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Issue No. 12, Fall 1993

Clean Coal Today

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

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

Clean Coal Briefs

While this issue of *Clean Coal Today* focuses on the **Second Annual Clean Coal Technology (CCT) Conference** in Atlanta, good news continues to come in from the individual projects in the program as clean coal technologies continue their march into the commercial marketplace. A complete list of papers presented at the CCT Conference appears in this newsletter.

Plan now for the **Third Annual Clean Coal Technology Conference** which will be held in Chicago, IL, September 6-8, 1994.

In the last issue, we told you about the first commercial sale to directly result from the Clean Coal Program. Now, **Babcock & Wilcox** officials report that they have sold their second **Low NO_x Cell™ Burner System**, again to Allegheny Power Systems. And, in another success from Ohio, **Ohio Edison Company** announced it would maintain the **ABB Combustion Engineering's SNOX™ system** at its Niles plant on a permanent basis and that the technology would become a key part of the utility's Clean Air Act Amendments compliance strategy.

If you learn about other commercialization success stories arising from the Clean Coal Technology Program, the editors of *Clean Coal Today* would like

See "Briefs" on page 9 . . .

In This Issue

An International Showcase

2nd Annual CCT Conference Examines Technology Markets

ATLANTA, GA - "The envy of the world" (Power Engineering, August 1993) is how one observer recently described the U.S. Clean Coal Technology Demonstration Program, and one could not help but hear that same message as the international clean coal community gathered in September for the Second Annual Clean Coal Technology Conference.

The U.S. private and public sectors have made an unparalleled investment in a new generation of "clean coal" power technologies, and that investment is beginning to reap dividends as the program's first commercial success stories unfold. Nearly 400 attendees from 16 nations—including Russia, People's Republic of China, England, Japan, France, Poland, Finland, Czech Republic, Slovakia, Hungary, Romania, Ukraine, Latvia, Kazakhstan, Bulgaria—filled The Atlanta Hilton and Towers to hear some of those success stories and get a firsthand status report on the program's 45 showcase demonstration projects.

Yet the audience heard a sobering message as well. While markets for clean coal technologies are burgeoning overseas, these technologies face a host of hurdles in the commercial marketplace in this country, in the form of economic, regulatory, environmental, and political issues that have the potential to stop the commercialization of clean coal technologies.

See "CCT Conference" on page 2 . . .

Moderator Jack Siege,l Acting Asst. Secretary for Fossil Energy, U.S. DOE, opened the first Plenary Session. Seated L to R: Kenneth Nemeth, Exec. Dir. Southern States Energy Board; Lee Conn, VP, Georgia Power Co.; William White, Deputy Secretary, U.S. DOE; Kurt Yeager, Sr. VP, Technical Operations, Elec. Power Research Inst.; Lynn Shishido-Topel, Commissioner, Illinois Commerce Comm.; Flynt Kennedy, VP, Res. & Dev., CONSOL, Inc.; and John Paul, Southeastern Regional Dir., Center for Energy & Economic Dev.

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William White, Deputy Secretary, U.S. DOE, addressed the opening Plenary Session urging the nation's utilities to move forward with clean coal technologies.

The Conference opened with welcomes from Jack Siegel, DOE's Acting Assistant Secretary for Fossil Energy, Ken Nemeth, Executive Director of the Southern States Energy Board (DOE's co-sponsor for this year's conference), and Lee Conn, Vice President for Power Generation, Georgia Power Company,

In the keynote address, Deputy Secretary of Energy William White noted the international significance of the conference and issued a challenge to the nation's utilities to move forward with clean coal technologies. He stated "We're seeing some fundamental redirection in the attitudes that we take toward the preservation of the environment during a period of explosive economic growth...and clean coal technology fits right in the middle of that."

White pointed out that nations throughout the world are looking toward unparalled economic growth, growth "that requires the basic infrastructure of countries -- power, transportation, water, legal rights-- to be in place." It is the commercial deployment of clean coal technologies that will provide the critical link between environmental concerns and the need for economic growth.

"There's not a serious, thoughtful thinker that can say that coal is not a part of the power future of this country, and we in this Administration are committed to seeing that the coal technologies of this country advance in a way that's compatible (with the environment)." Now is the time for industry to move forward with clean coal technologies, White continued. "The government has....put its money where its mouth is through the Clean Coal Technology program as have our industrial partners....The question I have is this: will the industry, starting with the utility industry, be willing to step out and get ahead of the curve? Or will they wait to be pushed along? And if they wait, will the trend overpower them and pass them by?"

White recognized the risks involved with deploying new technologies, especially from regulatory commissions that penalize rather than reward risk. "But," he said, "the most risky strategy for any industry, the utility included, is not to change, and not to try to remain in front of the trend." In support of that effort, White committed the resources of the Department of Energy, recognizing its "obligation to get information into the hands of people as quickly as possible." But, he said, government cannot run the economy "*....It is going to be utilities and vendors who understand the regulatory framework with which they operate who are going to have to take some risks with these new technologies. We challenge you to do that.*"

The Opening Plenary Session continued with remarks by Kurt Yeager, Senior Vice President of Technical Operations, Electric Power Research Institute (EPRI), who discussed the future of clean coal technologies in a rapidly changing power market. Prior to the development of clean coal technologies, Yeager explained, power generation had reached its limits of efficiency improvements that could be achieved with a conventional Rankine cycle. At the same time, environmental challenges were becoming greater and greater, creating an "unsustainable future" for the power generation industry.

With the advent of clean coal technologies, Yeager stated, came a "fundamental change in the way we produce power." No longer would we be limited to central station generating and distribution. Instead, we have a combustion turbine that can be sized to meet market demand with the "economies of precision." Yeager noted that today's generating fleet is aging, but that the majority of plants will outlast their retirement dates and operate for up to 70 years. The challenge will be, he said, to repower and rebuild those plants for the future.

Looking at the relationship between economic growth and electricity throughout the world, Yeager pointed out that a full half of the world's population today exists on only 1-2% of the electricity available in the U.S., Japan and Western Europe. That cannot last, he said, as developing nations seek to improve living standards. Yeager called growth the ultimate global environmental threat as coal—with its worldwide abundance and low cost—is expected to be the preferred fuel. The combination of clean coal technologies and electrification will be one of the most important global business opportunities in the future, he noted.

Looking at the regulatory climate for clean coal technologies, Lynn Shishido-Topel, a Commissioner of the Illinois Commerce Commission, told the audience that "the most important issue for CCT is how well it will fare in a more competitive electricity generation industry" that may include retail wheeling and utility adoption of least-cost planning. Shishido-Topel recognized that today's regulatory climate is not conducive to clean coal technologies, but that may change if technologies develop faster payback times so they can compete. If, as expected, least cost planning becomes widely implemented, options will be evaluated over a

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shorter planning horizon, and the future will become harder and harder to predict. In this climate, ". . . Long-lived, capital intensive projects with big upfront costs, and payoffs far into the future fare less well than projects with lower upfront costs and faster payoffs."

Representing the coal industry, Flynt Kennedy, Vice President for Research & Development at CONSOL Inc., provided an overview of CONSOL's extensive involvement with clean coal technologies. From a coal company's perspective, Kennedy observed, the concern is whether clean coal technologies will be enough to keep coal competitive with increasingly stringent environmental standards. Potential NO_x standards in non-attainment areas may be enough to wipe out any coal technologies in the future. Toxics, solid waste management, and potential limits on carbon dioxide emissions are other issues that can seriously threaten coal's future.

Luncheon speaker, David C. Crikelair, VP, Texaco, Inc., focused his remarks on the international markets for CCTs, especially in developing nations.

The Plenary Session concluded with remarks by John Paul, Southeastern Regional Director of The Center for Energy & Economic Development (CEED). CEED is a relatively new organization that was formed specifically to support grassroots efforts to improve public awareness of coal and clean coal technology. Spurred largely by the ability of anti-coal campaigns to affect public opinion and prohibit the construction of new coal plants, CEED seeks to provide up-to-date information on the benefits of clean coal technologies at the grassroots level where decisions are made. With offices already established in St. Louis, Denver, Atlanta, Pittsburgh, and Washington, D.C., Paul emphasized CEED's long-term commitment to improving the public awareness and the image of coal and has provided resources needed to meet that need.

Michael K. Reilly, wearing dual hats as Chairman of the National Coal Association and Chairman & CEO of Zeigler Coal Holding Company, spoke at the first-day luncheon. The world's coal industries have survived crises before, he said, dating back to an edict by King Edward I in the 1300s warning of the hazards of coal. Coal has met the challenges posed by the Clean Air Act, and will meet the new challenges of the 1990 amendments. Natural gas, today's energy "darling," is still viewed suspiciously by the utility industry, which is wary of its availability and future costs. Reilly pointed out that while this nation has more than a hundred years' supply of coal, we know only of an eight-year supply of gas.

Coal today does suffer from an image problem, Reilly noted. And the key to improving that image is to make people aware of technology. It is technology—in both mining productivity and in utilization—that has kept coal as an option and has carried it from crisis to crisis. Improving public awareness of the benefits of clean coal technologies is the key to bridging the gap between the perception and reality of coal.

Luncheon speaker Michael K. Reilly, Chairman & CEO, Zeigler Coal Holding Co., discussed coal as a fuel of choice and necessity, noting improved public awareness of the benefits of CCTs is the key to bridging the gap between the perception and reality of coal.

At the luncheon on the second day of the Conference, David Crikelair, Vice President of Texaco, focused his remarks on the international markets for clean coal technologies, especially in developing nations. In these nations, he said, the major concerns are to improve the balance of trade, economic stability, and economic growth. To the extent that there are environmental concerns, they are lower priorities and nations struggling economically are reluctant to pay a premium for environmental benefits. Another factor to consider, he noted, is that there are limited funds for these projects, and limited guarantees.

Despite these odds, Crikelair continued, good projects can and will happen, and he pointed to a unique coal gasifica-

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Editor: Arvid Strom
Assoc. Editor: Mary Jo Zacchero

Comments are welcome and may be submitted to the Editor (FE-22)
(301) 903-2790
FAX (301) 903-9438

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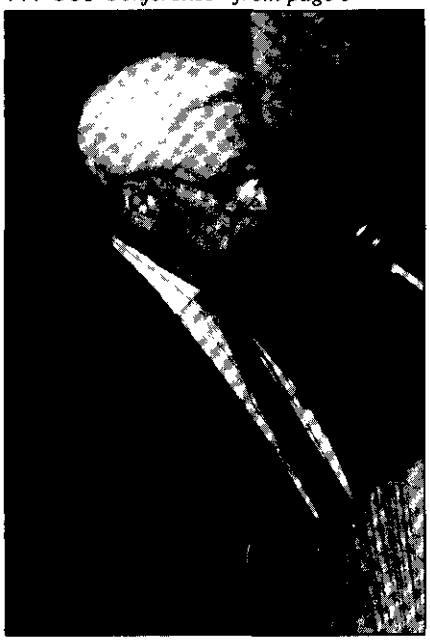

Moderator Lowell Miller, Assoc. Dep. Asst. Secretary for Clean Coal, U.S. DOE, addressed the second Plenary Session which discussed emerging issues and environmental concerns relevant to clean coal technologies.

tion power project being undertaken in the Czech Republic. The plant will gasify a mixture of 80% coal and 20% high sulfur resid to provide power and steam for a district heating plant. Texaco's partners in the project include Air Products & Chemicals, General Electric, Mission Energy, a Czech utility and a Czech refinery. Crikelair noted that China plans to build at least 10 gasification plants as part of its efforts to reduce ammonia imports and improve its balance of trade.

The concluding Emerging Issues and Environmental Plenary Session was chaired by Lowell Miller of DOE. Robert Long of the Global Climate Coalition spoke on global climate change and the role of CCTs. He believes that international CCT deployment is related to the controversial concept of "joint implementation." This would involve parties from both developed and developing nations cooperating to implement greenhouse gas-reducing measures, including installation of CCTs, at sites in developing nations, where greater benefits per dollar invested can be achieved than at sites in developed nations where plant efficiencies are already relatively high and pollution controls tight. He noted that the U.S. Action Plan is expected to encompass joint implementation.

Ian Torrens of EPRI addressed the status of efforts to define utility trace element emissions and risks. He reported the progress of EPRI's Power Plant Integrated Systems: Chemical Emissions Study (PISCES) in which a data base and model are being developed of the source, distribution, and fate of chemicals in both conventional and advanced fossil-fuel-fired power systems. By the end of 1993, EPRI will have acquired field test data from more than 20 power plant sites. In addition, PETC has under way a complementary program at 8 more locations. EPRI and EPA are jointly sponsoring a field validation test of full-scale power plant stack gas for mercury concentrations. EPRI's Comprehensive Risk Evaluation (CORE) project is integrating the information about trace substances, their behavior in the environment, and the particular way in which they might impact human health. EPRI expects to issue the Air Toxics Synthesis Report by late 1993.

Stephen Jenkins of TECO Power Services Corporation discussed CAAA compliance strategies and their impact on CCT deployment. He reported that under Phase I the majority of affected utilities are installing low-NO_x burners. However, least-cost options for SO_2 compliance generally involve switching to lower sulfur coals and using emissions credits. Scrubbers and CCTs that control SO_2 are being installed in relatively few power plants under Phase I. He concluded that the major U.S. markets for CCTs will expand toward the end of the first decade in the next century in response to Phase II requirements, the need to repower aging power plants, and the need for increased generation capacity.

David Eskinazi summarized EPRI's NO_x control technology program and presented the emissions reduction potential, capital cost, operating cost, and application issues relating to low-NO_x burners, low-NO_x burners with overfire air, reburning, selective non-catalytic reduction, selective catalytic reduction, and combined NO_x/SO_2 reduction technology. He described the

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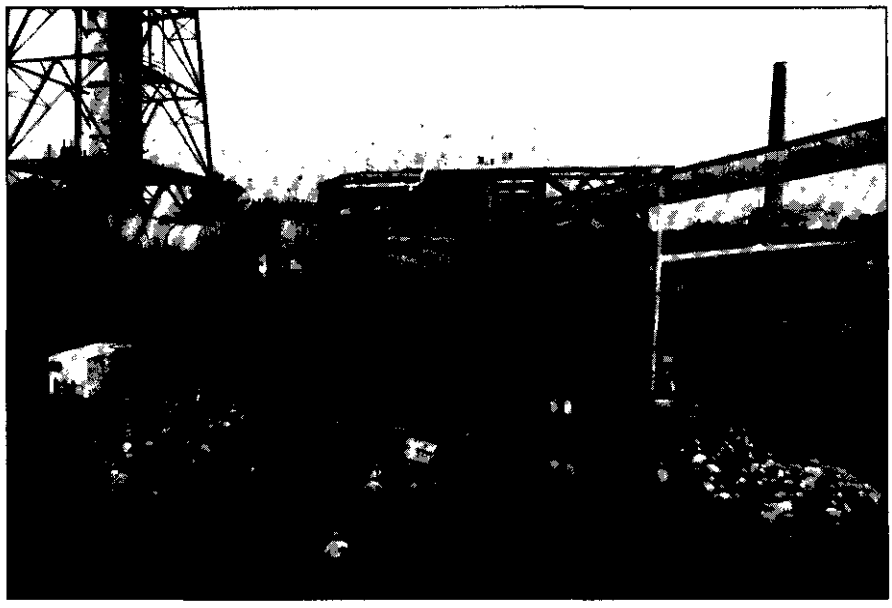

Groups of conference attendees toured the 100 MWe, CT-121 advanced flue gas desulfurization facility at Georgia Power Co.'s Plant Yates, Newnan, Georgia. At center of photo is the novel jet bubbling reactor, left is the flue gas stack, both constructed of fiberglass.

CCT Markets Session Examines Market Opportunities at Home and Abroad

In the CCT Market session chaired by Herbert Wheary, Chairman, Utility Advisory Committee, Southern States Energy Board, both utility and independent power representatives presented their perspectives on the domestic and international markets for clean coal technologies.

George Preston of the Electric Power Research Institute outlined the evolution of the domestic utility market structure through the next century. He highlighted several of the key market factors -- more sophisticated customers, utility mergers, the rise of nonutility generators, changing financial approaches, and major regulatory changes.

Preston said that rapid technology changes, that make generating systems obsolete long before the end of their 30-year life, may shorten the economic life of power plants and actually inhibit commercial deployment of CCTs. Technologies that can be built in replaceable modules may be advantageous in some conditions, allowing new technology to replace an obsolete module to keep a unit's generating cost competitive.

Steven Fluevog, Georgia Power Company, spoke about the impact of integrated resource planning on supply-side options. He noted that cost is and will continue to be the key hurdle for CCTs.

Southern Company Service's Ray Billups looked at the impacts of federal energy policy on utility planning, and concluded that, to remain competitive, utilities will need to be more involved in electric wholesale generation, electric vehicles, and demand side management.

Paul Ashline of Pure Air outlined his company's own-and-operate approach to keeping costs competitive, which lowers the utility costs by sharing in the benefits of the technology's performance.

Barry Worthington of the United States Energy Association reviewed opportunities for CCT deployment throughout the world. He pointed out that a rapid increase in worldwide energy demand is projected over the next 30 years and that most of that growth will be in non-western countries with sizeable coal resources, such as China, India, and Thailand. At the same time, he said, environmental movements are rapidly emerging in these same countries, and, with coal's poor public image, there is going to be resistance to any new coal-based energy facility siting. Worthington also observed that there is much uncertainty in these nations about matters such as regulatory structure, environmental regulation, and the changing public/private structure of the utility industry.

Looking at the world from the perspective of independent power, Chris Iribe of U.S. Generating Company said that because lenders are averse to risk, IPPs will generally avoid new technologies. And, at current prices, gas-based generation systems are preferable to coal systems. In international markets, however, he noted that coal is the fuel of choice for power generation because most countries lack the type of gas infrastructure needed to support widespread gas generation of electricity.

Applied Energy Services' Roger Naill also discussed foreign markets for CCTs and presented a case study of international deployment, noting in particular that China and India are potentially huge CCT markets. Strategies for deploying CCTs in foreign markets include building new capacity additions and participating in privatization by buying existing power plants. Other measures that could help CCTs in the international arena include 1) encouraging countries to tighten environmental standards similar to those in the U.S. and Europe, 2) lowering the cost of CCTs to be competitive with conventional technology, and 3) finding third party sources of funding for the premium cost of CCTs. CCT

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NO_x compliance planning process which involves assessing NO_x regulations, characterizing existing units, evaluating commercially available options, considering system-wide factors, and selecting and installing controls. Planning objectives are to meet emissions compliance, minimize cost, maximize reliability, and retain flexibility.

Joseph Van den Berg of the Edison Electric Institute discussed state externality trends. He highlighted some of the barriers to utilities accelerating technology adoption: cost-effectiveness tests exclude productivity benefits, state laws and regulations, prudence issues, promotional practices and load building restrictions, economic development and customer retention. Key changes are occurring in the utility industry: capacity margins are down; generation, transmission, and distribution construction expenses are up; nonutility generators are up; transmission access is increasing; and utilities are downsizing. He concluded with an overview of the direction of other utility industry changes, such as changes from regulation to competition; from economic regulation to environmental and social regulations, from cost pricing to market pricing, and from supply orientation to demand orientation.

Craig Harrison of Hunton & Williams presented regulatory issues that may affect the future development of CCTs. Key issues concern (1) potential for

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Delegates Exchange Plans for Coal at International Roundtable Forum

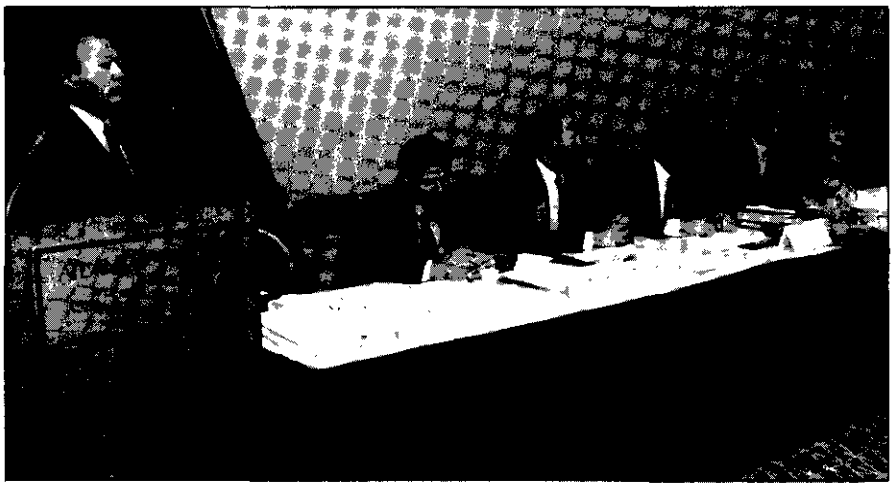
Deployment/Outreach Panel Addresses Opportunities for Commercial Success

"Now that we know that these technologies work, will anybody buy it?" That's the question Ben Yamagata, Executive Director of the Clean Coal Technology Coalition, asked of his panel on Technology Transfer and Deployment on the second afternoon of the conference.

Robert Porter, Director of DOE's Fossil Energy Office of Communications, began the discussion with an outline of the challenges clean coal technologies face from the general public in the United States. Coal is fundamentally important to the nation's energy future, he noted, but that future is by no means assured. Indeed, coal has been losing ground with the public over the past decade. What coal's future hinges almost solely upon is the public's understanding of the benefits of clean coal technology, and Porter continued that such an understanding will be achieved not with a national media campaign, but rather a grass-roots level effort focused on influential local citizens.

Porter reviewed nearly 20 years of polling data on public attitudes toward energy and coal, and told the audience that while there is no linkage in the public's mind between economic growth and reliable energy, there is a clear link between energy and the environment. Polls show that "*environmentalism has moved beyond being a cause celebre -- something to protest about. Instead, it has become a core value of Americans.*" Porter, therefore, recommended that an outreach program be focused on coal's environmental, not its energy security, attributes. He pointed to the formation of CEED as a real "glimmer of hope," as a group "willing to work at the grassroots -- in areas where key decisions regarding coal are on the near term horizon."

In his remarks, Yamagata outlined an approach endorsed by the CCT Coalition designed to help assure commercial acceptance of new technologies. Such an "enhanced CCT program" would help move previously demonstrated technologies into the marketplace by helping to assume some of the financial risk. The government would help fund projects that represent a clear "innovation or evolution from past demonstrations" but at a much smaller cost-sharing ratio than with previous projects.



Standing, Ben Yamagata, Exec. Dir., Clean Coal Technology Coalition, moderator for the CCT Deployment/Technology Transfer/Outreach Session. Seated L to R: Robert Porter, Dir. Office of Communications, Fossil Energy, U.S. DOE; Stuart M. Dalton, Program Mgr., SO_2 Control Program, Elec. Power Research Inst.; David W. South, Program Mgr., Argonne Nat'l Lab.; Ted Atwood, Off. of Clean Coal Tech., U.S. DOE.

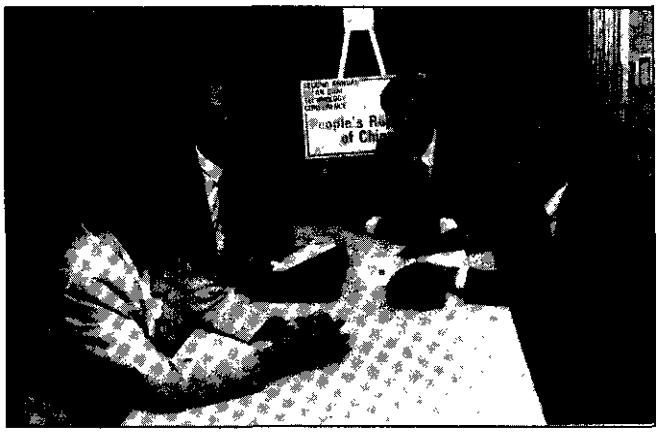
Looking at overseas markets, Yamagata cited projections that showed that 45% of the additional capacity built by developing nations in 1990-2000 will come from coal. China, particularly, with 950 billion tons of proven reserves, will rely on coal, with India not far behind. For the most part, these nations will be content with cheap, abundant energy, and are unwilling to pay much of a premium for pollution control. Yamagata estimated the projected market for clean coal technologies to be between $210-750 billion, or about $20 billion a year.

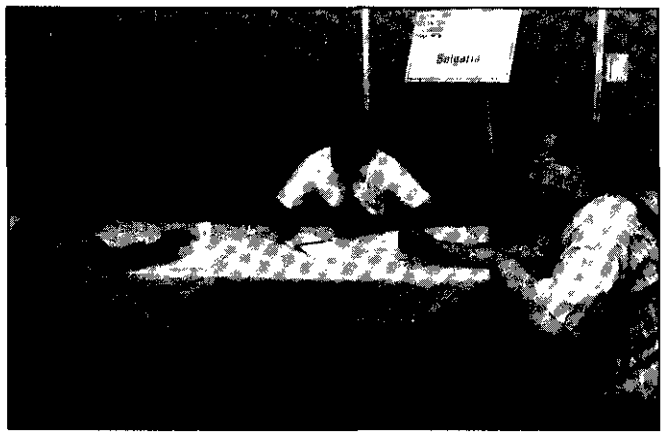
Ted Atwood, from DOE's Office of Clean Coal Technology, brought the audience up-to-date on DOE's implementation of the Energy Policy Act's international clean coal technology provisions. Atwood outlined a twofold approach designed to serve two objectives.

The first objective would be to demonstrate a few advanced "showcase" technologies—that have already been demonstrated in the U.S. but still maintain some risk along with significant potential for replication—in key market areas. Government financing would be available up to 50% of the eligible capital and operating costs along with repayment provisions, providing a source of financing not obtainable through the commercial markets.

The second approach would be focused on those technologies not yet available in host countries. DOE would sponsor so-called "project definition" activities, such as the engineering and design needed to support an adequate cost estimate for financing, developing

See "Panel" on page 14 . . .





The Deployment/Technology Transfer/Outreach Session provided an opportunity for international delegates from Eastern European countries, the Russian Federation and Asian countries to address the session, and for individual countries to enter into roundtable discussions regarding strategic plans for coal and clean coal technologies in their respective countries. This informal international exchange of information was a highlight of the conference.

Clean Coal Program participants, including the U.S. DOE, provided exhibits of their technologies and programs. The luncheons again provided opportunities for informal exchange of views and global information. Photos show Deputy Secretary William White and Acting Assistant Secretary for Fossil Energy Jack Siegel, U.S. DOE, exchanging views with delegates from foreign countries. Also shown is the DOE exhibit.

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to hear from you (contact U.S. DOE, FE-22, Washington, DC 20585, FAX: (301) 903-9438, Phone: (202) 586-6503 or (301) 903-2790).

In other news, Nevada's Public Service Commission approved construction of **Sierra Pacific Power Company's** planned 95-megawatt integrated gasification combined-cycle power plant in early November. In its decision, the Commission cited the advanced technology's "flexibility, diversity, and reliability" as compared to other technologies considered by the utility. The project will demonstrate M.W. Kellogg's air-blown, fluidized-bed gasifier.

A major roadblock to the **Alaska Industrial Development and Economic Authority's (AIDEA) Healy, AK, project** was cleared on November 12 when the federal Departments of Interior and Energy reached agreement with AIDEA and the Golden Valley Electric Authority to move forward with the project. Under the agreement, the National Park Service will drop its objections to the proposed plant—based largely on its potential impact on air quality in nearby Denali National Park—and the utility agreed to clean emissions from an existing plant at the same time. DOE issued the final EIS on December 15, 1993.

"A Change is in the Air" was the theme at the recent inauguration of the **Milliken Clean Coal Technology Project** now under construction at **New York State Electric & Gas's** (NYSEG) Milliken Station on the eastern shores of Cayuga Lake near Lansing, NY. Among the featured speakers was U.S. Representative Sherwood Boehlert (R-NY). All project participants provided articles for a time capsule that was placed in the foundation of the project's construction. Donated items included present day air samples from the Finger Lakes area and water samples form the Adirondack Mountains that can be compared to samples 20 years from now when the capsule is opened.

DOE also announced this quarter that it had approved a request by **Air Products & Chemicals, Inc.,** to move its proposed methanol demonstration project from the Cool Water Coal Gasification plant in California to Eastman Chemical Company's chemical processing complex in Kingsport, TN. The advanced coal-to-methanol process is expected to be useful in producing oxygenated additives for gasoline . . . And in York, PA, the Township Board of Supervisors approved a provision clearing a major local hurdle for the proposed project by **York County Energy Partners**. The night before, DOE held its second public scoping to allow the local residents a full opportunity to air their concerns.

Ohio Power Company's 70-megawatt Tidd pressurized fluidized-bed combustion plant reached another milestone on October 25 when it achieved its 5,000th hour of coal-fired operation. On-going tests are investigating alternate coals and sulfur sorbents. In a related item, the **Pittsburgh Coal Conference's Pitt Award** for innovation in coal science has been presented to Dr. James Markowsky, vice president of engineering and construction at the American Electric Power Service Corporation. Markowsky was honored for his involvement in the development of pressurized fluidized bed combustion systems.

Bethlehem Steel began construction activities for demonstrating direct injection of granulated coal into two blast furnaces at its **Burns Harbor, IN**, plant. All concrete forms were scheduled to be in place before winter, with structural steel and major vessels scheduled to arrive by barge before Lake Michigan traffic shuts down for the year.

TEXPAR Corporation of Waukesha, WI, has found a buyer for 250,000 gallons of liquid product from **ENCOAL Corporation's** mild gasification demonstration plant located near **Gillette, WY. Dakota Gasification Company** will use the liquid to fuel primary boilers at its Great Plains Gasification Plant in Beulah, ND.

Texaco Inc. of White Plains, NY, and Energy International Corp. of Pittsburgh, PA, are conducting pre-investment studies of international clean coal projects with funds made available by the Department of Energy through the **Federal International Energy Trade and Development Opportunities Program** (FIETOP). Energy International received $200,000 to help support an analysis of using methane gas underground coal gasification to fuel a 250-megawatt gas turbine power plant planned for New Zealand. Texaco's $300,000 grant will be used to study the feasibility of the commercial installation of an IGCC cogeneration plant at an oil refinery in the Czech Republic.

FIETOP was formed to support international clean coal technology projects that improve efficiency, reduce pollution and provide opportunities for U.S. exports. Applicants must show that their projects have a high potential for success and contribute 50 percent of the cost. DOE hopes to use these studies to develop international energy-related trade opportunities for U.S. industry, while assuring sustainable economic development in foreign countries. Applications should include a description of the proposed project and estimated costs, along with a scope of work and a budget. For further information, contact Peter Cover, FE-4, U.S. Department of Energy, Office of Fossil Energy, 1000 Independence Avenue S.W., Washington, DC 20585, (202) 586-7297.

The **Industrial Commission of North Dakota** has completed a study conducted by Bechtel Corporation which indicates potential marketing opportunities for up to 11.7 million tons of upgraded lignite in Minnesota and Wisconsin. The *Upgraded Lignite Market Assessment Study* concluded that there are three general areas of opportunity for upgraded lignite: blending stock with high-sulfur bituminous coal to meet sulfur emissions regulations; premium fuel to replace high-sulfur bituminous coal; and primary coal to replace subbituminous coal. Additional information is available on lignite research and development funding in North Dakota—contact Marc Conrad, (701) 258-7117.

CCT

Status of Clean Coal Technology Demonstration Projects

American Electric Power. Tidd PFBC Demonstration Project. (Brilliant, OH)
Continuous runs of 26 days and 22 days were completed during the September through November time period. To date, the plant has logged approximately 5,500 hours of coal-fired operation, including some 1,800 hours of operation with hot particle filters on a slipstream.

CQ, Inc. Coal Quality Expert. (Homer City, PA)
All six field tests were completed in late-April, with the sixth and final test at Brayton Point, Massachusetts. A fully functional Coal Quality Expert prototype that will predict the impact of coal quality upon boiler operations, maintenance, bus bar costs, and emissions is scheduled for completion by March 1994.

EER Corporation. Enhancing the Use of Coal by Gas Reburning and Sorbent Injection. (Hennepin and Springfield, IL)
Illinois Power has decided to retain the Gas Reburning system at Hennepin for possible use in 1995 for NO_x control. Other removal and restoration has been completed. Work continues on the report of the results of long-term testing. At the Lakeside Station of City Water Light & Power in Springfield, IL, parametric testing of gas reburning, sorbent injection, and combined gas reburning-sorbent injection has been completed. The optimum operating conditions were established for the one year long term testing program which began on November 15, 1993. The completed parametric and initial long term results show that the goals of 60% NO_x reduction and 50% SO_2 reduction are being met.

Rosebud Syncoal Partnership. Advanced Coal Conversion Process Demonstration (Colstrip, MT)
The Advanced Coal Conversion Process Demonstration facility underwent a complete maintenance turnaround from June 6 to August 13, 1993 which reestablished dual train operation. Also, a new fines conveying, cooling and loadout system was installed. Shipments of the up-grade "SynCoal" product to several Midwest utilities and industrial customers are being made for handling tests and test burns. Since tests began, the plant has processed more than 160,000 tons of raw coal and is now operating at full capacity.

York County Energy Partners. Circulating Fluidized Bed Cogeneration Project. (North Codorus Township, PA)
A continuation of the August 19 public scoping meeting was held on October 5. The public comment period for scoping the Environmental Impact Statement closed on November 5. A draft EIS is now being prepared by DOE. The North Codorus Township Board of Supervisors has granted a Land Development and Subdivision approval for the preliminary project plan. Metropolitan Edison has officially approved the project's move from West Manchester Township.

ABB Combustion Engineering. IGCC Repowering Project. (Springfield, IL)
Efforts continue to address the high capital cost projection for the project.

ABB Combustion Engineering. SNOX Flue Gas Cleanup Project. (Niles, OH)
The plant continues to operate smoothly in meeting or exceeding the goal of 95% SO_2 removal and reduction of over 90% of NO_x emissions while producing a high purity sulfuric acid. The unit has accumulated over 7,000 hours of operation, and 4,800 tons of acid have been sold. Operations will continue until December 1994. The host company, Ohio Edison, will operate SNOX after the demonstration project has been completed.

American Electric Power Service Corp. PFBC Utility Demonstration Project. (New Haven, WV)
Value engineering activities are continuing to refine the preliminary design for a 340-MW greenfield plant.

Babcock & Wilcox. Coal Reburning for NO_x Control. (Cassville, WI)
Results of parametric and optimization testing with bituminous coal show that NO_x emissions are reduced by 50-55 percent between full load (110 MW) and 70 MW. From 70 to 40 MW the NO_x reductions range from 50 to 35 percent. Results of reburn testing on western coal are better than those obtained on bituminous coal. All testing, including air toxics emissions testing, is complete. Wisconsin Power & Light has accepted ownership of the reburn retrofit.

Babcock & Wilcox. SNRB Flue Gas Clean-Up Project. (Dilles Bottom, OH)
This project is now in the data analysis and reporting stage. All test work has been completed except for chemical analysis. Preliminary economic analyses indicate that this combined, three-pollutant control process will cost less than a combination of the three separate flue gas clean-up processes—wet scrubbing, SCR and pulse-jet baghouse.

Bethlehem Steel Corp. Blast Furnace Granulated Coal Injection. (Burns Harbor, IN)
Detailed design is nearing the 90 percent completion mark. Plant construction was initiated on September 7. All concrete forms were expected to be in place by mid-November. Shipping of critical structural steel and storage silos via Lake Michigan barge is expected prior to normal winter closing of lake traffic in late December.

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

Passamaquoddy Tribe. Cement Kiln Flue Gas Recovery Scrubber. (Thomaston, ME)
Final reports on the project are being prepared.

Pure Air. Advanced Flue Gas Desulfurization Demonstration Project. (Chesterton, IN)
The FGD scrubber is operating and has demonstrated the capability to reduce SO_2 emissions by greater than 95 percent, thereby removing some 60,000 tons of SO_2 on an annual basis. Byproduct gypsum is 97 percent pure and is being sold to U.S. Gypsum. Air toxics sampling has been conducted; laboratory analyses are underway. Tests with 3-3.5 percent sulfur coal and with 3.5-4 percent sulfur coal have been completed. Smooth operations are continuing.

Southern Co. Services. Chiyoda Thoroughbred 121 FGD Process. (Newnan, GA)
Preliminary results of long term testing, which began in March 1993, substantiated results achieved during earlier parametric

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testing, with SO_2 removal reaching a high of 98.7 percent. Particulate removal was greater than 99 percent and the limestone utilization rate is about 97 percent. Since the project came on line in October 1992, the scrubber has recorded 98 percent reliability and availability indices while logging over 6,000 hours of operation.

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

Long-term test data from operating the Low NO_x Concentric Firing System Level I, II, and III equipment (three basic air/coal feed configurations tested) indicated full load NO_x reductions up to 37, 40, and 48 percent, respectively, compared to the baseline emission data. A report has been prepared on the completed air toxics testing. Additional Level III tests have shown that increasing the fineness of the fuel significantly reduces the unburned carbon levels of the fly ash with no effect on NO_x emissions. Final reports were submitted in the last quarter of 1993.

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

Long-term testing of the Advanced Over Fire Air (AOFA), Low-NO_x Burners (LNB), and combined AOFA and LNB has been completed. Chemical emissions testing was completed in May 1993. Low-NO_x digital control system (LNDCS) preliminary engineering is complete, and selection of an Artificial Intelligence Software supplier is underway. Testing of the LNDCS with the software package is scheduled for the summer of 1994.

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

The nine reactor SCR facility start-up and shakedown were completed in June 1993. Catalyst loading was completed in late June 1993. Test operations are now in progress.

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

DOE approved Eastman Chemical Company's integrated coal gasification facility as an alternative host site on October 8, 1993. Project definition activities are underway.

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

Parametric tests have been completed and results indicate that the GSA is capable of 90+% SO_2 removal efficiencies. Air toxics testing has been completed. An economic evaluation has shown that the capital and operating costs are 31% and 20% less, respectively, than the corresponding costs for a limestone forced oxidation system. A recently published article in Power Magazine (October 1993) compares the GSA systems favorably to other dry and wet scrubbing processes.

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

Engineering and permitting efforts are proceeding. TRW completed combustor design verification testing in March, successfully firing a full-scale pre-combustor module using a newly designed coal feed system. DOE issued the final EIS on December 15, 1993.

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

Optimization testing was completed in July 1992; long term baseline testing is complete. NO_x emission reductions exceeded the 50 percent target level. Dayton Power & Light has accepted ownership of the LNCB™ retrofit.

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

Parametric testing using type S, pressurized dolomitic lime slurry injection indicated that SO_2 removals near 50% can be achieved. However, the 6-month continuous run encountered problems associated with the slurry injection nozzles. Therefore, Bechtel terminated the Clean Coal Demonstration July 1, 1993. Clean Coal Final Reporting is in preparation and Bechtel and Penelec are discussing the possibility of a follow-on demonstration with a modified CZD system, which would achieve the project goals.

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

The current project definition phase was extended by 12 months to allow completion of activities associated with the verification of hot particulate filter design and process economics.

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

The Gas Reburn system continues to operate in automatic load following mode with preliminary results indicating the 70% NO_x removal goal can be achieved.

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

The plant has been shut down in order to complete major modifications to the solids cooling system, rotating grate seals, water slurry fines handling system, and feed coal and solid product conveying systems. The plant is scheduled to resume operation in early January.

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

Parametric testing began in February 1993. Increased opacity levels as a result of LIFAC operation have caused some delay in parametric testing. Modifications were made to the ESP to correct the opacity problem and parametric testing has been completed. Optimization testing will start in January 1994.

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

Preliminary design activities continue. The design is now incorporating the results of pilot testing. In July 1993, NOXSO announced that the demonstration would not proceed at the planned Niles, OH, site. The sponsors are evaluating the possibility of an alternate site.

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

A combination of low-NO_x burners, overfire air, and furnace urea injection at full load resulted in up to 80 percent NO_x reduction. Duct injection of sodium based reagents resulted in up to 70 percent SO_2 reduction. Preliminary results of duct injection of calcium reagents with humidification resulted in up to 40 percent SO_2 reduction. Longer term integrated testing using duct injection of sodium based reagents is scheduled to begin in January 1994. All on-site Air Toxics Monitoring has been completed. Testing will be completed in mid-1994.

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

State of Florida hearings on the permits for the plant were held on October 13. No dissenting opinions from either State or county representatives were voiced. A second draft of the Environmental Impact Statement has been completed and comments have been returned to the Environmental Protection Agency (the Lead Agency for the EIS).

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

Project definition activities are continuing. Preliminary design of the coal cleaning plant is more than 95 percent complete. NEPA approval is expected in January 1994.

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

NEPA completed August 1993 with EA/FONSI. Design has been completed. Construction is about 85 percent complete.

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

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

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

Design and construction are expected to overlap for a short period, and construction should be completed in late Fall or early Winter 1994.

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

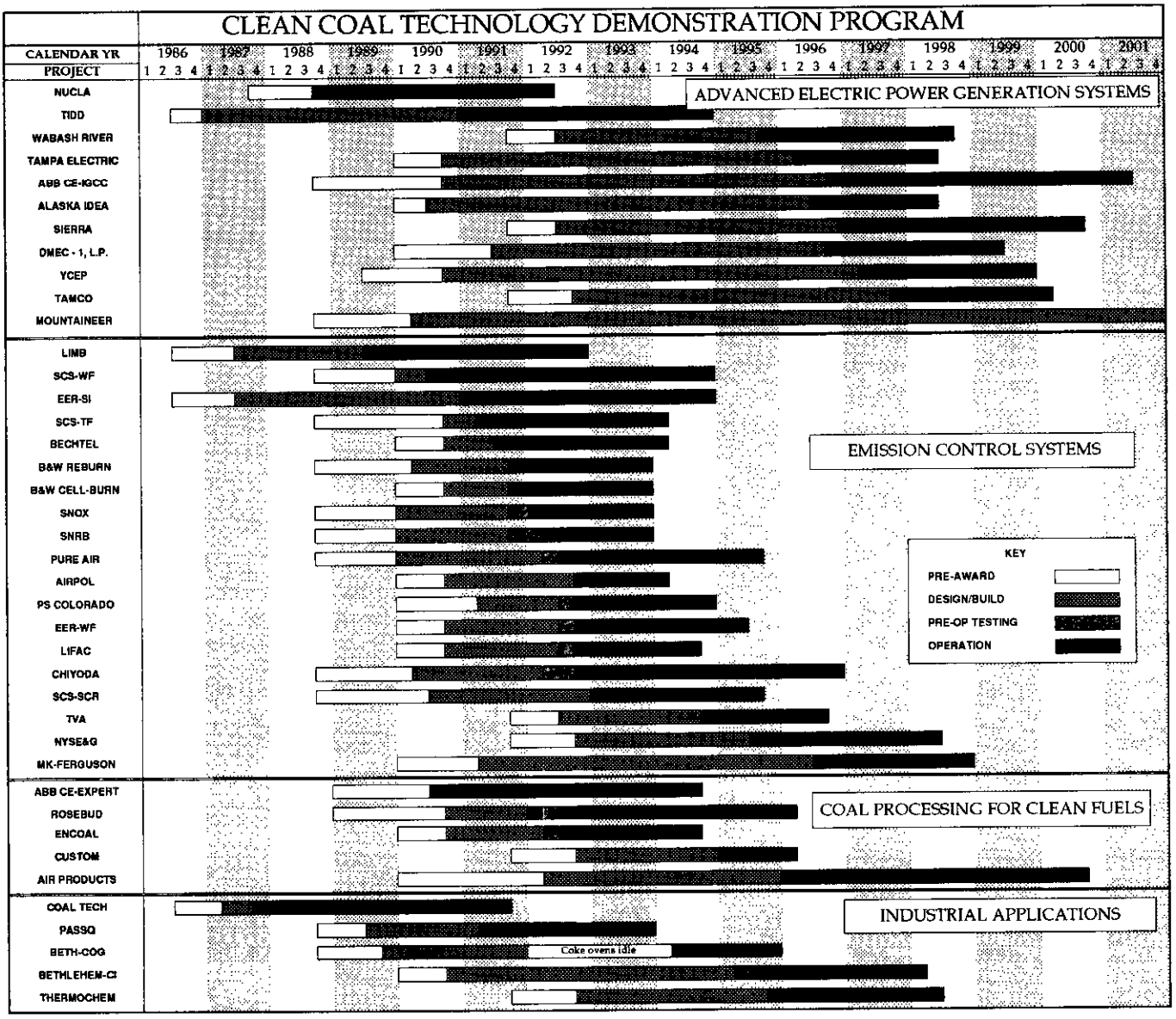
A preliminary design of the ThermoChem coal gasification demonstration plant integrated with the host K-Fuel facility was completed in April 1993. Test gasification of the design coal is underway at ThermoChem's Baltimore, MD facility.

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

The Public Service Commission of Nevada approved the project on October 25. A draft Environmental Impact Statement is being prepared by DOE.

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

Project design is approximately 90 percent complete. Site preparation work has been finished and construction is under way. Major equipment procurement is in progress. Design, supply, and erection contracts for steel support towers, data acquisition system, and coal handling system were awarded in September.



Upcoming Events

Date	Event	Contact
January 25-27, 1994	***University of Coal Research Reviewers Meeting*** Holiday Inn Airport, Pittsburgh, PA	Sean Plasynski (412) 892-4867
February 1994	***Technology Working Group Meeting for Utility Air Toxics Emissions Characterization***, Durham, NC	Chuck Schmidt (412) 892-4690
February 13-14, 1994	***1994 Spring Granular Flow Advanced Research Objective (GRFARO) Review and Planning Meeting***, Pittsburgh, PA	Sean Plasynski (412) 892-4867
March 23-24, 1994	***19th International Conference on Coal Utilization and Slurry Technologies,*** Sheraton Sand Key, Clearwater, Florida	John Winslow (412) 892-6272

CCT Reports Update

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

Sept 1993	Topical Report Number 3	*Reduction of NO_x and SO_2 Using Gas Reburning, Sorbent Injection and Integrated Technologies* (Contact Doug Archer, (301) 903-9443)
Jun 1992	DOE/MC/25177-3307	*Clean Coal Reference Plants: Atmospheric CFB (Topical Report, Task 1)*

The following papers, authored by DOE employees or CCT participants, were delivered at the Second Annual Clean Coal Technology Conference. The proceedings are available through NTIS. For further information, contact Doug Archer, Office of Clean Coal Technology, at (301) 903-9443. Papers delivered at other conferences, as indicated, are also included.

"Air-Blown IGCC=Clean Coal Power." Michael Schmid, TAMCO Power Partners.

"American Electric Power Pressurized Fluidized Bed Combustion Technology Status." Mario Marrocco, American Electric Power Service Corporation.

"DMEC-I Pressurized Circulating Fluidized Bed Demonstration Project." Gary E. Kruempel, Midwest Power.

"IGCC Demonstration Project Status: Combustion Engineering IGCC Repowering Project." Robert Glamuzina and Lawrence J. Peletz, ABB Combustion Engineering Systems.

"Piñon Pine IGCC Project Status - August 1993." E. Brent Higginbotham, Sierra Pacific Power Company.

"Tampa Electric Company: Integrated Gasification Combined-Cycle Project." Donald E. Pless, TECO Power Services.

"The Wabash River Coal Gasification Repowering Project: Program Update." Phil Amick, Destec Energy, Inc.

"York County Energy Partners COGEN Facility." Shoou-I Wang, Air Products and Chemicals, Inc.

"Demonstration of Bechtel's Confined Zone Dispersion Process at Pennsylvania Electric Company's Seward Station: Project Status." Joseph J. Batista, Jr., Pennsylvania Electric Company.

"Demonstration of Selective Catalytic Reduction (SCR) Technology for the Control of Nitrogen Oxide (NO_x) Emission from High Sulfur Coal-Fired Boilers." Scott Hinton, Gulf Power Company

"Design Methodology for a Micronized Coal Reburn System Using Modeling." Tom Kosvic, Radian Corporation.

"Enhancing the Use of Coal by Gas Reburning and Sorbent Injection." James C. Opatrny, Energy and Environmental Research Corporation.

"Gas Reburning and Low-NO_x Burners on a Wall-Fired Boiler." Henry M. Moser, Energy and Environmental Research Corporation.

"Initial Results of Parametric Testing on the Chiyoda CT-121 CCT Project at Georgia Power's Plant Yates." David P. Burford, Southern Company Services, Inc.

"LIFAC Sorbent Injection for Flue Gas Desulfurization." Juhani Viiala, Tampella Power Corporation.

"Measurement of Air Toxic Emissions from a Coal-Fired Boiler Equipped with a Tangentially Fired Low NO_x Combustion System." Edward B. Dismukes, Principal Chemist, Southern Research Institute.

"Performance and Operating Results from the Demonstration of Advanced Combustion Techniques for a Wall-Fired Boiler." John N. Sorge, Southern Company Services, Inc.

"Performance Results from the 35 MW SNOX Demonstration at Ohio Edison's Niles Station." Don Borio, ABB Environmental Systems.

"Preliminary Performance and Operating Results from the Integrated Dry NO_x/SO_2 Emissions Control System." Terry Hunt, Public Service Company of Colorado.

See "Reports" on page 14 . . .

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"Results of Babcock & Wilcox Company's Clean Coal Technology Combustion Modification Projects: Coal Reburning for Cyclone Boiler NO_x Control and Low-NO_x Cell™ Burner Demonstrations." Tony Yagiela, The Babcock & Wilcox Company.

"SOx-NOx-Rox-Box™ Demonstration Performance." Kevin Redinger, The Babcock & Wilcox Company.

"Status of the Milliken Clean Coal Technology Demonstration Project." Clayton M. Ellis, New York State Electric & Gas Corporation.

"The NOXSO Combined SO_2/NO_x Removal Flue Gas Cleanup System Commercial Demonstration." James B. Black, NOXSO Corporation.

"Update of Performance and Operating Results from Pure Air on the Lake's Advanced Flue Gas Desulfurization Demonstration Project." John Henderson, Pure Air.

"10 MWe Demonstration of Gas Suspension Absorption." Frank E. Hsu, Airpol, Inc.

"LIFAC Sorbent Injection for Flue Gas Desulfurization." J. Hervol, ICF Kaiser Engineers, Inc.; J. Viiala and T. Pokki, Tampella Power Corp.; and I. Huffman, Richmond Power & Light; *EPRI/EPA/DOE Sulfur Dioxide Control Symposium,* Boston, MA, August 1993.

"SO_x Emission Control with the SOx-NOx-ROX BOX." A.R. Holmes, K.E. Redinger, and G.T. Amrhein, Babcock & Wilcox; *EPRI/EPA/DOE Sulfur Dioxide Control Symposium,* Boston, MA, August 1993.

"Advanced NO_x Control Technologies." A. Sanyal, T.M. Sommer, C.C. Hong, B.A. Folsom, R. Payne, and W.R. Seeker, Energy and Environmental Research Corporation; and H.J. Ritz, U.S. Department of Energy; *Tenth Annual International Pittsburgh Coal Conference,* Pittsburgh, PA, September 1993.

"Flue Gas Humidification for ESP Performance Enhancement." R.A. Ashworth, R.Z. Beshai, H.E. Hill, C.C. Hong, J.C. Opatrny, R.T. Keen, A.Sanyal, and T.M. Sommer, Energy and Environmental Research Corporation; *International Joint Power Generation Conference and Exhibition,* Kansas City, MO, October 1993.

"HCl-HF Removal By Sorbent Injection In a Pulverized Coal Fired Utility Boiler Furnace." C.C. Hong, J.C. Opatrny, A.Sanyal, T.M. Sommer, and B.A. Folsom, Energy and Environmental Research Corporation; *International Joint Power Generation Conference and Exhibition,* Kansas City, MO, October 1993.

"ENCOAL Mild Coal Gasification Project: Plant Testing and Operation." James P. Frederick, ENCOAL Corporation.

"Rosebud SynCoal Partnership: Advanced Coal Conversion Process Demonstration Project." Ray W. Sheldon, Rosebud SynCoal Partnership.

"Self-Scrubbing Coal™: An Integrated Approach to Clean Air." Robin L. Godfrey, Custom Coals International.

"The Coal Quality Expert: A Focus on Slagging and Fouling." Richard Borio, ABB Combustion Engineering.

"The Healy Clean Coal Project: Design Verification Tests." Shiva Ubhayakar, TRW.

"Blast Furnace Granular Coal Injection." Daniel Kwasnoski, Bethlehem Steel Corporation.

"Demonstration of a Pulse Combustion in an Application for Steam Gasification of Coal." K. Durai-Swamy, ThermoChem, Inc.

"Industrial Pollution Control: 1993 Performance Update of the Recovery Scrubber." John McDowell, Pittsburgh Energy Technology Center/U.S. Department of Energy.

"Status of Air-Cooled Slagging Combustor." Bert Zauderer, Coal Tech Corporation.

. . ."CCT Conference" from page 5

standards of hazardous air pollutants from electric steam units, (2) remedial measures to attain ozone standards, (3) possible limitations on SO_2 and NO_x control strategies, (4) remediation and prevention of visibility impairment of Class I areas, (5) pressures to reduce health risks by tightening standards for SO_2, ozone, and particulates (PM-10), (6) action plan for measures to mitigate global climate change, (7) future of the unit modification (WEPCO) rule, and (8) pending rules for CAAA's repowering provisions. CCT

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supply and sales agreements, defining risks and approaches to mitigate risk, sufficient to obtain financing through the Export-Import Bank or other commercial lenders. DOE would provide these sources with the technical experts for evaluating investments and would help monitor the projects' technical progress.

Atwood observed that DOE is looking for feedback on this proposed approach from the clean coal technology community. CCT