT Program, these technologies — either individually or in combination — will be able to fill local needs for electric power, transportation fuels, and manufactured chemical products, all from a domestic resource.

Construction of the \$35 million LPMEOH™ demonstration facility officially began on October 16, 1995, at the groundbreaking ceremony. Honored guests at the groundbreaking ceremony included Earnest W. Deavenport, Jr., Chairman and CEO of Eastman; Harold A. Wagner, Chairman, President, and CEO of Air Products; U.S. Representative James Quillen; and Alan Edwards, DOE's former Principal Deputy Assistant Secretary of Fossil Energy. "This project illustrates just how well government and industry can work together to address our nation's goals for energy independence and a cleaner environment," noted Wagner at the ceremony.

## Technology Features

The project's novel liquid phase reactor, which combines the chemical reaction and heat-removal systems, distinguishes LPMEOH™ from other commercial methanol-production processes. In contrast to commonly used fixed beds of dry catalyst pellets, the liquid phase (an inert mineral oil) suspends a micron-size, temperature-sensitive copper catalyst (the slurry)

and acts as an efficient means to remove heat from the catalyst's surface. This allows synthesis gas streams to be fed directly to the reactor without shift conversion.

Providing excellent heat management, the slurry reactor offers an attractive alternative to the traditional fixed-bed reactor, particularly where strict temperature control is needed for product selectivity or extending catalyst life. The slurry reactor designed for the LPMEOH™ process is aimed at treating synthesis gas rich in carbon monoxide typically produced in modern gasifiers. This gas, which is difficult for conventional fixed-bed reactors to handle, has the potential for high conversions with a slurry reactor.

The LPMEOH™ process allows higher synthesis gas conversions without accelerated loss of catalyst life. Typically, gas conversions in a fixed-bed reactor are limited to 15 to 18 percent, whereas the slurry reactor is expected to achieve twice this gas conversion. The reactor is particularly applicable to once-through designs in which methanol is coproduced with power in a combined-cycle coal gasification plant. The Kingsport demonstration provides an opportunity to show, at full commercial scale, the advantages of slurry reactors.

A carefully developed test plan will allow operations to simulate electricity demand load-following in coal-based IGCC facilities. The operations also will demonstrate the enhanced stability and heat dissipation of the conversion process, its reliable on/off operation, and its ability to use methanol as a fuel without additional upgrading. These benefits supplement the cost savings that could be realized when utilities manufacture and sell two products: electricity and methanol. For ex-



The LPMEOH™ project will start operations this fall and will demonstrate the coproduction of methanol and electric power.

ample, a typical, commercial scale IGCC co-production facility could generate 200 to 350 MW of electricity, and also could manufacture from 45,000 to 300,000 gallons per day of methanol.

### Demonstration Plan

The Air Products Liquid Phase Conversion Company, L.P., will own and operate the demonstration facility. In addition to managing the facility, Air Products will design and construct the LPMEOH™ unit. Eastman will operate the unit and supply it with coal-derived synthesis gas. Joining Air Products and Eastman in the demonstration project is Acurex Environmental Corporation, which will provide co-funding and fuel methanol testing services. The Electric Power Research Institute will provide guidance for commercial acceptance.

Methanol product testing will be conducted to demonstrate how a centrally located clean coal electric power plant with methanol coproduct could provide energy services to local communities. Off-site testing will be conducted for small modular power generators, including fuel cells; and, in mobile applications, testing will illustrate the advantages of using a clean-burning substitute fuel for buses and van pools. In the laboratory, methanol will be analyzed to determine its suitability in producing methyl tertiary butyl ether (MTBE), a gasoline octane enhancer and a valuable additive in reformulated gasoline, which is being used to help reduce mobile source emissions in heavily polluted areas throughout the United States.

If practical, producing dimethyl ether (DME) as a coproduct will also be pursued during the last six months of the four-year demonstration period. In a storable blend with metha-

anol, the mixture can be used for peak-power production and as a chemical feedstock for synthesizing other chemicals, such as new oxygenated fuel additives. DME also may have other potential commercial uses, such as being combined with methanol as a diesel engine fuel.

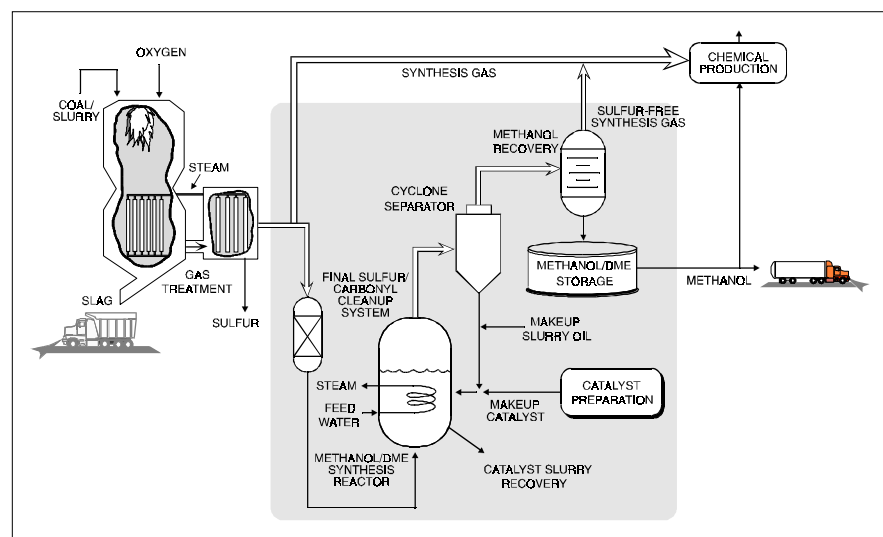
The host site, Eastman's integrated coal gasification facility, has been commercially producing synthesis gas since 1983 from Eastern high-sulfur bituminous coal containing 3-5 percent sulfur and 10 percent ash. At optimum output, the LPMEOH™ demonstration facility will produce 80,000 gallons per day of methanol, a majority of which Eastman will use as a chemical feedstock on site. If successful, the project could provide a cost-effective alternative to conventional methanol production. ★

### Marketing Efforts

Air Products has been actively marketing the LPMEOH™ process for the coproduction of methanol and electric power since its successful test runs in 1989 at the DOE-owned process development unit at LaPorte, Texas. Recent marketing efforts have

generated interest in the LPMEOH™ demonstration at Kingsport, Tennessee. Several parties are studying the possibility of coproducing methanol with electric power using IGCC both domestically and internationally. While many of these are coal-based electric power plants, a number of them include petroleum coke or other high-sulfur, environmentally unattractive feedstocks. Air Products expects to market the LPMEOH™ technology through licensing, owning and operating, and tolling arrangements. ★

The total estimated cost of the LPMEOH™ demonstration project is \$213.7 million, with DOE providing \$92.7 million, or 43 percent of the cost, and the private industry participants financing the remaining \$121 million. The LPMEOH™ process demonstration is the 31st of 43 Clean Coal Technology projects to begin construction. Twenty-six projects are now in operation or have completed test runs.



Process schematic of the Commercial-Scale Demonstration of the Liquid-Phase Methanol (LPMEOH™) Process showing coal processing for clean fuels/indirect liquefaction.

# Status of CCT Demonstration Projects

## Advanced Electric Power Generation

### The Appalachian Power Co.

*PFBC Utility Project.* Efforts continue to restructure and re-site the project. (Site to be determined)

### DMEC-1 Ltd. Partnership

*PCFB Project.* Efforts continue to restructure and re-site the project. Ahlstrom Pyropower, recently merged into Foster Wheeler, has been installed as the General Partner. MidAmerican Energy (formerly MidWest Power) is now one of two Limited Partners (Dairyland Power is also a Limited Partner). Foster Wheeler is establishing the feasibility of combining the DMEC-1 and Four Rivers technologies into a single project. (Site under negotiation)

### Four Rivers Energy Partners, L.P.

*Four Rivers Energy Modernization Project.* DOE granted Four Rivers Energy Partners a no-cost extension to provide sufficient opportunity to establish the feasibility of combining the DMEC-1 and Four Rivers into a single project. (Site under negotiation)

### The Ohio Power Co.

*Tidd PFBC Project.* The Ohio Power completed all testing and is in the process of decommissioning the plant. The Final Report has been submitted and will be available to the public from the National Technical Information Service and the Office of Scientific and Technical Information. (Brilliant, OH)

### Tri-State Generation and Transmission Association, Inc.

*Nucla CFB Project.* The project was completed April 1992. (Nucla, CO)

### York County Energy Partners, L.P.

*York County Energy Partners Cogeneration Project.* YCEP and the local utility, Metropolitan Edison, announced in September 1995 that the 250-MWe CFB cogeneration plant planned for the site at North Codorus Township will not be built.

### ABB Combustion Engineering, Inc.

*Combustion Engineering IGCC Repowering Project.* Efforts continue to restructure and re-site the project. (Site to be determined)

### Clean Energy Partners, L.P.

*Clean Energy Project.* Efforts continue to restructure the project. (Site under negotiation)

### Sierra Pacific Power Co.

*Piñon Pine IGCC Power Project.* The project is in its construction phase. By the end of 1995, plant construction had reached a 40 percent completion point. (Reno, NV)

### TAMCO Power Partners

*Toms Creek IGCC Project.* The Cooperative Agreement ended, effective March 31 1995. (Coeburn, VA)

### Tampa Electric Co.

*Tampa Electric Integrated Gasification Combined-Cycle Project.* Construction of the 250-MWe Integrated Gasification Combined-Cycle (IGCC) project is nearly 70 percent complete. All structural steel is in place and acceptance testing of the major equipment will be conducted this Spring. The project is on schedule for September 1996 startup at Tampa's Polk Power Station in central Florida. (Lakeland, FL)

### Wabash River Joint Venture

*Wabash River Coal Gasification Repowering Project.* Plant construction and startup activities have been completed. Commercial operation began December 1, 1995. Operational performance continues to improve with increasingly longer continuous runs. (West Terre Haute, IN)

### Alaska Industrial Development and Export Authority

*Healy Clean Coal Project.* Construction efforts began in May 1995, and were completed for the season on schedule in October 1995. During the 1995 construction season, approximately 12,000 cubic yards of concrete were poured and over 48,000 cubic yards of structural backfill were hauled and compacted. Erection of structural steel is 30% complete. All major equipment vendors have been authorized to begin fabrication. Equipment items continue to be shipped to the site. Construction at the site is scheduled to resume in March 1996. (Healy, AK)

### Arthur D. Little, Inc.

*Coal Diesel Combined-Cycle Project.* The original host for the Diesel Cogeneration Clean Coal Project, Easton Utilities, has withdrawn from the project. Arthur D. Little (participant) and Cooper-Bessemer (technology vendor) are investigating a promising site at the University of Fairbanks, Alaska. (Site undetermined)

### Pennsylvania Electric Co.

*Warren Station Externally Fired Combined-Cycle Project.* Project activity has stopped as DOE and Penelec assess the technical readiness of the ceramic air heater — the critical element of the power island. (Warren, PA)

## Environmental Control Devices

### The Babcock & Wilcox Co.

*Demonstration of Coal Reburning for Cyclone Boiler NO<sub>x</sub> Control.* The project is complete. The final report has been received and is in review. (Cassville, WI)

### The Babcock & Wilcox Co.

*Full-Scale Demonstration of Low-NO<sub>x</sub> Burner Retrofit.* The project was completed in September 1995. (Aberdeen, OH)

### Energy and Environmental Research Corp.

*Evaluation of Gas Reburning and Low-NO<sub>x</sub> Burners on Wall-Fired Boiler.* Testing was completed in December 1995. The results of the demonstration have shown that this lower capital method for NO<sub>x</sub> reduction is successful. The final report of the project is in preparation. (Denver, CO)

### Southern Company Services, Inc.

*Advanced Combustion Techniques for a Wall-Fired Boiler.* The project was scheduled for completion in March 1996. (Coosa, GA)

### Southern Company Services, Inc.

*180-MWe Advanced Tangentially Fired Combustion Techniques for the Reduction of NO<sub>x</sub> Emissions from Coal-Fired Boilers.* The project was completed in June 1994. (Lynn Haven, FL)

**Southern Company Services, Inc.**

*SCR Technology for the Control of NO<sub>x</sub> Emissions from High-Sulfur-Coal Boilers.* The project was completed in December 1995. (Pensacola, FL)

**Tennessee Valley Authority**

*Micronized Coal Reburning for NO<sub>x</sub> Control on a 175-MWe Wall-Fired Unit.* TVA and New York State Electric & Gas (NYSEG), in association with Eastman Kodak Company, have agreed to host the project. Testing will be performed at NYSEG Milliken Station on a 150-MWe T-Fired unit and on an 85-MWe equivalent cyclone boiler at Kodak's Rochester, New York production facilities. The project intends to demonstrate that micronized coal (80% passing 325 mesh), when used as a reburn fuel, will reduce NO<sub>x</sub> by up to 60%. Preliminary testing is scheduled to begin at Milliken Station by the end of 1996. (Site undetermined)

**AirPol, Inc.**

*10-MWe Demonstration of Gas Suspension Absorption.* The project was completed in June 1995. (West Paducah, KY)

**Bechtel Corp.**

*Confined Zone Dispersion Flue Gas Desulfurization.* The Final Report is in review. (Seward, PA)

**LIFAC N. America**

*LIFAC Sorbent Injection Desulfurization Project.* The Final Report is in preparation. (Richmond, IN)

**Pure Air on the Lake, L.P.**

*Advanced Flue Gas Desulfurization.* The project was completed in September 1995. (Chesterton, IN)

**Southern Company Services, Inc.**

*Innovative Applications of Technology for the CT-121 FGD Process.* The project was completed in December 1995. (Newnan, GA)

**ABB Combustion Engineering**

*SNOX Flue Gas Cleanup Project.* The project operations are complete. Final reporting is now in progress, and is scheduled to be released in the summer of 1996. The demonstration was a total success. The plant consistently removed 96% of the SO<sub>2</sub>, 94% of the NO<sub>x</sub>, and 99% of the particulate emissions. Ohio Edison, the host site, has decided to keep the system and utilize it as part of their environmental compliance plant. The process produces no waste products. Its by-product is concentrated sulfuric acid that has a ready commercial market. (Niles, OH)

**The Babcock & Wilcox Co.**

*LIMB Project Extension and Coolside Demonstration.* The project was completed in November 1992. (Lorain, OH)

**The Babcock & Wilcox Co.**

*SNRB™ Flue Gas Clean-Up Project.* The project was completed in September 1995. (Dilles Bottom, OH)

**Energy and Environmental Research Corp.**

*Enhancing the Use of Coal by Gas Reburning and Sorbent Injection.* The combined project final report is in progress. All required restoration has been accomplished. Illinois Power has chosen to keep the gas reburn system at its Hennepin Station. City, Water, Light & Power has chosen to keep both the gas reburn and sorbent injection systems at its Springfield, Lakeside station. The project goals of 60% NO<sub>x</sub> removal and 50% SO<sub>2</sub> removal were met and exceeded under normal operating conditions. The final report will be released in the summer of 1996. (Hennepin and Springfield, IL)

**New York State Electric & Gas Corp.**

*Milliken Clean Coal Technology Demonstration Project.* Total scrubber operations began when the second module of the S-H-U split modular scrubber commenced on June 20, 1995. The first module commenced operation in January of 1995. The scrubber has consistently had an SO<sub>2</sub> removal rate of 98%. Operations are scheduled to continue until July 1997. (Lansing, NY)

**NOXSO Corp.**

*Commercial Demonstration of the NOXSO SO<sub>2</sub>/NO<sub>x</sub> Flue Gas Cleanup System.* Final design for the 150 MWe plant at Alcoa's Warrick Station near Evansville, Indiana, is in progress. Construction is scheduled to begin in the Spring of 1996. (Niles, OH)

**Public Service Company of CO.**

*Integrated Dry NO<sub>x</sub>/SO<sub>2</sub> Control System.* Integrated system testing is ongoing for sodium-based dry sorbent injection, the urea lance, and wall injection ports. Low-NO<sub>x</sub> burners and overfire air testing will be completed late March/early April 1996. The Final Report will be issued in July 1996. (Denver, CO)

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## Coal Processing for Clean Fuels

**ABB Combustion Engineering, Inc. and CQ Inc.**

*Development of the Coal Quality Expert.* Final version released for testing by four utilities. (Homer City, PA)

**Custom Coals International**

*Self Scrubbing Coal™: An Integrated Approach to Clean Air.* An Integrated Approach to Clean Air: Plant construction is complete except for some minor ancillary electrical work. Plant start-up procedures are nearing completion with the completion of water balancing, introduction of magnetite, and introduction of coal into the plant. Operations are expected to commence upon completion of reliability testing. The first test burn would be completed at Pennsylvania Power and Light's Martins Creek Plant in Lower Mount Bethel Township, Northampton County, Pennsylvania. (Lower Mount Bethel Township, PA; Richmond, IN; Ashtabula, OH)

**Rosebud Syncoal Partnership**

*Advanced Coal Conversion Process Demonstration.* The ACCP demonstration facility has processed over 1 million tons of raw subbituminous coal, producing a SynCoal® product. The reliable operation status of the ACCP facility has supplied SynCoal® products to a wide range of customers, including industrials and utilities. Focus has intensified in the commercialization arena and in the completion of a Reference Plant Design. (Colstrip, MT)

**ENCOAL Corp.**

*ENCOAL Mild Coal Gasification Project.* The project's operating phase has been extended to September 1996. Approximately 7,000 hours of operation on coal have been logged to date. Some 2.2 million gallons of liquid product and 43,189 tons of solid product (in blends ranging from 15-92 percent) have been shipped to industrial and utility customers, respectively, and successfully burned. (Gillette, WY)

**Air Products Liquid Phase Conversion Company, L.P.**

*Commercial-Scale Liquid Phase Methanol Process.* Construction began in October 1995. Detailed design, procurement, and construction activities are at a peak. Site preparation work is complete and foundation installation is continuing. Purchased equipment is being delivered to the site. Construction is expected to be completed in November of 1996. (Kingsport, TN)

**Industrial Applications**

**Bethlehem Steel Corp.**

*Blast Furnace Granulated Coal Injection System Project.* The plant startup is complete; full plant operation activities are under way. Reasonable amounts of granulated coal are being injected through 26 tuyeres in both "D" Furnace and "C" Furnace. (Burns Harbor, IN)

**Bethlehem Steel Corp.**

*Coke Oven Gas Cleaning System.* DOE and Bethlehem Steel Corporation executed a mutual termination of the Cooperative Agreement on April 10, 1995. This mutual termination follows a decision by Bethlehem to suspend coke-making at their Sparrows Point (Maryland) Plant effective December of 1991. This decision indefinitely delayed start-up, shakedown, and operation of the demonstration facility. This demonstration had been "on-hold" at the end of construction. (Sparrows Point, MD)

**Centerior Energy Corp.**

*Clean Power from Integrated Coal/Ore Reduction (COREX®).* Project continues in negotiation. (Vineyard, UT)

**Coal Tech Corp.**

*Advanced Cyclone Combustor with Internal Sulfur, Nitrogen, and Ash Control.* The project was completed in September, 1991. (Williamsport, PA)

**Passamaquoddy Tribe**

*Cement Kiln Flue Gas Recovery Scrubber.* The project was completed in February, 1994. (Thomaston, ME)

**ThermoChem, Inc.**

*Demonstration of Pulse Combustion in an Application for Steam Gasification of Coal.* The project has ended. (Silver Bay, MN)

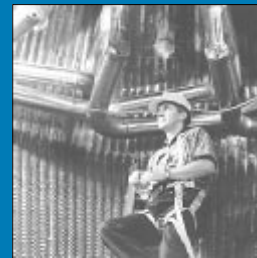
**Fifth Annual Clean Coal Technology Conference  
Site Tour**

**January 7, 1997**

**Tampa Electric Company's Integrated Gasification Combined Cycle Plant  
Lakeland, Florida**



— **Advanced Electric Power Generation/Integrated Gasification Combined Cycle** — Integrated gasification combined-cycle system using **Texaco's pressurized, oxygen-blown, entrained-flow gasifier technology and incorporating both conventional, low-temperature acid-gas removal as well as hot-gas moving-bed desulfurization**



# Fifth Annual Clean Coal Technology Conference

*Powering the Next Millennium*

January 7-10, 1997

Tampa, Florida

The focus of the Fifth Annual Clean Coal Technology Conference will be on the strategies and approaches that will enable clean coal technologies to resolve the competing, interrelated demands for power, economic viability, and environmental awareness in the post-2000 era. Recognition will be given to dynamic changes that will result from utility competition and industry restructuring as well as the evolution of markets abroad. The current projections for power confirm the preferential role that electric power has in accomplishing the long-range goals of most nations. These increased demands can be met by coal with technologies that achieve environmental goals while keeping the cost-per-unit of energy competitive. The results from the existing projects in the Clean Coal Technology Program confirm that technology is the pathway to achieving these goals.

The industry/government partnership, cemented over the past 10 years, is focused on moving the technologies into the domestic and international marketplaces. The Fifth Annual Clean Coal Technology Conference will provide a forum to discuss these benchmark issues and the role and need for these technologies in the post-2000 era.

The Fifth Annual Clean Coal Technology Conference will be held at the Hyatt Regency Westshore, 6200 Courtney Campbell Causeway, Tampa, Florida, approximately five minutes from Tampa International Airport. The Hotel and Business Center features 445 guest rooms. Exhibit space is available to project participants, and remaining space will be opened to the general public on a first-come, first-served basis.

A block of guest rooms has been reserved for the Conference. The special Conference rate is \$100.00 plus tax (single or double). However, reservations must be made by December 12, 1996, to guarantee this rate. Reservations can be made by calling 800-233-1234 or 813-874-1234. Mention the Fifth Annual Clean Coal Technology Conference.

If you would like more information on the Conference, please contact Ms. Faith Cline by telephone at 202-586-7920 or facsimile at 202-586-8488. Future updates will be posted on the Fossil Energy Homepage at <http://www.fe.doe.gov>.

Cosponsors:

**U.S. Department of Energy**

**The Center for Energy & Economic Development**

**National Mining Association**

**Electric Power Research Institute**

## Recent CCT Publications

*CCT Publications are available to DOE contractors from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831; for prices, call (615) 576-8401.*

*Available to the public from the National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4600. If not yet available from NTIS, limited copies of "DOE/MC" publications are available from the Library (MS B02) at Morgantown Energy Technology Center, Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507-0889, (304) 285-4184.*

<b>Date</b>	<b>Publication Number</b>	<b>Title</b>
July 1995	DOE/MC/27362-4089	Blast Furnace Granular Coal Injection Project Annual Report for 1994
July 1995	DOE/FE-0339	Clean Coal Technology Demonstration Program: Project Fact Sheets
July 1995	DOE/FE-0291 (revised)	The Investment Pays Off
June 1995	DOE/FE-0334	Report to Congress: Expressions of Interest in Commercial Clean Coal Technology Projects in Foreign Countries
June 1995	DE/95016681	10-MWe Demonstration of Gas Suspension Absorption, Final Project Performance and Economics Report (AirPol, Inc.)
May 1995	DOE/MC/27363-5012	IGCC Demonstration Project, Annual Report for 1994 (Tampa Electric)
April 1995	Topical Report 4	Clean Coal Technology SO <sub>2</sub> Removal Using Gas Suspension Absorption Technology, AirPol Topical Report (Available from PETC, (412) 892-6244)
April 1995	DOE/FE-0330	Clean Coal Technology Demonstration Program, Annual Program Update Report
April 1995	DOE/MC/24132-5037	Tidd PFBC Demonstration Project, First Three Years of Operation, Topical Report (2 Volumes)
March 1995	DOE/MC/27339-4064	ENCOAL Mild Coal Gasification Project Annual Report for 1994
March 1995	DOE/MC/27339-4088	The ENCOAL Project: Initial Commercial Shipment and Utilization of Both Solid and Liquid Products, Topical
March 1995	DOE/MC/27362-4073	Blast Furnace Granular Coal Injection System Demonstration Project — Public Design Report
January 1995	DOE/MC/29309-4054	Piñon Pine Power Project Annual Report for 1994

## Upcoming Events

<b>Date</b>	<b>Event</b>	<b>Contact</b>
May 20-22, 1996	Fifth International Symposium on Biological Procession of Fossil Fuels	F. Brown, 412-892-5942 PETC
June 4-5, 1996	Repowering Workshop: Innovative Repowering Strategies with Advanced Gas Turbines	L. Ruth, 412-892-4461 PETC
July 15-18, 1996	Joint Power and Fuel Systems Contractor Review Meeting	C. Drummond, 412-892-4889 PETC