



CLEAN COAL TODAY

A NEWSLETTER ABOUT INNOVATIVE TECHNOLOGIES FOR COAL UTILIZATION

PROJECT NEWS BYTES

The **Wabash River Coal Gasification Repowering Project** was recently selected for *Power Magazine's* 1996 Power Plant Award. The recipients are PSI Energy, Inc., and Destec Energy, Inc., along with the U.S. Department of Energy. The award is in recognition of building, operating, and funding a "next millennium power plant." The facility is the largest single-train coal gasification plant in the world and the first to include several advanced design features, e.g., an advanced-class gas turbine firing gasified coal and high-temperature, dry particulate removal at full commercial scale. Since the beginning of commercial operation late last year through mid-October 1996, the gasifier has accumulated about 2,000 hours of operation on coal. The combined cycle has operated over 1,400 hours on syngas, with the longest continuous run being

See "Project News Bytes" on page 8. . .

TAMPA ELECTRIC'S GREENFIELD IGCC READY FOR DEMONSTRATION

Tampa Electric Company (TEC) has reached a major milestone in its goal to bring clean, low-cost energy to the consumer well into the 21st century. Begun with an independent community plant siting effort, TEC in October initiated operation of a 250-MWe (net) Integrated Gasification Combined-Cycle (IGCC) system. This is the first increment of a planned build-out to 1,150 MWe at the new Polk Power Plant in Polk County, Florida.

The advanced IGCC system offers high efficiency, extremely low emissions, and saleable solids and liquids in lieu of wastes. In addition to using an



Aerial view shows Tampa Electric's 250-MWe greenfield IGCC unit at the Polk Power Station in Lakeland, FL.

environmentally advanced power generation technology, the project will convert some 1,500 acres of phosphate mining spoils to useable wetlands and uplands for native plants and animals. A total of 1,400 construction jobs and 75 new full-time jobs were created for operation and maintenance of the IGCC plant. Secondary jobs related to plant operation, such as coal truck drivers, also will result, and the local economy is expected to benefit from additional tax revenues of about \$7 million per year.

The project, funded under Round III of the Clean Coal Technology Demonstration Program (CCT Program), is a 50/50 cost shared partnership between DOE and TEC, with a total value of some \$286 million, the goals of which are to evaluate environmental, economic, and plant performance. Additional team members include: Texaco Development Corporation to provide the gasifier technology; General Electric to supply the combined-cycle system and hot gas cleanup; Bechtel Power Corporation to serve as architect and engineer; and TECO Power Services Corporation to manage the project. The DOE/TEC demonstration will span the first four years of plant operation.

The project began with an independent Community Siting Task Force comprised of environmentalists, educators, economists, and community leaders. The project site in southwestern Polk County was selected after

See "Tampa" on page 2. . .

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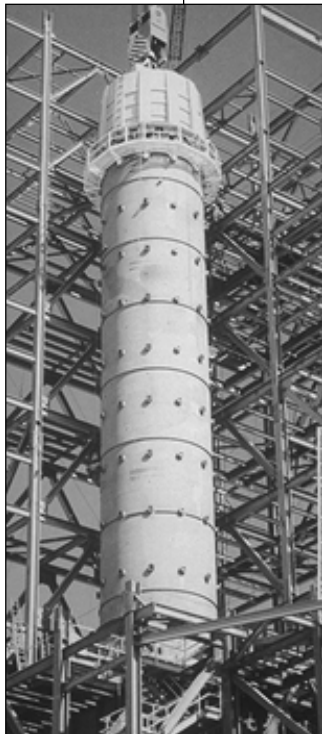
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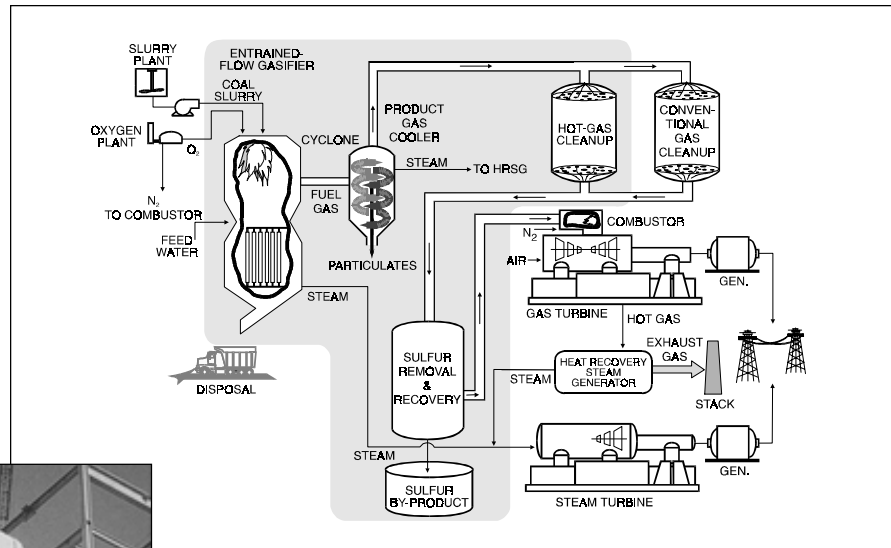
considering environmental and economic factors at 35 sites in 6 counties. Following an Environmental Impact Statement effort to assess and publicly discuss environmental consequences of the project, a favorable Record of Decision was issued in August 1994. The plant is constructed as a fully integrated, greenfield facility, and operates on Illinois No. 6 and Pittsburgh No. 8 coals averaging 2.5 to 3.5 percent sulfur. Key features include Texaco's pressurized, oxygen blown, entrained flow gasifier and General Electric's hot gas cleanup and advanced combustion turbine.

The technology that makes IGCC such an efficient and environmentally sound power generation system starts with Texaco's entrained flow gasifier. Under high pressure and temperature and in the presence 95 percent pure oxygen, the gasifier converts the coal to medium-Btu gas and the ash component to an inert, glassy slag useful in the construction industry. The medium-Btu gas is effectively stripped of sulfur compounds through a hot gas cleanup process that removes 96 percent of the sulfur.

The project is the first test of hot gas cleanup using an intermittently moving bed of metal oxide-based sorbent to remove sulfur-bearing compounds and residual dust from syngas produced by the gasifier. The technology developed by General



The 750-ton Radiant Syngas Vessel placed in the Polk Power Plant structure.



Electric will process about 10 percent of the syngas. Sulfur compounds captured by the metal oxide catalyst are removed in a separate regeneration unit and the processed catalyst returned to service. By operating at about 900°F, the system affords greater efficiency by avoiding heat loss through cooling.

The cleaned medium-Btu gas is injected along with 98 percent pure nitrogen into a General Electric Model MS 7001F(A) gas turbine for combustion to produce 192 MWe (gross). Hot exhaust gas from the gas turbine passes through a Heat Recovery Steam Generator, which produces steam to drive a 121-MWe (gross) turbine generator. This use of heat recovery to produce power, called combined cycle, is why high efficiency is achieved — about 20 percent greater than a conventional pulverized coal-fired plant with emission controls. Efficiency is estimated

at 39.7 percent and the heat rate is estimated at an impressive 8,600 Btu/kWh.

Sulfur retrieved from cleanup is processed to make sulfuric acid and is sold to the local phosphate mining industry. Another new feature of the process is the use of nitrogen as a syngas diluent to enhance gas turbine performance and reduce NO_x emissions. The nitrogen addition increases mass flow through the gas turbine, producing more power, and the pure nitrogen suppresses NO_x formation. NO_x emissions are expected to be controlled to below 0.27 lb/million Btu.

The Polk Power Plant will be one of the most efficient and environmentally responsive operations in the U.S., which will help to meet growing demand for base-load power at low cost. Low cost, reliable power combined with low emissions, and lower resource requirements will result in benefits to both rate payers and the environment. A successful demonstration at Tampa would provide the impetus for future use of IGCC technology both domestically and inter-

nationally.

PROJECT NOTES



- Tampa Electric Company is a wholly owned subsidiary of TECO Energy, Inc., an energy-related holding company with over 3,300 MWe of generating capacity, of which 97 percent is coal-fired.
- The project is located on a 4,400 acre site in Polk County about 45 miles southeast of Tampa and 7 miles south of Mulberry, Florida—the heart of central Florida’s phosphate mining region.
- About 1/3 of the site will be used for power generation, 1/3 transformed into useable wetlands and uplands, and the remaining 1/3 used for site access and a visual buffer.
- About 2,300 tons per day of coal, delivered by truck from TEC’s Big Bend transloading facility, will be processed in a single Texaco gasifier to produce 250 Btu/scf syngas.
- The plant is undergoing final check-out and startup efforts. Recent accomplishments include light-off of the gasifier on Pittsburgh No. 8 coal in July 1996, and the first production of power from clean coal syngas in September 1996.
- The demonstrated IGCC system is suitable for new power generation, repowering, and cogeneration applications. The low heat rate and low emissions (96 percent SO₂ capture with NO_x emissions reduced by 90 percent) make it very attractive for baseload applications.
- By-products from the process — sulfuric acid and slag — can be sold commercially. The sulfuric acid is valuable in chemical processing, and the inert slag in roofing shingles, asphalt roads, and as structural fill.



TWO PCFB PROJECTS RE-SITED TO LAKELAND, FLORIDA

On October 29, 1996, the Assistant Secretary for Fossil Energy approved transferring two cooperative agreements to the City of Lakeland to demonstrate “non-topped” and “topped” PCFB technology at Lakeland’s C.D. McIntosh, Jr. Power Plant Unit 4. The restructured project is the result of combining the DMEC-1 PCFB Demonstration Project (selected in CCT Round III) and the Four Rivers Energy Modernization Project (selected in CCT Round V). Until this decision, neither project had been sited and faced uncertain futures. A 157-MWe non-topped PCFB, which will begin operation in 2000, is expected to have an efficiency of approximately 40 percent. If successful, a 12-MWe topping cycle will be added to boost the total system to 169 MWe and the efficiency to about 47 percent. This topping cycle relies on a carbonizer to process coal into fuel gas and char. The char is fed into the PCFB, along with fresh coal and sorbent, while the fuel gas is cleaned and burned in a gas turbine. The system, which will remove more than 95 percent of the SO₂ emissions, will meet the region’s strict air quality standards without adding expensive scrubbers. The efficiency enhancements of both the topped and non-topped systems will result in a significant reduction in CO₂ emissions.

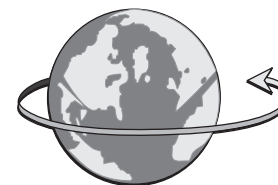
Technology suppliers are Foster Wheeler Energy Corporation, owner of both PCFB technologies, and Westinghouse Electric Corporation, which will supply barrier filters, and gas- and steam-turbine/generator technologies.

Total estimated cost of the project is \$405.3 million with DOE cost-sharing \$202.5 million, just under 50 percent. Combining the two projects at one site will save an estimated \$158 million (DOE share \$33 million). The City of Lakeland plans to complete demonstration of both the non-topped and the topped PCFB technologies in 2004. The first milestone for the project team is to complete the environmental permitting process by early 1998.

COMMERCIAL BRIEF

On October 22, 1996, ENCOAL™ Corporation announced that it is beginning permitting for a full-scale Liquids From Coal (LFC) plant in Campbell County, Wyoming, a project 15 times larger than the CCT demonstration project. ENCOAL™, one of the CCT Round III projects jointly funded by DOE, has successfully demonstrated the LFC process, which converts low-rank coals into two products: Process Derived Fuel, which is a low-sulfur clean coal product with a higher heating value than the source coal; and Coal Derived Liquid, which is a low-sulfur hydrocarbon liquid with distillate properties. ENCOAL™ is conducting permitting and engineering work on a plant that would have the capacity to upgrade some 6 million tons of feedstock coal annually. No construction date has yet been announced. In another commercial area, TEK-KOL, which owns and licenses the LFC process, is discussing options to license full-scale plants overseas. TEK-KOL Development Center has tested and analyzed 10 domestic and 21 foreign coals to determine the most promising candidate coals for LFC processing. Based on these tests, letters of intent for engineering and economic assessments are in place with two Indonesian companies, and other international opportunities are being developed.

INTERNATIONAL INITIATIVES



FE TO CO-CHAIR NEW U.S.-INDIA COAL ADVISORY GROUP

As a result of the Communique signed this August at the second annual round of U.S.-India Bilateral Energy Consultations in New Delhi, India, the U.S. Department of Energy, Office of Fossil Energy and India's Ministry of Coal will co-chair a newly created Coal Advisory Group to provide technical input in the areas of combustion cleanup, ash utilization, and other technical issues raised by the Bilateral Consultations that require clarification. U.S. industry associations will participate along with counterpart Indian groups.



Trade Mission to India — This photograph was taken during one of Energy Secretary Hazel O'Leary's two trips to India. The Secretary travelled to India in July 1994 as the head of a U.S. delegation on *Sustainable Energy and Trade*. She returned to India in February 1995 to conduct follow-up discussions.

The continuing series of consultations were initiated by a Memorandum of Understanding, signed in 1994, between Secretary O'Leary and the Government of India. The goal is to promote trade and investment in India's energy sector. The first set of talks was held in Washington, D.C., in June 1995. India has large reserves of high-ash coal, which result in inefficiencies in transportation, combustion, and waste disposal. Further, India is currently faced with a 20 percent shortfall in electric power, while plant load factors are considerably below the international average. Modernization, as well as additional capacity, are needed. The country is also experiencing problems in extending power to rural areas, and in upgrading and expanding transmission. India is successfully implementing a "fast-track" permitting process for large energy projects in order to encourage foreign investment.

The Communique, which related to a variety of energy areas including oil, natural gas, renewables, electric power, energy efficiency, and the environment, contained several important provisions for coal. In addition to forming the new advisory panel, the signatories:

- Agreed to continue studies on coal beneficiation and attempt to hasten commercialization;
- Endorsed the idea of a joint workshop on combustion efficiency to address an overriding need for more efficient power generation technologies;
- Agreed to establish a new coal ash subgroup to address utilization and recycling issues; and
- Agreed to assist in the establishment of a dialogue between the small but growing number of Indian independent power producers and their U.S. counterparts, as well as exchange information regarding mine safety and rescue, subsidence, and reclamation.

A unique feature of these bilateral talks was private sector input. A business round table, sponsored by the U.S.-Indian Business Council and the Federation of Indian Chambers of Commerce and Industry, met prior to the talks and developed recommendations for the Government of India for reforms in the electric power sector intended to streamline the energy permitting process, improve financing mechanisms, and restructure State Electricity Boards to operate more independently and speed privatization.

UPDATES TO THE FOSSIL ENERGY INTERNATIONAL WORLD WIDE WEB PAGES

The Office of Fossil Energy (FE) continues to expand and upgrade the information available through the FE Home Page, with the total number of web pages at the FE International internet site now exceeding 110. At the FE International web site, three new countries have



been added to the Western Europe page (Greece, Ireland, and Norway), and nine additional country pages have been added to the Africa page (Botswana, Egypt, Gabon, Kenya, Lesotho, Malawi, Mali, Swaziland, and Uganda). There now is a total of 18 Africa country pages at this site. Many other country pages have undergone incremental upgrades. Several pages now have links to specific DOE projects and activities, such as the details about the DOE/PETC MOU with two Republic of Korea research institutes. This information is available through the South Korea page on the Pacific Rim Region page. Also, there are newly added details about the DOE/FE Small Boilers project in the Krakow, Poland area, accessible through the Poland page on the Eastern Europe Region page. Details about the Fuels Evaluation Test Facility project in India, are accessible through the India page on the South Asia & Near East Region page. All of these sites can be reached through the Fossil Energy Home Page (<http://www.fe.doe.gov>), by activating the “international” hyperlink there.

CLEAN COAL TECHNOLOGY WORKSHOP IN INDIA

As an offshoot of the series of bilateral talks (see article on page 4), DOE’s Office of Fossil Energy (FE) and the Electric Power Research Institute sponsored an all-day clean coal technology workshop in September at the “Energy Summit ’96” Conference and Exhibition in Madras, India. The conference was sponsored by the Confederation of Indian Industry (CII) and attended by 700 delegates, of whom 110 attended the clean coal workshop. In 1994, FE participated in CII’s first conference by sending and staffing one of the clean coal technology exhibits, for which DOE won the “Best Participation” award.

Morning and afternoon technical sessions were conducted on “Advanced Power Generation” and on “Advanced Industrial and Clean Fuels Technologies,” and featured a broad range of coal-using technologies and approaches focused on describing how American coal and CCTs can contribute to cleanly and economically supplying India’s energy needs. In each session, the Indian viewpoint was reflected in opening remarks by notable Indian industrial dignitaries, and by technical presentations of the Indian perspectives on these approaches.

Indian officials had an opportunity to learn about how American CCTs may help address their short- and long-term energy problems — primarily the need for additional electric power. The conference focused on ways to provide electricity that is needed in the immediate short term (the next 7 years) and addressed ways to close the gap between supply and demand. Attendees agreed that there is a major potential market for CCTs in India. The CCT that holds the most promise is coal preparation, which is most immediately applicable, and most versatile with regard to the ability to handle a wide range of coal quality. Most India coal has a high ash content, which means that questions of disposal and/or recycling wastes are important impediments to overcome, coupled with funding difficulties.

Workshop proceedings are being prepared, and will be available from K. Harish, CII, 13, Harrington Road Chepet, Madras, India 600 031; FAX: 91-44-826 8438; Phone: 91-4-823 4019.

Following the Energy Summit workshop, DOE shared the latest information on CCTs through a clean coal exhibit and a paper presented at the Power-Gen Asia Conference and Exhibit in New Delhi.



CPICOR™ PROJECT AWARDED

On October 11, 1996, DOE awarded the last project selected in Round V of the CCT Program to the CPICOR™ Management Company, L.L.C., which is composed of subsidiaries of Centerior Energy Corporation, Air Products and Chemicals, Inc., and the Geneva Steel Company. The objective of the Clean Power from Integrated Coal/Ore Reduction (CPICOR™) Project is to demonstrate the integration of a direct iron-making process (COREX®) with the co-production of electricity using various U.S. coals in an efficient and environmentally responsible manner. The demonstration plant will produce 195 MWe (net) of electricity and 3,300 tons per day of hot metal. The project, including the operations phase, will last 76 months at a total cost of \$1,065,805,000. The DOE share will be 14 percent, or \$149,469,242.

The plant will be located at Geneva Steel's Vineyard, Utah plant. In the COREX® process, molten iron is produced by continuous reduction and smelting of iron ore in two integrated unit operations — a shaft furnace and a melter-pyrolizer. This combination is a new configuration, which uses a single integrated operation instead of separate coking and blast furnace processes. A nominal 3,300 tons per day of hot metal will be produced, while the clean, medium-Btu (220-225 Btu/scf) gas generated in the process will be used to fuel a combined-cycle power generation facility producing 195 MWe of net export power.

Because the COREX® process replaces the conventional coke oven plant and blast furnace used in virgin hot metal production with a single integrated operation, the emissions associated with conventional coke ovens are avoided. The COREX® process incorporates desulfurization by introducing calcined

limestone/dolomite to the gases rising from the melter into the reduction shaft furnace. Also, the reducing atmosphere in the melter minimizes formation of NO_x compounds. Particulate removal is accomplished with a wet scrubbing system.

In addition, the thermal efficiency of the CPICOR™ plant is over 35 percent greater than competing commercial technology when consideration is given to the production of both hot metal and electric power. The thermal efficiency of the COREX® process is 9 percent higher than the conventional coke oven/blast furnace, primarily attributable to the single, self-contained process that effectively retains and uses the heat generated in the process. (In the conventional process, the heat contained in the hot coke is lost in quenching.) In addition, the combined-cycle electric generating system achieves nearly 50 percent energy efficiencies compared to a maximum of 34 percent with conventional coal-based power systems with flue gas SO₂ scrubbing, for a 47

COMPARISON BETWEEN COREX® AND CONVENTIONAL IRON-MAKING PROCESSES

Air Emissions	Conventional	COREX®
Sulfur dioxide	6.6	0.5
Nitrogen oxides	2.4	0.046
Particulates	4.2	0.036

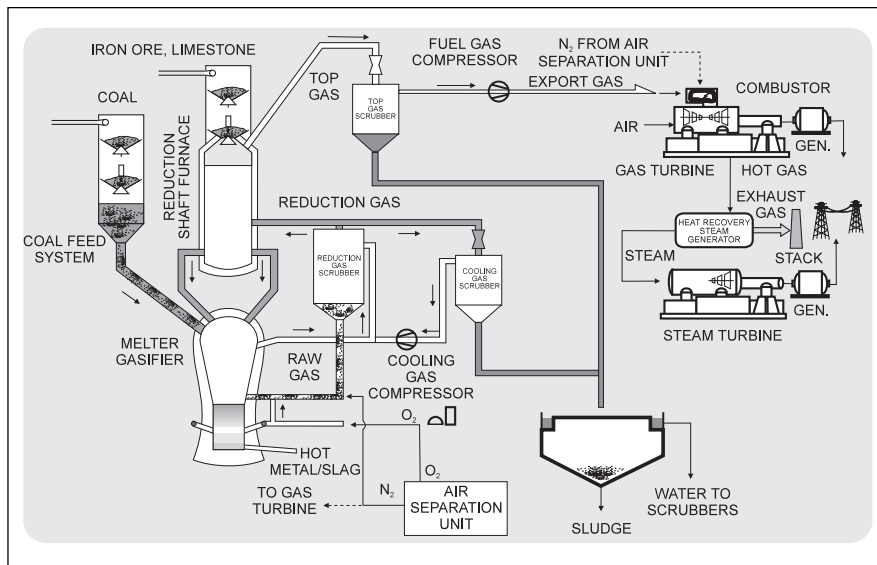
Air Emissions (pounds per ton of hot metal produced)

percent improvement. This energy efficiency is achieved by capturing waste heat from the gas turbine to drive a steam turbine.

As shown in the flow diagram, the three major systems of the CPICOR™ demonstration project are: 1) the COREX® Unit, supplied by Voest-Alpine Industrieanlagenbau GmbH.; 2) the air separation unit, which will be supplied by Air Products and Chemicals Inc. (APCI); and 3) the gas combined-cycle power plant, which will be supplied and marketed by both APCI and Centerior Energy.

In the COREX® process, the iron ore, along with additives, is introduced into the top of the reduction shaft and flows by gravity toward the bottom, from which it is moved to the top of the melter-pyrolyzer. Coal is introduced directly into the top of the melter, while oxygen is introduced through nozzles, called tuyeres, around the circumference of the melter, which is done to maintain a reactor temperature of 3,000°F. These reactions produce a medium-Btu “reducing synthesis gas.” After passing through a dust separation cyclone, the gas enters the bottom of the reduction shaft. The gas flows counter-current to the descending iron ore/limestone additives. In the reduction shaft, operating at 1,550°F, the iron ore is partially reduced to metallic iron, while the sulfur contained in the gas is retained by the highly reactive limestone additives.

The direct-reduced iron and additives are further reduced in the melter to form hot liquid metal and slag, which are separately collected. All excess synthesis gas from the process, which has been desulfurized by the limestone additives, is sent to a wet scrubbing system for particulate



Expansion of the existing iron-making capacity at the POSCO Pohang Works (Republic of Korea) using COREX® technology.

removal. This clean gas is then suitable for a conventional combined-cycle power generation system.

In the U.S., there are about 60 blast furnaces, all of which have been operating for more than 10 years (with some originally installed up to 90 years ago). These aging blast furnaces, as well as the coke ovens that fuel them, are subject to increasingly stringent environmental regulations.

Commercialization of the CPICOR™ technology will contribute greatly to growing domestic and international coal markets by using cleaner, more efficient technologies, while reducing U.S. dependence on foreign oil, coke, and raw iron. Replicating the technology also will provide a significant number of additional jobs for U.S. workers.

PUBLICATION AVAILABLE

More information on this project is available in “Comprehensive Report to Congress, Clean Coal Technology Program, Clean Power from Integrated Coal/Ore Reduction (CPICOR™) Demonstration Project.” The report, Document No. DOE/FE-0349, can be obtained from: National Technical Information Service, Springfield, VA 22161, 703-487-4650 (general public); or Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, 423-576-8401 (DOE and DOE contractors).

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151 hours. The Wabash Plant has not been problem-free however, which is typical for the first year of operation of new clean coal technology projects. Operating problems, which are being addressed through modifications and further testing, include reliability of the ceramic candle filters in the particulate cleanup unit, and deactivation of the carbonyl sulfide hydrolysis unit catalyst beds.

Bethlehem Steel Corporation (BSC) continues to steadily increase the coal injection rate in the main test unit at their Blast Furnace Granular Coal Injection plant in Burns Harbor, Indiana. They are currently finding stable operation and high iron production at a coal injection rate of about 300 lb coal/net ton of hot metal (#/NTHM) on the "C" Furnace, their primary test unit, which has a design rate of approximately 400 #/NTHM. Equally important is the drop in coke rate to almost 625 #coke/NTHM, which represents a significant savings from some 770 #/NTHM required without coal injection. An injection rate of approximately 200 #/NTHM is being achieved on their "D" Furnace which is well above its design point. It is expected that these rates will be maintained and improved as the test progresses continues. Such trends greatly decrease the cost of iron making and reduce overall coke requirements. Since these furnaces provide BSC's primary source of liquid iron (about 7,000 tons per day per furnace), it is critical to make incremental increases in coal injection without reducing either daily production quotas or product quality.

The **Piñon Pine Integrated Gasification Combined-Cycle Power Project** has reached an important milestone by successfully coupling the heat recovery steam generator

with the outlet of a 6FA combustion turbine and a steam turbine. Both electric generators have been fully synchronized with the grid such that the power island now is capable of producing up to 100 MWe using natural gas as fuel. Achieving this milestone essentially completes all work on the power island portion of this project. Sierra Pacific Power Company will now fully utilize this unit for dispatch purposes. In completing this milestone, overall construction progress has reached the 95 percent completion point. Startup of the gasifier island is ongoing, with full integration with the power island expected during the first quarter of 1997.

Rosebud SynCoal® Partnership (RSCP) was contracted by the U.S. Department of Energy, National Energy Technology Center (NETC) to provide 25 tons of upgraded high-sulfur sub-bituminous "C" coal for use in METC's coal gasification test program. The coal provided was a specific sized SynCoal® that was uncleaned and produced in the Advanced Coal Conversion Process (ACCP) facility in Colstrip, Montana. The product produced had five characteristics: > 11,000 Btu/lb; ash content of 13 percent (+/-2 percent); moisture content of 2 percent (+/-0.5 percent); volatile matter of 35 percent (+/-3 percent); and sulfur content of 1.75 percent (+/-0.5 percent). The ACCP plant had to be carefully adjusted and monitored to produce the product with the above specifications. The SynCoal® was sized to 14 x 60 mesh using DOE-supplied screening equipment. The finished product was shipped during October 1996 in 204 55-gallon barrels with lids and liners.

OTHER NEWS

Coal-fired power plants provide cheapest electricity. "The average production cost of electricity dropped below \$20 per megawatt-hour in 1995 for the first time since 1961," according to a newly released Utility Data Institute (UDI) report. The report includes generation, total production cost expense, total fuel expenses, and cost per megawatt-hour for almost 800 U.S. utility-owned power plants. The lowest-cost electric utility production plants are coal-fired, reported UDI. The weighted average production cost (including fuel) at the 793 power plants surveyed, was \$19.91/MWhr in 1995, down four percent from the previous year, dropping 14 percent since 1991. Some decreases are due to a decline in O&M and staffing expenditures, according to UDI.

The plants in UDI's database supply 88 percent of all U.S. utility-produced electricity. The plants surveyed were fired by coal (429), gas and/or oil (279), nuclear (71), and other fuels (14). Average production costs in 1995 ranged from \$18.78/MWhr for coal to \$37.70/MWhr for the oil-fired units. UDI's list of the 25 lowest-cost plants is composed of 22 coal-fired and three nuclear facilities. The lowest-cost nuclear plant came in ninth. The lowest-cost producer for 1995 was a two-unit coal-fired facility, which recorded a production cost of \$9.73/MWhr. The report ranks the top 100 least-cost plants in the United States by total new generation, average expenses per net megawatt-hour, and plant heat rate. For more information, contact UDI at (202) 942-8788.

OPPORTUNITIES FOR IGCC

Over 300 utility, industry, and international representatives attended the 1996 Gasification Technologies Conference, "Technology Advances in a Competitive Environment," held in San Francisco, CA, October 2-4, 1996. The newly formed Gasification Technologies Council joined the Electric Power Research Institute in sponsoring the conference. The Gasification Technologies Conference continues to be a leading conference on gasification applications for power, refining, and chemical and fuel applications, and the increased attendance continues to reflect growing domestic and international commercial interest in the technologies. Next year's conference also is planned to be held in San Francisco from October 6-8, 1997.

In his keynote speech, Robert S. Kripowicz, Principal Deputy Assistant Secretary for Fossil Energy, who spoke in place of Assistant Secretary Patricia Godley, characterized the Administration's global climate change policy as promoting innovation and development of cost-effective technologies.

CO₂ and global climate change, he indicated, would be the major drivers for post-2000 technology. Integrated Gasification Combined-Cycle (IGCC), whose efficiencies may top the 50 percent mark in the next few years, are "the power plants of the next millennium." Kripowicz summed up the progress of the DOE CCT program's three pioneering IGCC projects, all of which are becoming operational and are the forerunners of a new era of environmentally superior clean coal technologies.

Robert S. Kripowicz, Fossil Energy's Principal Deputy Assistant Secretary, characterized the Administration's global climate change policy as promoting innovation and development of cost-effective technologies.

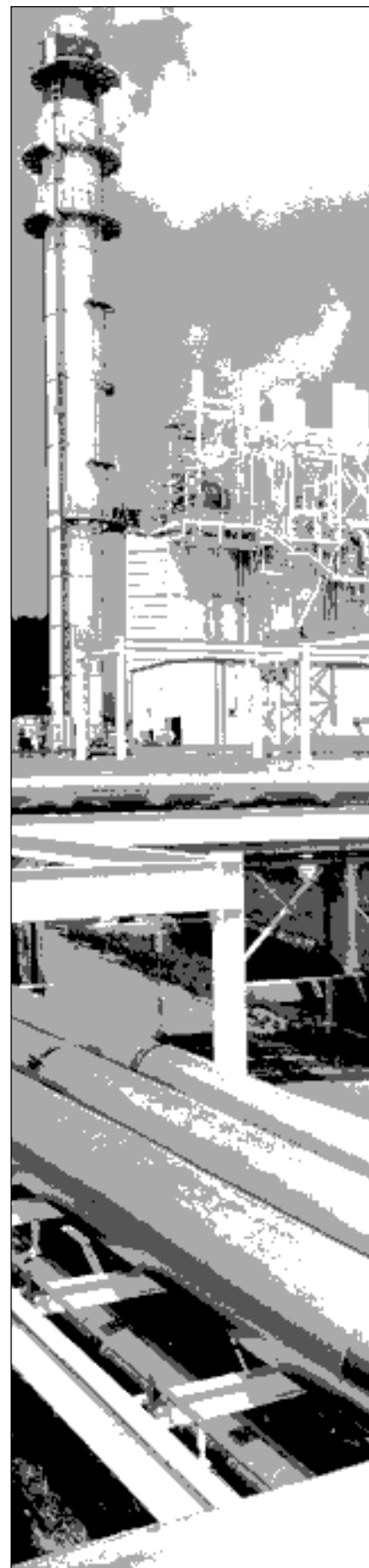
Wabash — 262-MWe, two-stage oxygen blown entrained-flow gasifier, dedicated in 1995 as the largest gasification combined-cycle power plant of its type in the world; located in Terre Haute, IN.

Tampa Electric — 250-MWe, oxygen blown, entrained-flow gasifier, located at a site where an abandoned phosphate mine was turned into a model of ecological reclamation; located in Mulberry, FL.

Piñon Pine — 99-MWe, air blown, fluidized-bed gasifier now in its final stage of construction, will use the world's first GE 6FA gas turbine; located in Reno, NV.

Some of the other projects that were discussed included Texaco Gasification Power Systems projects, one sited in Italy, and the El Dorado Gasification project in Kansas; the Demkolec BV IGCC project in Buggenum, The Netherlands; and the planned Api Energia Mission Energy 280-MW IGCC plant in Italy.

Conference participants, who spoke about a variety of experiences acquired while operating existing gasification projects (not all coal), emphasized the promise of IGCC while being aware of the economic challenges associated with penetrating the increasingly unregulated utility market. Based on the number of current projects coming on-line and planned, it appears that gasification technology is on the commercial horizon.



STATUS OF CCT DEMONSTRATION PROJECTS

ADVANCED ELECTRIC POWER GENERATION

The Appalachian Power Co. – *PFBC Utility Demonstration Project*. The project has been withdrawn.

DMEC-1 Ltd. Partnership – *PCFB Demonstration Project*. In combination with the **Four Rivers Energy Partners, L.P.** – *Four Rivers Energy Modernization Project*, these projects have been restructured and re-sited to Lakeland, Florida's McIntosh Unit 4. (Lakeland, FL)

The Ohio Power Co. – *Tidd PFBC Demonstration Project*. The project ended December 31, 1995. DOE released the Final Report and will close out the project after a final audit. (Brilliant, OH)

Tri-State Generation and Transmission Association, Inc. – *NUCLA CFB Demonstration Project*. The project was completed April 1992. (Nucla, CO)

York County Energy Partners – *ACFB Demonstration Project*. Discussions are under way with a major utility to re-site this project. (Site pending.)

ABB Combustion Engineering, Inc. – *Combustion Engineering IGCC Repowering Project*. The project has been withdrawn.

Clean Energy Partners, L.P. – *Clean Energy Demonstration Project*. The project is being restructured. (Site under negotiation for an east coast location.)

Sierra Pacific Power Company – *Piñon Pine IGCC Power Project*. The project is in its startup phase. By the end of 1996, plant construction had reached the 95% completion point. The power island was operating in the natural gas combined-cycle mode. The gasifier island was expected to begin firing by the first quarter of 1997. (Reno, NV)

Tampa Electric Co. *Tampa Electric Integrated Gasification Combined-Cycle Project*. Construction has been completed. The project entered operations in October 1996. (See feature article on page 1.) (Mulberry, FL)

Wabash River Joint Venture – *Wabash River Coal Gasification Repowering Project*. Since the beginning of commercial operation late last year through mid-October 1996, the gasifier accumulated about 2,000 hours of

operation on coal. The combined-cycle has operated over 1,400 hours on syngas, with the longest continuous run being 151 hours. (West Terre Haute, IN)

Alaska Industrial Development and Export Authority – *Healy Clean Coal Project*. Construction and engineering efforts are at a peak with construction about 70 percent complete. The installation of the stack and the spray dryer absorber, coal handling, and wastewater treatment, and the retrofit to Unit No. 1 (installation of low-NO_x burners and over-fire air) was completed on schedule. The installation of the slagging combustor and boiler systems is continuing. (Healy, AK)

Arthur D. Little, Inc. – *Coal-Fueled Diesel Engine Demonstration Project*. Representatives from DOE met with Alaskan environmental regulators in preparation for issuing an Environmental Assessment. (Fairbanks, AK)

Pennsylvania Electric Co. – *Externally Fired Combined-Cycle Demonstration 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_x Control*. The project is complete. The Final Report has been received. (Cassville, WI)

The Babcock & Wilcox Co. – *Full-Scale Demonstration of Low-NO_x Cell Burner Retrofit*. The project was completed in September 1995. The final report has been received. (Aberdeen, OH)

Energy and Environmental Research Corp. *Evaluation of Gas Reburning and Low-NO_x Burners on a Wall-Fired Boiler*. Testing was completed in December 1995. The Final Report is in preparation. (Denver, CO)

Southern Company Services, Inc. – *Demonstration of Advanced Combustion Techniques for a Wall-Fired Boiler*. Long-term testing of the advanced overfire air (AOFA), low-NO_x burners (LNB), and combined

LNB+AOFA systems are complete. Final testing of GNOCIS in a closed-loop configuration is still on hold due to unit unavailability. The project has been extended until March 1997 to allow completion of GNOCIS testing. (Coosa, GA)

Southern Company Services, Inc. – *Demonstration of Selective Catalytic Reduction Technology for the Control of NO_x Emissions from High-Sulfur Coal-Fired Boilers*. The project testing program was completed in December 1995. The final report has been finalized and was expected to be published at press time. (Pensacola, FL)

Southern Company Services, Inc. – *180-MWe Demonstration of Advanced Tangentially-Fired Combustion Techniques for Coal-Fired Boilers*. The project was completed in June 1994. The Final Report has been published. (Lynn Haven, FL)

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 Demonstration*. The Final Report is being prepared for distribution. (Seward, PA)

LIFAC-North America – *LIFAC Sorbent Injection Desulfurization Demonstration Project*. The Final Report is in preparation. (Richmond, IN)

Pure Air on the Lake, L.P. – *Advanced Flue Gas Desulfurization Demonstration Project*. Project operations are complete. The Final Report has been issued. (Chesterton, IN)

Southern Company Services, Inc. – *Demonstration of Innovative Applications of Technology for the CT-121 FGD Process*. The Final Report is in preparation. (Newnan, GA)

ABB Environmental Systems – *SNOX™ Flue Gas Cleaning Demonstration Project*. The project was completed in October 1995. The Final Report has been published. (Niles, OH)

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

The Babcock & Wilcox Co. – *SO_x-NO_x-Rox Box™ Flue Gas Cleanup Demonstration Project*. The project was completed in September 1995. The final report has been received. (Dilles Bottom, OH)

Energy and Environmental Research Corp. – *Enhancing the Use of Coals by Gas Reburning and Sorbent Injection*. Testing was completed for both Illinois Power, Hennepin Station, and City Water, Light & Power, Lakeside Station. The Final Report is in preparation. (Hennepin and Springfield, IL)

New York State Electric & Gas Corp. – *Milliken Clean Coal Technology Demonstration Project*. Heat pipe performance testing was done during June. Evaluation is in progress. Design coal FGD testing began in mid-May and will continue until Spring 1997. Full load NO_x testing of the LNCF III showed a 41 percent reduction in NO_x levels with an LOI below 4 percent. (Lansing, NY)

New York State Electric & Gas Corp. – *Micronized Coal Reburning Demonstration for NO_x Control*. Construction is 60 percent complete at the Kodak site, and burner modifications are ongoing at Milliken. Testing at both sites is scheduled to start in January 1997. (Lansing, NY and Rochester, NY)

NOXSO Corp. – *Commercial Demonstration of the NOXSO SO₂/NO_x Removal Flue Gas Cleanup System*. Design engineering continues on piping, electrical, and instrument systems. Contracts have been issued for duct work and piping tie-ins, rerouting of underground piping, and vessel fabrication and erection. Construction began in mid-1996. (Newburgh, IN) All materials have been received for the liquid SO₂ facility. Final assembly of piping, electricals, and instrumentation is under way. Commissioning is being completed as each system is mechanically completed. (Charleston, TN)

Public Service Company of Colorado – *Integrated Dry NO_x/SO₂ Emissions Control System*. Initial testing of the newly designed urea injection lance on the west side of the boiler was promising, and another lance was ordered. Integrated testing of the baseline sodium system with two of the newly designed urea injection lances is planned for October 1996. (Denver, CO)

COAL PROCESSING FOR CLEAN FUELS

CQ Inc. and ABB Combustion Engineering, Inc. – *Coal Quality Expert*. CQE was released in December 1995 and is now being offered commercially. The Draft Final Report has been submitted and is being reviewed. (Homer City, PA)

Custom Coals International – *Self Scrubbing Coal™: An Integrated Approach to Clean Air*. The plant continues to increase its availability as various process optimization progresses. The plant had processed a cumulative 483,600 tons of raw coal through October 31, 1996, producing 309,600 tons of clean coal with a clean coal quality averaging 8.74 percent ash and 0.92 percent sulfur. Power plant testing of Carefree™ Coal was scheduled for November 1996. (Central City, PA; Lower Mt. Bethel Township, PA; Richmond, IN; Ashtabula, OH)

Rosebud SynCoal® Partnership – *Advanced Coal Conversion Process (ACCP) Demonstration*. The ACCP demonstration facility continues to process raw subbituminous coal, producing over 850,000 tons of SynCoal® product to date. Nearly 777,000 tons of SynCoal® product has been supplied to customers, including industrials (primarily cement and lime plants) and utilities. Testing is in progress on the use of SynCoal® in Colstrip Project Units 1 and 2 in Colstrip, MT. (Colstrip, MT)

ENCOAL™ Corp. – *ENCOAL™ Mild Coal Gasification Project*. ENCOAL's plant continues to operate satisfactorily. To date, the plant has operated more than 12,000 hours on coal, and has shipped 3.0 million gallons of liquid product and 73,000 tons of solid product. (Gillette, WY)

Air Products Liquid Phase Conversion Company, L.P. – *Commercial-Scale Demonstration of the Liquid-Phase Methanol (LPMEOH™) Process*. Overall, construction is 92 percent complete. The erection of structural steel and installation of equipment and process piping is complete. The installation of electrical and instrumentation, fireproofing, painting, and grading and paving is continuing on schedule. Commissioning began in mid-October and operator training began in November. Construction is scheduled to be completed in late-December of 1996 with startup expected to begin in mid-January of 1997. (Kingsport, TN)

INDUSTRIAL APPLICATIONS

Bethlehem Steel Corp. – *Blast Furnace Granulated Coal Injection System Project*. The plant is operating smoothly above the new baseline coal injection rates of 275 lbs/net ton hot metal (#/NTHM) on "C" Furnace and 180 #/NTHM on "D" Furnace. The plant has evaluated one high volatile and three low volatile coal feedstocks. Coke rates on each furnace continue to decrease as operating experience improves. (Burns Harbor, IN)

CPICOR Management Company, L.L.C. – *Clean Power from Integrated Coal/Ore Reduction (COREX)*. The Cooperative Agreement has been signed. (See separate article on page 6.) (Vineyard, UT)

Coal Tech Corp. – *Advanced Cyclone Combustor with Internal Sulfur, Nitrogen, and Ash Control*. The project was completed in September 1991. The final report has been received. (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 is being restructured. (Gillette, WY)

NEW PUBLICATIONS

The following new reports will be available at the Fifth Annual CCT Conference to be held in Tampa, Florida, January 7-10, 1997.

Topical Reports

- No. 5 — Low-NO_x Burners, Sept. 1996
- No. 6 — Tampa Electric Integrated Gasification Combined-Cycle Project, Oct. 1996
- No. 7 — Wabash River Coal Gasification Repowering Project, Nov. 1996
- No. 8 — Piñon Pine IGCC Repowering Project, Dec. 1996

Bibliography

Clean Coal Technology Demonstration Program Publications, Presentations, and Papers Bibliography.

CCT CONFERENCE PREVIEW

The Fifth Annual Clean Coal Technology Conference, to be held in Tampa, Florida, January 7-10, 1997, will focus on presenting strategies and approaches that will enable clean coal technologies to resolve the competing, interrelated demands for power and economic viability in the face of environmental constraints to coal use in the post-2000 era. The program will address the dynamic changes that will result from utility competition and industry restructuring and considers the potential inherent in the evolution of markets abroad.

On Tuesday, January 7, the conference starts with an International Business Forum Brunch, to provide an opportunity to meet the international delegations, followed by a panel on options for financing projects and feasibility studies. Informal discussions will follow among the international delegations and U.S. business attendees. The afternoon will feature a tour of the Tampa Electric Company's 250-MWe Integrated Gasification Combined-Cycle Project, which started operations in October 1996 (see article on Tampa Electric's Greenfield IGCC, page 1). The first day will conclude with a dinner sponsored by Tampa Electric Company at the Museum of Science and Industry.

Wednesday's keynote address will present "Vision and Challenges to Ensure that CCTs Contribute in the New Millennium." The program then will address four central issues of importance to the deployment of clean coal technology in the 21st century. These issues will be summarized (and conclusions presented) at the Friday Closing Plenary Session. These issues are:

Issue 1: International Markets for CCTs will focus on the opportunities and obstacles for CCTs to compete in the international marketplace. Results of IEA studies and activities, findings of the Coal Industry Advisory Board, implications of privatization on technology choice, and specific experiences in the export of CCTs are among the subjects to be discussed.

Issue 2: Role of CCTs in the Evolving Domestic Electricity Market will focus on the need to understand and follow the power production industry as it evolves in the era of deregulation and competition. The conference will address the impact on CCTs under deregulated market conditions and in light of natural gas competition. Further, the potential for industrial market and regulatory incentives will be discussed. Finally, attendees will have the opportunity to understand the issues faced by the rural electric industry and their impact on future deployment of CCTs and distributed power generation.

Issue 3: Environmental Issues Affecting CCT Deployment, both domestic and international, will be explored to create an understanding of how CCTs can be used to assure that solutions are available to accomplish environmental goals, while achieving benefits that outweigh the costs. Specifically, international environmental issues and new and projected domestic environmental requirements and their impact on future CCT deployment will be evaluated. An update will be provided about ongoing climate change negotiations. Finally, participants will explore the environmental benefits of electro technologies.

Issue 4: CCT Deployment—From Today Into the Next Millennium will focus on the opportunities and the obstacles to CCT deployment as well as

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strategies and approaches to enhancing the deployment process. This will be accomplished by gaining an understanding of the issue through the perspective of the electric utility, non-utility generators, technology suppliers, fuel providers, and state co-funders of CCT projects.

The conference program is designed to sequentially develop the four issues in three steps:

1. Identify and articulate the issues in the Opening Plenary;
2. Expand, explore, and formulate resolutions in Panel Sessions; and
3. Summarize and draw conclusions in the Closing Plenary.

To benefit fully from exploration of the four issues, all coordinated conference sessions should be attended.

Technical sessions on the DOE clean coal projects will be conducted concurrently with the issue panel sessions on Thursday, January 9. Sessions will be held on Advanced Coal Process Systems, Advanced Industrial Systems, Advanced Cleanup Systems, and Advanced Power Generation Systems.

On the last day, participants will be honored by presentations from The Honorable Ralph Regula, Chairman, Subcommittee on Interior and Related Agencies, Committee on Appropriations, U.S. House of Representatives, and The Honorable Hazel O'Leary, Secretary of Energy.

Other conference events include: a tour of Tampa Electric Company's Electric Technology Resource Center on Wednesday, January 8; the conference reception on Thursday, January 9; numerous exhibits from January 7-10; and a poster session on Thursday, January 9.

