

CLEAN COAL TODAY

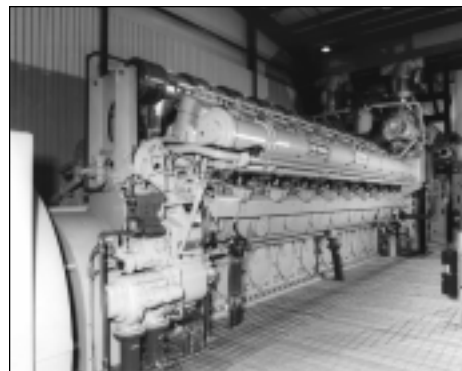
A NEWSLETTER ABOUT INNOVATIVE TECHNOLOGIES FOR COAL UTILIZATION

PROJECT NEWS BYTES

Construction for the **Alaska Industrial Development and Export Authority's Healy Clean Coal Project** site in central Alaska was completed in November of 1997. This 50-megawatt, coal-fired power plant will demonstrate advanced combustion and flue gas cleanup technologies developed by TRW Inc. and the Babcock and Wilcox Company. Located in an environmentally sensitive area four miles from Denali National Park and Preserve, the demonstration is expected to confirm that emissions of NO_x, SO₂, and particulates can be significantly reduced while at the same time producing power more efficiently and at less cost. Start-up and commissioning are underway, with demonstration operations expected to begin in January 1998.

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COAL-FUELED DIESEL DEMONSTRATION GIVEN GO-AHEAD FOR ALASKA



Shown is the oil-fueled version of Coltec-Pielstick 10-cylinder diesel engine.

In August, U.S. Department of Energy (DOE) gave final approval to Arthur D. Little to complete final design and initiate construction on a 6.4-MWe coal diesel engine and a 100-ton-per-day low-rank coal-water fuel (LRCWF) processing plant. The Coal Fired Diesel Project, selected under Round 5 of the Clean Coal Technology Demonstration Program, consists of the design, construction, and operation of a 6.4-MWe, 18-cylinder diesel engine modified to operate on Alaska subbituminous coals. The coal-fired diesel will be fueled with a coal slurry prepared using an advanced coal drying process to produce low rank coal-water fuel. The LRCWF process allows the dried coal to be micronized and then slurried in water for injection into the diesel engine. LRCWF also can be used as an alternative to fuel oil in conventional oil-fired industrial boilers. The University of Alaska at Fairbanks is working with Arthur D. Little to install and operate the coal-diesel engine and a retrofitted 5-MWe oil-fired boiler on LRCWF at their campus in Fairbanks, Alaska. The new engine would also provide black-start capability for the University.

The Coal Fired Diesel Project is the only power generating technology in the Clean Coal Technology Program for applications of 50 MWe or less. The technology is expected to operate at very low NO_x and SO₂ emission levels (50-70 percent below current New Source Performance Standards). The plant is expected to achieve 41 percent efficiency, with future plants expected to achieve 48 percent efficiency resulting in 25 percent lower CO₂ emissions compared to conventional coal steam plants. The DOE National Environmental Policy Act (NEPA) process was completed with publication of an Environmental Assessment in May 1997 and a Finding of No Significant Impact in June 1997, and all environmental permits have been received.

Team members working with Arthur D. Little, Inc., include the University of Alaska, Alaska Science and Technology Foundation, Coltec Industries, Usibelli Coal Mine, Inc., Energy and Environmental Research Center, and R.W. Beck. The total value of the agreement is over \$48 million, with DOE

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cost-sharing some \$24 million. The objective of the demonstration is to obtain long-term (over 6,000 hours) durability data on a heavy-duty coal-diesel engine using LRCWF.

The Pielstick diesel engine is manufactured by Coltec Industries, formerly Fairbanks-Morse, in Beloit, Wisconsin. Coltec will be modifying the injectors, exhaust valves, and the piston ring and lubricating oil system to accommodate abrasive wear of the coal-water fuel. DOE has been working with diesel manufacturers since the mid-1980s to develop technologies to harden these components. Coltec plans to use hard sapphire inserts in the injector tips, an advanced technology previously tested on smaller diesel engines manufactured by GE Locomotive and Cooper-Cameron Inc., to reduce injector hole wear.

Fabrication of the engine started in November 1997, and delivery is expected in December 1998. Arthur D. Little and the University of Alaska plan on holding a formal groundbreaking ceremony at the site in May 1998.

Potential customers of the technology include government agencies, public and privately owned utilities, institutions such as hospitals and universities, large industrial plants, and municipalities. The domestic U.S. diesel market is projected to exceed 60,000 MWe (over 7,000 engines) through 2020. The worldwide market for diesel engines is projected to be 70 times that in the United States. Alaska alone has over 20 communities with a combined capacity requirement exceeding 250 MWe that can be met with coal-fueled diesel engines. For communities in remote locations, fuel oil

prices can reach \$1.90/gallon and electricity costs can exceed 30 cents per kWh. Much of the diesel engine success is due to its multiple fuel capabilities, and its ability to burn low quality fuels, such as fish oil, digester gas, petroleum residuals, and now coal-water fuels.

Evidence of strong international interest in this technology was recently illustrated by inquiries about the coal-diesel engines. The JGC Corporation of Japan has requested Coltec to quote costs for a 10-MWe coal-diesel engine for a power plant in Indonesia. Diesel engines could dominate the power generation market below 50 MWe due to their high efficiency (45 percent). JGC's interest in the CCT project is significant since FE's repayment plan with Arthur D. Little, the University of Alaska, and Coltec includes the international sale of engines.

LARGE-SCALE ATMOSPHERIC CIRCULATING FLUIDIZED BED COMBUSTION TECHNOLOGY

On September 29, 1997, the Assistant Secretary for Fossil Energy approved a cooperative agreement with the **Jacksonville Electric Authority** (JEA) to demonstrate large-scale atmospheric circulating fluidized bed (CFB) combustion technology at JEA's North Side Generating Station. The project originated in Florida at the City of Tallahassee's Arvah B. Hopkins Station, and was later transferred to York County, Pennsylvania.

DOE and JEA will share the cost of the \$309 million refurbishment of one of three units of JEA's Northside Generation Station. The new CFB combustion system will be installed on Unit 2, which has been out of service since 1983. Once the new system is brought on-line, JEA plans to install a second, identical CFB system to repower Unit 1.

The project, coupled with other operational improvements, will boost the power plant's electricity production by 168 percent while reducing the air emissions (NO_x , SO_2 , and particulates) and groundwater consumption by 10 percent. The CFB combustor will be the largest in the world, with a gross nameplate rating of nearly 300 MWe. The combustor, itself, will eliminate more than 90 percent of SO_2 emissions. JEA will add a further flue gas polishing scrubber system to achieve an overall SO_2 removal of 98 percent. Projected environmental performance of the two refurbished units will meet or exceed recently proposed EPA air quality standards that are not slated to become effective until 2004.

The total capital cost of repowering Units 1 and 2 is estimated at \$463 million. DOE's share will total \$74.7 million and will apply only to the first unit, including two years of operations. The remainder of project financing will be arranged by JEA, and Foster Wheeler Power Systems, Inc., which will provide the CFB technology. The demonstration period of the first unit is scheduled for April 2002 through March 2004, during which both coal as well as combinations of coal and petroleum coke will likely be burned.

COMMERCIAL REPORT



On September 22, 1997, **Hydrocarbon Technologies Inc. (HTI)** signed an historic agreement with the **Shenhua Group Corporation, Ltd.**, and the **China Coal Research Institute** to undertake a feasibility study for construction of a direct coal liquefaction plant. The technology was developed under U.S. DOE, Office of Fossil Energy sponsorship over the past few years at the HTI facility in Lawrenceville, New Jersey. The commercial plant will process 12,000 tons of Shenhua coal per day to produce 50,000 barrels of oil per day.

The agreement involves two distinct phases. Phase I is a pre-feasibility study that involves processing 110 pounds of Shenhua coal per day in HTI's bench-scale direct coal liquefaction unit in Lawrenceville. Bench testing and base-case economic analysis of the 12,000-ton-per-day planned facility were completed in November 1997. In Phase II, HTI will use its 5 ton-per-day pilot plant to confirm process performance and validate process economics.



Seated, from left to right: Tu Zhuming, Vice Chairman of the Shenhua Group, Ltd., Theo L.K. Lee, Vice President of Hydrocarbon Technologies, Inc., and Zhu Deren, President of the China Coal Research Institute, surrounded by U.S. and Chinese delegations.

Development of clean coal technologies (CCT) is having impacts beyond the coal realm, according to the **Gasification Technologies Council**. At the Council's recent annual conference, held early October in San Francisco, California, EXXON announced that it will be spending between \$1-2 billion on gasification applications in the next couple of years, primarily on gasification of petroleum coke and refinery waste. Plans are underway for EXXON to build refineries in Texas, Japan, and Singapore, among other locations. A spokesman for the Council cites the success of the Clean Coal Technology Demonstration Program, as "leading the way" for this activity. He notes that coal is the hardest feedstock to gasify, and CCT developers should "take credit for it — declare victory!" Even the CCT Program IGCCs are

experimenting with running on fuels other than coal-derived gas (both Wabash and Tampa have had recent runs using petroleum coke). The Council cites that chemical refining is a major market, and will be an important market for all gasification technologies.

Nalco Fuel Tech, Naperville, Illinois, has realized at least a dozen commercial sales of its NO_xOUT® selective non-catalytic reduction (SNCR) and derivative systems over the past year. More than 20 units, valued at several millions of dollars, have been sold in the United States, Taiwan, and Korea. This technology is an integral part of the CCT-Round 4 *Milliken Clean Coal Technology Demonstration Project*.

Expenditures for power plant flue-gas desulfurization (FGD) systems are projected to rise from \$9.4 billion/yr in 1997 to over \$17 billion/yr in 2006. In a new report by the **McIlvaine Company**, "World Flue-Gas Desulfurization Markets 1997-2006," Europe/Africa is currently the largest market segment, but by 2006 the Americas will again be the largest with expenditures of \$7 billion in 2006. A significant amount of these expenditures will be for components — in 1997 the suppliers of fans, dampers, and expansion joints had revenues of \$311 million and suppliers of pumps and valves for FGD systems had revenues of \$135 million. The number of U.S. component suppliers has been shrinking while the number of Asian suppliers has been growing. However, FGD system suppliers — **ABB, Babcock & Wilcox, Mitsubishi, Chiyoda, Lurgi/Lentjes, and General Electric** — are expected to receive the lion's share of the expenditures, according to the report.

DOE/INDUSTRY SEMINARS IDENTIFY CCT OPPORTUNITIES AND CHALLENGES

To better understand the dynamics of the decision making process for adopting new power generating technologies, the U.S. Department of Energy, Office of Fossil Energy (FE) has been conducting a series of Executive Seminars, holding some 50 meetings since 1992 with influential leaders in the utility, independent power, regulatory, and financial communities. Through these meetings, FE seeks insights from key corporate officials whose views will influence the future of advanced FE technologies in power generation and in industrial applications.

The power industry is facing many economic, environmental, and regulatory issues, with some unintended consequences arising from competition. As utilities are exposed to the discipline of market forces, they are making efforts to improve reliability, keep costs down, and deliver improved power and services to customers. Concerns have been expressed that as utilities strive to lower electricity prices, there will be a dramatic slowdown in the pursuit of the next generation of more efficient, cleaner energy supply technologies. By opening a dialog with decisionmakers, such as through the Executive Seminars, the most current information concerning market needs and technology options can be exchanged and the benefits and pitfalls of deregulation better identified.

Feedback has been received on pending market changes and opportunities for integrating advanced technologies, risk sharing and mitigation, potential government-provided incentives for commercialization, and impacts of federal funding cuts. In addition, the Seminars provide FE input to development of future fossil energy RD&D strategies.

The focus of the Seminars has evolved with the needs of the marketplace. The initial series focused on compliance strategies for phases I and II of the Clean Air Act Amendments of 1990. The next series focused on deregulation and risk mitigation strategies, while the latest series has concentrated on competitive issues and commercial adoption of clean coal technologies.

There still is much uncertainty regarding deregulation, even as major consolidations have occurred in the electric and gas utility industries. As deregulation continues, industry desires a strong federal role to provide consistency, as opposed to a state-by-state process that can create a patchwork of regulatory schemes.

Coal still is the most favored fuel choice and will be considered in all planning scenarios for baseload plants. However, peaking and intermediate capacity is being fueled with natural gas, and for at least five years, natural gas prices are projected to remain low. In the domestic market, there is no new baseload capacity projected until after 2005. This is a result of much unused capacity in coal baseload plants due to conservative capacity ratings, reserve margins, and capacity factors. Many utilities intend to extend existing baseload plant life from 40 years to 60-70 years. Therefore, it is not surprising that international markets are the targets of intensive marketing efforts.

Environmental issues remain a major concern, representing an additional cost factor threatening low-cost producers. To be cost competitive, it is

believed that electricity generated from new technologies must cost, at most, 3 cents/kWh. Though there is interest in both IGCC and PFBC, it is felt that higher capital costs of these technologies pose competitive disadvantages for at least the next 7-10 years in the United States. Distributed power generation systems are being given some consideration.

A common message voiced by industry representatives at the Seminars is that DOE should continue to work closely with the U.S. Environmental Protection Agency and provide factual information and science, as well as technology inputs. Some participants felt that DOE should take the lead on carbon dioxide issues and sequestration studies. Instead of control options, industry would like options that re-engineer the entire process and close the carbon cycle. There has been no agreement on the need or value of carbon emission allowances or credits.

Concern has been voiced over the declining R&D funding and resources in both the private and public sectors. All Executive Seminar participants would welcome collaborative R&D efforts with DOE. There have been recommendations to focus more on strategic alliances and partnerships with both traditional and non-traditional players. DOE was advised to focus on "great leaps" in R&D (defined as better than 20 percent improvements) while not excluding demonstrations for incremental improvements.

Lastly, it was noted that coal needs a strong advocacy group like that which supports natural gas and renewables. Executive Seminar participants also emphasize the need to educate industry and state legislators on the clean coal technologies, and to educate the public on the benefits of coal.

CCT NO_x CONTROLS REALIZE COMMERCIAL ACCEPTANCE

As the Clean Air Act Amendments of 1990 (CAAA) were being forged, NO_x was identified as a precursor to both acid rain and ozone formation, and was targeted for control. Only a few, cost-intensive control measures existed. Recognizing this shortfall, the Clean Coal Technology (CCT) Program began implementing government/industry partnerships, as early as 1987, to address this and other environmental challenges associated with coal use. As a result, a portfolio of cost-effective NO_x control technologies for the full range of boiler types has been made available for when they are needed.

Data from Southern Company Services' CCT projects evaluating NO_x control on wall- and tangentially-fired boilers was used by the U.S. Environmental Protection Agency to formulate CAAA provisions. Utilities affected



Southern Company Services' Demonstration of Advanced Combustion Techniques for a Wall-Fired Boiler, Low-NO_x burner mounted into its boiler penetration with igniter installed.

by Phase I CAAA NO_x provisions instituted in January 1996 had cost-effective options to choose from thanks to the CCT Program. As the more stringent year-2000 Phase II CAAA provisions come into effect, impacting more than 750 coal-fired boilers, the clean coal NO_x control technologies currently in place will again enable utilities to effectively respond.

Cost-effective NO_x control compliance options exist because the CCT government/industry partnerships ex-

panded the knowledge base in NO_x control, and proved performance through demonstration on a representative range of boiler types. NO_x control continues to receive attention due to its association with ozone. Proposed rulings would require further NO_x emission reductions for the future. The work done in the CCT Program on both combustion modification and post-combustion NO_x control processes has laid a solid foundation for meeting these challenges.

Commercial adoption of NO_x control technologies demonstrated through the CCT Program is a direct realization of successful teamwork between public and private sectors in pursuing technical goals. While the government set performance objectives and established provisions to protect public investment, equipment developers and potential technology users joined forces to determine the best technical approaches to NO_x control. Demonstrating CCT technologies at commercial scale and configuration in actual user environments has resulted in widespread industry acceptance of the technologies.

work has been done in post-combustion NO_x control processes, such as selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR), the thrust of the Program has been in combustion modification. Because of the relatively low cost for the large amount of NO_x removed, combustion modification will likely be a part of any NO_x reduction effort, including SCR applications.

Combustion modification processes deal with mitigating oxidation of fuel-bound nitrogen compounds (fuel-NO_x), and oxidation of the nitrogen in the air at high temperature (thermal-NO_x). Fuel-NO_x accounts for 75 percent or more of NO_x emissions from coal combustion, with thermal-NO_x making up the balance.

Several basic combustion modification approaches have evolved. Low-NO_x burners (LNBs) limit the amount of air available in the early stages of combustion (as nitrogen compounds are volatilized), stretching out the combustion process, which in turn reduces flame temperature and thermal-NO_x formation.

Where initial staging of combustion is not possible or is limited, reburning technology is applied. In reburning, some boiler fuel is injected above the primary combustion zone to create a fuel-rich, oxygen-deficient zone where hydrocarbon radicals strip oxygen from NO_x to form elemental nitrogen. To complete combustion, air is introduced through overfire air (OFA) ports above the reburning zone where temperatures are cooler. OFA allows staged combustion, and can be used as a stand-alone NO_x technology or in combination with LNBs.

Also, it became evident in pursuing combustion modification that ad-

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.... NO_x Controls continued

vanced control systems were an essential element to realizing the full potential of the NO_x controls while maintaining efficient boiler performance. Neural networks (artificial intelligence systems) were introduced to handle the myriad of parameters that must be controlled to affect optimum performance.

Performance objectives for CCT NO_x demonstrations have either been met or exceeded. Typically, NO_x

emission reductions achieved for the various approaches were: 40-50 percent for LNBs alone; 10-25 percent for OFA alone; 60-67 percent for LNB-OFA systems; and 50-67 percent for reburning systems. Advanced control systems demonstrated a capability to enhance boiler efficiency as well as reduce NO_x emissions by 10-15 percent.

Nearly a quarter of coal-fired capacity in the United States has installed combustion modification

NO_x control technology. Sales to date exceed \$750 million and will approach \$4 billion by 2000. These technologies provide the capability of achieving not only existing regulated levels, but those required by the Environmental Protection Agency for 2000. This a testament to the effectiveness of public/private sector partnerships in addressing issues of national concern.

NO_x CONTROL TECHNOLOGY COMMERCIAL SUCCESSES

Project and Participant	Commercialization Progress
Demonstration of Coal Reburning for Cyclone Boiler NO _x Control (The Babcock & Wilcox Company)	<ul style="list-style-type: none"> • Technology retained for commercial use at host site
Full-Scale Demonstration of Low-NO _x Cell Burner Retrofit (The Babcock & Wilcox Company)	<ul style="list-style-type: none"> • Technology retained for commercial use at host site • Seven commercial contracts awarded for 172 burners • Value — \$27 million • Employment benefit — 27 person-years
Enhancing the Use of Coals by Gas Reburning and Sorbent Injection (Energy and Environmental Research Corporation)	<ul style="list-style-type: none"> • Illinois Power retained gas reburning for commercial use • City Water, Light & Power retained full technology for commercial use
Evaluation of Gas Reburning and Low-NO _x Burners on a Wall-Fired Boiler (Energy and Environmental Research Corporation)	<ul style="list-style-type: none"> • Technology retained for commercial use at host site • Three commercial systems installed in New York State • Two commercial contracts awarded to equip five cyclone boilers • One commercial foreign sale to Ukraine
Demonstration of Advanced Combustion Techniques for a Wall-Fired Boiler (Southern Company Services, Inc.)	<ul style="list-style-type: none"> • Technology retained for commercial use at host site • Sales of Foster Wheeler's low-NO_x burners • Value — \$20 million • Employment benefit — 140 person-years • Sales of six GNOCIS neural-network controls • Projected 11 additional GNOCIS sales by end of 1997 • Organizations selected to market GNOCIS in U.S. and abroad
180-MWe Demonstration of Advanced Tangentially Fired Combustion Techniques (Southern Company Services, Inc.)	<ul style="list-style-type: none"> • Technology retained for commercial use at host site • Sales of 10 ABB Combustion Engineering LNCFS™ systems to 8 utilities
Milliken Clean Coal Technology Demonstration Project (New York State Electric & Gas Corporation)	<ul style="list-style-type: none"> • One sale of DHR Technologies' Plant Emission Optimization Advisor (PEOA™) and another 4 bids pending • At least 12 sales of NO_xOUT® SNCR system and derivatives • Wheelabrator licensed to market technology
Integrated Dry NO _x /SO ₂ Emissions Control System (Public Service Company of Colorado)	<ul style="list-style-type: none"> • Technology retained for commercial use at host site • Sale of Babcock & Wilcox DRB-XCL® low-NO_x burners for 101 boilers (55 domestic and 46 foreign) • Quantity — 1,829 burners for 23,664 MWe capacity • Value — \$240 million • Employment benefit — 1,670 person-years

SOLID FUELS AND FEEDSTOCKS PROGRAM BUILDS ON PAST SUCCESSSES

Although used in some 500 plants across the nation, coal preparation has been an often under-recognized but critical enabling technology for coal to keep pace with energy and environmental demands. R&D to produce offshoots of these technologies becomes increasingly important to broaden the market for coal into chemical feedstocks for manufacturing carbon products or fueling advanced coal technologies. Coal preparation provides a cost-effective pollution prevention approach. By removing pollutant precursors from the coal before use in power plants, the cost of power plant pollution control retrofits is minimized or avoided. Today's advances in these technologies also significantly reduce solid waste, and have potential for recovering 2.3 billion tons of coal fines buried in waste ponds.

The Department of Energy's Federal Energy Technology Center (FETC) and its predecessors have been conducting coal preparation research for over 80 years, moving coal preparation from the manual removal of refuse and rocks from run-of-mine coal, to sophisticated physical separation technologies. FETC was instrumental in establishing the database for advanced separation techniques and developing some of the technologies in commercial use today. Through the Clean Coal Technology Demonstration (CCT) Program, a step was taken beyond physical separation to transform the coal structure. Two projects pursued conversion of low-rank coal into high-heating-value, stable low-sulfur solid fuels and clean liquid fuels/chemical feedstocks.

In September, Fossil Energy invited industry representatives, the public, and other stakeholders to the 1997 Coal Liquefaction and Solid Fuels Contractor Review Conference. At the Solid Fuels and Feedstocks Workshop, attendees provided input on the coal preparation program. The thrust was to expand and restyle the program as a comprehensive "Solid Fuels and Feedstocks" effort to meet changing market needs and be responsive to stakeholders. Stakeholder input also was sought for the future "Grand Challenges" Program Research and Development Announcement that will seek proposals on a range of new technology ideas with the objectives of CO₂ reduction and improved environmental and economic performance. The revised program restructuring is part of the FY 99 budget submittal, and its new areas of focus include carbon recovery, carbon products, tailored feedstocks, hazardous air pollutant (HAP) precursor removal, greenhouse gas reduction, coal/biomass/waste co-utilization, foundry/metallurgical coke, and multi-use technologies for coal and minerals processing.

PREMIUM CARBON PRODUCTS

Two areas associated with the modified solid fuels and feedstock program are the development of feedstocks for premium carbon products such as high-value, lightweight carbon products, and the co-production and co-utilization of biomass/waste fuels with coal.

Until the 1940s, feedstocks from coal enjoyed a large market. These were mainly the by-products of carbonization (coking). Later, the petrochemical industry became the major supplier for the organic chemicals industry and captured the market held by coal for supplying chemical feedstocks. At

present, coal tars are used in production of solvents, dyes, pharmaceuticals, and plastics. In addition, the aluminum industry accounts for over 90 percent of the market for binder pitch produced from coke-oven coal tar. However, with a declining domestic coke market, new technologies must be developed to produce these same feedstocks and, ideally, expand into markets for specialty chemicals that cannot be derived from petroleum.

Participants in the Workshop saw potential niche markets in the near term for coal-derived products in both the resource market (for polyacrylonitrile (PAN), pitches, and coke) and in the commodity or interim products markets to supply carbon fibers and graphite for the manufacture of finished products. These markets could expand in the out years as technology is developed. For example, the transportation sector is seen as a particular target for new lightweight carbon-based composite materials. Here, fuel efficiency of the eight million trucks, vans, and Sports Utility Vehicles sold per year, could increase and air emissions improve. The market for carbon products is increasing and coal-derived feedstocks are promising in several areas:

- Carbon electrodes : Feedstocks for electrode production range from \$200-250/ton for regular petroleum coke and \$550-750/ton for needle coke. Pollutants in coke impair the electrode, increase resistivity, and cause energy losses. A need exists for a lower-cost feedstock with fewer impurities that coal preparation possibly can provide.
- Carbon Fibers and Carbon Fiber Composites: A wide spectrum of products are manufactured from carbon fibers and the range of applications is increasing. Through

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.... *Solid Fuels continued*

coal preparation, coal can be modified to supply feedstocks for carbon filters.

- Other products: heat shields for space vehicles, energy absorbing materials, electronics packaging, and rechargeable batteries could be produced with coal-derived raw materials substitutes. In this respect, anthracite and low-rank (sub-bituminous) coals are potential raw materials, along with bituminous coal for all of the above-described products.

SOLID FUEL ADVANCES

The restructured program builds on FETC's success stories of the past. FETC's on-site continuous bench-scale test facility is used to evaluate promising concepts for potential commercialization. Physical coal cleaning technologies studied at FETC and elsewhere under DOE sponsorship include triboelectro-static separation, selective hydrocarbon agglomeration, froth flotation, micronized-magnetite cycloning, high-gradient magnetic separation, low-rank coal drying/pelletizing, and filter cake hardening, as well as various chemical and biological beneficiation processes. FETC holds a number of patents and has worked closely with the private sector to commercialize several technologies.

Under the CCT program, Custom Coals International is demonstrating a commercial scale, dense-media cyclone using finely sized magnetite to produce two coal-based compliance fuels. The Rosebud SynCoal Partnership is applying physical separation techniques and process steps to change coal-surface conditions to produce high-heating-value, stable compliance fuel from low-rank coal.

Technology innovation in coal preparation technology already has addressed a range of problems across the environmental spectrum. Physical cleaning processes remove mineral-phase sulfur (pyritic sulfur) from coal, but not sulfur bound to the carbon (organic sulfur). Chemical processes to remove organic sulfur are not yet competitive eco-



FETC's Solids Processing Research Facility is a fully integrated, 100-2,500 lb/hr continuous bench-scale facility for testing innovative, emerging solids processing equipment and technologies.

nomically. However, mild gasification such as used in the CCT Encoal® project removes a portion of the organic sulfur in producing an upgraded solid fuel and liquid product. The technology is on the verge of commercialization.

Currently, there is a focus on removal of HAPs precursors that appear as trace elements in run-of-mine coal. Since coal preparation decreases the amount of ash forming non-combustibles, even routine methods can remove significant amounts of HAPs precursors. One example is a joint effort on the part of CQ Inc., of Homer City, Pennsylvania, operating with funding from DOE, the Electric Power Research Institute, and industry, and working with Howard University and Fossil Fuel Sciences. Under this partnership, a promising chemical method

was developed and tested at bench scale that is designed to remove half the mercury remaining in coal after conventional coal cleaning. Costs are estimated at less than \$3 per ton of coal treated. Virginia Polytechnic Institute and State University (VPI) also is working to develop HAP characterization data and innovative bioremediation techniques.

The ability to process rather than dump finer coal (and fly ash), is another area of emphasis for solid waste reduction. Economics is the challenge. Some 30 million tons of coal fines are dumped annually in ponds, landfills, and impoundments. These fines, and those already buried, are potentially recoverable with improvements in dewatering and cleaning technology that would allow fines to be made into usable pellets or briquettes.

Two of FETC's better known technology successes can help reduce solid waste. One effective method for fine coal cleaning, successfully commercialized and applicable to high-ash fines in waste ponds, is Microcel™ microbubble flotation, developed by VPI with early support from FETC, and licensed to ICF Kaiser Engineers of Pittsburgh. Granuflow, another FETC-developed technology now being commercialized, is effectively a cheap pelletizing technology for fine coal utilization.

Fossil Energy's newly defined solid fuels and feedstocks program will continue to develop the next generation of advanced coal technologies that is likely to meet increasing demands for cleaner feedstocks and new coal-derived products.

INTERNATIONAL INITIATIVES

INTERNATIONAL PITTSBURGH COAL CONFERENCE



The 14th International Pittsburgh Coal Conference, held in Taiyuan, China, September 23-25, 1997, was attended by over 300 delegates representing 18 countries and over 200 major international corporations, government agencies, research organizations, and educational institutions. According to University of Pittsburgh Professor Shiao-Hung Chiang, executive officer and organizer for the conference, the theme, "A Bridge to Global Opportunity," was realized due to the excellent exchange of technological information among the international delegates through well-coordinated technical and poster sessions.



In addition to the University of Pittsburgh, co-sponsors of the event included the Shanxi Energy Research Society (China), the Institute of Coal Chemistry, Chinese Academy of Sciences (China), and the U.S. DOE Federal Energy Technology Center (FETC). U.S. DOE representatives on the conference planning team were Sharon K. Marchant (FETC), Bruce Utz (FETC), and C. Lowell Miller (FE).

The Opening Ceremony featured keynote speeches by Dr. Sun W. Chun, Senior Executive Advisor for the Assistant Secretary for U.S. DOE, Office of Fossil Energy, and Dr. Dinghuan Shi, Director of the Chinese State Science and Technology Commission. Both emphasized the need for international cooperation through scientific and technological exchanges.

One of the highlights of the conference was the International Coal Forum, moderated by Rita A. Bajura, Director, U.S. DOE, FETC. Distinguished panelists included James Wood, President of Babcock & Wilcox Power Generation Group, Guang Hwa Li from the Chinese National Power Corporation, Charles Johnson from the East-West Center, Hawaii, and Dagang Tang, Director of the Atmospheric Environment Institute, China. Their presentations emphasized the collaborative spirit in which the conference was organized, and set the tone for the exchange of technical information between the international and Chinese participants.

At the awards ceremony, the Pitt Award, annually given to honor an individual who has made a recent and significant contribution to new technologies, new procedures, or new policies toward coal utilization, was presented to Dr. David H. Pai, President and CEO of Foster Wheeler Development Corporation. Dr. Pai, the first Chinese-American to win this award, led the development of both fossil and nuclear energy components and systems. Awards also were presented for outstanding technical paper and best poster.

DOE SPONSORS CCT AND COAL UTILIZATION WORKSHOP

A major feature of the 14th International Pittsburgh Coal Conference Agenda was the U.S. DOE/FETC-sponsored two-day *Clean Coal Technology and Coal Utilization Workshop*, held on September 26-27, 1997, in Taiyuan, China. The workshop focused on economics and commercialization of demonstrated innovative and conventional technologies potentially applicable to markets in China and the Pacific Rim countries. The workshop was organized by Sharon K. Marchant, FETC Executive Officer, and Professor Zhu Ping, Vice Chair, Shanxi Energy Research Society, China.

In the Workshop's Opening Plenary Session, Rita A. Bajura, Director of U.S. DOE, FETC, presented an overview of the FETC and its Clean Coal Technology and Advanced Coal Programs, as well as potential opportunities for Chinese/U.S. cooperation. Bao-Qing Li, Shanxi Province Representative, presented a welcoming address. Ja Jun Ma, Director, Shanxi Economy and State Committee, presented an overview of the application of coal technologies in China with a special focus on Shanxi Province. For example, Shanxi Province produces 350 million tons of coal annually, which is nearly 30 percent of China's total annual coal production. Additionally, Ted Atwood, International Program Manager for Pacific Rim, U.S. DOE Fossil Energy, discussed how to finance energy and environmental projects.

Following the Opening Plenary Session, the program was divided into two concurrent sessions with a total of 12 technical sessions. Track I covered two technical areas, "Combustion and Emissions Control," and "Coal Conversion and Byproduct Utilization." Track II covered two technical areas, "Coal Preparation," and "Domestic and Industrial Use of Coal." The sessions were chaired by U.S. and Chinese moderators. The U.S. DOE moderators were Sharon K. Marchant (FETC), C. Lowell Miller (FE), Bruce Utz (FETC), Ted Atwood (FE), and Scott Smouse (FETC).

More than 120 technologists from China, the U.S., and sixteen other countries attended the workshop. Over 40 presentations were made by various representatives of the U.S. and Chinese industrial firms, with each presentation delivered to an audience of 25 to 50 attendees from the international community. Some 24 of the presentations represented U.S. clean coal technologies (CCTs) and coal utilization technologies. The remainder of the presentations represented Chinese use of CCTs and utilization technologies, and their potential need for more and better applications. The format of the workshop encouraged discussions and the exchange of information.

KOREA ENERGY/ENVIRONMENT WORKSHOP A SUCCESS



DOE's Office of Fossil Energy and the U.S. Department of Commerce co-sponsored the highly successful 12th Korea-U.S. Joint Workshop on Energy and Environment, in Taejon, Korea, October 6-11, 1997. This year's workshop was combined with a trade mission so that the U.S. delegation included 36 representatives from 16 firms specializing in advanced power generation, air pollution control, and waste management, who met with potential Korean partners at on-the-spot appointments. On the Korean side, the workshop was organized by the Korea Institute of Energy Research and sponsored by the Ministry of Trade, Industry and Energy, with participation by the Korea Electric Power Corporation. Also participating were 124 Korean industry representatives. The workshop, which included a 2-day technical conference and site visits, achieved its major goal of introducing a broad range of U.S. energy and environmental companies to Korea and provided an effective forum for information exchange on energy and environmental technologies, for which there is a large Korean market.

Clean coal technologies are seen as promising for replacing aging power plants in the next century. Korean energy demand is growing rapidly, and coal is expected to meet 27.3 percent of projected capacity required in 2010. Financing of \$3-4 billion a year, some from foreign sources, may be required to meet projected demand. In addition, after 40 years of steady industrial growth, Korea faces substantial environmental problems, so the market for air pollution control equipment, waste treatment facilities, and incineration equipment is also expected to be robust.

In all, the workshop was an example of effective interagency coordination, and a valuable forum for U.S. industry to showcase its capabilities to the growing power and environmental markets in Korea.

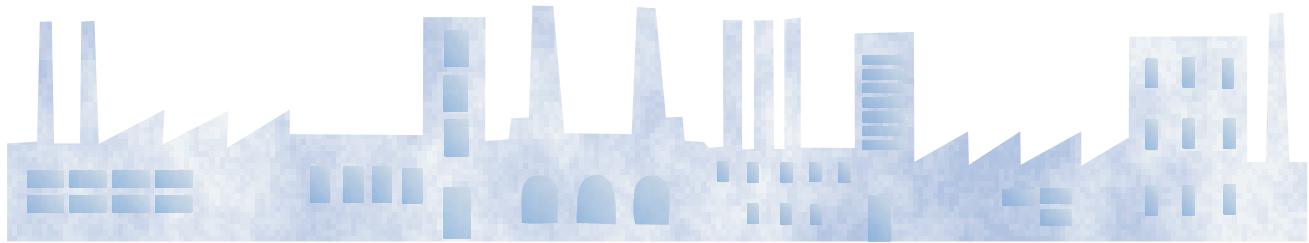
FE ADVOCATES CCTs THROUGH APEC

The U.S. DOE Office of Fossil Energy (FE) recently participated in the Fifth Annual Technical Seminar of Asia-Pacific Economic Cooperation (APEC) Expert's Group on Clean Fossil Energy. This seminar, held in Reno, Nevada, in October 1997, brought together senior energy policy officials from around the globe. It followed a series of four previous meetings of the Expert's Group held in Thailand, Indonesia, South Korea, and the People's Republic of China.

Historically, APEC nations have been able to gain insight into the plans and actions of all member countries while at the same time being afforded an opportunity to participate in the formulation of policies, procedures, trade regulations, and other issues that impact individual economies. Of interest to members are environmental and economic factors and functions. In particular, APEC has provided a forum for encouraging coal use in the Pacific Rim, and has expended a great deal of effort to make coal a high-profile fuel. Australia and the United States share the lead responsibility for the energy and environment activity, which emphasizes coal and clean coal technology. The goal of this activity is to assist APEC members in reducing their dependency on imported oil by using more coal, increasing efficiency of energy use in the region, and promoting U.S. energy exports.

The Expert's Group can claim some important accomplishments. In February 1996, a work plan and design for the Group's Joint Multilateral Demonstration Project for Recovery and Utilization of Coal Mine Gas was approved. This project is being supported by joint funding from Australia and Japan, among others. The United States also funded preparation of an APEC report, "The Role of Coal and Clean Coal Technologies in the Asia-Pacific Region," which was based on questionnaires completed by member countries with input from their respective private sectors. APEC expects that this report will lead to a better understanding of regional issues concerning environmental aspects of coal and clean coal technologies, and should assist policy planners and decision makers in both the public and private sectors.

This year, the Annual Technical Seminar focused on how environmental legislation, technology, and fuel choices are changing in the Asia-Pacific Region. It provided an opportunity for member countries to share information on many local and regional issues and activities, and to compare problems, opportunities, and progress in expanding coal and clean coal technology use throughout APEC nations. In addition, participants were invited to tour the Sierra Pacific Power Company's Piñon Pine integrated gasification combined cycle power plant. FE will continue supporting the Expert's Group even while the role of APEC in activities of member economies continues to grow.



INTERNATIONAL NEWS BYTES

The Office of Fossil Energy (FE), Office of Coal and Power Systems sponsored a well attended "Roundtable on the Deployment of Clean Power Systems for Power Generation Technologies" at the September "Meeting on Natural Gas and Electric Power Integration in the Southern Cone" held in Uruguay. The Government of Uruguay was overall conference host, and co-sponsored the workshop with DOE, Department of State, Department of Commerce, and the U.S. Trade and Development Agency. Over 200 government officials and industry executives from the U.S., Argentina, Bolivia, Brazil, Chile, Paraguay, and Uruguay attended. The Roundtable

consisted of sessions on Alternative Advanced Clean Energy Technologies, and Financing of Clean Energy Projects. U.S. representatives made presentations on IGCC, FBC, and fuel cells. Participants discussed potential areas of collaboration, opportunities for U.S. companies in Latin America, and barriers to business opportunities.

FE representatives participated in the 10th Annual FETC/Japanese Technical Meeting on Coal Liquefaction and Materials for Coal Liquefaction, held in Tokyo in October. The meeting provided an excellent opportunity for exchange of technical information. Participants also had the opportunity to tour Japan's 150 ton/day direct coal liquefaction demonstration plant outside of Tokyo. The demonstration plant, which went on-line in November 1996, is

the largest in existence and will operate for three years to obtain scale-up data for a commercial plant and to evaluate the economic feasibility of the project.

In October, representatives from FE participated in the Executive Committee meeting of the International Energy Agency's Clean Coal Center, IEA's coal research activity. The Committee agreed to initiate studies in the following areas: blast furnace coal injection; management of coal stockpiles; opportunities for coal preparation to lower emissions; particulate emissions from coal combustion (PM₁₀, PM_{2.5}); computers and air pollution control; a NO_x control systems database; coal-fired power stations and water quality; and coal-fired power generation and air pollution control in South Asia.

SPOTLIGHT ON AWARD-WINNING CCT PROJECTS

PROJECT AND PARTICIPANT	AWARD
Full-Scale Demonstration of Low-NO _x Cell Burner Retrofit (The Babcock & Wilcox Company)	1994 R&D 100 Award presented by <i>R&D</i> magazine.
Evaluation of Gas Reburning and Low-NO _x Burners on a Wall-Fired Boiler; Enhancing the Use of Coals by Gas Reburning and Sorbent Injection (Energy and Environmental Research Corporation)	1997 J. Deanne Sensenbaugh Award presented by the Air and Waste Management Association.
Advanced Flue Gas Desulfurization Demonstration Project (Pure Air on the Lake, L.P.)	1993 Powerplant Award presented by <i>Power</i> magazine. 1992 Outstanding Engineering Achievement Award presented by the National Society of Professional Engineers.
Demonstration of Innovative Applications of Technology for the CT-121 FGD Process (Southern Company Services, Inc.)	1995 Design Award presented by the Society of Plastics Industries. 1994 Powerplant Award presented by <i>Power</i> magazine. 1994 Outstanding Achievement Award presented of the Georgia Chapter of the Air and Waste Management Association. 1993 Environmental Award presented by the Georgia Chamber of Commerce.
Tidd PFBC Demonstration Project (The Ohio Power Company)	1992 National Energy Resource Organization Award. 1991 Powerplant Award presented by <i>Power</i> magazine.
Tampa Electric Integrated Gasification Combined-Cycle Project (Tampa Electric Company)	1997 Powerplant Award presented by <i>Power</i> magazine. 1996 Association of Builders and Contractors Award presented to Tampa Electric. 1993 Ecological Society of America Corporate Award. 1993 Timer Powers Conflict Resolution Award. 1991 Florida Audubon Society Corporate Award.
Wabash River Coal Gasification Repowering Project (Wabash River Coal Gasification Repowering Project Joint Venture)	1996 Powerplant Award presented by <i>Power</i> magazine. 1996 Engineering Excellence Award.

.... *News Bytes continued*

Initial operating results from **Air Products Liquid Phase Conversion Company's Liquid Phase Methanol (LPMEOH™) Demonstration Project** were featured recently at the Electric Power Research Institute/ Gasification Technologies Council Conference in San Francisco, California, and the 15th Annual World Methanol Conference in Tampa, Florida. The LPMEOH™ technology was developed to enhance economics and efficiency of integrated coal gasification combined cycle (IGCC) power generation by producing a clean burning, storable liquid (methanol) from the

clean coal-derived gas during periods of low power demand. This technology will be able to fill local needs for electric power, transportation fuels, and manufactured chemical products. Presentations discussed the project's initial operating results and the plan for a four-year operational period to demonstrate the technical feasibility and gain commercial acceptance of the technology. Based on recent studies, the LPMEOH™ technology can provide competitive methanol economics at small plant sizes, and a freight and cost advantage in local markets (<50 cents per gallon) through offshore remote gas methanol.

The **Tampa Electric 250-MW IGCC** project completed an initial test run using a fuel blend of 75 percent Indiana coal and 25 percent petroleum coke, the first blended fuels tested. Four coals have been tested since the demonstration phase began in October 1996. The next steps are long-duration runs to determine long-term effects on the gasifier and downstream equipment. Blending petroleum coke (considered a waste product) with coal enables utilities to use higher ash coals that might normally be discarded.

STATUS OF CCT DEMONSTRATION PROJECTS

ENVIRONMENTAL CONTROL DEVICES

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 continuing. The project was extended until February 1998 to allow completion of the final report. A Draft Final Report for Phases 1-3 has been received and is being reviewed. (Coosa, GA)

New York State Electric & Gas – *Milliken Clean Coal Technology Demonstration Project.* Design Coal testing of the scrubber has restarted and will continue until Spring 1998. Reports on ESP performance and LNCF-3 testing have been completed. (Lansing, NY)

New York State Electric & Gas – *Micronized Coal Reburning Demonstration for NO_x Control.* Construction at the Kodak site is complete. Characterization testing has been completed. Long-term testing to start in early Spring 1998. The modifications for deep stage burning of micronized coal for part 1 of the demonstration at Milliken Station is complete. Burner simulation was accomplished in March/April 1997. Testing was accomplished in May 1997. Modifications for part 2 of the demonstration, injector distribution, should begin in early Spring 1998. (Lansing, NY and Rochester, NY)

NOXSO Corporation – *Commercial Demonstration of the NOXSO SO₂/NO_x Removal Flue Gas Cleanup System.* Construction of the liquid SO₂ facility has been completed and the plant is operating. The host site was withdrawn, and discussions are ongoing with a major utility to re-site this project. (Site pending)

ADVANCED ELECTRIC POWER GENERATION

City of Lakeland, Department of Water & Electric Utilities McIntosh Unit 4A PCFB Demonstration Project. In combination with the *McIntosh Unit 4B Topped PCFB Demonstration Project*, these projects have been restructured and re-sited to Lakeland, Florida. Foster Wheeler gave the City of Lakeland a turnkey proposal to build a greenfield PCFB plant at Lakeland's McIntosh Power Plant.

The City of Lakeland and Foster Wheeler are negotiating the price and terms of an agreement to proceed with the PCFB plant. (Lakeland, FL)

Jacksonville Electric Authority (formally York County Energy Partners) – *ACFB Demonstration Project.* On September 29, 1997, DOE signed an agreement with Jacksonville (FL) Electric Authority to cost-share refurbishment of the first (Unit 2) of two units at North Side Generating Station. Capital cost of repowering Unit 2 is \$309 million, of which DOE's cost-share is \$74.7 million, or 24%. Construction is planned to begin in March 1999, with operation in early 2002, and two years of operations. (Jacksonville, FL)

Clean Energy Partners, L.P. – *Clean Energy Demonstration Project.* Discussions are under way to re-site this project. (Site pending.)

Sierra Pacific Power Co. – *Piñon Pine IGCC Power Project.* Sierra Pacific continues to encounter balance of plant problems during the startup and operation of their gasifier island. A recent flare issue has deferred firing on coal until early 1998. The plant continues to operate in the gas combined cycle. (Reno, NV)

Tampa Electric Co. – *Tampa Electric Integrated Gasification Combined-Cycle Project.* The plant achieved 80% availability during the high-demand months of July and August. Pittsburgh #8 and Kentucky #11 have been burned successfully. (Mulberry, FL)

Wabash River Joint Venture – *Wabash River Coal Gasification Repowering Project.* In 1997 operations through September the combined cycle plant has operated over 2,500 hours on syngas (compared to about 1,500 hours in all of 1996) In its second year of commercial operation, the plant has averaged 57% availability. (West Terre Haute, IN)

Alaska Industrial Development and Export Authority – *Healy Clean Coal Project.* Construction was completed in November 1997. Startup and commissioning are underway. Demonstration operations are expected to begin in January 1998. Performance testing of the low-NO_x burners and over-fire air system installed at Healy Unit No. 1 is planned in early 1998. (Healy, AK)

Arthur D. Little, Inc. – *Coal-Fueled Diesel Engine Demonstration Project.* In August, DOE approved the construction phase of the project. The NEPA process – an EA and FONSI – has been completed. (Fairbanks, AK)

COAL PROCESSING FOR CLEAN FUELS

Custom Coals International – *Self Scrubbing Coal™: An Integrated Approach to Clean Air.* The plant has temporarily halted operations due to financial and environmental constraints. Negotiations are continuing toward a restart of the plant. The plant has processed over 650,000 tons of raw coal and shipped over 400,000 tons of clean coal product. (Central City, PA; Martins Creek, PA; Richmond, IN; Ashtabula, OH)

Rosebud SynCoal® Partnership – *Advanced Coal Conversion Process (ACCP) Demonstration.* The ACCP facility continues to process raw subbituminous coal, producing over 1 million tons of SynCoal® product to date. Nearly 870,000 tons of SynCoal® product has been supplied to customers, including industrial (primarily cement and lime plants) and utilities. SynCoal® product continues to be supplied to Units 1 and 2 of Montana Power's Colstrip Power Station. (Colstrip, MT)

ENCOAL® Corp. – *ENCOAL® Mild Coal Gasification Project.* ENCOAL® has completed all testing. DOE will issue all final reports in both hard copy and CD format. ENCOAL continues to seek both domestic and off-shore opportunities for large-scale commercial plants. (Gillette, WY)

Air Products Liquid Phase Conversion Company, L.P. – *Liquid Phase Methanol Process Demonstration Project.* Stable operation of the LPMEOH™ Process Demonstration Facility continued since initial operations began on April 2, 1997. Demonstrating the unit's ability to accept a wide range of feed gas compositions, a 12-day operational period using a CO-rich synthesis gas (Texaco-type with a H₂/CO=0.7) was completed. The methanol production rate over this period averaged over 58,000 gallons per day. A 31-day continuous operating campaign, the longest achieved to date, was also completed in November 1997. Overall, unit availability has approached 90 percent since startup. During the initial catalyst aging period, catalyst poisons and aging

phenomena are being investigated. All methanol produced at the facility has been accepted by Eastman Chemical Company for use in downstream chemical processes. (Kingsport, TN)

INDUSTRIAL APPLICATIONS

Bethlehem Steel Corporation – Blast Furnace Granulated Coal Injection System Project. After replacing two coal storage bins, Bethlehem Steel Corporation will begin a test run using pulverized coal for comparison to the baseline granular coal system. This operation will use both commercial furnaces operating at the baseline design

conditions. Test runs using high-ash and high-volatile-matter-coal have been completed. (Burns Harbor, IN)

CPICOR™ Management Company, L.L.C. – *Clean Power from Integrated Coal/Ore Reduction (COREX®)*. CPICOR™ continues to evaluate technical and cost details in an attempt to determine the optimum direct iron-making and waste energy utilization configurations. Technical readiness and power utilization issues are being modeled. NEPA activities are on hold pending completion of these baseline studies. (Vineyard, UT)

CLEAN COAL TODAY

Published quarterly by:
The Office of Fossil Energy
U.S. Department of Energy (FE-24)
Washington, DC 20585

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Completed Projects – Participants

Final Reports

Environmental Control Devices

- 10-MWe Demonstration of Gas Suspension Absorption – *AirPol, Inc.* NTIS #DE960003270
- Confined Zone Dispersion Flue Gas Desulfurization Demonstration – *Bechtel Corporation* DOE/PC/90546-T10
- LIFAC Sorbent Injection Desulfurization Demonstration Project – *LIFAC-North America* NTIS #DE96004421
- Advanced Flue Gas Desulfurization Demonstration Project – *Pure Air on the Lake, L.P.* NTIS #DE96050313
- Demonstration of Innovative Applications of Technology for the CT-121 FGD Process – *Southern Company Services, Inc.* NTIS #DE94016053
- Demonstration of Coal Reburning for Cyclone Boiler NO_x Control – *The Babcock & Wilcox Company* In Review
- Full-Scale Demonstration of Low-NO_x Cell Burner Retrofit – *The Babcock & Wilcox Company* NTIS #DE96003766
- Evaluation of Gas Reburning and Low-NO_x Burners on a Wall-Fired Boiler – *Energy and Environmental Research Corporation* Not Yet Available
- Demonstration of Selective Catalytic Reduction Technology for the Control of NO_x Emissions from High-Sulfur Coal-Fired Boilers – *Southern Company Services, Inc.* NTIS #DE97050873
- 180-MWe Demonstration of Advanced Tangentially Fired Combustion Techniques for the Reduction of NO_x Emissions from Coal-Fired Boilers – *Southern Company Services, Inc.* NTIS #DE94011174
- SNOX™ Flue Gas Cleaning Demonstration Project – *ABB Environmental Systems* NTIS #DE94018832
- LIMB Demonstration Project Extension and Coolside Demonstration – *The Babcock & Wilcox Company* NTIS #DE93005979
- SO_x-NO_x-Rox Box™ Flue Gas Cleanup Demonstration Project – *The Babcock & Wilcox Company* NTIS #DE96003839
- Enhancing the Use of Coals by Gas Reburning and Sorbent Injection – *Energy and Environmental Research Corporation* NTIS #DE96011869
- Integrated Dry NO_x/SO₂ Emissions Control System – *Public Service Company of Colorado* In Preparation

Advanced Electric Power Generation

- Tidd PFBC Demonstration Project – *The Ohio Power Company* NTIS #DE96000650
- Nucla CFB Demonstration Project – *Tri-State Generation and Transmission Association, Inc.* DOE/MC/25137-3046

Coal Processing for Clean Fuels

- Development of the Coal Quality Expert™ – *ABB Combustion Engineering, Inc., and CQ Inc.* In Preparation

Industrial Applications

- Advanced Cyclone Combustor with Internal Sulfur, Nitrogen, and Ash Control – *Coal Tech Corporation* NTIS #DE92002587/92002588
- Cement Kiln Flue Gas Recovery Scrubber – *Passamaquoddy Tribe* NTIS #DE94011175/94011176

Publications are available to the public from the National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4600. For a copy of the “DOE/MC” report, contact: Library, FETC-Morgantown, 3610 Collins Ferry Road, Morgantown, WV 26507-0889, (304) 285-4184. For a copy of the “DOE/PC” report, contact: Library, FETC-Pittsburgh, 626 Cochran Mill Road, Pittsburgh, PA 15236-0940, (412) 892-6819.

Sixth Clean Coal Technology Conference

Clean Coal for the 21st Century

— What Will It Take? —

Come to the Sixth Clean Coal Technology Conference, which will focus on the ability of clean coal technologies (CCTs) to meet increasingly demanding environmental requirements while simultaneously remaining competitive in both international and domestic markets. Conference speakers will assess environmental, economic, and technical issues and will identify approaches that will enhance CCT deployment in an era of competing, interrelated demands for energy, economic growth, and environmental protection. Recognition will be given to the dynamic changes that will result from increasing competition in electricity and fuel markets and industry restructuring, both domestically and internationally.

Critical to economic growth, energy use is growing quickly in many regions of the world. Much of this increased demand can be met by coal with technologies that achieve environmental goals while keeping the cost per unit of energy competitive. Private sector commercial experience and results from the CCT Demonstration Program are providing information on economic, environmental, and market issues that will enable conclusions to be drawn about the competitiveness of the CCTs domestically and internationally.

The industry/government partnership, cemented over the past 11 years, is focused on moving the technologies into the domestic and international marketplace. The Sixth Clean Coal Technology Conference will provide a forum to discuss benchmark issues and the role and need for these technologies in the next millennium.

Co-Sponsors:

Center for Energy & Economic Development, Council of Industrial Boiler Owners, Electric Power Research Institute, National Mining Association, and U.S. Department of Energy

Mark Your Calendar:

April 28 - May 1, 1998

Reno, Nevada

Accommodations and Reservations

A block of guest rooms at John Ascuaga's Nugget Hotel, 110 Nugget Avenue, Reno, Nevada, has been reserved at a special conference rate of \$92.00 per night. To make reservations, call 800-648-1177 by March 25, 1998. Mention the Sixth CCT Conference to get the special rate.

Additional Information

Contact Ms. Faith Cline by telephone at 202-586-7920 or by facsimile at 202-586-8488. Future updates will be posted on the Fossil Energy Homepage at <http://www.fe.doe.gov>.

Site Tour

April 28, 1998, Sierra Pacific Power Company's Pinon Pine Integrated Gasification Combined Cycle Power Project.



