CLEAN COAL TECHNOLOGY

DOE/FE-0503

Clean Coal Technology Programs: Program Update 2006

Includes Clean Coal Technology Demonstration Program (CCTDP), Power Plant Improvement Initiative (PPII), and Clean Coal Power Initiative (CCPI) Projects

As of June 2006

U.S. Department of Energy
Assistant Secretary for Fossil Energy
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	Not Used	Not Effective				Very Effective	Comments?
Executive Summary	0	1	2	3	4	5	
Chapter 1. Role of Clean Coal Technology Demonstrations	0	1	2	3	4	5	
Chapter 2. Funding and Costs	0	1	2	3	4	5	
Chapter 3. Projects	0	1	2	3	4	5	
Appendix A. Historical Perspective, Legislative History, and Public Laws	0	1	2	3	4	5	
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Appendix D. Acronyms, Abbreviations, and Symbols	0	1	2	3	4	5	

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Executive Summary

Introduction

The purpose of the *Clean Coal Technology Programs: Program Update 2006* is to provide an updated status of the DOE commercial-scale demonstrations of clean coal technologies (CCTs). These demonstrations are performed under the Clean Coal Technology Demonstration Program (CCTDP), the Power Plant Improvement Initiative (PPII), and the Clean Coal Power Initiative (CCPI). *Program Update 2006* provides: (1) a discussion of the role of clean coal technology demonstrations in improving the nation's energy security and reliability, while protecting the environment using the nation's most abundant energy resource — coal; (2) a summary of the funding and costs of the demonstrations; and (3) an overview of the technologies being demonstrated, with fact sheets for demonstration projects that are active, recently completed, withdrawn, or ended, including status as of June 30, 2006.

Role of Clean Coal Technology Demonstrations

Coal accounts for over 94 percent of the proven fossil energy reserves in the United States, and supplies over 50 percent of the electricity vital to the nation's economy and global competitiveness. The expanded use of coal in electricity generation, industrial heat and power, and production of fuels and high value chemicals is dependent on the removal of environmental and economic barriers. The need to mitigate these barriers brought about a major federally sponsored clean coal research and development (R&D) program in the 1970s. However, it was recognized that the success of this coal R&D ultimately would be judged on the extent to which emerging technologies penetrated domestic and international marketplaces.

In order to achieve success in the marketplace, the technical and financial risk associated with the deployment of new coal technologies had to be reduced. Thus, in 1985 DOE initiated the CCTDP. This program was directed toward taking the most promising technologies emerging from coal R&D and demonstrating them at a scale and in an operational environment sufficient to determine their potential for satisfying the technical, economic, and environmental needs of the marketplace.

These demonstrations were made possible by forging cost-sharing partnerships between the federal government, other public institutions, and the technology suppliers and users, which reduced the financial and technical risk of participants to acceptable levels. The CCTDP is nearly concluded, with 33 successfully completed demonstration projects. In 2001, DOE implemented the PPII in a single solicitation applying basic CCTDP principles resulting in four demonstrations specifically addressing electric power reliability concerns. In 2002, President Bush launched the comprehensive CCPI, which is designed to address an array of domestic and global 21st century energy issues through a series of demonstrations over 10 years.

Collectively, these demonstration programs, as part of an integrated CCT research, development, and demonstration (RD&D) program, contribute to the DOE strategic theme of "Promoting America's energy security through reliable, clean and affordable energy."

The CCT RD&D Program advances a number of Presidential initiatives designed to achieve the DOE strategic goal, including the President's Coal Research Initiative, FutureGen Initiative, Global Climate Change Initiative, Hydrogen Fuel Initiative, and Clear Skies Initiative (CSI). The program further addresses the requirements of the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR).

Clean Coal Technology Demonstrations

The CCTDP focused on commercializing processes that helped reduce sulfur dioxide (SO_2) and nitrogen oxide (NO_x) emissions; demonstrating more efficient and environmentally friendly alternatives to traditional pulverized coal boilers; demonstrating coal preparation and coal conversion technologies leading to cleaner fuels; and demonstrating improved industrial technologies for clean coal use. With 33 successfully completed projects, the CCTDP has yielded technologies that meet existing environmental regulations, compete in the electric power marketplace, and provide a technical foundation for meeting future environmental demands.

Congress directed establishment of the PPII to provide for the commercial-scale demonstration of technologies to assure the reliability of the nation's energy supply from existing and new electric generating facilities. The single solicitation required participants to offer significant improvements in power plant performance, thereby leading to enhanced electric reliability.

CCPI is a 10-year, $2 billion technology demonstration program that fosters more efficient clean coal technologies for use in new and existing U.S. electric power generating facilities. Technologies emerging from the program will help to meet new environmental objectives for America embodied in the President's Clear Skies Initiative, Global Climate Change Initiative, FutureGen Initiative, the Hydrogen Initiative, CAIR, and CAMR. Early CCPI demonstrations offer avenues to commercialization for the most promising technologies emerging from the R&D pipeline since the last major CCT solicitation in 1992. Later demonstrations are expected to include cutting edge technology of the future, such as advanced turbines, gas separation membranes, fuel cells, new gasification processes, carbon sequestration, hydrogen production, and other advanced energy system technologies. The CCPI is the capstone of the President's Coal Research Initiative managed by the DOE Office of Fossil Energy.

Clean Coal Technology Demonstration Funding

Funding for CCT demonstrations (CCTDP, PPII, and CCPI) was previously provided to DOE through the annual appropriations bills for the Department of Interior and Related Agencies. Current appropriations are provided through the Energy and Water Subcommittees.

Federal funding has exceeded $1.3 billion for the 33 successfully completed projects under the CCTDP. Project sponsors have contributed over an additional $1.9 billion to these projects, representing 60 percent of overall project funding, far surpassing the 50 percent cost-sharing required by law.

The single PPII solicitation was conducted in 2001 with funding provided by appropriations for fiscal year 2001 (FY01) that established a transfer of $95 million in previously appropriated funding for the CCTDP. As of June 30, 2006, two projects were ongoing and two projects were complete. Three projects withdrew during the negotiation phase prior to contract award. One project withdrew after award, but prior to successful completion. The DOE funding commitments for the PPII projects total over $30 million, with participants contributing an additional $40 million or 57 percent of the total project costs.

The solicitation and project selections for Round 1 of CCPI (CCPI-1) were completed in January 2003 with the naming of eight projects selected for negotiation. As of June 30, 2006, five projects were under way with several

projects in the operation phase. One project remained in the negotiation phase and two projects did not progress beyond the negotiation phase. Of the six remaining projects, DOE's funding commitments represent less than 30 percent ($259 million) of the total estimated costs ($941 million) for the projects, while participant commitments are over $680 million.

The CCPI Round 2 (CCPI-2) solicitation and selections were made in October 2004, resulting in the selection of four projects. As of June 30, 2006, three projects were under way and one project ended during the negotiation phase. The three active projects are valued at $2.7 billion with DOE commitments of over $275 million.

Clean Coal Technology Programs

The *Clean Coal Technology Programs: Program Update 2006* provides project fact sheets for 20 CCTDP, PPII, and CCPI projects. These fact sheets are organized by market sector rather than program to better enable stakeholders to see the scope of activity in key areas of interest. These market sectors are: (1) emissions control for existing and new power plants; (2) advanced power systems for repowering existing plants and providing new generating capacity; (3) clean coal fuels for converting the nation's vast coal resources to low-emission fuels; and (4) industrial applications for coal and coal by-products. Exhibit ES-1 breaks the projects down by market sector, demonstration program, and participants, and provides status as of June 30, 2006. Four of the projects have been completed. The following section provides an overview of the major technologies included in the above market sectors.

Emissions Control

Advanced NO_x Controls. Advanced NO_x controls provide the means to meet the following: (1) the U.S. Environmental Protection Agency (EPA) Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone (commonly referred to as the NO_x SIP Call); (2) EPA's Standards of Performance for Electric Utility Steam Generating Units, *et al*, dated 2/27/06; (3) EPA's Clean Air Interstate Rule (CAIR); (4) EPA's Clean Air Mercury Rule (CAMR); and (5) the proposed Clear Skies Initiative (CSI).

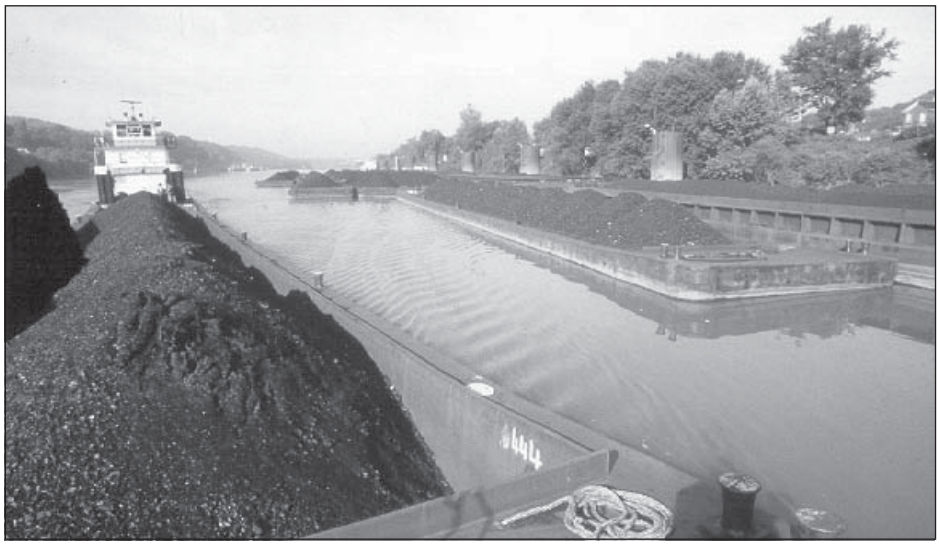
Advanced NO_x control technologies to meet NO_x emission caps proposed under the CSI include:

- Low-NO_x burners and reburning systems that limit NO_x formation by staging the introduction of air in the combustion process (combustion modification);
- Selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), and other chemical processes that act upon and reduce NO_x already formed (post-combustion processes); and
- Oxygen-enhanced combustion that displaces a portion of the air with oxygen in low-NO_x burners.

Mercury Controls. Mercury controls address EPA CAIR/CAMR regulations and proposed Clear Skies Initiative targets regarding mercury emissions from coal-based power generation, which represent roughly one-third of U.S. mercury emissions. The mercury control program includes:

- Sorbents and oxidizing agents to transform mercury into a solid, to be removed along with fly ash in electrostatic precipitators (ESP) or fabric filter dust collectors (FFDC);
- Oxidizing agents in conjunction with wet flue gas desulfurization (FGD) scrubbers to capture mercury in sulfate by-products; and
- Real-time measurement of mercury to aid mercury control.

Particulate Matter Controls. Particulate matter controls respond to EPA's CAIR regulations and to revised NAAQS for $PM_{2.5}$ for primary particulate matter (fly ash) and acid aerosols that can cause localized plume opacity and visibility impairment, and have been linked to human health impacts. Acid aerosols are required to be reported under the EPA Toxic Release Inventory. Secondary $PM_{2.5}$ emissions are formed chemically in the atmosphere by precursors such as NO_x and SO_2. Particulate matter control technologies include:



- ESP/FFDC hybrids to leverage the best features of both NO_x and SO_2 control technologies;
- Flue gas preconditioning to enhance ESP performance;
- Concentration of particulate matter at ESP outlets for recycle;
- Alkaline injection for sulfur trioxide (SO_3) acid aerosol precursor control; and
- Continuous SO_3 analyzers for process control and validation.

Advanced Power Systems

Advanced Power Systems. Advanced power systems address Global Climate Change, Clear Skies, and Hydrogen Fuel Initiatives by enhancing power generation efficiency, producing near-zero pollutant emissions, and providing for hydrogen separation and carbon dioxide (CO_2) capture and sequestration. Advanced power system technologies include:

- Integrated gasification combined-cycle (IGCC) systems that: convert coal to a clean synthesis gas (syngas) amenable to use by gas turbines and advanced fuel cells, and separate out hydrogen and CO_2; and transform residual gases and solids into salable by-products.
- Circulating fluidized-bed (CFB) combustion systems that utilize low-grade fuels and waste materials to generate power at high efficiency and very low emissions, without the parasitic power drain of add-on environmental controls.
- Hybrids that effectively integrate IGCC and CFB technologies.
- Advanced combustion that uses oxygen in lieu of air or chemical means, such as chemical looping, to effect the equivalent of combustion.

Clean Coal Fuels

Upgrading. Upgrading coal enhances power plant efficiency and reduces emissions per kilowatt of electricity produced, which supports both the Clear Skies and Global Climate Change Initiatives. Technologies include coal drying and ash removal methods to significantly increase coal energy density.

Conversion. Conversion of coal to clean liquid fuels, chemicals, or hydrogen enhances energy security and supports the Clear Skies, Global Climate Change, and Hydrogen Fuel Initiatives. Technologies include coal liquefaction, which involves converting coal-gasification derived synthesis gas into zero-sulfur, aromatic-free transportation fuels using the Fischer-Tropsch process; and hydrogen-from-coal processing techniques, which currently are under development.

Industrial Applications

Direct Coal Use. Efforts under this area address substitution of coal for premium fuels in industrial applications, such as coal for coke in steel making operations, and coal for oil or natural gas in energy production.

By-Product Use. Efforts under this area address utilization of the vast amount of solid residue that is the by-product of coal cleaning and combustion — coal utilization by-products (CUBs). There are two primary targets: (1) abandoned coal waste piles from old mining operations, and (2) ash produced from existing coal-fired plants. Coal waste represents both a threat to groundwater contamination and a potential source of energy. Coal ash is a relatively untapped resource for construction materials that is largely disposed of in landfills, posing a problem as landfill space becomes increasingly limited. By-product use technologies include:

- Coal waste use in power production, and recycle of ash to support reclamation of abandoned coal waste piles; and
- Conversion of coal ash to cement substitutes or additives, and construction-grade aggregates.

Exhibit ES-1

Projects by Market Sector

Project	Program	Participant	Status[a]	Page
Emissions Control				
Achieving NSPS Emission Standards Through Integration of Low-NO_x Burners with an Optimization Plan for Boiler Combustion	PPII	Sunflower Electric Power Corporation	Withdrawn	3-12
Airborne Process Commercial Scale Demonstration	CCPI-2	Mustang Clean Energy	Withdrawn	3-14
Big Bend Power Station Neural Network-Sootblower Optimization	PPII	Tampa Electric Company	Completed	3-16
Demonstration of a Full-Scale Retrofit of the Advanced Hybrid Particulate Collector (Advanced Hybrid™) Technology	PPII	Otter Tail Power Company	Completed	3-20
Demonstration of Integrated Optimization Software at the Baldwin Energy Complex	CCPI-1	NeuCo, Inc.	Operation	3-22
Development of Hybrid FLGR/SNCR/SCR Advanced NO_x Control	PPII	TIAX, LLC	Withdrawn	3-24
Greenidge Multi-Pollutant Control Project	PPII	CONSOL Energy, Inc.	Construction	3-26
Mercury Specie and Multi-Pollutant Control	CCPI-2	Pegasus Technologies	Design	3-28
TOXECON Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers	CCPI-1	Wisconsin Electric Power Company	Operation	3-30
Advanced Power Systems				
Clean Coal Diesel Demonstration Project	CCTDP	TIAX, LLC	Withdrawn	3-34
Demonstration of a 285-MWe Coal-Based Transport Gasifier	CCPI-2	Southern Company Services, Inc.	Design	3-36
JEA Large-Scale CFB Combustion Demonstration Project	CCTDP	JEA	Completed	3-38
Kentucky Pioneer Energy IGCC Demonstration Project	CCTDP	Kentucky Pioneer Energy, LLC	Withdrawn	3-42
Mesaba Energy Project – Unit 1	CCPI-2	MEP-I LLC	Design	3-44
Clean Coal Fuels				
Advanced Coal Conversion Process Demonstration	CCTDP	Western SynCoal LLC	Completed	3-48
Gilberton Coal-to-Clean Fuels and Power Co-Production Project	CCPI-1	WMPI PTY., LLC	Negotiation	3-52
Increasing Power Plant Efficiency – Lignite Fuel Enhancement	CCPI-1	Great River Energy	Design	3-54
Industrial Applications				
Advanced Multi-Product Coal Utilization By-Product Processing Plant	CCPI-1	University of Kentucky Research Foundation	Design	3-58
Commercial Demonstration of the Manufactured Aggregate Processing Technology Utilizing Spray Dryer Ash	PPII	Universal Aggregates, LLC	Operation	3-60
Western Greenbrier Co-Production Demonstration Project	CCPI-1	Western Greenbrier Co-Generation, LLC	Design	3-62

[a] Withdrawn: Project prematurely ended activities, voluntarily or involuntarily at the behest of DOE, prior to the completion of planned project activities. Withdrawals have occurred preceding and subsequent to the award of a Cooperative Agreement.

1. Role of Clean Coal Technology Demonstrations

Introduction

Coal is recognized as an essential element in providing the United States with energy and economic stability and security to its citizens. Coal, which accounts for over 94 percent of the proven fossil energy reserves in the United States, supplies over 50 percent of the electricity vital to the nation's economy and global competitiveness. To support continued domestic economic growth over the next two decades, demand for electricity is projected to increase by nearly 50 percent. For reasons of energy security and economic stability, coal is being counted upon to provide much of that generation, maintaining at least a 50 percent share of total generation. Moreover, coal is envisioned as an economically stable source of environmentally friendly fuels such as hydrogen, as well as strategically important chemicals. The expanded use of coal is dependent on developing technological capabilities that eliminate environmental concerns associated with coal use at a cost and efficiency that support economic growth. This new generation of technologies has been designated "clean coal technologies."

CCT research and development (R&D) began in the 1970s. By the 1980s, many promising technologies had emerged. However, there was a realization that moving the technologies into the marketplace, where they could have an impact, required overcoming one major remaining hurdle — demonstration. Demonstration proves the competitive cost and performance of a technology in a commercial setting in order to reduce risk to acceptable levels in the financial and technical arenas. To overcome the risks at the demonstration stage, the U.S. Department of Energy (DOE) initiated the Clean Coal Technology Demonstration Program (CCTDP) in 1985. The CCTDP forged cost-sharing partnerships between DOE, non-federal public entities, and technology suppliers and users, which reduced the financial and technical risk facing participants to acceptable levels. CCTDP demonstrations were required to be at a scale and in an operational environment sufficient to determine their potential for satisfying marketplace technical, economic, and environmental needs.

The CCTDP is nearly concluded, with 33 successfully completed demonstration projects. The final active project withdrew in March 2006 prior to completion, and is preparing a Final Report of activities performed. In 2001, DOE implemented the Power Plant Improvement Initiative (PPII) in a single solicitation applying CCTDP principles to secure demonstrations specifically addressing electric power reliability concerns. In 2002, President Bush launched the comprehensive Clean Coal Power Initiative (CCPI), which is designed to address an array of domestic and global 21st century energy issues through a series of demonstrations over 10 years.

Collectively, these demonstration programs, as part of an integrated CCT research, development, and demonstration (RD&D) program, contribute to the DOE strategic theme of promoting America's energy security through reliable, clean, and affordable energy.

The CCT RD&D program advances a number of Presidential initiatives designed to achieve the DOE strategic goal, including:

- *President's Coal Research Initiative*: to produce public benefits by conducting research and development on coal-related technologies that will improve coal's competitiveness in future energy supply markets.

- *Clear Skies Initiative*: to cut the three worst power plant emissions — nitrogen oxides (NO_x), sulfur dioxide (SO_2), and mercury (Hg) — by 70 percent during the next 15 years using a proven market-based approach.
- *Global Climate Change Initiative*: to cut greenhouse gas intensity 18 percent by 2012 by supporting vital climate change research. This places the United States on a path to slow the growth of greenhouse gas emissions and, as the science allows, to stop and reverse the growth.
- *Hydrogen Fuel Initiative*: to reverse the growing dependency of the United States on foreign oil by developing the technologies and infrastructure to produce, store, and distribute hydrogen for use in vehicles and electric power generation.
- *FutureGen Initiative*: to establish the capability and feasibility of co-producing electricity and hydrogen from coal with essentially zero emissions, including the low-cost capture and storage of carbon dioxide (CO_2).

The successful contributions of CCT demonstrations to the above goals and initiatives are the result of applying sound fundamental principles to ensure effective government/industry partnerships. These principles include:

- Strong and stable financial commitment for the life of a project, including full funding of the government's share of the costs;
- Multiple solicitations spread over a number of years enabling clean coal technologies to address a broad range of national needs with a portfolio of evolving technologies;
- Demonstrations conducted at commercial-scale in actual user environments, allowing clear assessment of a technology's commercial potential;
- A technical agenda established by industry, not the government, enhancing commercialization potential;
- Clearly defined roles of government and industry, reflecting the degree of cost-sharing required;
- A requirement for at least 50 percent cost-sharing throughout all project phases, enhancing participants' commitment;
- A requirement for industry to commit to commercialize the technology, reflecting commercialization goals;
- A requirement for repayment up to the government's cost-share; and
- A review of environmental impacts of a project according to National Environmental Policy Act (NEPA) requirements.

Discussed below are the respective roles of the CCTDP, PPII, and CCPI in ensuring the coal-based systems meet 21st century energy and environmental demands.

CCTDP

Begun in 1985, the CCTDP was the most ambitious government-industry initiative ever undertaken to develop environmental solutions for the use of the nation's abundant coal resources. The program's goal was to demonstrate the best, most innovative technology emerging from the world's engineering laboratories at a scale large enough so that industry could determine whether the new processes had commercial merit.

Originally, the CCTDP was a response to concerns over acid rain, which is formed by sulfur and nitrogen pollut-

ants that can be emitted by coal-burning power plants. Based on recommendations from Special Envoys appointed by the U.S. and Canadian governments, President Reagan commissioned the CCTDP as a cost-shared effort among the U.S. government, state agencies, and the private sector. Projects proposed by industry were selected through a series of five national competitions aimed at attracting promising technologies that had not yet been proven commercially. The commercial-scale projects have included SO_2 control systems, NO_x control technologies, fluidized-bed combustion, gasification, advanced coal processing technologies, and industrial process technologies. These technologies have allowed U.S. reliance on coal to continue, while cutting multiple pollutant emission levels by anywhere from 30 percent to 95 percent. More than 20 of the technologies tested in the original program have achieved commercial success.

PPII

When U.S. consumers were confronted in 1999 and 2000 with blackouts and brownouts of electric power in major regions of the country, Congress responded by directing DOE to issue "a general request for proposals for the commercial-scale demonstration of technologies to assure the reliability of the nation's energy supply from existing and new electric generating facilities... ."

On February 6, 2001, DOE issued a solicitation for proposals under the program it called the PPII. By the deadline of April 19, 2001, some 24 candidate projects had been submitted for government cost-shared financial assistance.

On September 28, 2001, DOE selected eight projects. Subsequently, three of the eight projects were withdrawn by their industrial sponsors.

CCPI

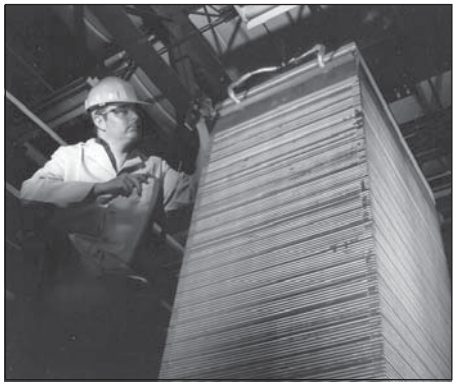
In the 21st century, additional environmental concerns have emerged: the potential health impacts of trace emissions of mercury, the effects of microscopic particles on people with respiratory problems, and the potential global climate-altering impact of greenhouse gases.

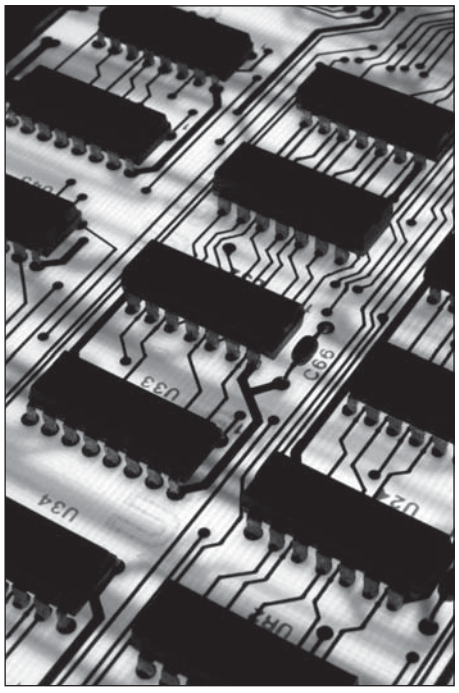
With coal likely to remain one of the nation's lowest-cost electric power suppliers for the foreseeable future, President Bush has pledged a new commitment to even more advanced clean coal technologies.

As the President said in presenting his National Energy Policy to the American public on May 17, 2001, "More than half of the electricity generated in America today comes from coal. If we weren't blessed with this natural resource, we would face even greater [energy] shortages and higher prices today. Yet, coal presents an environmental challenge. So our plan funds research into new, clean coal technologies."

Building on the successes of the original CCTDP, the new CCPI encompasses a broad spectrum of research and large-scale projects that target today's most pressing environmental challenges. The CCPI is designed to be implemented over 10 years, with a federal investment totaling $2 billion and an industry cost-share of 50 percent at a minimum.

Initially, the CCPI is providing government co-financing for new coal technologies that can help utilities meet the President's Clear Skies Initiative to cut sulfur, nitrogen, and mercury pollutants from power plants nearly 70 percent by 2018. Also, some of the early projects are showing ways to reduce greenhouse gases from coal plants by boosting the efficiency at which coal is converted to electricity or other energy forms.





The CCPI is closely linked with R&D activities that are conducted throughout the core elements of the President's Coal Research Initiative, which are driving toward ultra-clean, fossil-fuel-based energy complexes in the 21st century. The Clean Coal Technology Roadmap, developed cooperatively with the coal and power industry, addresses short- and long-term coal technology needs. When integrated with other DOE initiatives, CCPI will help the nation successfully commercialize advanced power systems that will produce electricity at efficiencies nearly double that of today's technologies, attain near-zero emissions, produce clean fuels, and have CO_2 management capabilities. The President's Global Climate Change Initiative commits the United States to reduce greenhouse gas intensity (the ratio of greenhouse emissions to economic output) by 18 percent over the next decade. Improving power plant efficiency is a potentially significant way to reduce carbon emissions in the near- and mid-term. In the longer term, CCPI technologies offering CO_2 capture and sequestration will remove fossil-fueled power as a threat to global climate change.

In Round 1 of CCPI (CCPI-1), the criteria for candidate projects was very broad — specifically, the solicitation was open to "any technology advancement related to coal-based power generation that results in efficiency, environmental, and economic improvement compared to currently available state-of-the-art alternatives." In many respects, CCPI-1 was intended to capture a snapshot of the full range of technological advancements made since the last major clean coal technology solicitation had been issued in 1992.

Of the six CCPI-1 projects, three are expected to contribute to the Global Climate Change Initiative to reduce greenhouse gases. Two of the projects will reduce CO_2 emissions, a primary greenhouse gas, by boosting the fuel use efficiency of power plants. The third project will demonstrate a process to convert coal by-products to a construction-grade aggregate. In addition, one project will install a high-tech process to a power plant that will absorb mercury and other air toxic emissions from the plant's flue gases, thus contributing to achieving the standards set by EPA CAMR and the President's Clear Skies Initiative. The two remaining projects will reduce air pollution through advanced gasification and combustion systems designed to extract the potential energy from waste coal piles (scattered throughout many areas of Pennsylvania and West Virginia) as a new source of fuel.

In February 2004, the second CCPI solicitation (CCPI-2) was issued and encouraged proposals to demonstrate advances in coal gasification systems, technologies that permit improved management of carbon emissions, and advancements that reduce mercury and other power plant emissions. In October 2004, DOE announced the selection of four projects from 13 proposals. As of June 30, 2006, three projects were under way and one project ended during the negotiation phase. The three active projects are valued at $2.7 billion, with DOE commitments of over $275 million.

The choice of the CCPI-2 solicitation categories reflected the Department's judgment of the most pressing technological needs confronting the nation's power industry in the 2010 to 2020 time frame. Two projects involve integrated gasification combined-cycle (IGCC) and the third addresses mercury control as well as other power plant emissions.

The future focus of the clean coal program will emphasize cutting-edge technologies. For example, rather than reducing emissions of a single pollutant, future pollution control projects will be encouraged to combine technologies into multi-pollutant control "packages" that can achieve superior

environmental effectiveness at the lowest possible cost. The remaining competitions are also likely to emphasize advanced technologies for reducing greenhouse gas emissions through dramatic improvements in fuel use and power generating efficiencies, by carbon capture and sequestration, or perhaps a combination of both.

2. Funding and Costs

Introduction

Funding for the Clean Coal Technology Demonstration Program (CCTDP), Power Plant Improvement Initiative (PPII), and Clean Coal Power Initiative (CCPI) previously was provided through the annual appropriations bills for the Department of the Interior and Related Agencies. Current appropriations are provided through the Energy and Water Subcommittees.

Congress has appropriated a net amount of $2.1 billion for the CCTDP based on appropriations bills that began in 1986. These funds were committed to demonstration projects selected through five competitive solicitations. As of June 30, 2006, there were 33 successfully completed projects. The final active project withdrew in March 2006 prior to completion, and is preparing a Final Report of activities performed.

A single PPII solicitation was conducted in 2001, with funding provided by appropriations for fiscal year 2001 (FY01) that established a transfer of $95 million in previously appropriated funding for the CCTDP. As of June 30, 2006, two projects were ongoing and two projects were complete. Three projects withdrew during the negotiation phase prior to contract award. One project withdrew after award, but prior to successful completion.

In addition to the $95 million made available for PPII, over $550 million has been appropriated for the CCPI. Exhibit 2-1 summarizes the funding by fiscal year for the PPII and CCPI programs. The amount of appropriated funds available for project awards is reduced by Program Support, the Small Business Innovation Research (SBIR) program, the Small Business Technology Transfer (STTR) program, and other adjustments. Program Support provides for a share of the DOE administrative expenses of the programs. The SBIR program implements the Small Business Innovation Development Act of 1982, and provides funding for small, innovative firms in selected research and development areas. The STTR program implements the Small Business Technology Transfer Act of 1992, which provides funding for small business concerns performing cooperative research and development (R&D) efforts. Other adjustments include across-the-board general and omnibus reductions that were imposed by Congress.

The Round 1 CCPI (CCPI-1) solicitation was conducted in 2002 based on funding provided by appropriations for FY02 and FY03. The Round 2 CCPI (CCPI-2) solicitation was conducted in 2005 with funding provided by appropriations for FY04 and FY05, along with uncommitted funds from prior CCPI and PPII appropriations. As of June 30, 2006, eight projects were under way with one project remaining in the negotiation phase. Three projects did not progress beyond the negotiation phase.

Exhibit 2-1

Funding for the CCPI and PPII Programs
(Dollars in Thousands)

	Fiscal Year						
	2001	2002	2003	2004	2005	2006	Total
PPII Projects	93,843						93,843
CCPI-1 Projects		144,565	143,626				288,191
CCPI-2 Projects				163,471	47,446		210,917
CCPI-3 Projects						47,633	47,633
Program Support	948	1,500	1,490	1,701	493	495	6,627
SBIR & STTR[a]		3,935	3,909	4,709	1,367	1,372	15,292
Other Adjustments[b]	209		975	2,119	694	500	4,497
Total	**95,000**	**150,000**	**150,000**	**172,000**	**50,000**	**50,000**	**667,000**

[a] Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) Programs. All Fossil Energy programs are required to contribute to these programs on an equal percentage basis.

[b] Across-the-board general and omnibus reductions required by the annual Appropriations Bills.

CCTDP

Congress has appropriated a net amount of $2.1 billion for CCTDP project awards and program administration expenses. These funds have been committed to demonstration projects selected through five competitive solicitations. As of June 30, 2006, there were 33 successfully completed projects. The final active project withdrew prior to completion in March 2006, and is preparing a Final Report of activities performed. The successfully completed projects resulted in a combined investment by the federal government and the private sector of $3.25 billion. DOE contributed $1.3 billion toward these projects, representing approximately 40 percent of the total project costs. Project participants contributed the majority of the project costs, averaging 60 percent for the 33 successfully completed projects.

In April 2006, DOE accepted the participant's request from the final remaining CCTDP project to terminate remaining activities. A Final Report of project accomplishments is being prepared. Exhibit 2-2 summarizes the project costs and financial status of the last active CCTDP project. The amount of funds DOE has made available as of June 30, 2006, for each active project is shown in Exhibits 2-2 through 2-5 under the "DOE Obligated" column. "DOE Cost" is the actual amount spent from the funds available.

PPII

The PPII was established by appropriations made for FY01 (Public Law 106-291) through a transfer of $95 million in funding previously appropriated for the CCTDP. Funds were committed to demonstration projects from a single solicitation issued in February 2001. From 24 applications, eight projects were selected for negotiation in September 2001.

As of June 30, 2006, two projects had been completed. Three projects withdrew during the negotiation phase prior to contract award. One project withdrew after award, but prior to successful completion. There are two ongoing projects. No additional solicitations are planned, and unused funds are intended for use under CCPI.

As of June 30, 2006, the DOE funding commitments for the PPII projects total over $30 million. The total funding commitment for the projects is over $70 million. For the PPII projects, participants have committed to funding 57 percent of the total project costs. Exhibit 2-3 summarizes the project costs and financial status of the PPII projects as of June 30, 2006.

Exhibit 2-2

Project Costs and Financial Status of Active CCTDP Projects
(Dollars in Thousands)

	Total Project Costs	DOE Share	DOE Obligated	DOE Cost
Clean Coal Diesel Demonstration Project (withdrawn, but preparing final reports)	41,611,958	20,805,979	20,805,979	17,672,062
Total Active CCTDP	**41,611,958**	**20,805,979**	**20,805,979**	**17,672,062**

CCPI

The CCPI supports the National Energy Policy (NEP) recommendation to increase investment in clean coal technology. The CCPI is a cost-shared partnership between government and industry to demonstrate advanced coal-based technologies, with the goal of accelerating commercial deployment of promising technologies to ensure the nation has clean, reliable, and affordable electricity. Thus far, two solicitations have been issued (CCPI-1 and CCPI-2).

Funding provided by appropriations for FY02 and FY03 served as the basis for the CCPI-1 solicitation. The initial CCPI competition began in March 2002 when DOE issued a solicitation offering $330 million in federal matching funds for industry-proposed projects. In January 2003, DOE announced that eight projects, valued at more than $1.3 billion, would make up the first round of the CCPI. Subsequently, two projects were withdrawn. Of the remaining six projects, five are ongoing and one remains in negotiation. As of June 30, 2006, the total cost of the projects was estimated at about $941 million, with the DOE share being approximately $259 million.

DOE funding commitments for the six active CCPI-1 projects represent less than 30 percent of the total estimated cost, while participant commitments exceed $680 million. The largest project in terms of total cost has proposed

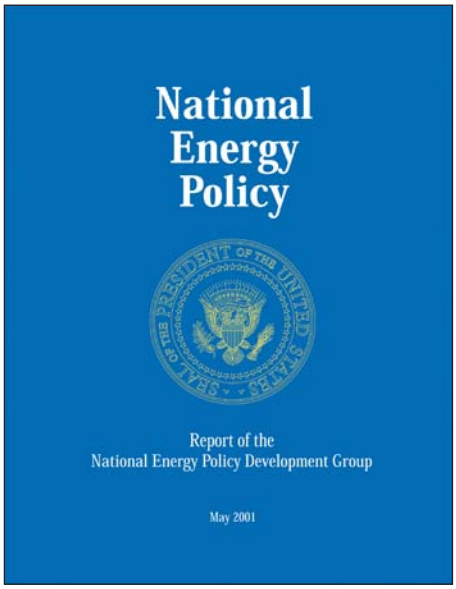


Exhibit 2-3

PPII Project Costs and Financial Status
(Dollars in Thousands)

	Total Project Costs	DOE Share	DOE Obligated	DOE Cost
Achieving NSPS Emission Standards Through Integration of Low-NO_x Burners with an Optimization Plan for Boiler Combustion (project ended prior to completion)	3,005,169	1,387,530	1,387,530	1,387,530
Big Bend Power Station Neural Network-Sootblower Optimization (project complete)	2,381,614	905,013	905,013	905,013
Commercial Demonstration of the Manufactured Aggregate Processing Technology Utilizing Spray Dryer Ash	19,581,734	7,224,000	7,224,000	7,224,000
Demonstration of a Full-Scale Retrofit of the Advanced Hybrid Particulate Collector (Advanced Hybrid™) Technology (project complete)	13,353,288	6,490,585	6,490,585	6,490,585
Greenidge Multi-Pollutant Control Project	33,127,188	14,509,708	12,603,257	0
Total PPII	**71,448,993**	**30,516,836**	**28,610,385**	**16,007,128**

over 80 percent participant funding, showing the strong commitment by participants to demonstrate clean coal technologies. Exhibit 2-4 summarizes the project cost and financial status of the CCPI-1 projects as of June 30, 2006.

Funding for CCPI-2 was provided by an appropriation of $172 million for FY04 and an appropriation of $50 million for FY05, along with uncommitted funds from prior CCPI and PPII appropriations. Round 2 of CCPI (CCPI-2) began in February 2004 when DOE issued a solicitation offering approximately $280 million in federal funds. In October 2004, four projects were selected, with DOE committing nearly $297 million. Subsequently, one project has withdrawn and three are under way. The IGCC projects under CCPI-2 represent several of the largest projects to date, with one having the largest total project cost at $2.1 billion (DOE commitment of $36 million) and one representing the largest DOE contribution of $235 million of a $569 million total project cost.

Exhibit 2-5 summarizes the project costs and financial status of the CCPI-2 projects as of June 30, 2006.

General Provisions and Project Administration

Projects in the CCTDP, PPII, and CCPI are subject to similar requirements and oversight. A principal characteristic of the demonstration projects is the cooperative funding agreement between the participant and the federal government referred to as cost-sharing. This cost-sharing approach was introduced in Public Law 99-190, An Act Making Appropriations for the Department of the Interior and Related Agencies for the Fiscal Year Ending September 30, 1986, and for Other Purposes. General concepts and requirements of the cost-sharing principle, as applied to the demonstration projects, include the following elements:

Exhibit 2-4

CCPI-1 Project Costs and Financial Status
(Dollars in Thousands)

	Total Project Costs	DOE Share	DOE Obligated	DOE Cost
Advanced Multi-Product Coal Utilization By-Product Processing Plant	8,979,544	4,480,793	621,407	486,122
Demonstration of Integrated Optimization Software at the Baldwin Energy Complex	19,904,733	8,592,630	8,592,630	5,719,063
Gilberton Coal-to-Clean Fuels and Power Co-Production Project (in negotiation)	612,480,000	100,000,000	0	0
Increasing Power Plant Efficiency – Lignite Fuel Enhancement	31,512,215	13,518,737	5,428,260	5,428,260
TOXECON Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers	52,978,115	24,859,578	24,859,578	24,859,578
Western Greenbrier Co-Production Demonstration Project	214,983,758	107,491,879	6,034,645	5,944,048
Total CCPI-1	**940,838,365**	**258,943,617**	**45,536,520**	**42,437,071**

Exhibit 2-5

CCPI-2 Project Costs and Financial Status
(Dollars in Thousands)

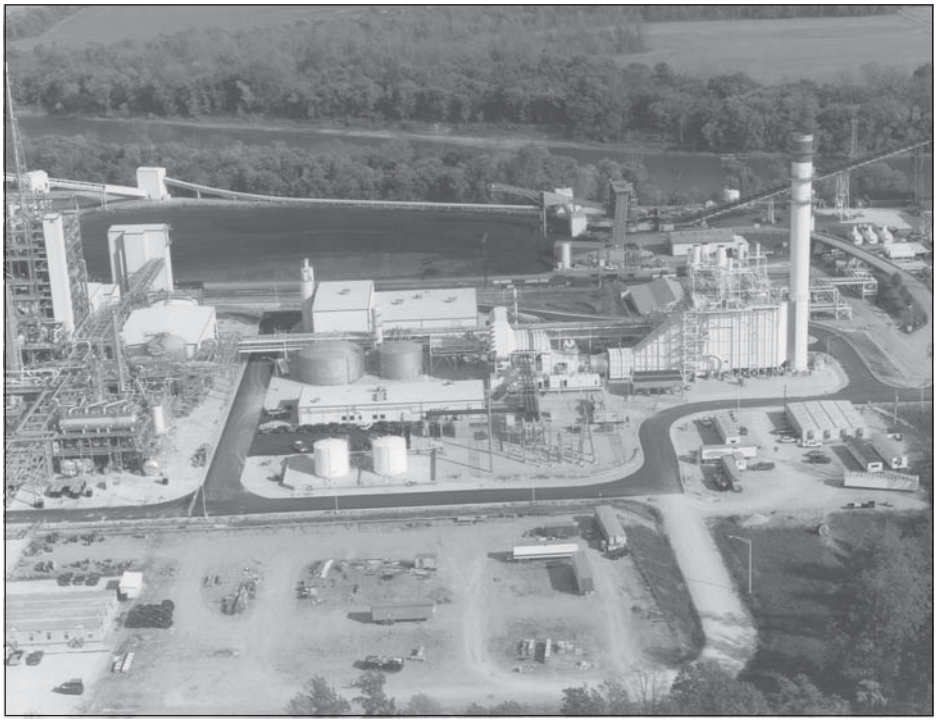
	Total Project Costs	DOE Share	DOE Obligated	DOE Cost
Demonstration of a 285-MWe Coal-Based Transport Gasifier	568,768,646	235,000,000	13,762,832	0
Mercury Specie and Multi-Pollutant Control	15,560,811	6,079,479	3,577,451	553,454
Mesaba Energy Project – Unit 1	2,155,680,783	36,000,000	22,245,505	7,196,123
Total CCPI-2	**2,740,010,240**	**277,079,479**	**39,585,788**	**7,749,577**

- The federal government may not finance more than 50 percent of the total costs of a project;
- Cost-sharing by the project participant is required throughout the project (design, construction, and operation);
- The federal government may share in project cost growth (within the scope of work defined in the original cooperative agreement) up to 25 percent of the originally negotiated government share of the project;
- The participant's cost-sharing contribution must occur as project expenses are incurred, and cannot be offset or delayed based on prospective project revenues, proceeds, or royalties; and
- Investments in existing facilities, equipment, or previously expended R&D funds are not allowed for the purpose of cost-sharing.

Another principal characteristic of the demonstration projects is an agreement made by the participant for the federal government to recoup up to the full amount of the federal government's contribution. This approach enables taxpayers to benefit from commercially successful projects. This is in addition to the benefits derived from the demonstration and commercial deployment of technologies, which improve environmental quality and promote the efficient use of the nation's coal resources. While the specific repayment terms have varied to some degree between the solicitations, the repayment requirement has been present since the first CCTDP solicitation. The duration of the repayment period is usually 20 years following the end of the project demonstration period. In accordance with Congressional direction, funds obtained from repayment provisions will be retained by DOE for future activities.

In terms of day-to-day oversight of the projects, the participant has responsibility for project management activities. The federal government monitors project activities, provides technical advice, and assesses progress by periodically reviewing project performance with the participant. The federal government also participates in decision making at key project junctures. These junctures are used to divide most projects into several time and funding intervals known as budget periods. The number of budget periods is determined during the negotiation process for each project prior to contract award. At the beginning of each budget period, DOE makes available the incremental amount of federal funds necessary to

cover the government's cost-share for that period. This procedure limits the government's financial exposure and assures that DOE fully participates in the decision to proceed with each major phase of project implementation. Through these activities, the federal government ensures the efficient use of public funds in the achievement of individual project and overall program objectives.



Wabash River Generating Station IGCC.

3. Projects

Introduction

This document provides fact sheets on clean coal technology demonstration projects encompassing the Clean Coal Technology Demonstration Program (CCTDP), Power Plant Improvement Initiative (PPII), and Clean Coal Power Initiative (CCPI). The project fact sheets reflect activities that have occurred since publication of the *2005 Clean Coal Technology Programs: Project Fact Sheets*.

The project fact sheets are organized by market sector rather than program to better enable stakeholders to see the scope of activity in key areas of interest. These market sectors are: (1) emissions control for existing and new power plants; (2) advanced power systems for repowering existing plants and providing new generation capacity; (3) clean coal fuels for converting the nation's vast coal resources to low-emission fuels; and (4) industrial applications for coal and coal by-products.

Two-page fact sheets are presented for 17 of the 20 projects covered in the report. The two-page fact sheets provide information on project participants, location, and funding; present project objectives; describe the project and technology; delineate benefits derived from the project; characterize project status and accomplishments; and define planned schedules.

Four-page fact sheets are provided for three projects (Advanced Coal Conversion Process, JEA Large-Scale CFB Combustion Demonstration Project, and Big Bend Power Station Neural Network-Sootblower Optimization) that have completed final documentation of project activities in time for inclusion in this report. These fact sheets include key findings and sufficient project discussion to establish a context for the findings and identify sources for additional information. One of the projects was completed in December 2004, with the issuance of a final technical report (Advanced Coal Conversion Process Demonstration). Although completed in 2004, it is included here because performance information was not available in time for the last fact sheet publication. The other three projects were completed in June 2005.

Technology Overview

Following is an overview of some of the major technology areas, underlying drivers, and associated challenges that are the current focus of CCPI, as well as PPII and the remaining CCTDP projects.

Emissions Control

Advanced NO_x Controls. Advanced nitrogen oxide (NO_x) controls address the need to comply with stringent emission requirements resulting from the following regulations/legislation: (1) the U.S. Environmental Protection Agency (EPA) Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone (commonly referred to as the NO_x SIP Call); (2) EPA's Standards of Performance for Electric Utility Steam Generating Units, *et al*, dated 2/27/06; (3) EPA's Clean Air Interstate Rule (CAIR); (4) EPA's Clean Air Mercury Rule (CAMR); and (5) the proposed Clear Skies Initiative (CSI).

Advanced NO_x control technologies include:

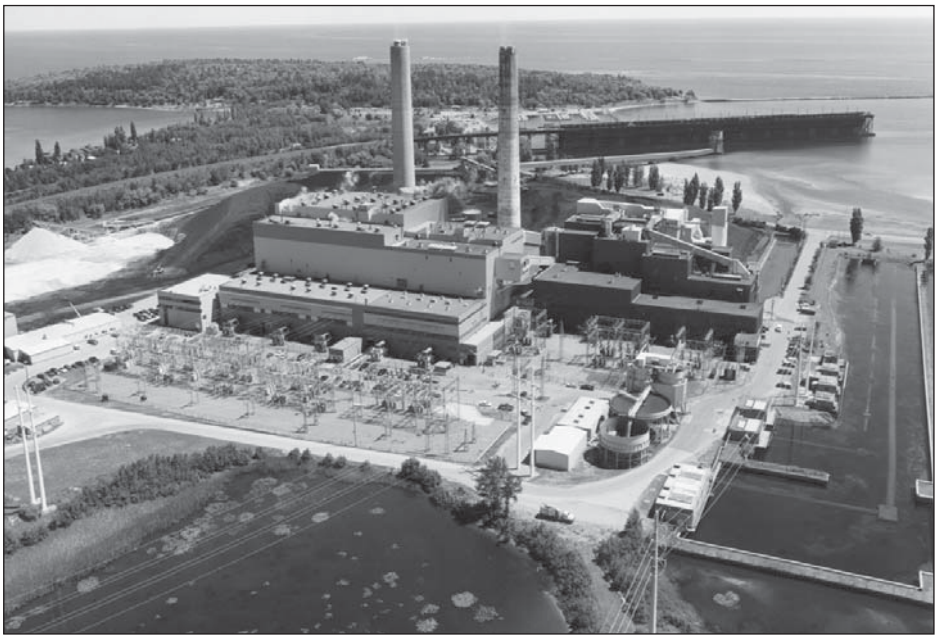
- Low-NO_x burners and reburning systems that limit NO_x formation by staging the introduction of air in the combustion process (combustion modification);
- Selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), and other chemical processes that act upon and reduce NO_x already formed (post-combustion processes); and

Advanced optimization software for enhanced emissions control is being demonstrated at Dynegy Midwest Generation's Baldwin Energy Complex in Baldwin, Illinois.

- Oxygen-enhanced combustion that displaces a portion of the air with oxygen in low-NO_x burners.

Low-NO_x burners: (1) limit the amount of air available in the initial stages of combustion when fuel-bound nitrogen is volatilized; (2) lengthen the flame to avoid hot spots; (3) usually are integrated with overfire air to complete combustion in a cooler zone; and (4) often are used with neural network controls for optimum load-following performances. Reburning systems inject fuel into flue gas to strip oxygen away from the NO_x and introduce overfire air to complete combustion. SCR and SNCR use ammonia/urea to transform NO_x into nitrogen and water. SCR typically requires an array of catalysts in a reactor vessel to operate at relatively low post-boiler application temperatures, whereas SNCR simply involves ammonia/urea injection in the boiler where temperatures are high. Oxygen-enhanced combustion reduces available nitrogen and enables deeper staging through increased combustion efficiency.

The challenge is to reduce NO_x emissions to 0.15 lb/10^6 Btu or less with technologies costing 25–50 percent less than current SCR systems. SCR has inherently high capital costs, and SNCR is inefficient. Thus, the options are to improve combustion modification techniques, improve SNCR efficiency, and/or use SCR more effectively.



TOXECON, a multi-pollutant control technology providing high mercury capture efficiency, is being demonstrated at Wisconsin Electric's Presque Isle Power Plant in Marquette, Michigan.

Mercury Controls. Mercury controls address proposed CSI targets and EPA regulations regarding mercury emissions from coal-based power generation, which represents roughly one-third of U.S. mercury emissions. In addition, a number of states have adopted or are moving to adopt more restrictive limits on mercury emissions. Mercury control technologies include:

- Sorbents and oxidizing agents to transform mercury into a solid to be removed along with fly ash in electrostatic precipitators (ESP) or fabric filter dust collectors (FFDCs), also referred to as "baghouses";
- Oxidizing agents in conjunction with wet flue gas desulfurization (FGD) scrubbers to capture mercury in sulfate by-products; and
- Real-time measurement of mercury species and total mercury, for process control and validation.

Solid sorbents adsorb the mercury and then are removed in either an ESP or FFDC. Oxidizing agents or mechanisms convert vapor-state elemental mercury to a solid-state mercury oxide that can be captured in ESPs, FFDCs, or wet FGDs. For plants equipped with wet FGDs, the oxidizing agent can be incorporated with the scrubber slurry used for sulfur capture. The mercury captured in the FGD by-product (gypsum, often used in wallboard), is chemically bound and precluded from re-release. Mercury instrumentation and controls measure both the mercury species (elemental and oxidized) entering the control device, and the total mercury entering the stack.

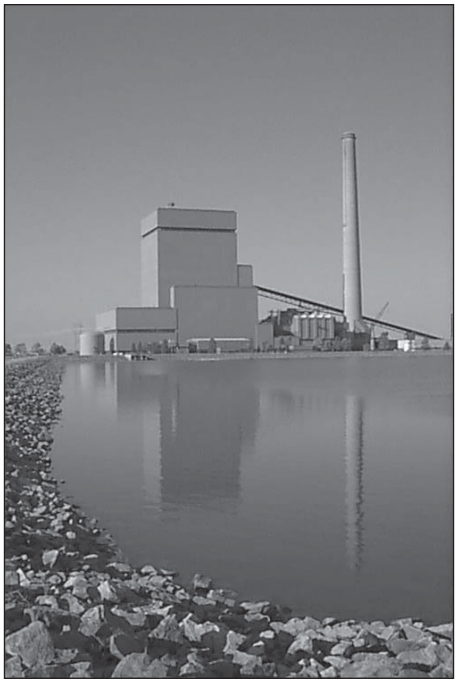
The challenge is to achieve 90 percent removal of mercury at 70 percent of today's cost of removal with activated carbon. Simple activated carbon injection techniques do not offer the efficient contact needed for 90 percent removal, because mercury occurs in highly dilute concentrations in power plant flue gas — typically around 30 parts per billion. FGD applications offer good mercury contact mechanisms, but mercury is subject to species shift from solid to vapor state in FGD processes.

Particulate Matter Controls. The control of particulate matter (PM), including PM equal to or less than 2.5 microns in size ($PM_{2.5}$), responds to EPA regulations and proposed CSI targets. The objective of the PM control program is to develop technology for coal-based sources that will result in substantial reductions in primary PM, its secondary precursors (SO_2 and NO_x), and problematic acid gases that can cause localized plume opacity and visibility impairment, and have been linked to human health impacts. Control technologies include:

- ESP/FFDC hybrids to leverage the best features of both NO_x and SO_2 removal;
- Flue gas preconditioning to enhance ESP performance;
- Concentration of particulate matter at ESP outlets for recycle;
- Alkaline injection for sulfur trioxide (SO_3) acid aerosol precursor control; and
- Continuous SO_3 analyzers for process control and validation.

ESPs electrically charge particulate matter for capture on collection plates. FFDCs use fabric filter bags that receive and collect particulate matter on the outside surface, and then are pulsed internally with jets of air to disengage the collected particulate. Preconditioning agents either lower resistivity or induce agglomeration of incoming particulate matter. Alkaline injection converts SO_2 and SO_3 acid precursors into readily captured sulfate particulates, and neutralizes other acid gases such as hydrochloric and hydroflouric acids. SO_3 analyzers measure input and output levels for control and validation.

The challenge is to control primary $PM_{2.5}$ to 0.01 lb/10^6 Btu or less with a 99.99 percent collection efficiency, and reduce acid aerosols by 95 percent. ESPs efficiently capture large volumes of primary PM in size ranges down to 10 microns. FFDCs efficiently capture fine particulates down to 0.1 micron, but at an economic penalty under large volumes; and many FFDC fabrics cannot stand the rigors of high SO_2 concentrations in the flue gas. Neither system alone can cost-effectively comply with a 99.99 percent removal of $PM_{2.5}$. The use of existing preconditioning agents to enhance ESP performance through agglomeration requires large quantities of ammonia, which under recent legislation has been classified as extremely hazardous. Aerosols readily escape conventional pollutant control devices. SCR applications exacerbate SO_3 production through catalytic oxidation of a



An advanced hybrid particulate collector is being demonstrated at Otter Tail Power Company's Big Stone Power Plant in Big Stone City, South Dakota.

Advanced CFB is being demonstrated at JEA's Northside Station in Jacksonville, Florida.

Lignite fuel upgrading is being demonstrated at Great River Energy's Coal Creek Station in Underwood, North Dakota.

Conversion of spray dryer ash to lightweight aggregate for construction materials is being demonstrated at the Birchwood Power Facility in King George, Virginia.

portion of the larger SO_2 fraction in the flue gas. No continuous SO_3 analyzer exists with the EPA Test Method sensitivity of 0.05 mg/m^3, which is needed to validate control.

Advanced Power Systems

Advanced Power Systems. Advanced power systems address Global Climate Change, Clear Skies, and Hydrogen Fuel Initiatives by enhancing power generation efficiency, producing near-zero pollutant emissions, and providing for hydrogen separation and carbon dioxide (CO_2) capture and sequestration. Advanced power technologies include:

- Integrated gasification combined-cycle (IGCC) systems that convert coal to a clean synthesis gas (syngas) amenable for use by gas turbines and advanced fuel cells; provide conversion to chemicals and clean transportation fuels, and separation into hydrogen and CO_2; and transform residual gases and solids into salable by-products;
- Circulating fluidized-bed (CFB) combustion systems that utilize low-grade fuels and waste materials to generate power at high efficiency and very low emissions, without the parasitic power drain of add-on environmental controls; and
- Advanced combustion techniques that use oxygen in lieu of air or chemical means, such as chemical looping, to effect the equivalent of combustion.

IGCC uses a gasifier to convert hydrocarbon feedstocks into largely gaseous components by applying heat under pressure in the presence of steam. Partial oxidation of the feedstock, typically with pure oxygen, provides the heat. Together the heat and pressure break the bonds between feedstock constituents and precipitate chemical reactions, producing syngas — primarily hydrogen

and carbon monoxide. Minerals in the feedstock (ash), separated in the gasifier, are largely salable. Sulfur emerges from the gasifier primarily as hydrogen sulfide, which is easily converted to either a pure sulfur or sulfuric acid by-product. CFBs use jets of air to support combustion, effectively mix feedstocks with SO_2 absorbents, and entrain the mixture. The entrained mixture is transported to a cyclone that separates the solids from the flue gas. Hot separated solids are returned to the CFB combustor. Relatively clean flue gas goes to a heat exchanger to produce steam that drives a steam turbine. The mixing and recycling action of the CFB allows high combustion efficiency at temperatures below the thermal NO_x formation temperature, and achieves high-efficiency SO_2 capture through lengthy and direct sorbent/SO_2 contact.

The challenge is to move today's coal-based advanced power systems from roughly 40 percent efficiency to 50 percent by 2010 and 60 percent by 2020 with capital costs approaching that of conventional coal-fired technologies.

Clean Coal Fuels

Upgrading. Upgrading coal quality enhances power plant efficiency and reduces emissions per kW of electricity produced, which supports CAIR, CAMR, and the Clear Skies and Global Climate Change Initiatives. Upgrading technologies include coal drying and ash removal methods to significantly increase coal energy density.

The challenge in coal drying and ash removal is to realize a net energy benefit in using the upgraded product; and for processes that export the product, a significant challenge resides in maintaining stability (preventing spontaneous combustion) of the product after removing *in-situ* water.

Conversion. Conversion of coal to clean liquid fuels, chemicals, or hydrogen enhances energy security and supports the Global Climate Change and Hydrogen Fuel Initiatives. Technologies include coal liquefaction, which involves converting coal gasification-derived synthesis gas into zero-sulfur, aromatic-free transportation fuels using the Fischer-Tropsch process; and hydrogen-from-coal processing techniques, which currently are under development.

The challenge resides in reducing process costs so that products are competitive with transportation fuels in the world market.

Industrial Applications

Direct Coal Use. Efforts under this area address substitution of coal for premium fuels in industrial applications such as coal for coke in steel making operations, and coal for oil or natural gas in energy production.

By-product Use. Efforts under this area address utilization of the vast amount of solid residue that is the by-product of coal cleaning and combustion — coal utilization by-products (CUBs). There are two primary targets: (1) abandoned coal waste piles from old mining operations, and (2) ash produced from existing coal-fired plants. Coal waste represents both a groundwater contamination threat and a potential source of energy. Coal ash, which represents a relatively untapped resource for construction materials, is, to a large extent, disposed of in landfills that are in increasingly short supply. By-product use technologies include:

- Coal waste reuse in power production to support reclamation of abandoned coal waste piles; and
- Conversion of coal ash to cement substitutes or additives and construction-grade aggregates.

The challenge is to demonstrate and document successful application of CUBs to provide the impetus for increased industry acceptance, leading to increased utilization from the current 30 percent to at least 50 percent by 2010.

Project Fact Sheets

An index to project fact sheets by market sector is provided in Exhibit 3-1, which is labeled in the order that the fact sheets appear. An index by program (CCTDP, PPII, CCPI-1, and CCPI-2) is provided in Exhibit 3-2. Within these breakdowns, projects are listed alphabetically by project name. Exhibit 3-3 is a map showing the location of the projects. Exhibit 3-4 presents the project schedules by market sector.

General project information is provided in side bars and headers surrounding the more detailed project information in each fact sheet. Above each schematic, specific technical thrusts within the four market sectors are indicated by a filled-in box (appears as a black box). At the top of the second page of each fact sheet, the project duration and period of operation are indicated in months. The project duration is the time from project award to the operation completed date. Schedules are provided by a series of vertically oriented bars designating the basic functional phases, starting with *Preaward* at the bottom and proceeding through *Design, Construction, Operation,* and final technical *Report Preparation* and completion. The length of the bar does not connote time (all phase bars are the same size); the time per phase is provided by dates at the beginning and end of each bar. Other milestone data of interest are provided to the right of the phase bars. General status is indicated by a continuous bar to the left of the phase bars that is shaded up to the approximate percent of completion of a phase.

All project fact sheets contain schematics of the demonstrated technology to help convey understanding. The portion of the process or facility central to the demonstration is denoted by a shaded area. For projects that have successfully completed the operation phase, the term *Demonstration Operations Complete* is shown directly below the project title. Projects that have withdrawn from the program include the term *Project Withdrawn* below the project title. Withdrawn projects are projects that have prematurely ended activities, either voluntarily or involuntarily at the behest of DOE. Withdrawals have occurred preceding and subsequent to the award of a Cooperative Agreement.

Other Information Sources

Other sources of information complement this document, allowing interested parties to follow programs and projects as they unfold. The Home Page of the DOE Office of Fossil Energy Web site provides the primary Internet gateway to clean coal technology program and project information at *http://www.fossil.energy.gov*. The National Energy Technology Laboratory (NETL) implements the clean coal technology programs, and provides another source of program and project information at *http://www.netl.doe.gov*, including a comprehensive repository for the latest published information — the *CCT Compendium* at *http://www.netl.doe.gov/technologies/coalpower/cctc/cctc_main.htm*. Also, the *Clean Coal Today* newsletter offers readers a quarterly look at clean coal technologies and related issues, highlighting key events, the latest project status, and listing the latest publications and upcoming events. Current and past editions of the *Clean Coal Today* newsletter can be found at *http://www.netl.doe.gov/technologies/coalpower/cctc/newsletter/newsletter.html*.

As projects unfold, NETL publishes *Topical Report* documents at critical junctures, highlighting particular technological advantages, project plans, and expected outcomes. Upon project completion, *Project Performance Summary* documents are published, providing synopses of the projects and highlighting operational, environmental, and economic performance. NETL also publishes a DOE assessment of each completed project.

Exhibit 3-1

Project Fact Sheets by Market Sector

Project	Program	Participant	Status[a]	Page
Emissions Control				
Achieving NSPS Emission Standards Through Integration of Low-NO_x Burners with an Optimization Plan for Boiler Combustion	PPII	Sunflower Electric Power Corporation	Withdrawn	3-12
Airborne Process Commercial Scale Demonstration	CCPI-2	Mustang Clean Energy	Withdrawn	3-14
Big Bend Power Station Neural Network-Sootblower Optimization	PPII	Tampa Electric Company	Completed	3-16
Demonstration of a Full-Scale Retrofit of the Advanced Hybrid Particulate Collector (Advanced Hybrid™) Technology	PPII	Otter Tail Power Company	Completed	3-20
Demonstration of Integrated Optimization Software at the Baldwin Energy Complex	CCPI-1	NeuCo, Inc.	Operation	3-22
Development of Hybrid FLGR/SNCR/SCR Advanced NO_x Control	PPII	TIAX, LLC	Withdrawn	3-24
Greenidge Multi-Pollutant Control Project	PPII	CONSOL Energy, Inc.	Construction	3-26
Mercury Specie and Multi-Pollutant Control	CCPI-2	Pegasus Technologies	Design	3-28
TOXECON Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers	CCPI-1	Wisconsin Electric Power Company	Operation	3-30
Advanced Power Systems				
Clean Coal Diesel Demonstration Project	CCTDP	TIAX, LLC	Withdrawn	3-34
Demonstration of a 285-MWe Coal-Based Transport Gasifier	CCPI-2	Southern Company Services, Inc.	Design	3-36
JEA Large-Scale CFB Combustion Demonstration Project	CCTDP	JEA	Completed	3-38
Kentucky Pioneer Energy IGCC Demonstration Project	CCTDP	Kentucky Pioneer Energy, LLC	Withdrawn	3-42
Mesaba Energy Project – Unit 1	CCPI-2	MEP-I LLC	Design	3-44
Clean Coal Fuels				
Advanced Coal Conversion Process Demonstration	CCTDP	Western SynCoal LLC	Completed	3-48
Gilberton Coal-to-Clean Fuels and Power Co-Production Project	CCPI-1	WMPI PTY., LLC	Negotiation	3-52
Increasing Power Plant Efficiency – Lignite Fuel Enhancement	CCPI-1	Great River Energy	Design	3-54
Industrial Applications				
Advanced Multi-Product Coal Utilization By-Product Processing Plant	CCPI-1	University of Kentucky Research Foundation	Design	3-58
Commercial Demonstration of the Manufactured Aggregate Processing Technology Utilizing Spray Dryer Ash	PPII	Universal Aggregates, LLC	Operation	3-60
Western Greenbrier Co-Production Demonstration Project	CCPI-1	Western Greenbrier Co-Generation, LLC	Design	3-62

[a] Withdrawn: Project prematurely ended activities, voluntarily or involuntarily at the behest of DOE, prior to the completion of planned project activities. Withdrawals have occurred preceding and subsequent to the award of a Cooperative Agreement.

Exhibit 3-2

Project Fact Sheets by Program

Project	Participant	Status[a]	Page
CCTDP			
Advanced Coal Conversion Process Demonstration	Western SynCoal LLC	Completed	3-48
Clean Coal Diesel Demonstration Project	TIAX, LLC	Withdrawn	3-34
JEA Large-Scale CFB Combustion Demonstration Project	JEA	Completed	3-38
Kentucky Pioneer Energy IGCC Demonstration Project	Kentucky Pioneer Energy, LLC	Withdrawn	3-42
PPII			
Achieving NSPS Emission Standards Through Integration of Low-NO_x Burners with an Optimization Plan for Boiler Combustion	Sunflower Electric Power Corporation	Withdrawn	3-12
Big Bend Power Station Neural Network-Sootblower Optimization	Tampa Electric Company	Completed	3-16
Commercial Demonstration of the Manufactured Aggregate Processing Technology Utilizing Spray Dryer Ash	Universal Aggregates, LLC	Operation	3-60
Demonstration of a Full-Scale Retrofit of the Advanced Hybrid Particulate Collector (Advanced Hybrid™) Technology	Otter Tail Power Company	Completed	3-20
Development of Hybrid FLGR/SNCR/SCR Advanced NO_x Control	TIAX, LLC	Withdrawn	3-24
Greenidge Multi-Pollutant Control Project	CONSOL Energy, Inc.	Construction	3-26
CCPI-1			
Advanced Multi-Product Coal Utilization By-Product Processing Plant	University of Kentucky Research Foundation	Design	3-58
Demonstration of Integrated Optimization Software at the Baldwin Energy Complex	NeuCo, Inc.	Operation	3-22
Gilberton Coal-to-Clean Fuels and Power Co-Production Project	WMPI PTY., LLC	Negotiation	3-52
Increasing Power Plant Efficiency – Lignite Fuel Enhancement	Great River Energy	Design	3-54
TOXECON Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers	Wisconsin Electric Power Company	Operation	3-30
Western Greenbrier Co-Production Demonstration Project	Western Greenbrier Co-Generation, LLC	Design	3-62
CCPI-2			
Airborne Process Commercial Scale Demonstration	Mustang Clean Energy	Withdrawn	3-14
Demonstration of a 285-MWe Coal-Based Transport Gasifier	Southern Company Services, Inc.	Design	3-36
Mercury Specie and Multi-Pollutant Control	Pegasus Technologies	Design	3-28
Mesaba Energy Project – Unit 1	MEP-I LLC	Design	3-44

[a] Withdrawn: Project prematurely ended activities, voluntarily or involuntarily at the behest of DOE, prior to the completion of planned project activities. Withdrawals have occurred preceding and subsequent to the award of a Cooperative Agreement.

Exhibit 3-3

Geographic Locations of Projects

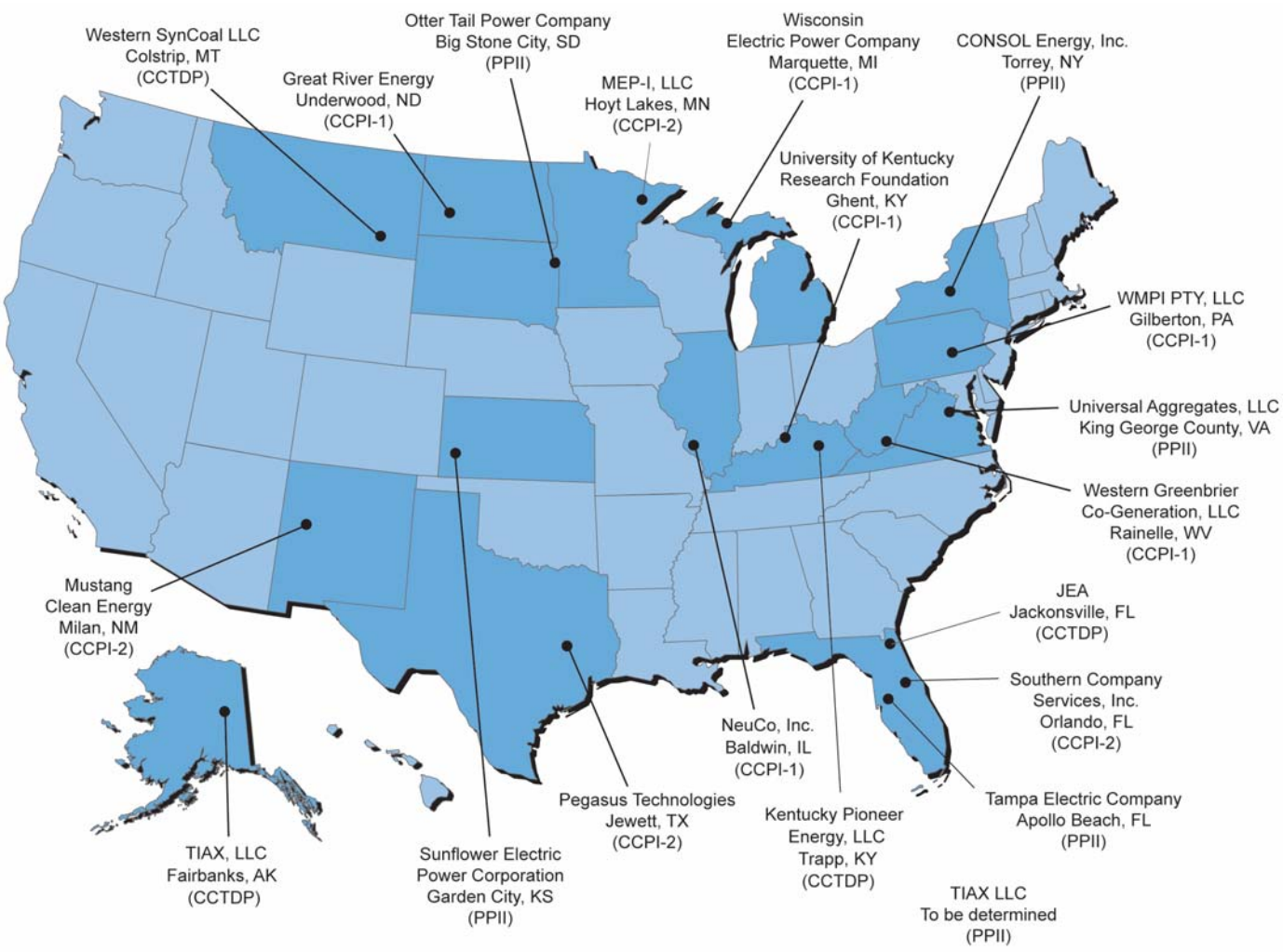
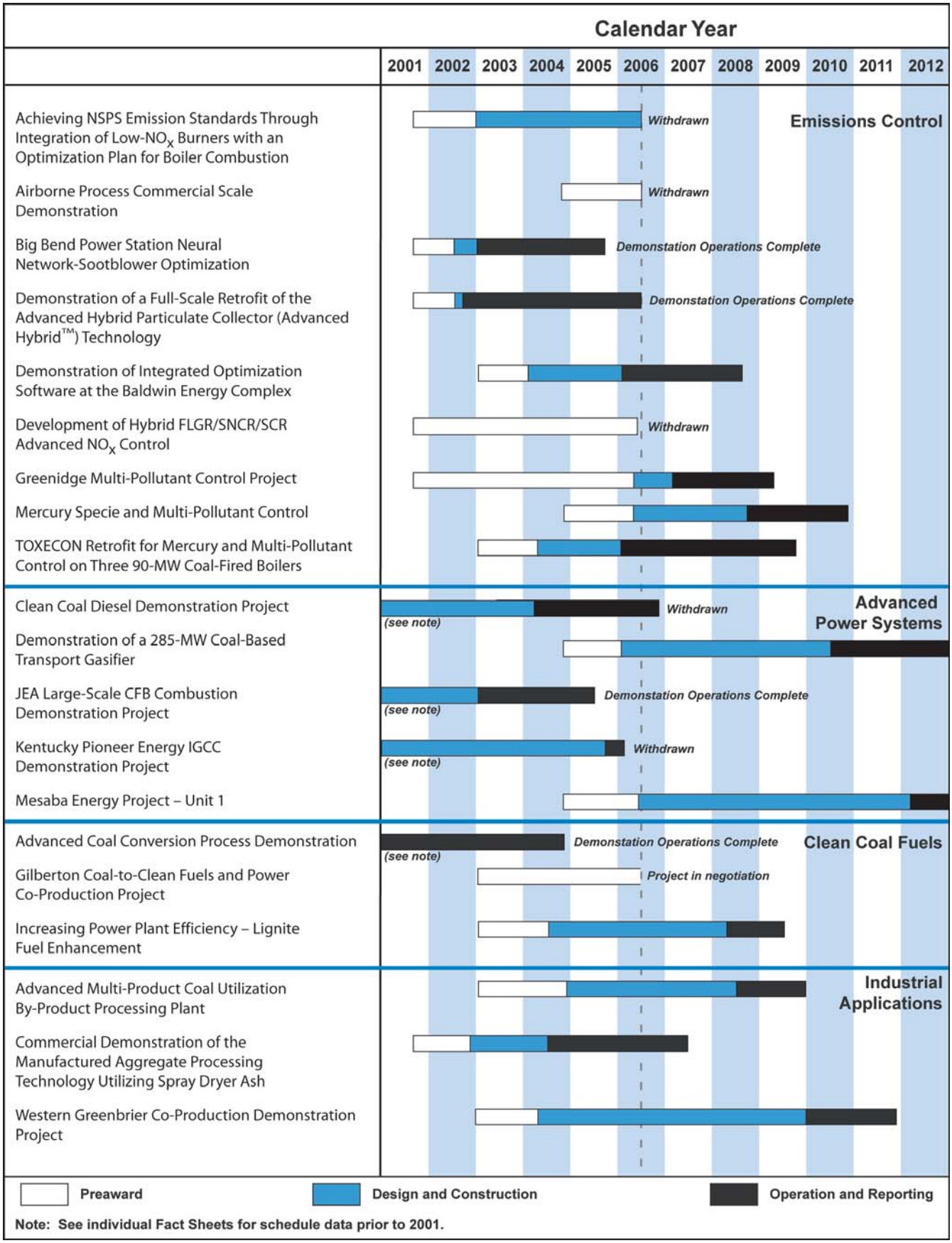


Exhibit 3-4

Project Schedules by Market Sector



Emissions Control

Achieving NSPS Emission Standards Through Integration of Low-NO_x Burners with an Optimization Plan for Boiler Combustion

Project Withdrawn

Participant

Sunflower Electric Power Corporation

Additional Team Members

Electric Power Research Institute — cofunder

GE Energy and Environmental Research Corp. — technology supplier

Location

Garden City, Finney County, KS (Sunflower Electric's Holcomb Station, Unit No. 1)

Technology

Modified low-NO_x burners (LNBs) with other combustion-staging controls

Plant Capacity/ Production

360 MW

Coal

Powder River Basin subbituminous

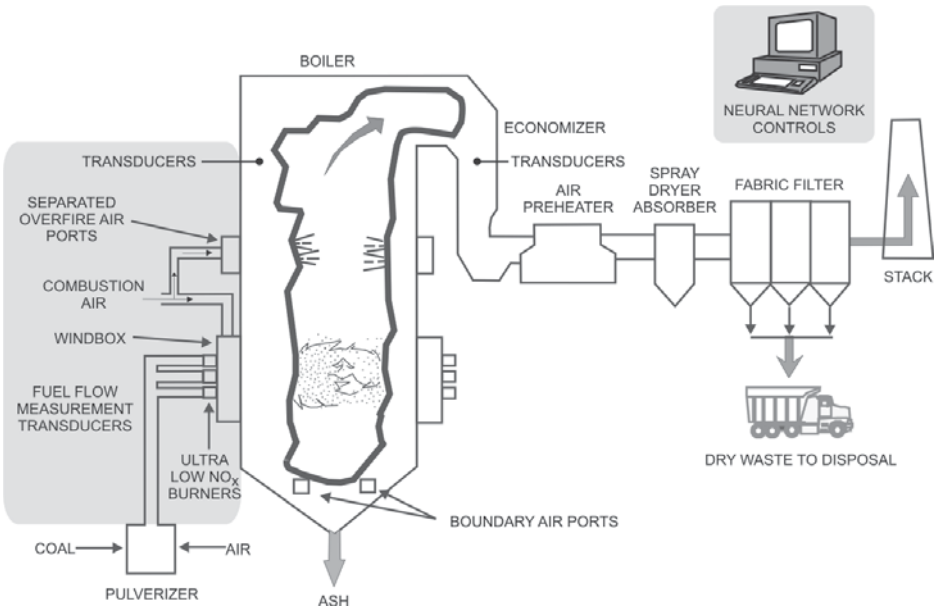
Project Funding

Total	$3,005,169	100%
DOE	1,387,530	48
Participant	1,617,639	52

PPII

Emissions Control

Mercury	☐	NO_x	■
SO_2	☐	$PM_{2.5}$	☐



Objectives

To demonstrate reduction of nitrogen oxide (NO_x) emissions to 0.15 lb/10^6 Btu by applying advanced low-NO_x burners (LNBs), coupled with separated overfire air (SOFA), sensors to measure key boiler parameters, and an artificial intelligence (AI) system to effectuate control; and to increase power output 7 MW by reducing the boiler heat rate.

Technology/Project Description

The project demonstrates modification of "first generation" LNBs and addition of SOFA and neural network controls to meet New Source Performance Standards (NSPS) for NO_x (0.15 lb/10^6 Btu), and improve heat rate on a 360-MW wall-fired boiler. This approach is being used in lieu of selective catalytic reduction (SCR) to reduce costs to ratepayers. Existing "first-generation" LNBs, which reduced NO_x emissions by 50 percent from uncontrolled emission rates, will be modified to optimize both the flame shape and the mixing of air and fuel. SOFA will be installed to allow the LNBs to operate under fuel-rich conditions, which reduces NO_x by providing air to complete combustion in a cooler zone above the LNBs. Staging the combustion and completing the combustion in a relatively cool zone of the boiler reduces NO_x emissions by avoiding hot spots and thermal NO_x emissions formation temperatures (2,800 ºF and above). Sensors and controls will be incorporated to measure and effectuate fuel flow and fuel/air balancing, and neural networks (AI systems) will allow integration of sensor input into optimization software to enhance boiler performance. With the high reactivity of the Powder River Basin coal being used, the LNB/SOFA system with neural network controls is expected to achieve an additional 40 percent reduction in NO_x emissions (beyond the original 50 percent reduction achieved). AI controls are expected to reduce boiler slagging and thereby improve heat rate. Incorporation of the combustion modification elements (LNB, SOFA, and AI sensors and controls) and modification of existing LNBs will be implemented sequentially to assess the benefits attributable to each action.

Project Duration 30 Months	Period of Operation *Project Withdrawn*	Status/Schedule *Estimated date

Benefits

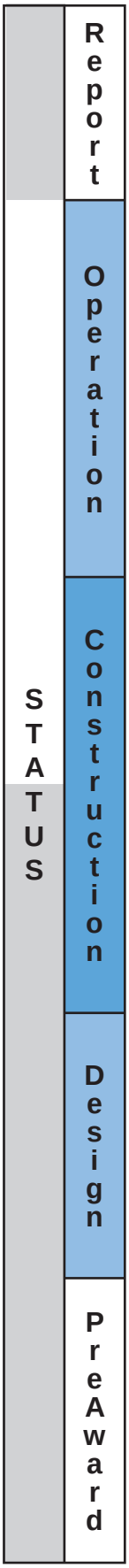
The combustion modification approach used in this project to meet NSPS NO_x emissions has distinct advantages over SCR, which is the conventional approach. While SCR can achieve low NO_x levels, it is 4 to 5 times more expensive than combustion modification; is difficult to retrofit; increases plant operating costs; reduces plant efficiency; and both uses and emits ammonia. The LNB/SOFA system in combination with AI sensors and controls offers a low-cost NO_x emissions compliance option that should enhance boiler efficiency and avoid escalation of annual operating costs. The outage time required for the combustion modification retrofit should be far less than that required for an SCR system. There are as many as 30 units throughout the United States for which this technology could be deployed to meet the current NSPS level (units that use high-reactivity coals, such as Powder River Basin coal). Additionally, there are about 60 units throughout the United States that will be able to achieve significant NO_x reductions, to levels of about 0.22 lb/10^6 Btu.

Status/Accomplishments

The project was selected for award on September 26, 2001. The cooperative agreement was awarded on December 17, 2002. To satisfy the National Environmental Policy Act (NEPA), DOE issued an Environmental Assessment (EA) in March 2003 and signed a Finding of No Significant Impact (FONSI) on March 11, 2003. Construction began immediately after signing of the FONSI.

A combustion optimization sensor package and coal flow monitoring system were installed. The existing LNBs were modified; however, problems caused delay of SOFA system installation. Sunflower decided to replace the existing LNBs and solicited bids for installation of new ultra low-NO_x burners and SOFA. Bids for the new low-NO_x burners came in higher than expected.

Due to significant cost increases associated with replacing the modified low-NO_x burners and other factors, Sunflower decided to withdraw their application to proceed with the second and final funding phase for the project. A Final Report of project activities was completed in June 2006.



Final Report Issued	*6/06*
Draft Report Issued	*9/05*
Operation Completed	*N/A*
Operation	*N/A*
Project Withdrawn	*6/05*
Construction	*3/03*
NEPA Completed (EA and FONSI)	*3/03*
Award	*12/02*
Selection	*9/01*

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Airborne Process Commercial Scale Demonstration

Project Withdrawn

Participant

Mustang Clean Energy
(a subsidiary of Peabody Energy)

Additional Team Members

Airborne Clean Energy, LLC — technology supplier/manager

Veolia Water North America — regeneration engineer/constructor

Icon Construction — fertilizer engineer/constructor

Mustang Energy Company, LLC — power plant owner/operator

Location

Milan, McKinley County, NM
(Mustang Generating Station)

Technology

Airborne Process for SO_x, NO_x, and mercury control with salable fertilizer by-products

Project Capacity/ Production

346 MW (gross); 300 MW (net)

Coal

El Segundo subbituminous

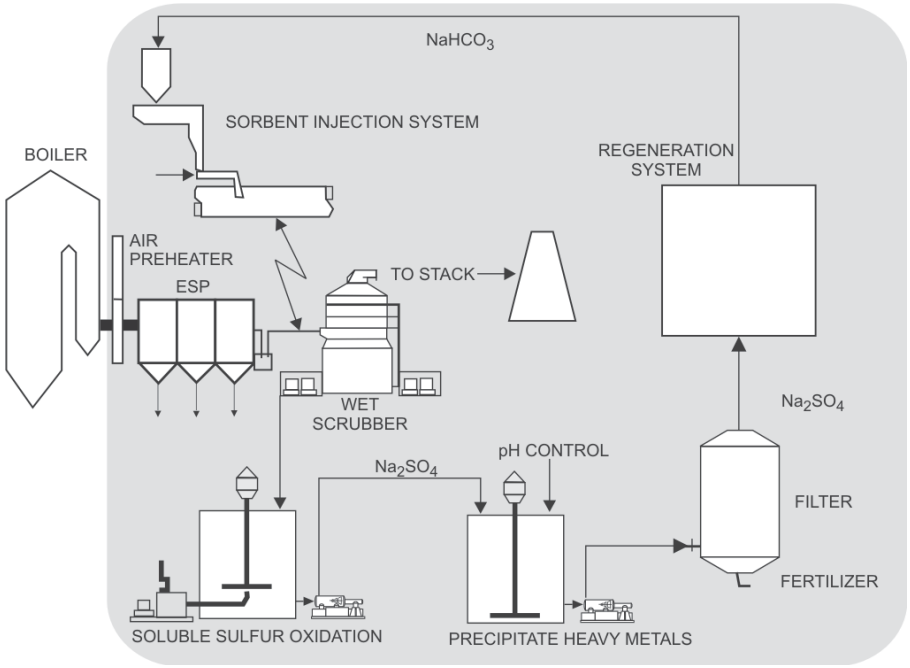
Project Funding (Proposed)

Total	$93,195,888	100%
DOE	19,700,000	21
Participant	73,495,888	79

CCPI-2

Emissions Control

Mercury	■	NO_x	■
SO_2	■	$PM_{2.5}$	■



Objectives

To successfully demonstrate 99.5 percent removal of sulfur dioxide (SO_2), 98 percent removal of sulfur trioxide (SO_3), 98 percent removal of nitrogen oxides (NO_x), and 90 percent removal of mercury while producing a high-quality, high-value granular fertilizer by-product; to improve cost competitiveness of coal-fired capacity by showing that a significant revenue stream can be generated from the fertilizer by-product; to demonstrate the commercial applicability of the Airborne Process to existing and new coal-fired plants; and to demonstrate 96 percent process availability during the first year of operation.

Technology/Project Description

The project will demonstrate the Airborne Process for high-capture efficiency multi-pollutant emissions control, and high-value fertilizer production at the 300-MW (net) pulverized coal-fired Mustang Generating Station. In the process, dry sodium bicarbonate ($NaHCO_3$) is injected in the flue gas duct downstream of the plant's particulate matter collection system (an electrostatic precipitator). The $NaHCO_3$ mixes with the flue gas containing SO_2, SO_3 (the $PM_{2.5}$ acid gas mist precursor), and NO_x. The sorbent and gases further react in a downstream sodium wet scrubber, forming sodium sulfate (Na_2SO_4) and sodium nitrate ($NaNO_3$). The process converts vapor-state elemental mercury to an oxidized form that is captured in the wet scrubber and precipitated from solution for safe disposal. The Na_2SO_4 and $NaNO_3$ compounds are further processed in the regeneration system by reaction with ammonium bicarbonate (NH_4HCO_3) to form a sodium bicarbonate ($NaHCO_3$) sorbent, which is reused in the flue gas scrubbing process, and an ammonium sulfate/ammonium nitrate ($(NH_4)_2SO_4/NH_4NO_3$) mixture. This mixture is processed by Airborne's patented granulation process into a salable fertilizer product.

Project Duration *Project Withdrawn*	Period of Operation *Project Withdrawn*	Status/Schedule *Estimated date

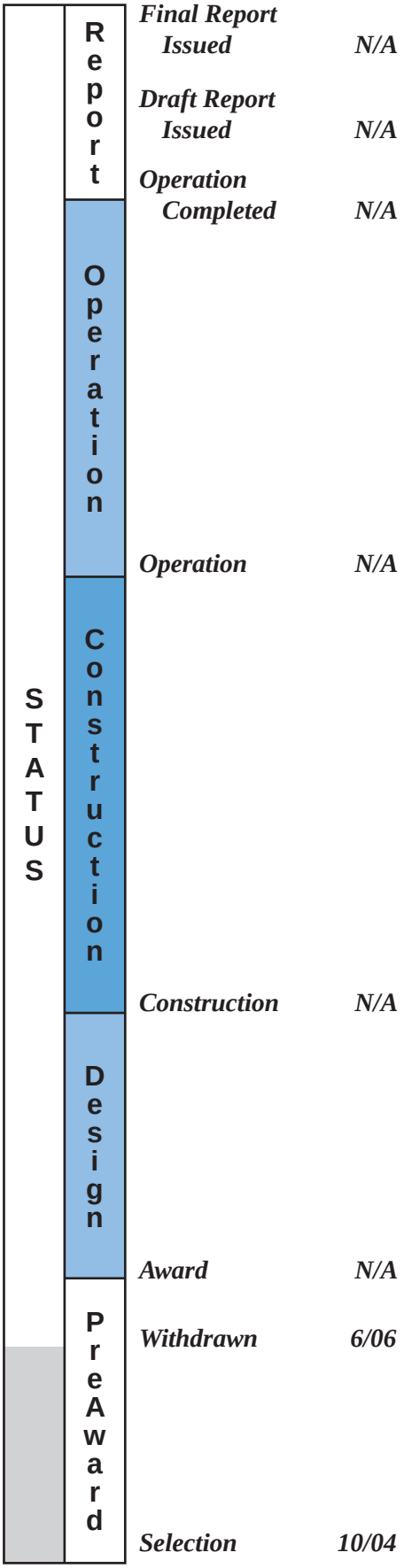
Benefits

The Airborne process offers a high-capture efficiency multi-pollutant control system that enables coal-fired plants to cost-effectively comply with current and projected emission standards, while producing a valuable by-product to help offset a portion of the operating costs and pay down the capital investment. The multi-pollutant control feature reduces capital investment per pound of pollutant controlled by using common capital equipment to control more than one pollutant. In addition to offsetting some of the operating costs with a by-product revenue stream, operating costs are reduced by regenerating sorbent for the process and avoiding solid waste disposal costs.

Status/Accomplishments

The project was one of four projects selected under the second round of the Clean Coal Power Initiative (CCPI), which received 13 proposals.

The New Mexico air permitting process has impacted the negotiation schedule. Peabody's application for an air permit was submitted to the state; however, the state was not anticipated to issue a permit for the project in the near future. In May 2005, DOE informed the participant that documented progress needed to be made toward obtaining an air permit, or negotiation activities could end. On June 14, 2006, DOE sent a letter to the participant withdrawing from negotiations.



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Big Bend Power Station Neural Network-Sootblower Optimization

Demonstration Operations Complete

Participant

Tampa Electric Company

Additional Team Members

Pegasus Technologies (a division of NeuCo, Inc.) — technology supplier

Location

Apollo Beach, Hillsborough County, FL (Tampa Electric's Big Bend Power Station)

Technology

NeuCo's Neural Network-Intelligent Sootblowing System (NN-ISB) control system with advanced sensors and water cannons

Plant Capacity/ Production

445 MW

Coal

Bituminous

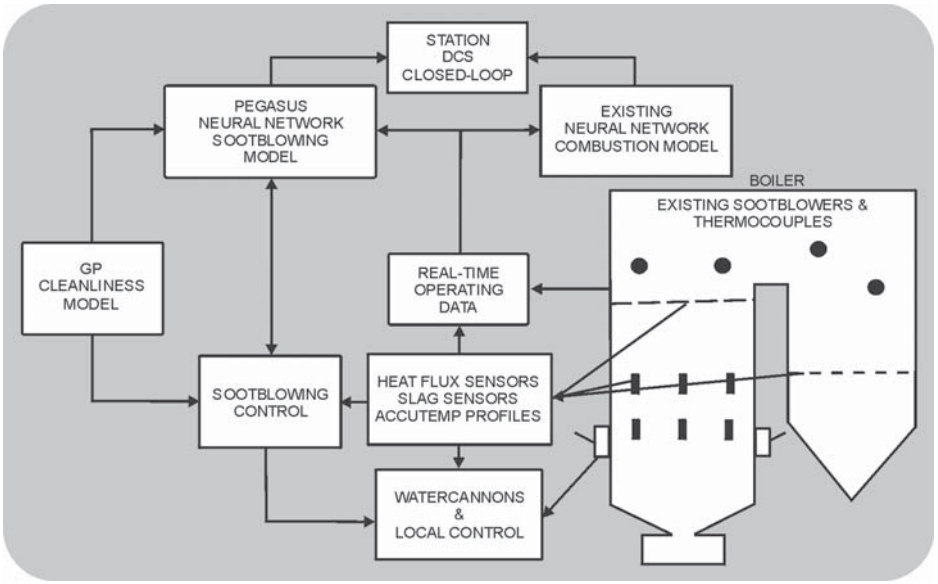
Project Funding

Total	$2,381,614	100%
DOE	905,013	38
Participant	1,476,601	62

PPII

Emissions Control

Mercury	☐	NO_x	■
SO_2	☐	$PM_{2.5}$	■



Objectives

To demonstrate that the Pegasus Technologies Neural Network-Intelligent Sootblowing System (NN-ISB) control system, along with advanced instrumentation and water cannons, can optimize sootblowing on a 445-MW boiler, reduce nitrogen oxide (NO_x) emissions by up to 30 percent, improve heat rate by 2 percent, and reduce particulate matter (PM) emissions by up to 5 percent.

Technology/Project Description

The project demonstrates Pegasus Technologies' NN-ISB control system, along with advanced instrumentation and water cannons, to optimize engagement of sootblowing systems in the control of boiler fouling on a 445-MW wet-bottom, turbo-fired boiler. Heat flux sensors, slag sensors, and temperature profiling instrumentation are applied at key locations to provide real-time data to the NN-ISB, which interprets the data through optimization software developed to send appropriate signals to existing sootblower controls. Signals are sent only to the sootblowers in the specific section(s) of the boiler requiring cleaning. The NN-ISB operates in a closed loop mode; *i.e.*, the on-line system responds to real-time data and adjusts controls without need of manual activation by the plant operator. Adjustments are made to optimization software as results are obtained. Also, water cannons are installed to provide sootblowing of boiler tube-walls in the furnace area. The NN-ISB optimization system is programmed to activate sootblowers only when and where needed. The need is determined by signals indicating that heat transfer from combustion products to the heat-absorbing surfaces in the boiler is being impacted to the point where NO_x emissions and heat loss could rise to unacceptable levels. Activation also is influenced by opacity readings. Spikes in opacity readings indicate that the PM control system is being overloaded, which calls for earlier or sequential activation of sootblowers.

Benefits

NN-ISB technology offers a low-cost approach to enhancing the efficiency and reducing NO_x and PM emissions at coal-fired plants by optimizing control of heat transfer surface fouling. Fouling of heat transfer surfaces in coal-fired boil-

Project Duration 30 Months	Period of Operation 24 Months	Status/Schedule *Estimated date

ers by ash and slag compromises plant efficiency by impeding transfer of heat to the working fluid (water/steam). Heat remains in the flue-gas and exits to the environment without beneficial use. This loss in efficiency translates to higher consumption of fuel for equivalent levels of electric generation; hence, more gaseous emissions are produced. Also, as fouling of the boiler increases and the rate of heat transfer decreases, peak temperatures increase, which increases NO_x emissions. Due to the composition of coal, PM is also a by-product of coal combustion. Modern utility boilers usually are fitted with electrostatic precipitators (ESP) to aid in the collection of PM. Although extremely efficient, these devices are sensitive to rapid changes in inlet mass concentration as well as total mass loading. Without extreme care and due diligence, excessive soot can overload an ESP, resulting in high levels of released PM. Utility boilers use sootblowers to dislodge and clean heat transfer surfaces through application of steam, water, or air using established rules or operator judgment. As noted above, NO_x and PM emissions and boiler performance are directly affected by the sootblowing practices on a unit. NN-ISB technology optimizes sootblowing by controlling ash and slag buildup based on real-time events and conditions in the boiler, through neural-networks that use programmed logic to act on the information before certain performance thresholds are crossed.

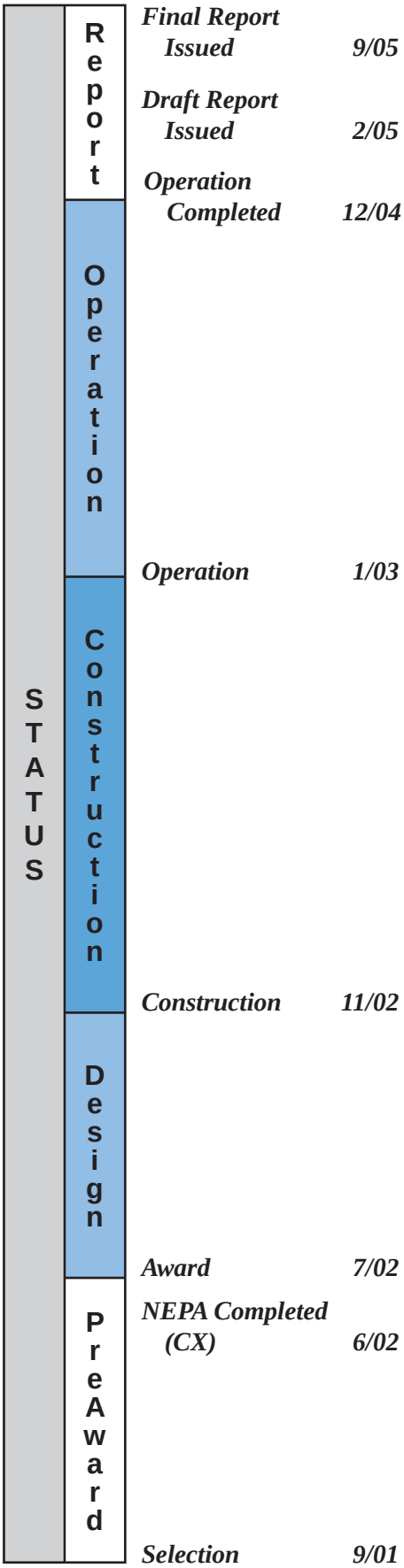
Status/Accomplishments

The project was selected for award on September 26, 2001. On July 9, 2002, a cooperative agreement was awarded. The National Environmental Policy Act (NEPA) requirements were met with a Categorical Exclusion (CX) on June 21, 2002.

Design, procurement, and installation of subsystems were completed in December 2002. Project operations were initiated in January 2003 when baseline testing of individual system components commenced. Checkout of each subsystem was conducted to verify the manufacturer's specifications.

In May 2003, parametric testing was initiated for training of the neural network, and preliminary first stage NN-ISB was installed at TECO Big Bend in September 2003.

Preliminary closed-loop (automatic mode) testing was initiated in December 2003, with verification and validation of automatic-mode operation using real-time operating data in April 2004.



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In August 2004, acceptance testing of the NN-ISB system in the automatic mode was completed. In late December 2004, testing of the system was completed, ending the "benefits demonstration" phase of the project.

The draft final report was issued in February 2005, and the final report was accepted by DOE in September 2005.

Results Summary

There are innumerable soot blowing control systems with varying levels of sophistication in use throughout the industry. The NN-ISB system is believed to be a superior control system largely because of the innovative software it employs. Indeed, the improvements demonstrated by this project are evident in NO_x emission reduction, efficiency, and opacity control, albeit the overall success of the technology was somewhat compromised by problems with water cannons and some other components originally intended for the project. The benefits achieved go well beyond ordinary manual sequencing protocol, and include higher integration of soot blowing systems. To accurately measure operating results, it was determined that open loop, closed loop, and extended modes of operation should be examined. These modes were performed in 15-minute intervals during the months of September and October 2004. Two types of coal blends were used during the open loop, closed loop, and extended modes, one producing relatively higher NO_x than the other. Specific conclusions from the demonstration follow.

Tampa Electric Big Bend Station.

1. A neural network soot-blowing system, *i.e.*, the NN-ISB system, was installed on the test unit along with the instrumentation to permit measurement of NO_x and opacity reduction, as well as improved efficiency. This instrumentation provided the measurements as planned.
2. Unit efficiency contribution was calculated by means of the total Performance Efficiency Index, revealing an improvement of 10 Btu/kWhr at high load to 50 Btu/kWhr at low load, when comparing the open loop to closed loop NN-ISB tests.
3. When the closed loop NN-ISB was compared to the 2002 baseline year, improvements of 20 Btu/kWhr at high load points to as much as 420 Btu/kWhr at low load were observed. The project participant acknowledges, however, that several other operational conditions may have contributed to these values.
4. NO_x reductions recorded by the NN-ISB ranged from no measurable difference to 8.5 percent NO_x reduction, compared to baseline conditions using a variety of coal and unit operating conditions.
5. Opacity measurements during the same period of NO_x data acquisition indicated no measurable difference, while examination of the opacity trends during open loop and closed loop indicated an improvement ranging from 1 percent to 1.5 percent during soot blowing activities.

Project Summary

The neural network process is dependent upon a component, known as the Executive Pegasus, for coordinating the tasks associated with the NN-ISB and an optimizer. The Executive Pegasus determines the optimum heat distribution relative to the target objectives of the project. The process adjusts the factors needed under the list of target objectives for use by the optimizer. A model is used to project the timing of soot buildup. The system also includes a process for generating and maintaining certain system constraints.

An Application Programing Interface (API) was used for several key components and sensors, and a Human Machine Interface (HMI) for the operators was programmed into the unit's existing Distributed Control System (DCS). In order to activate intelligent soot blowing, a set of standard displays was developed and coded for this component of the project. A set of overview displays also was created to track essential information.

Because there was an existing base of relevant knowledge gained from pre-existing soot-blowing practices, information was codified through a combination of parametric tests, and then was incorporated as part of the NN-ISB constraints. Information relevant to new factors also was gathered during the parametric tests, and similarly incorporated into the system.

While accumulation of data pertinent to the objectives of the project is necessary, the heart of the project remains the neural networks that provide the ability to build non-linear empirical models. This technology has the advantage of the capability to self re-tune the system while on-line. It is this feature that takes into account changing fuel conditions, equipment performance, and environmental conditions.

The project was full scale and established significant results for emissions reduction and unit performance improvements. The unit is rated at a nominal 455 MW, and in this respect was well suited to demonstrate applicability of the technology to other utility boilers. The unit also experienced a variety of typical unit circumstances during the demonstration period, and therefore was representative of units across the United States.

Economics

It is difficult to perform an economic analysis because the cost of installing a NN-ISB system will vary widely from plant to plant, depending on many factors including boiler type and size, fuel being burned, and the instrumentation and control system already in place. The following analysis is based on a new installation in a unit similar to Big Bend No. 2. Although the benefits assumed in this analysis were not fully achieved by this project, it is likely that they are achievable in a new installation that incorporates the lessons learned.

There are two major potential savings from installation of a NN-ISB system. The first is a reduction in coal usage as a result of an efficiency gain. The coal burned in Unit No. 2 is estimated at one million tons per year, at a cost of $40/ton. If an efficiency improvement of 1 percent can be achieved, this would decrease coal consumption by 10,000 tons/yr for a savings of $400,000/yr. Furthermore, this efficiency improvement would result in a reduction of SO_2 and CO_2 emissions in direct proportion to the reduction in fuel consumption.

The other potential savings is in the area of NO_x reduction, which can be quantified by using the value of a NO_x allowance on the trading market. At an assumed heat rate of 10,000 Btu/kWh and a capacity factor of 60 percent, the NO_x emitted from Big Bend Unit No. 2 is estimated to be 7,000 tons/yr (0.6 lb/10^6 Btu). A 5 percent reduction in NO_x emissions would eliminate 350 tons/yr of NO_x. Assuming that the NO_x cap and trade program is available at the plant installing the NN-ISB system, and that the value of one NO_x allowance is $2,000, this would amount to an annual revenue of $700,000.

The cost of this project was about $3,400,000, which included not only testing the NN-ISB system, but also testing water cannons and various novel instruments, as discussed above. The cost of the NN-ISB system alone was about $600,000. Because this was a first-of-a-kind project with special challenges, Pegasus Technologies estimates that costs for a new project to install NN-ISB incorporating lessons learned would be in the range of $300,000 to $500,000, provided that no new equipment or instrumentation were required at the plant. If only benefits from efficiency gains and NO_x reduction are considered, the project would pay off in five to nine months. Any additional benefits from improved performance or reduced maintenance would decrease this payout period, while any additional costs would increase the payout period.

Demonstration of a Full-Scale Retrofit of the Advanced Hybrid Particulate Collector (Advanced Hybrid™) Technology

Demonstration Operations Complete

Participant

Otter Tail Power Company

Additional Team Members

Montana-Dakota Utilities — co-host

NorthWestern Public Service — co-host

W.L. Gore & Associates, Inc. — licensee and filter bag provider

Energy and Environmental Research Center (University of North Dakota) — concept developer

Location

Big Stone City, Grant County, SD (Montana-Dakota Utilities and NorthWestern Public Service's Big Stone Power Plant)

Technology

Advanced Hybrid™ (formerly known as Advanced Hybrid Particulate Collector)

Plant Capacity/ Production

450 MW

Coal

Powder River Basin subbituminous

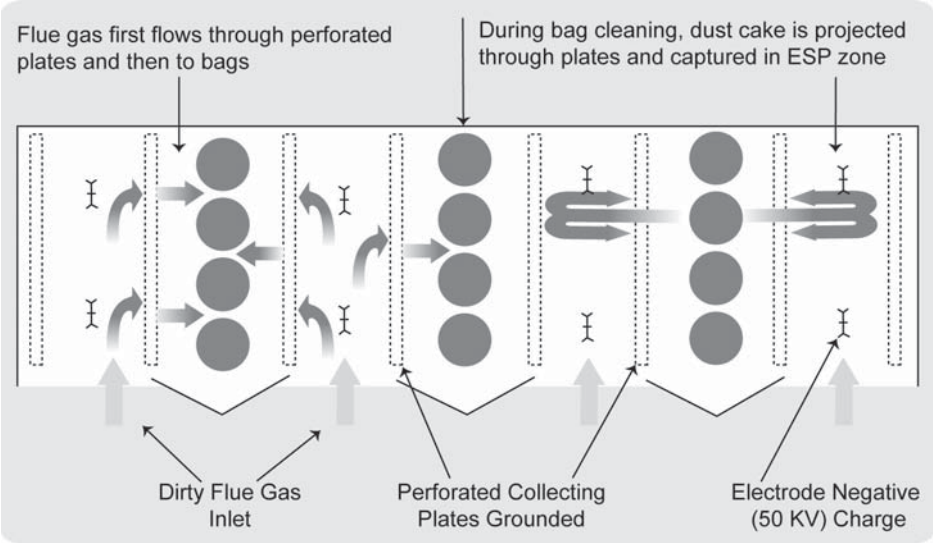
Project Funding

Total	$13,353,288	100%
DOE	6,490,585	49
Participant	6,862,703	51

PPII

Emissions Control

Mercury	☐	NO_x	☐
SO_2	☐	$PM_{2.5}$	■



Objectives

To demonstrate up to 99.99 percent overall particulate matter (PM) capture for all particle sizes greater than 0.01 microns, to demonstrate the ability of the Advanced Hybrid Particulate Collector (AHPC) to achieve low pressure drop (below 10 inches of water column) at an air-to-cloth ratio of 12 feet per minute, and to attain economic viability relative to competing technologies.

Technology/Project Description

The project demonstrates Advanced Hybrid™ technology in controlling PM from a 450-MW cyclone boiler burning Powder River Basin (PRB) coal. The Advanced Hybrid™ system combines electrostatic precipitator (ESP) and fabric filter dust collection (FFDC) technologies in a synergistic manner that leverages the best features of both. ESPs efficiently capture large volumes of PM in size ranges down to 10 microns. FFDCs efficiently capture fine particulates down to 0.1 micron, but at an economic penalty under large volumes. Leveraging these characteristics, the Advanced Hybrid™ uses an ESP to capture approximately 90 percent of the PM from incoming dirty flue gas, and uses an FFDC to capture only the balance of the PM. Perforated ESP plates surround the fabric filter bags and capture PM that is charged by electrodes placed between the plates. Remaining PM, which is predominately fines, passes to fabric filter bags made of highly efficient membrane material for removal. When the fabric filter bags are cleaned by pulsing jets of air from within, the re-entrained PM, not falling to a collection bin, is captured by the ESP.

Benefits

Revised National Ambient Air Quality Standards (NAAQS) for fine PM will require power plants to remove a high percentage of 2.5 microns or less ($PM_{2.5}$) in the 2007 to 2008 timeframe. FFDCs are the current state-of-the-art technology for $PM_{2.5}$ control. The Advanced Hybrid™ integrates an FFDC with an ESP in a synergistic manner that allows the systems to operate at far higher throughputs (2.5 to 4 times) than a stand-alone conventional FFDC. Advanced Hybrid™ fabric filter bag materials offer higher capture efficiency than conventional bags that must sustain full PM loading from incoming dirty flue gas. Stand-alone FFDCs

Project Duration 43 Months	Period of Operation 39 Months	Status/Schedule *Estimated date

also suffer from re-entrainment of PM when the bags are cleaned, a problem nearly eliminated in the Advanced Hybrid™. Testing the Advanced Hybrid™ with PRB coal affords an excellent test of the system since these coals offer high resistivity, which reduces the efficiency of ESPs.

Status/Accomplishments

The cooperative agreement was awarded July 2, 2002. The National Environmental Policy Act (NEPA) requirement was met with an Environmental Assessment (EA) and issuance of a Finding of No Significant Impact (FONSI) on June 11, 2002. Construction commenced in July 2002 and was completed in October 2002.

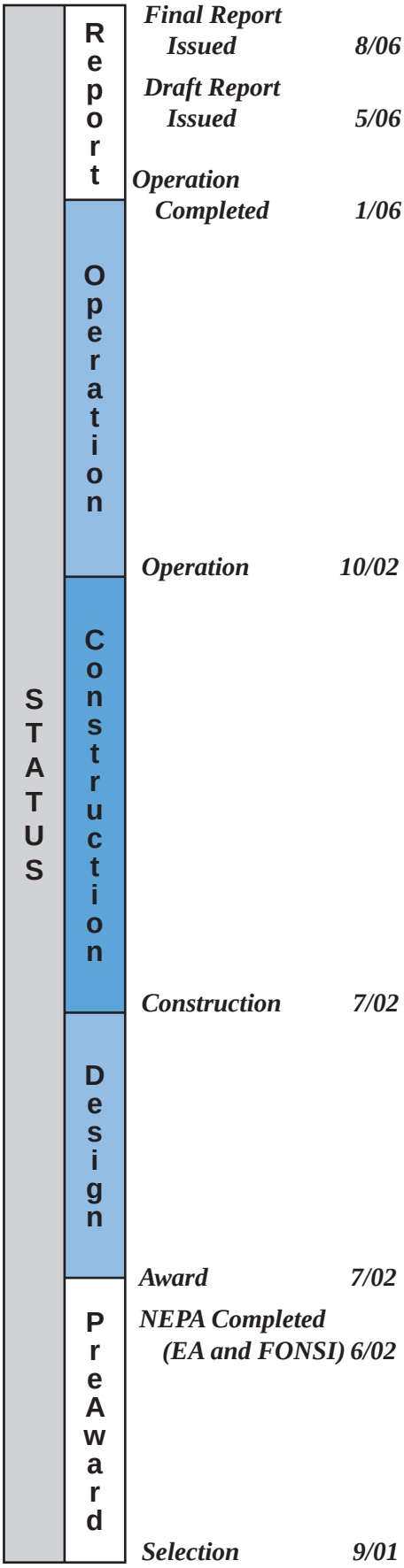
The first 6 months of operation showed very good particulate removal efficiency, but at a higher than anticipated pressure drop. Performance testing has shown that the outlet dust loading is almost two orders of magnitude lower than the guarantee limit of 0.002 grains per actual cubic foot.

While the technology provided high removal efficiency, problem areas included high pressure drop, shorter than expected bag life, and frequent cleaning cycles. In December 2003, operators replaced 3 out of 20 rows of bags in one compartment with the baffles, in an effort to improve flow and pressure drop. Also, one-third of the filter bags were replaced with bags made of a different material to evaluate performance.

In a June 2004 outage, baffles were installed in three compartments and approximately 40 percent of the bags were replaced. Unfortunately, bag life issues persisted and opacity limits were exceeded on several occasions due to bag failures. Additional bags were replaced in an October 2004 outage.

During 2005, pressure drop issues persisted and the ESP components developed problems. Repairs made in July 2005 to the ESP components were not effective and the plant was forced to lower production output on multiple occasions. Following modifications made in December 2005, problems with the particulate collector continued. Changes are needed to enable full load operations. Otter Tail is considering options to achieve acceptable performance.

The period of performance for the project ended on January 31, 2006, and final contract deliverables were received in June 2006. A four-page completed project fact sheet will be provided in the next *Program Update*.



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Demonstration of Integrated Optimization Software at the Baldwin Energy Complex

CCPI-1

Emissions Control

Mercury ■ NO_x ■

SO_2 ■ $PM_{2.5}$ ■

Participant
NeuCo, Inc.

Additional Team Members
Dynegy Midwest Generation — host

Location
Baldwin, Randolph County, IL (Dynegy Midwest Generation's Baldwin Energy Complex)

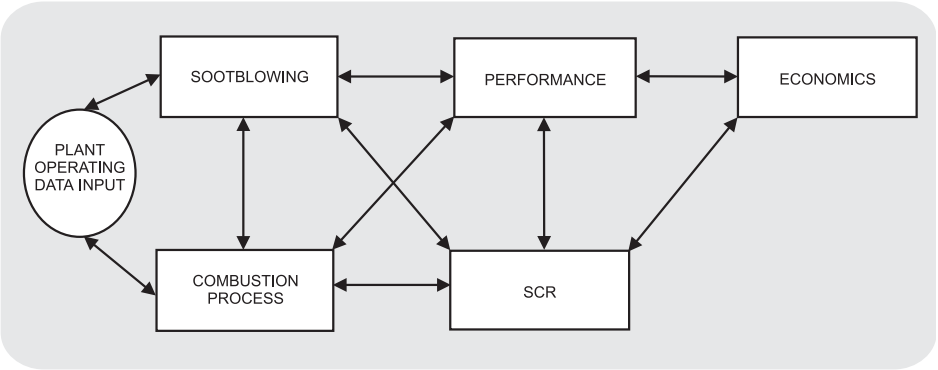
Technology
Advanced optimization software, building on NeuCo's ProcessLink™ technology

Project Capacity/ Production
1,768 MW

Coal
Powder River Basin subbituminous

Project Funding

Total	$19,094,733	100%
DOE	8,592,630	45
Participant	10,502,103	55



Objectives
To design and apply individual on-line optimization modules at the Baldwin Energy Complex for combustion, sootblowing, selective catalytic reduction (SCR) operations, overall unit thermal performance, and plant-wide economic optimization; to link individual optimization modules through NeuCo's ProcessLink™ platform; and to reduce the Baldwin Energy Complex nitrogen oxide (NO_x) emissions by 5 percent, and increase efficiency by 1.5 percentage points and improve reliability and availability, increasing net annual electrical power production by 1.5 percentage points.

Technology/Project Description
This project demonstrates an integrated on-line optimization control system at the Baldwin Energy Complex, incorporating inputs from two 585-MW cyclone-fired boilers with SCR and a 595-MW tangentially fired boiler with low-NO_x burners (LNBs). Optimization modules shall be developed and operated in a non-manual, neural control (closed loop) mode for control of combustion, sootblowing, SCR operations, overall unit thermal performance, and plant-wide economic operation. Modules include software and additional sensors and actuators, as required. These optimization modules are to be integrated through NeuCo's ProcessLink™ architectural platform that includes neural networks, genetic algorithms, and "fuzzy logic" techniques. ProcessLink™ capabilities enable the various optimization techniques at the Baldwin Energy Complex to be linked to each other, leveraging the existing control network. Each module is to be designed, installed, and tested individually to verify effectiveness, before being integrated with the other modules. The system allows collection of data and computations from other networked computers or resources rather than requiring that all data and logic be resident on a single computer. Ultimately, after the optimization modules and associated sensors/controls/actuators are integrated and optimized, the following benefits should result: substantial improvement in enhanced SCR performance for lower NO_x emissions; increased thermal efficiency and reliability for reduced overall emissions per unit of energy reduction; increased power output; and lower costs to consumers.

Benefits
NeuCo's ProcessLink™ architecture offers plant operators a highly flexible control platform. Optimization modules can be designed and applied to individual subsystems in a plant, leveraging existing sensors, actuators and networked

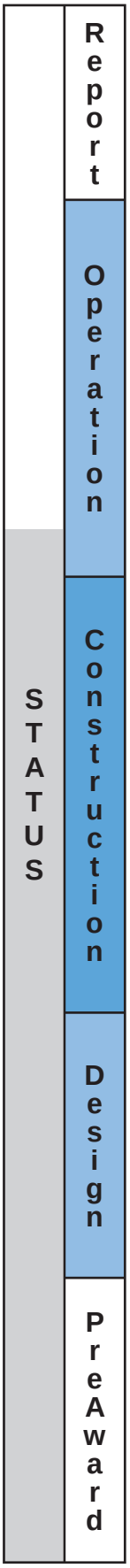
Project Duration 48 Months	Period of Operation 24 Months	Status/Schedule *Estimated date

computational resources, and then linked to other individual subsystems to afford overall integration of controls responsive to plant operator and corporate criteria. As plant complexity increases through retrofit and repowering applications, the introduction of new technologies, and plant modifications, this integrated process optimization approach can be an important tool for plant operators. In this application, upon linkage of five separate optimization modules, improved SCR performance is expected to reduce NO_x emissions by 5 percent while extending SCR catalyst life one year and reducing ammonia consumption by 15 percent. In parallel, Baldwin Energy Complex's thermal efficiency is expected to increase by 1.5 percentage points; and the plant's reliability and availability is expected to improve, increasing net annual electrical power production by 1.5 percentage points, which lowers the cost of electricity. Emissions of carbon dioxide (CO_2), mercury (Hg), sulfur dioxide (SO_2), and particulate matter (PM) are reduced in proportion to the efficiency gain per unit of energy produced.

Status/Accomplishments

The project was selected for award on January 8, 2003. On February 18, 2004, a cooperative agreement was awarded. The National Environmental Policy Act (NEPA) requirements were met with a Categorical Exclusion (CX) at the time of award.

NeuCo designed and installed combustion optimization (CombustionOpt) modules on the two cyclone-fired boilers (Units 1 and 2) and the tangentially fired boiler (Unit 3). NeuCo installed and tested an online ammonia analyzer to monitor ammonia slip in support of the SCR control optimization (as opposed to indirect optimization through combustion controls). Two software packages in support of the sootblowing optimization module (Soot-Opt) were installed on the tangentially fired boiler (Unit 3). Version 2 of ProcessLink™ was installed on Unit 3. NeuCo developed and operated a steam cycle model for the performance optimization module (PerformanceOpt). An integrated version of the real-time PerformanceOpt Complex Boiler Model and the Steam Cycle Model was installed on Units 1 and 2. Work continues on fine tuning the models to improve consistency. NeuCo has submitted its first repayment after the sale of two PerformanceOpt systems.



Final Report Issued	*8/08**
Draft Report Issued	*5/08**
Operation Completed	*2/08**
Operation	*2/06*
Construction	*5/04*
Award	*2/04*
NEPA Completed (CX)	*2/04*
Selection	*1/03*

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Development of Hybrid FLGR/SNCR/SCR Advanced NO_x Control

Project Withdrawn

Participant

TIAX, LLC (acquired the research contracts of Arthur D. Little, Inc. [ADL])

Additional Team Members

Fuel Tech — selective non-catalytic reduction (SNCR) technology supplier

Babcock Power — technology partner

Location

Multiple locations were attempted

Technology

A hybrid NO_x control system incorporating fuel-lean gas reburn/selective non-catalytic reduction (FLGR/SNCR), SNCR, and selective catalytic reduction (SCR)

Plant Capacity/ Production

N/A

Coal

Eastern bituminous

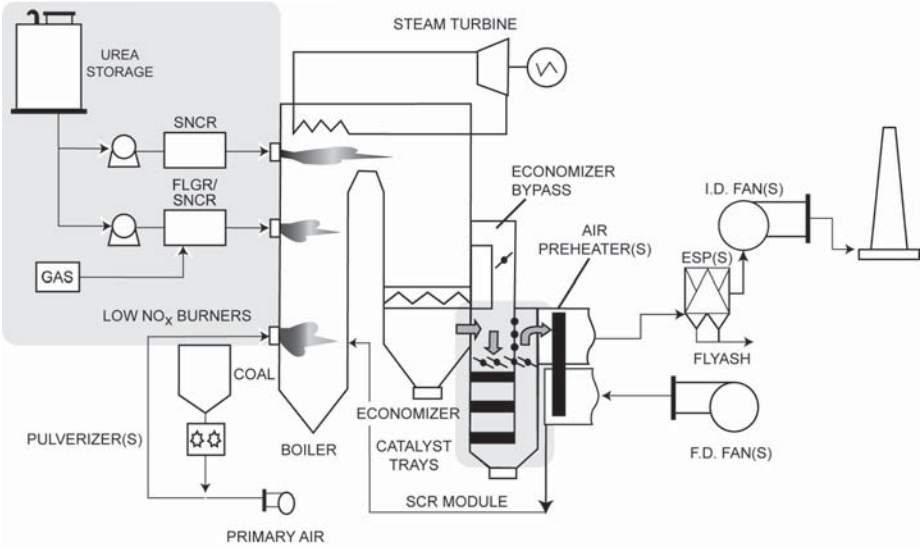
Project Funding (Proposed)

Total	$28,300,000	100%
DOE	13,900,000	49
Participant	14,400,000	51

PPII

Emissions Control

Mercury	☐	NO_x	■
SO_2	☐	$PM_{2.5}$	☐



Objectives

To demonstrate that a hybrid nitrogen oxide (NO_x) control system integrating and optimizing fuel-lean gas reburn/selective non-catalytic reduction (FLGR/SNCR), SNCR, and compact selective catalytic reduction (SCR) can reduce NO_x emissions to 0.15 lb/10^6 Btu at lower costs than a single, full-scale conventional SCR unit; and to demonstrate the flexibility of the hybrid to respond to an array of dispatch requirements through selected engagement of hybrid components.

Technology/Project Description

In this process, the individual components (FLGR/SNCR, SNCR, and compact SCR) are arranged in such a manner as to be complementary/synergistic. FLGR/SNCR is itself a proven synergistic integration that affords better NO_x control in combination than the individual components alone. FLGR/SNCR is installed above the existing low NO_x burners (LNBs), and complements the LNBs by providing boiler-level combustion staging that allows the LNBs to operate with less oxygen, which reduces NO_x formation. SNCR follows with urea injection at a location in the boiler providing optimum SNCR process temperatures to act upon residual NO_x from FLGR/SNCR processing, and to provide urea for the downstream SCR module. The compact SCR is sized to control only the residual NO_x from the FLGR/SNCR and SNCR. The hybrid components can be operated individually or in selected combination to provide the operator flexibility in dispatching the unit in accordance with allowed emissions that may change with the season and other factors.

Project Duration *Project Withdrawn*	Period of Operation *Project Withdrawn*	Status/Schedule *Estimated date

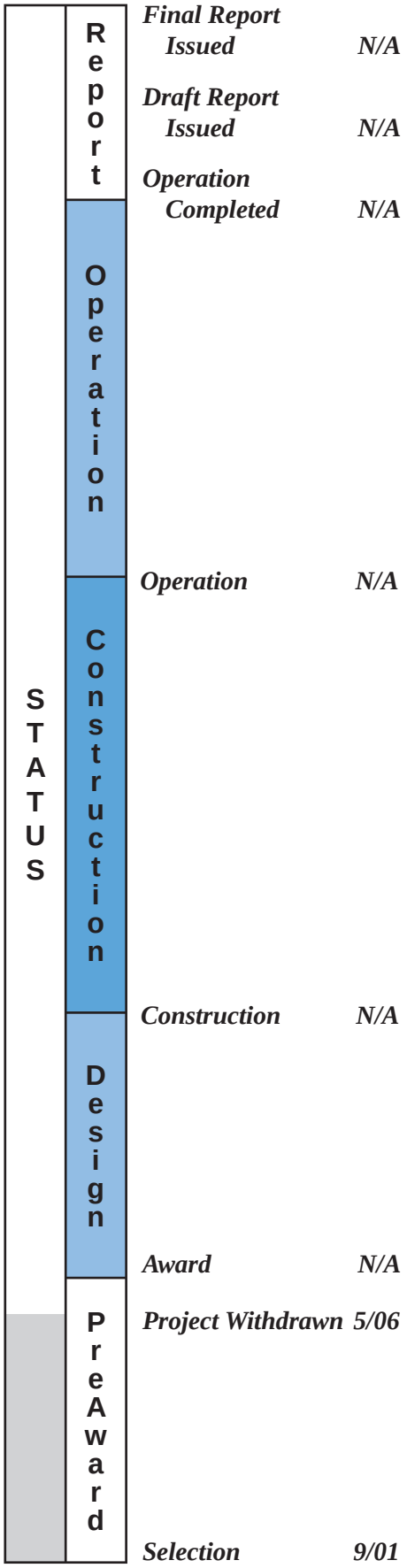
Benefits

Coal-fired power boiler operators are facing a dual challenge of remaining competitive while adapting to deregulation and impending stringent NO_x controls. The NO_x control technologies available are not optimized for cost-effective NO_x reduction over a wide operational range. This range is needed to allow each boiler and the integrated system to respond competitively to market conditions. Current reliance on SCR, with the associated high capital cost, will not typically give a utility sufficient dispatch flexibility to maximize competitiveness. Projections indicate that 30 percent of coal-fired boilers will be retrofitted with SCR. Power generators are looking for a lower cost, more flexible means to design the balance of units for competitive dispatch required in the current market. This demonstration was intended to confirm that the hybrid is a lower cost alternative to conventional SCR while achieving 0.15 lb/10^6 Btu NO_x emission levels.

The FLGR/SNCR and SNCR components of the hybrid system have demonstrated significant NO_x reduction and lower costs relative to SCR, but have fallen short of the 0.15 lb/10^6 Btu NO_x emissions level requisite to meeting the most stringent dispatch requirement under new regulations. While SCR alone can meet the NO_x emissions requirement, the technology is expensive to install and operate. The hybrid system offers the synergy to achieve 0.15 lb/10^6 Btu NO_x emission levels at lower costs than conventional SCR alone, and provides needed dispatch flexibility.

Status/Accomplishments

The project was selected for award on September 26, 2001. Originally, ADL was the project sponsor and Orion Power's Avon Lake Unit No. 9 near Cleveland, Ohio, was to be the host site. However, Reliant Energy bought Orion Power and decided not to pursue the project. TIAX, LLC acquired the research contracts of ADL and proceeded to find another host site. Following several unsuccessful attempts to secure a new host site, TIAX withdrew the proposed project in May 2006.



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Greenidge Multi-Pollutant Control Project

PPII

Emissions Control

Mercury	■	NO_x	■
SO_2	■	$PM_{2.5}$	■

Participant
CONSOL Energy Inc.

Additional Team Members
AES Greenidge, LLC — host

Babcock Power Environmental, Inc. — (EPC Contractor)

Location
Dresden, NY
(AES Greenidge Unit No. 4)

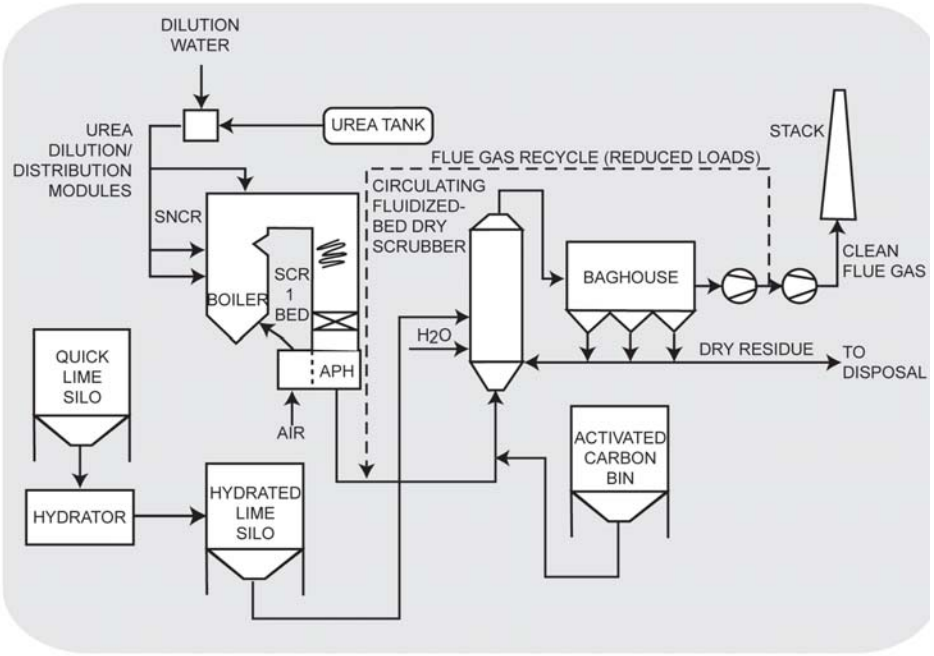
Technology
Hybrid selective non-catalytic reduction (SNCR)/in-duct selective catalytic reduction (SCR) in combination with low-NO_x burners to control NO_x and a circulating fluidized-bed dry scrubber (CFBDS) to control SO_2, mercury, and acid gases

Plant Capacity/ Production
104 MW (Unit No. 4)

Coal
Bituminous coal (>2% sulfur) co-fired with up to 10% biomass

Project Funding

Total	$33,127,188	100%
DOE	14,509,708	43.8
Participant	18,617,480	56.2



Objectives

To demonstrate cost-effective multi-pollutant control for relatively small power plants using a selective non-catalytic reduction (SNCR)/in-duct selective catalytic reduction (SCR); in combination with low-NO_x burners and a circulating fluidized-bed dry scrubber (CFBDS) system with recycled baghouse ash and activated carbon injection; to control nitrogen oxide (NO_x) emissions to 0.10 lb/10^6 Btu at full load, and reduce sulfur dioxide (SO_2) by 95 percent, mercury by 90 percent, and acid gases by 95 percent; and to evaluate the impact of biomass co-firing up to 10 percent heat input on the performance of the SNCR/SCR hybrid and CFBDS system.

Technology/Project Description

This project will demonstrate an in-duct SNCR/SCR hybrid in combination with low-NO_x burners and a CFBDS system using recycled baghouse ash and activated carbon injection to cost-effectively reduce emissions of NO_x, SO_2, mercury, and acidic gases to levels equal to or lower than those required by regulation at an existing 104-MW plant. The project also will evaluate the effect of biomass co-firing on the multi-pollutant control system. To complement existing low-NO_x burners, an SNCR is strategically located upstream of a single-bed in-duct SCR. Urea injection required for the SNCR also generates the ammonia required for the SCR. Having the SCR downstream of the SNCR allows the SNCR to operate at lower temperatures than normal (normally avoided to protect against ammonia slip), which enhances performance. The CFBDS system uses a reactor vessel to facilitate contact of flue gas with separately injected dry hydrated lime, activated carbon, and water. The activated carbon absorbs mercury, and the lime reacts with the sulfur dioxide (SO_2) and sulfur trioxide (SO_3), hydrochloric acid (HCl), and hydrofluoric acid (HF) gases to form benign solids, all of which are captured in the baghouse. Lime and activated carbon sorbents captured in the baghouse are recycled to the CFBDS to enhance utilization. Performance testing of the SNCR/SCR hybrid and CFBDS will include an assessment of the impact

Project Duration 29 Months	Period of Operation 20 Months	Status/Schedule *Estimated date

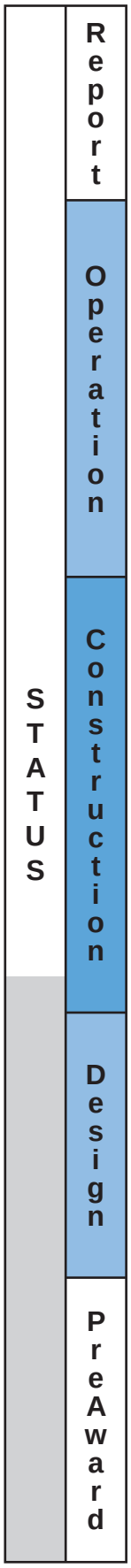
of biomass co-firing with the coal at heat inputs up to 10 percent to measure performance impact.

Benefits

The power industry is seeking lower cost and more compatible multi-pollutant control alternatives to SCR and wet scrubbers for the 473 domestic coal-fired generating units with capacities ranging from 50–300 MW. Economics of scale that make SCR and wet scrubbers viable for large plants do not apply to these relatively small units, and small units typically are space constrained, making it difficult, if not impossible, to install conventional SCR and wet scrubbers. Greenidge Unit No. 4 is representative of the small coal-fired electricity generating units that together represent almost one-quarter of the U.S. coal-fired generating capacity. The NO_x control technology to be demonstrated at Greenidge is estimated to require about 65 percent of the capital costs and 75 percent of the operating costs of a conventional SCR unit. The CFBDS is projected to use at least 2.5 times less activated carbon for a given level of mercury control because the carbon has a greater average contact time in the CFBDS reactor than in a flue gas duct. Reducing the carbon feed rate results in substantial mercury control cost savings. Also, the CFBDS is estimated to be about half the capital cost of a conventional wet scrubber. The acid gas control afforded by the CFBDS is important because this removes the precursors to acid aerosols, which can form $PM_{2.5}$ once emitted. Acid gases must be reported to the U.S. Environmental Protection Agency (EPA) as part of the Toxic Release Inventory. Moreover, biomass co-firing may improve overall emissions performance through reduced fuel-bound nitrogen and sulfur levels, increased volatile content, and general combustion characteristics.

Status/Accomplishments

The project was selected for award on September 26, 2001. An Environmental Assessment (EA) has been completed and a Finding of No Significant Impact (FONSI) was issued on December 3, 2004. Negotiation activities were protracted due to contract issues. The project was awarded on May 19, 2006 with design and construction activities already underway.



Final Report Issued	*4/09**
Draft Report Issued	*1/09**
Operation Completed	*10/08**
Operation	*2/07**
Construction	*Ongoing at award*
Award	*5/06*
NEPA Completed (EA and FONSI)	*12/04*
Selection	*9/01*

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Mercury Specie and Multi-Pollutant Control

Participant
Pegasus Technologies (a division of NeuCo, Inc.)

Additional Team Members
NRG Texas, LLC — collaborator and host

Location
Jewett, Leon County, TX (NRG Texas Limestone Plant)

Technology
Pegasus Technologies' sensors and neural network-based optimization and control system for enhanced mercury and multi-pollutant control

Project Capacity/ Production
890 MW (gross); 14,500 tons of coal/day input

Coal
Texas lignite and Powder River Basin subbituminous

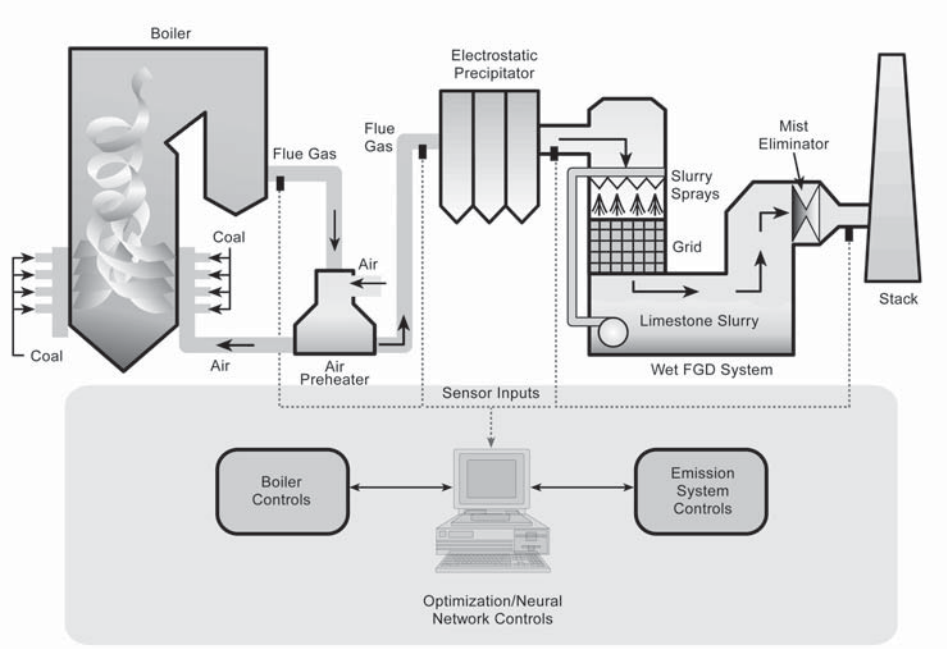
Project Funding

Total	$15,560,811	100%
DOE	6,079,479	39
Participant	9,481,332	61

CCPI-2

Emissions Control

Mercury	■	NO_x	□
SO_2	□	$PM_{2.5}$	□



Objectives
To demonstrate that state-of-the-art sensors and neural network-based optimization and controls can measure and effect mercury species, control mercury emissions with existing flue gas desulfurization (FGD) and electrostatic precipitator (ESP) systems, and reduce pollutant emissions in general without major capital expenditure.

Technology/Project Description
The project will demonstrate non-intrusive advanced sensors and neural network-based optimization and control technologies for enhanced mercury and multi-pollutant control on an 890-MW tangentially fired boiler at the NRG Texas Limestone Plant in Jewett, Texas. The plant is equipped with both a cold-side ESP rated at 99.8 percent particulate removal efficiency, and a wet limestone FGD system rated at 90 percent sulfur dioxide (SO_2) removal efficiency. Both the ESP and wet FGD system are capable of high mercury capture efficiency if the mercury is in an oxidized solid state rather than elemental vapor state. The plant burns a blend of Texas lignite and Powder River Basin subbituminous coal, which are known to emit relatively high levels of elemental mercury under routine combustion conditions. Pegasus Technologies will apply sensors to evaluate the mercury species (elemental and oxidized mercury) at key locations, develop optimization software that results in the best plant conditions to promote mercury oxidation and minimize emissions in general, and use neural networks to effect the optimization conditions.

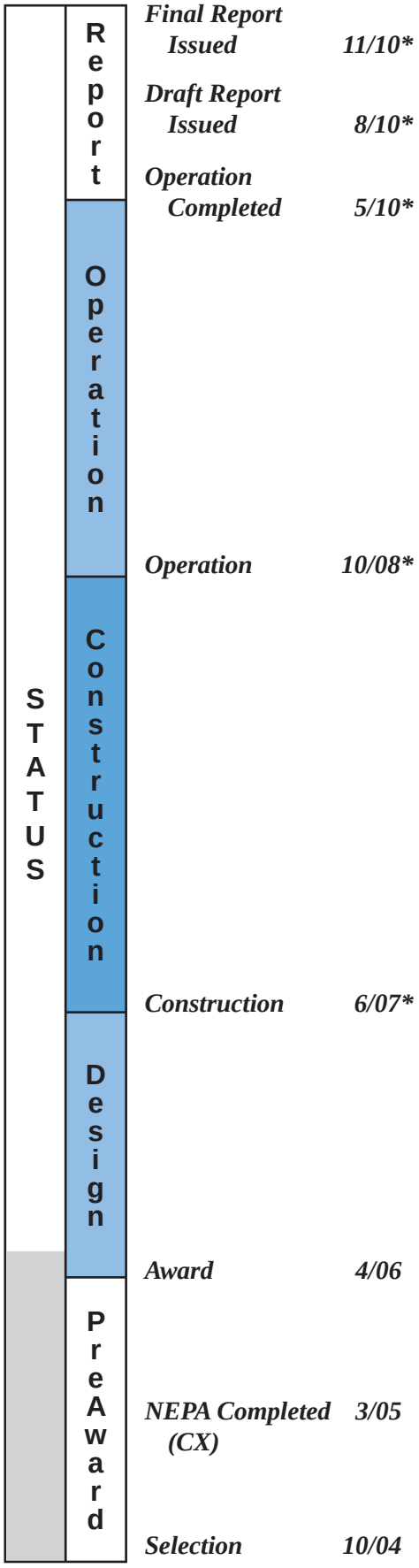
Project Duration 49 Months	Period of Operation 19 Months	Status/Schedule *Estimated date

Benefits

The technology affords plant operators the means to assess how plant operating parameters affect mercury species determination, and the capture efficiency of existing FGD and ESP systems; translate the data into optimization software that provides the lowest possible pollutant emissions; and effect optimization through neural networks. The technology allows operators to maximize emissions control with existing pollutant control systems. This capability reduces risk of non-compliance with minimal capital expenditure. The technology should have broad application to the existing fleet of coal-fired boilers and have minimal impacts on the quality of salable by-products, such as fly ash.

Status/Accomplishments

The Categorical Exclusion (CX) for the project was signed in March 2005, and the Cooperative Agreement (CA) was signed in April 2006. Installation of key process components is under way.



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TOXECON Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers

CCPI-1

Emissions Control

Mercury	■	NO_x	■
SO_2	■	$PM_{2.5}$	■

Participant
Wisconsin Electric Power Company (We Energies)

Additional Team Members
ADA-ES — Management Support/Design Input

Cummins & Barnard — A/E Services/Construction Management

Wheelabrator Air Pollution Control, Inc. — Baghouse Design and Installation

Electric Power Research Institute — Technology supplier

Location
Marquette, Marquette County, MI (Wisconsin Electric's Presque Isle Power Plant Units 7, 8, and 9)

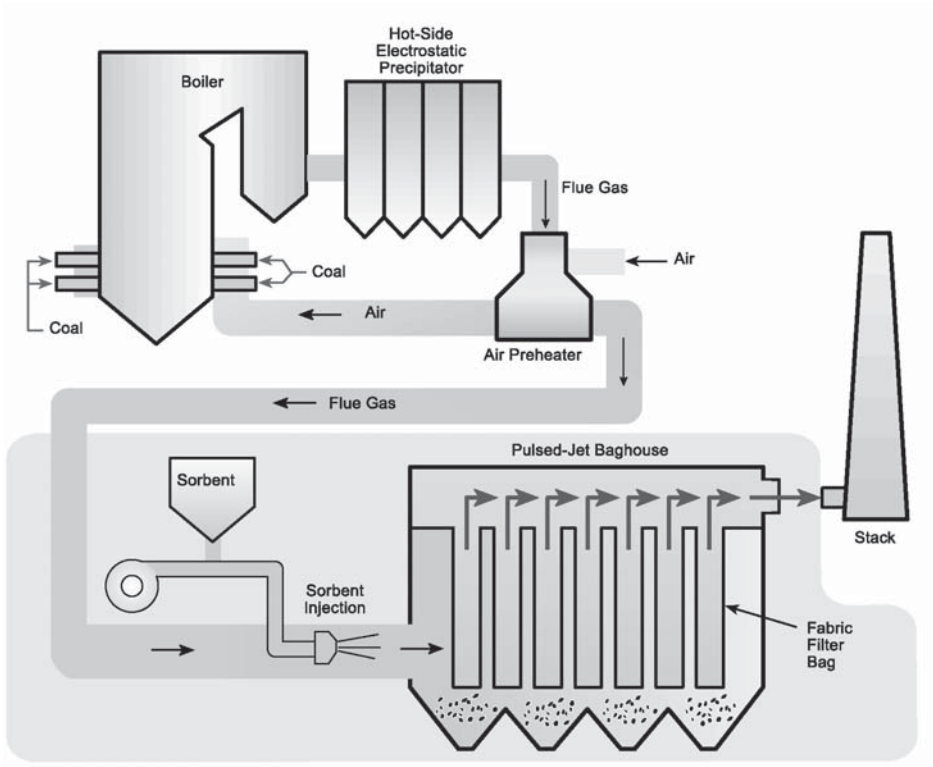
Technology
TOXECON sorbent injection process

Capacity
270 MW

Coal
Powder River Basin subbituminous

Project Funding

Total	$52,978,115	100%
DOE	24,859,578	47
Participant	28,118,537	53



Objectives
To achieve 90 percent mercury removal through injection of activated carbon; increase particulate matter (PM) collection efficiency (particularly for PM of 2.5 microns or less in size [$PM_{2.5}$]); to reduce already low sulfur dioxide (SO_2) and nitrogen oxide (NO_x) emissions at the plant by an additional 70 percent and 30 percent, respectively; to recover 90 percent of mercury captured in the sorbent; to achieve 100 percent fly ash utilization; to advance the reliability of mercury continuous monitors; and to successfully integrate the entire system.

Technology/Project Description
The project will demonstrate the TOXECON sorbent injection process for multi-pollutant control of a combined flue gas stream from three units totaling 270 MW. TOXECON, an Electric Power Research Institute (EPRI)-patented process, injects activated carbon and sodium-based sorbents into a pulsed-jet baghouse installed downstream of a plant's PM control device, which in this application is a hot side electrostatic precipitator. The primary PM control device removes the bulk of the PM. The TOXECON process is placed downstream of the air preheater to operate at relatively cool temperatures conducive to mercury and other pollutant absorption. Activated carbon and sodium-based sorbents are injected into the ductwork upstream of the pulsed-jet baghouse, where they mix and absorb pollutants in the flue gas. Upon entering the pulsed-jet baghouse, in-flight pollutant absorption continues and is significantly enhanced by fixed-bed absorption as pollutants pass through a sorbent filter cake that forms on the fabric filter bags in the baghouse. Sorbent captured in the baghouse is processed to recover up to 90 percent of the mercury to enable 100 percent fly ash utilization.

Project Duration 60 Months	Period of Operation 39 Months	Status/Schedule *Estimated date

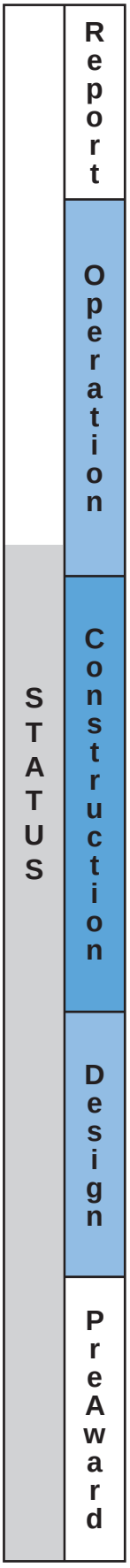
Benefits

The TOXECON process leverages the high PM capture efficiency inherent in pulsed-jet baghouses and baghouse location to effectively utilize proven sorbents in achieving high mercury capture efficiency and added SO_2 and NO_x control, and to retain the sales value of fly ash as a cement additive. The advantages of this approach include: affording enhanced contact between sorbents and dilute phase pollutants; providing a temperature regime conducive to pollutant absorption; and requiring application to only a small portion of the fly ash. Demonstrating the TOXECON process on Powder River Basin (PRB) coal is an excellent test of the technology and representative of a broad market application. PRB coal is widely used and, as with other western subbituminous coals, contains high percentages of elemental mercury, which, because of its vapor state upon combustion, is more difficult to remove than solid state oxides of mercury (the form more common in bituminous coals). The TOXECON process has application to an estimated 167 gigawatts of existing coal-fired capacity. The TOXECON project alone is expected to annually remove 97 pounds of mercury, 4,020 tons of SO_2, 1,470 tons of NO_x, and 32 tons of fine PM.

Status/Accomplishments

The project was selected January 8, 2003 under the first round of Clean Coal Power Initiative (CCPI), and was awarded a cooperative agreement April 21, 2004. The National Environmental Policy Act (NEPA) requirements were met with an Environmental Assessment (EA) and issuance of a Finding of No Significant Impact (FONSI) in September 2003.

Construction activities were initiated in November 2004 and were completed in December 2005, at which time flue gas from Unit 7 at the Presque Isle Power Plant was directed to the TOXECON baghouse. Units 8 and 9 were brought on line in January 2006, and activated carbon was first injected into the system later the same month. Initial results are promising, demonstrating mercury emission reductions. Results will be quantified and optimized through parametric testing during 2006.



Final Report Issued	*10/09**
Draft Report Issued	*7/09**
Operation Completed	*4/09**
Operation	*1/06*
Construction	*11/04*
Award	*4/04*
NEPA Completed (EA and FONSI)	*9/03*
Selection	*1/03*

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Advanced Power Systems

Clean Coal Diesel Demonstration Project

Project Withdrawn

CCTDP

Advanced Power Systems

IGCC	☐	CFB	☐
Hybrid	☐	Adv Comb	■

Participant

TIAX, LLC (acquired the research contracts of Arthur D. Little, Inc.)

Additional Team Members

University of Alaska at Fairbanks (UAF) — host and co-funder

Fairbanks Morse Engine (FME) — host and diesel engine technology vendor

CQ, Inc. — coal-water fuel (CWF) formulation and production

Location

Fairbanks, AK (UAF facility)

Beloit, WI (FME facility)

Technology

Fairbanks Morse coal/water-fueled diesel engine

Plant Capacity/ Production

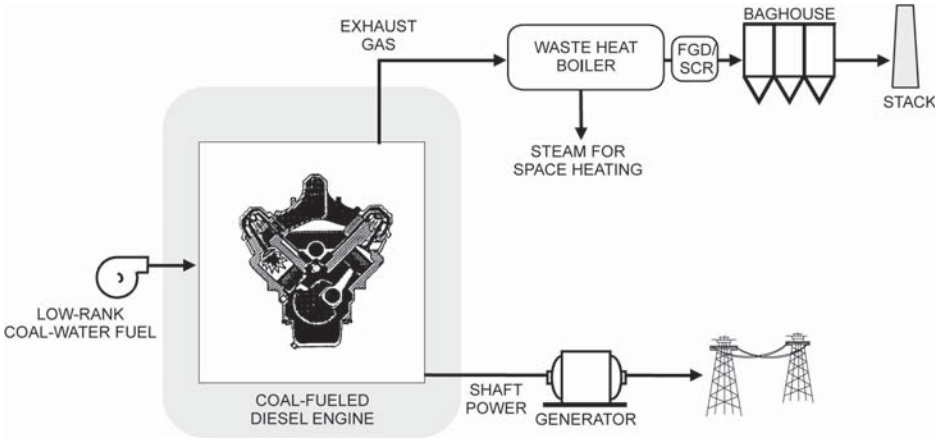
18-cylinder engine at UAF (6.4 MW) and 2-cylinder engine at FME

Coal

Kentucky bituminous and Alaskan subbituminous

Project Funding

Total	$41,611,958	100%
DOE	20,805,979	50
Participant	20,805,979	50



Objectives

To demonstrate that large-bore, heavy duty diesel engines can operate on relatively low-cost coal-water fuel (CWF) at acceptable performance levels and maintenance intervals with emissions at or below New Source Performance Standards.

Technology/Project Description

CWF testing is being conducted on a 2-cylinder engine in Beloit, Wisconsin, identical to the 6.4-MW equivalent 18-cylinder engine installed at the University of Alaska at Fairbanks (UAF) in terms of per cylinder horsepower, emissions, fuel rate, wear rate, and exhaust flow. The test plan for the 2-cylinder engine firing CWF specifies initial runs without the installation of hardened parts, such as special injectors and piston rings, to establish engine operating parameters (air pre-heat, number and size of injector tip holes, and timing and amount of diesel fuel for startup). Initial tests will be followed by the installation of hardened parts and four 250-hour tests (12 hours per day), between which Fairbanks Morse Engine inspects engine parts. Simultaneously, UAF is to integrate the 18-cylinder engine with balance of plant systems to enable commercial operation, including a generator, waste heat boiler, a selective catalytic reduction (SCR) system, and baghouse; and conduct baseline testing on diesel fuel. Subsequent to 2-cylinder testing, UAF is to incorporate hardened engine parts and provide performance data on CWF operation. CWFs to be tested include those derived from Alaskan subbituminous coals and from Kentucky bituminous coals.

Benefits

Diesel engines offer an attractive distributed generation option in the 5- to 20-MW range from the standpoint of efficiency, reliability, and established support infrastructure, but are hampered by high fuel costs in a world competing for oil. The U.S. market for diesels in the 5- to 20-MW range is projected to exceed 60,000 MW through 2020, and the worldwide market is estimated at 70 times the U.S. market. CWF-fueled diesel engines have particular overseas application in coal-rich developing Asia, where the bulk of energy expansion is occurring. Converging advancements in the fields of materials science and coal preparation make possible the use of coal to power diesel engines at acceptable performance and emission levels. Grinding coal to micron size allows release of most of the

Project Duration 142 Months	Period of Operation *Project Withdrawn*	Status/Schedule *Estimated date

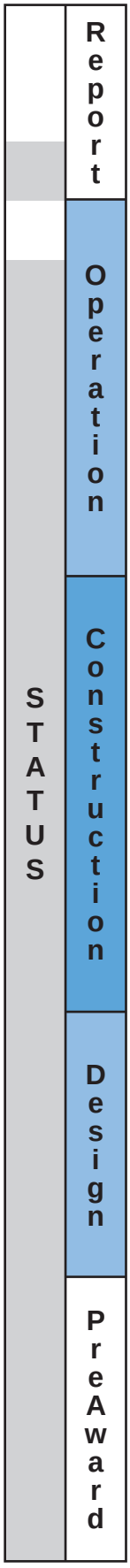
ash and sulfur, and when mixed with water in high solids concentration slurries, provides a high-energy-density fuel. Abrasion-resistant materials emerging from materials research can be placed at high wear sites in diesel engines to sustain effective operation at the reduced lubricity levels associated with CWFs. Diesel engines emit far less nitrogen oxides (NO_x) when operated on CWF in lieu of diesel fuel, reducing the degree of control required. Efficiencies up to 48 percent are expected, with a projected heat rate of 6,830 Btu/kWh. Sulfur dioxide (SO_2) and particulate matter (PM) control requirements are minimal because most of the ash and sulfur are removed during CWF production.

Status/Accomplishments

The 18-cylinder engine at UAF began operation on diesel fuel in September 1999, started generating power in October 1999, demonstrated 90 percent NO_x reduction with the SCR in August 2000, and supplied all the UAF power requirements until a forced outage in August of 2004. Because the original planned source of CWF in Alaska was not viable, the unit continued to operate on diesel fuel. Eventually, CWF sources were located and a revision was made to the cooperative agreement to meet project objectives at reduced cost. In August 2003, DOE modified the cooperative agreement to execute the CWF test plan on a 2-cylinder engine at Fairbank Morse Engine facilities in Beloit, Wisconsin instead of the 18-cylinder engine installed at UAF.

In April 2004, the 2-cylinder engine was operated on Usibelli coal-derived CWF with a heating value of approximately 4,000 Btu/lb. The CWF-fired engine produced 270 horsepower and emitted 150 parts per million (ppm) of NO_x, which compared well with the 1,100 ppm NO_x emissions on diesel fuel. Preparations were under way for operation on bituminous coal-derived CWF, however, these tests were suspended due to test facility modifications and contractual matters.

The project has not been able to move forward due to legal proceedings on payment claims made by UAF for work performed on the project while Arthur D. Little, Inc. was the participant. TIAX requested termination of the project because they have been unable to continue work while waiting for the lawsuit to be settled. DOE concurred on the termination request in April 2006. TIAX is in the process of preparing a final report of project activities.



Final Report Issued	*11/06**
Draft Report Issued	*9/06**
Operation Completed	*NA*
Project Withdrawn	*4/06*
Operation on CWF	*4/04*
Scope Modified	*8/03*
Operation on Diesel	*9/99*
Construction	*6/98*
NEPA Completed	*6/97*
Project Restructured	*8/96*
Award	*7/94*
Selection	*5/93*

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Demonstration of a 285-MWe Coal-Based Transport Gasifier

CCPI-2

Advanced Power Systems

IGCC	■	CFB	□
Hybrid	□	Adv Comb	□

Participant
Southern Company Services, Inc.

Additional Team Members
Southern Power Company — host utility co-owner

Orlando Utilities Commission — host utility co-owner

Kellogg Brown and Root (KBR) — technology supplier

Location
Orlando, Orange County, FL (Stanton Energy Center)

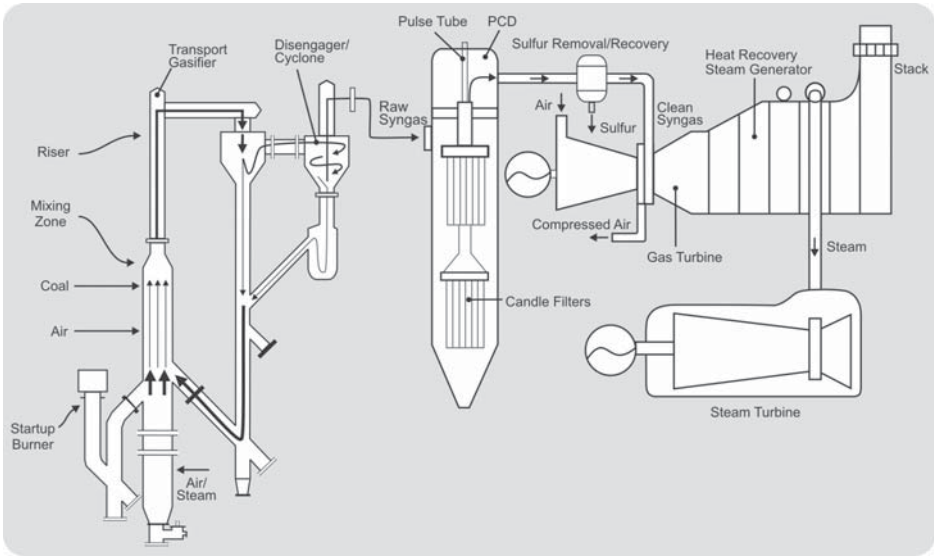
Technology
KBR air-blown transport gasifier fueled by low-rank coal in an integrated gasification combined-cycle (IGCC) application

Capacity
285 MW (net); 3,300 tons of coal/day input

Coal
Powder River Basin subbituminous

Project Funding

Total	$568,768,646	100%
DOE Share	235,000,000	41
Participant	333,768,646	59



Objectives

To assess the operational, environmental, and economic performance of the air-blown transport gasifier-based 285-MW (net) integrated gasification combined-cycle (IGCC) system; and to achieve a heat rate of 8,400 Btu per kilowatt-hour, which equates to 40.6 percent efficiency on a higher heating value (HHV) basis.

Technology/Project Description

The project will demonstrate a 285-MW (net) IGCC unit applying the Kellogg Brown and Root (KBR) transport gasifier in an air blown mode. KBR's transport gasifier consists of two sections: a short, larger-diameter mixing zone and a longer, smaller-diameter riser. Air and steam are introduced at the bottom of the mixing zone to raise heat by burning the carbon in recirculated char. Coal and sorbent are fed to the top of the mixing zone to separate the coal from the oxidant and avoid burning volatile material produced when the coal is heated. All of the solids and gases are carried from the mixing zone into the riser where devolatilization and carbon-steam gasification reactions occur to produce synthesis gas (syngas). In addition, some of the sulfur released from the coal is captured as calcium sulfide by the calcium in the coal and added calcium-based sorbent. The majority of the unreacted char and sorbent-derived material leaving the riser is captured by a disengager and cyclone assembly and recycled back to the mixing zone through a standpipe and a nonmechanical "J-valve." The synthesis gas and fine char that are not captured in the cyclone are cooled in a heat exchanger before entering a metallic candle-filter particulate collection device (PCD), which removes any remaining particulate matter from the gas. Beyond the candle-filter PCD, state-of-the-art emission controls will be used.

Project Duration 106 Months	Period of Operation 53 Months	Status/Schedule *Estimated date

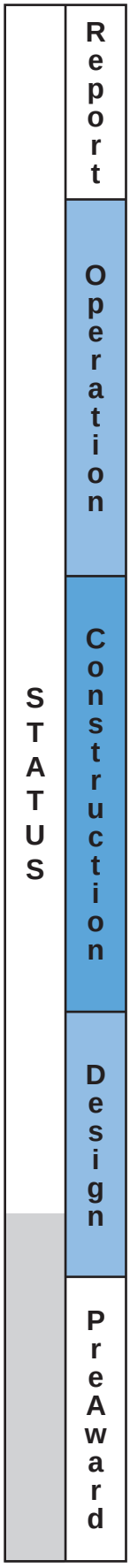
Benefits

The KBR transport gasifier offers a simple, robust, and efficient means of processing, which has been proven over 50 years in the petroleum refining industry. The transport gasifier operates at considerably higher circulation rates, velocities, and riser densities than does a conventional circulating fluidized-bed, resulting in higher throughput, better mixing, conditions more conducive to long refractory life, and higher mass and heat transfer rates. The recycling of solids increases the effective residence time, increases carbon conversion, and improves sorbent utilization. Moreover, the transport gasifier represents a major efficiency gain relative to slagging gasifiers for applications using high-ash, high-melting point coals. It does not depend on slagging (melting) the ash to remove minerals from the process. Slagging requires a large amount of energy, which cannot be recovered. This process technology makes possible the cost effective production of synthesis gas from low-rank, high-moisture, and high-ash coals whereas most other gasification technologies cannot. Such coals make up half the proven reserves in both the United States and the world. The transport gasifier can also be operated on oxygen, which affords the option to produce chemicals and adapt to carbon management requirements.

Status/Accomplishments

The project was selected in October 2004 and the Cooperative Agreement was awarded on January 30, 2006. Preparation of an Environmental Impact Statement is under way based on the Public Scoping Meeting held on August 30, 2005.

Engineering design activities are ongoing. The Florida Department of Environmental Protection is reviewing the Site Certification Application (SCA).



Final Report Issued	*5/15**
Draft Report Issued	*2/15**
Operation Completed	*11/14**
Operation	*6/10**
Construction	*4/07**
Award	*1/06*
Selection	*10/04*

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JEA Large-Scale CFB Combustion Demonstration Project

Demonstration Operations Complete

Participant

JEA (formerly Jacksonville Electric Authority)

Additional Team Members

Foster Wheeler Energy Corporation — technology supplier

Location

Jacksonville, Duval County, FL (JEA's Northside Station, Unit No. 2)

Technology

Foster Wheeler's atmospheric circulating fluidized-bed (ACFB) combustor

Plant Capacity/ Production

297.5 MWe (gross), 265 MWe (net)

Coal

Eastern bituminous and Petroleum coke (petcoke)

Project Funding

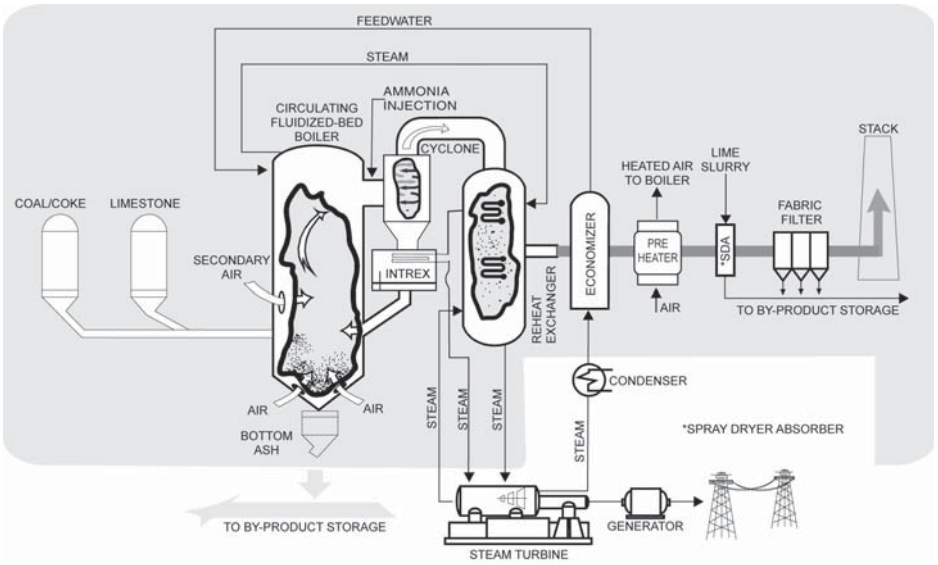
Total	$321,392,624	100%
DOE	74,723,785	23
Participant	246,668,839	77

CCTDP

Advanced Power Systems

IGCC ☐ CFB ■

Hybrid ☐ Adv Comb ☐



Objectives

To demonstrate scale-up of atmospheric circulating fluidized-bed combustion (ACFB) to 297.5 MWe (gross); to verify ACFB technology cost and performance expectations; to provide potential users with data requisite to assessing ACFB as an option for large-scale commercial capacity additions or retrofits; to achieve greater than 90 percent sulfur dioxide (SO_2) removal; and to reduce nitrogen oxide (NO_x) emissions below New Source Performance Standards (NSPS).

Technology/Project Description

The project demonstrates replacement of an inoperable oil/natural gas-fired Unit 2 boiler rated at 275 MWe with a 297.5-MWe (gross) ACFB. In the ACFB system, coal or coal fuel blends are crushed to minus 1/4 inch, mixed with crushed limestone (sand size), and pneumatically injected into the base of the ACFB. The mixing action of the ACFB enables efficient combustion at temperatures below 1,600 ºF (well below thermal NO_x formation temperatures), and provides greater than 90 percent sulfur capture through good sorbent contact with SO_2 released during combustion. Secondary air assists mixing and combustion and helps move the lighter combusted materials out of the combustor. Aqueous ammonia is injected prior to the entrained materials entering a cyclone separator. The cyclone separator mixes the ammonia, which reduces NO_x to nitrogen and water; separated solids pass over an INTREX™ steam superheater; and the solids return to the combustor. A portion of the solids leave the combustor as ash and calcium sulfate. Gas from the cyclone heats steam in reheater/superheater tube bundles located in a relatively soot-free chamber; further heat is recovered in an economizer that heats feed water and in a combustion air preheater. High-pressure steam from the INTREX™ (2.0×10^6 lb/hr, 2,500 psig, 1,000 ºF) and low-pressure steam from the reheater (1.78×10^6 lb/hr, 548 psig, 1,000 ºF) drive a steam turbine-generator unit. Flue gas from the air preheater passes through a polishing spray dryer absorber (SDA) using a lime slurry to further reduce SO_2 emissions, and through a baghouse to remove particulates.

Project Duration 169 Months	Period of Operation 24 Months	Status/Schedule *Estimated date

Benefits

ACFB offers superior cost and performance compared to conventional pulverized coal-fired (PC) plants in highly competitive power markets requiring superior environmental performance to ensure plant acceptance. In either greenfield or repowering applications, ACFBs outperform PC plants by meeting stringent environmental requirements without having to install expensive and energy-robbing post-combustion controls, such as selective catalytic reduction and large wet flue gas desulfurization units. This capability affords an efficiency gain and reduces the significant capital costs associated with large post-combustion controls. Also, ACFBs provide a high degree of fuel flexibility that extends beyond all types of coal to renewables and wastes, such as petroleum coke (petcoke). Petcoke is a refinery waste in plentiful supply that represents a solid waste management problem to refineries, but a low-cost, high-energy fuel to ACFBs. This fuel flexibility equates to low operating costs relative to PC plants. This project moves ACFB technology into the large utility boiler arena, an important market sector.

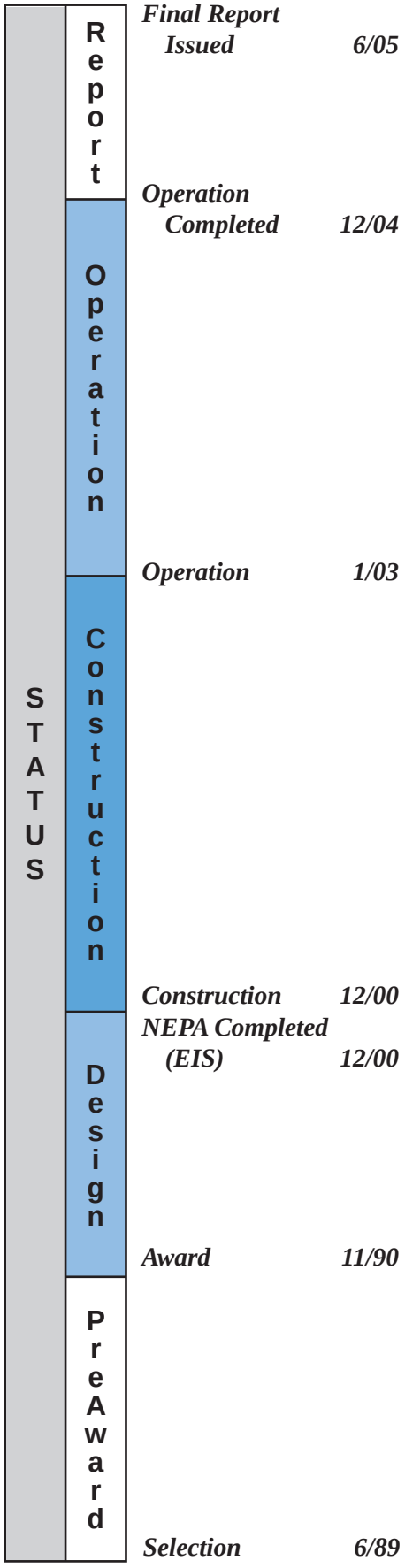
Status/Accomplishments

The Final Technical Report was issued in June 2005, completing this project.

Results Summary

Operational

- Over a 24-month operating period, the demonstration unit was on-line for 12,293 hours producing 3,031,408 MWh (net) of electricity.
- During 2003 and 2004, the unit operated at an average heat rate of 9,516 Btu/kWh (35.9 percent efficiency).
- The performance test results confirm that the full load boiler efficiencies for three of the four fuels exceeded 90 percent (the boiler efficiency on Illinois 6 was 88 percent).
- The design basis for SO_2 removal efficiency was 85 percent (typical) in the boiler and 12.1 percent (typical) in the polishing scrubber. The as-tested efficiencies ranged between 95 percent and 98 percent in the boiler and between 1 percent and 4 percent in the scrubber.



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- The average Equivalent Availability Factor (EAF) for the demonstration project was approximately 66 percent. For comparison purposes, the North American Electric Reliability Council (NERC) Generating Availability Data System indicates EAF to be approximately 84 percent for similar sized units (mostly pulverized coal).

Environmental

- As shown in Exhibit 3-5, stack emissions were well below permit limits.
- During the 100 percent load test on 80/20 (petcoke/Pitt 8 coal) blended fuel, the spray dryer absorber removed 98 percent of the incoming mercury.
- Ash in the By-Product Storage Area (BSA) sets up to form a low strength aggregate type material, with essentially the only water run-off being precipitation.
- The Florida Department of Environmental Protection has classified Unit 2's ACFB blended ash by-product (bed ash and fly ash) as an "industrial by-product" allowing it to be used for beneficial purposes.

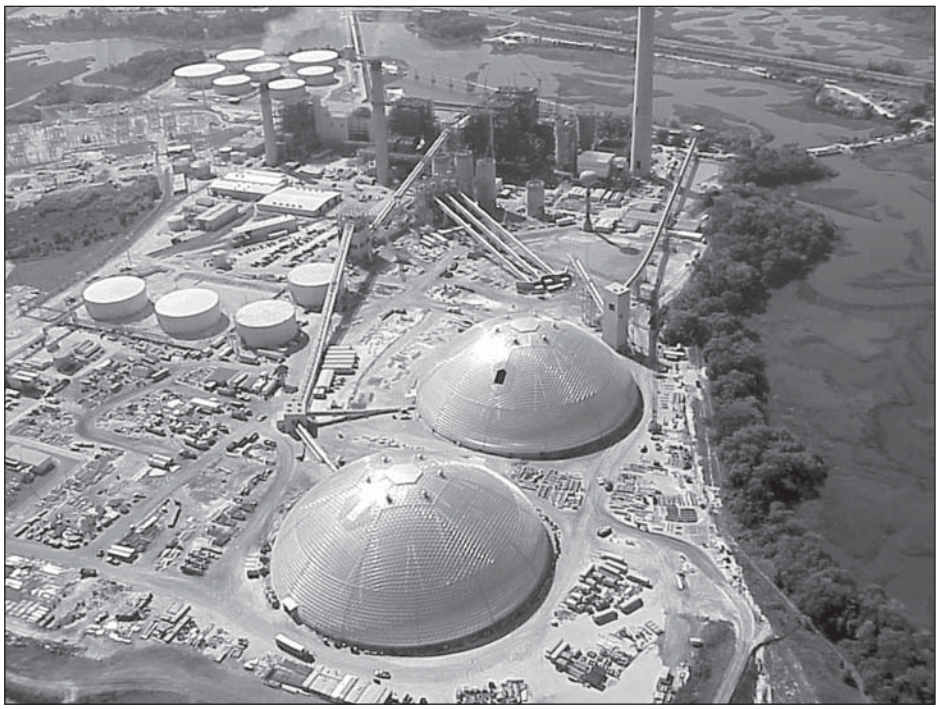
Economic

- At project completion, the actual capital cost was $321,392,624 for Unit 2 and one-half of the shared facilities or $1,080/kW at the gross output rating of the unit.

Project Summary

JEA Northside Unit 2 has demonstrated the successful, commercial operation of a 300-MW class ACFB boiler. As tested, boiler efficiencies on various fuels met or exceeded the design values and proved competitive with PC boilers of the same size.

During testing on each of four different fuels, the project operated steadily at each of four different loads (100



JEA's Northside Station with Fuel yard in foreground and Foster Wheeler's ACFB in background.

percent, 80 percent, 60 percent, and 40 percent) without any deviation in unit output, proving fuel flexibility. The 40 percent load test on the 80/20 blended fuel was not conducted due to Hurricane Charlie. Some blending of petcoke and coal was required, however, to prevent ash agglomeration experienced when firing 100 percent petcoke.

As shown in Exhibit 3-5, Unit 2 reduced stack emissions well below permit limits. The overall SO_2 removal rate exceeded 98 percent. Design flexibility allowed JEA to operate Unit 2 at a much higher boiler SO_2 removal rate than originally specified to offset problems experienced with the polishing scrubber limestone feed system. Modifications to the limestone system were planned following the demonstration period to allow a change back to the original design basis.

During the 2-year demonstration period, the EAF was significantly lower than industry average values. The project successfully identified a number of recommended changes to improve unit reliability and availability for future commercial service. These include modifications to the following systems/equipment:

- INTREX system,
- Expansion joints,
- Stripper cooler, and
- Limestone system.

FW has concluded that the INTREX design is not viable, and is no longer offering this design feature on new ACFB boilers.

The project has received *Power* magazine's 2002 Power Plant Award, and was nominated for *Power Engineering* magazine's 2003 Power Plant of the Year Award. JEA's project manager was awarded the Florida Engineering Society's Technical Achievement Award 2002 for his work on the project.

Exhibit 3-5
Stack Emissions Data

Parameter	CY 2003	CY 2004	Permit Limit
SO_2, lb/MMBtu, 24-hr avg.	0.14	0.17	0.20
NO_x, lb/MMBtu, 30-day avg.	0.07	0.08	0.09
CO, lb/hr, 24-hr avg.	84	100	350
PM, lb/MMBtu	0.005	0.005	N/A

Kentucky Pioneer Energy IGCC Demonstration Project

Project Withdrawn

Participant

Kentucky Pioneer Energy, LLC

Additional Team Members

Fuel Cell Energy, Inc. (formerly Energy Research Corporation) — molten carbonate fuel cell designer and supplier, and cofunder

Location

Trapp, Clark County, KY (East Kentucky Power Cooperative's Smith site)

Technology

Integrated gasification combined-cycle (IGCC) using a BG/L (formerly British Gas/Lurgi) slagging fixed-bed gasification system coupled with Fuel Cell Energy's molten carbonate fuel cell (MCFC)

Plant Capacity/ Production

580 MW (gross); 540 MW (net) IGCC; 2.0 MW MCFC

Coal

High-sulfur Kentucky bituminous coal and pelletized refuse-derived fuel (RDF)

Project Funding

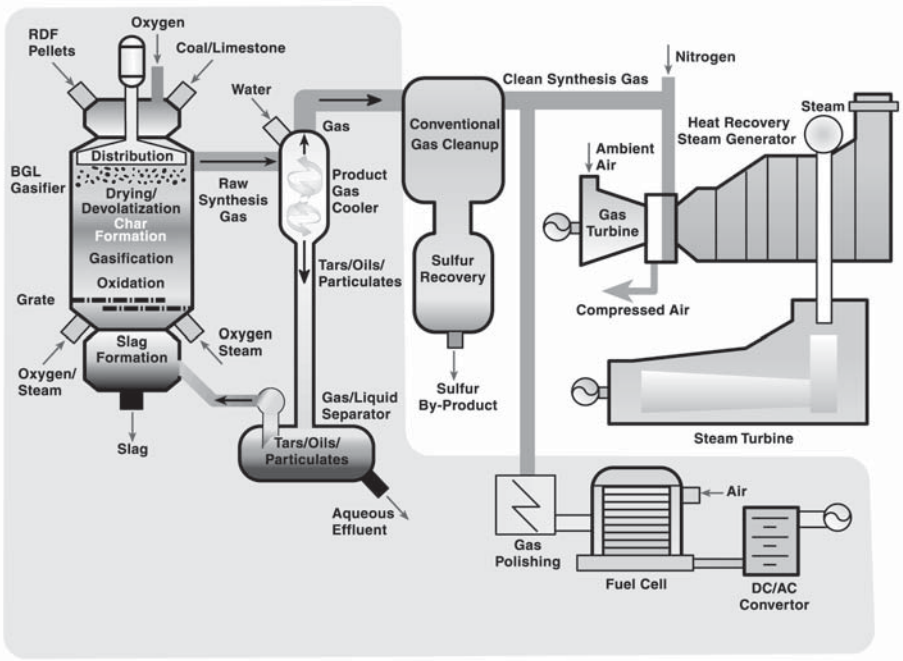
Total	$53,306,321	100%
DOE	20,045,329	38
Participant	33,260,992	62

CCTDP

Advanced Power Systems

IGCC ■ CFB □

Hybrid □ Adv Comb □



Objectives

To assess the operational, environmental, and economic performance of oxygen-blown, fixed-bed, slagging gasifiers fueled by high-sulfur coal and refuse-derived fuel (RDF) blends; and to assess the operational and environmental characteristics of a molten carbonate fuel cell (MCFC) fueled by coal-derived synthesis gas.

Technology/Project Description

Four BG/L gasifiers fueled with coal and pelletized RDF will produce synthesis gas to fire two gas turbines in an integrated gasification combined-cycle (IGCC) mode. In the gasifiers, a motorized distributor/mixer stirs and evenly distributes the incoming coal/RDF blend and limestone flux at the top of the gasifier, sustaining a bed of this mixture as the coal/RDF is consumed. Oxygen (from an on-site oxygen plant) and steam are injected into the gasifier through sidewall-mounted tuyeres (lances) at the base of the gasifier, where combustion and slag formation occur. The combustion provides process heat by consuming carbon remaining after gasification of descending fuel, produces a liquified slag with the aid of the limestone flux, and causes the bed of coal/RDF/limestone to descend with the aid of a moving grate. The upward moving heat and steam dry and release volatile material from the incoming coal/RDF, transform it into char, and gasify the char to produce a medium-Btu synthesis gas exiting the gasifier at approximately 1,050 °F. The synthesis gas exits near the top of the gasifier and passes into a water quench vessel (product gas cooler), which reduces the synthesis gas temperature to 300 °F and preheats boiler feed water. Water soluble materials, solids, and tars/oils separate from the synthesis gas; tars, oils, and particulates are further separated and recycled to the gasifier. Sulfur is removed and recovered with conventional systems. Integration of a gasifier and an MCFC is a part of the project, which is to be carried out at Global Energy's Wabash River Energy Ltd. commercial gasification facility in Terre Haute, Indiana. Tests employed a 2-MW Fuel Cell Energy MCFC (a Direct FuelCell® 3000).

Project Duration 69 Months	Period of Operation *Project Withdrawn*	Status/Schedule *Estimated date

Benefits

BG/L gasifiers offer proven performance at high reliability on a number of coals and represent a means to effectively dispose of wastes through use of RDF while far surpassing the efficiency and environmental performance of pulverized coal-fired (PC) plants. BG/L gasifier tolerance to RDF addresses a growing domestic solid waste management problem that PC plants have had limited effect upon because of basic design considerations. The heat rate of the IGCC demonstration facility is projected to be 8,560 Btu/kWh (40 percent efficiency on a higher heating value [HHV] basis), and the commercial embodiment of the system has a projected heat rate of 8,035 Btu/kWh (42 percent efficiency, HHV). These efficiencies represent a greater than 20 percent reduction in emissions of CO_2 when compared to a conventional PC plant equipped to meet New Source Performance Standards (NSPS). The IGCC system is expected to surpass NSPS by reducing SO_2 emissions to 0.1 lb/10^6 Btu (99 percent reduction) and NO_x emissions to less than 0.15 lb/10^6 Btu.

Status/Accomplishments

In November 1999, DOE signed the cooperative agreement that launched this project. The National Environmental Policy Act (NEPA) requirements for the IGCC portion of the project were met with an Environmental Impact Statement (EIS) and issuance of a Record of Decision on January 29, 2003. The NEPA process for the MCFC portion of the project was satisfied with a Categorical Exclusion (CX) on the same date.

Installation of the MCFC and associated support equipment at the Wabash River Generating Station was completed in August 2004, but operation was put on hold pending closure on a natural gas purchase agreement needed to support MCFC comparative testing on natural gas and synthesis gas.

In October 2004, the Kentucky Public Service Commission (PSC) withdrew its approval of an agreement by East Kentucky Power Cooperative, Inc. to purchase electric power from the proposed Kentucky Pioneer Energy generating plant.

Due to issues with proceeding at the proposed project site, and lack of progress in moving forward, DOE provided notice to the participant in August 2005 that project closeout activities had been initiated. A Final Report on the Fuel Cell Demonstration was issued in February 2006.

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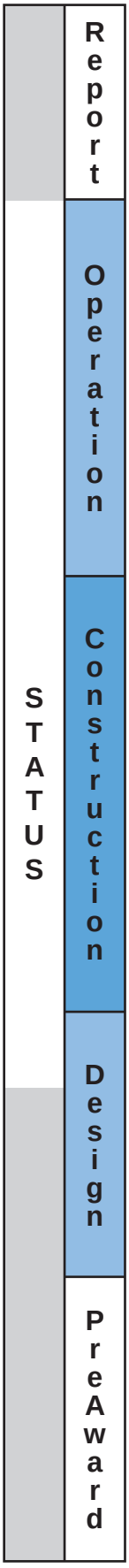


Final Report Issued (Fuel Cell only)	*2/06*
Draft Report Issued	*N/A*
Operation Completed	*N/A*
Operation	*N/A*
Construction	*N/A*
Project Withdrawn	*8/05*
NEPA Completed	
IGCC (EIS)	*1/03*
MCFC (CX)	*1/03*
Award	*11/99*
Selection	*5/93*

Mesaba Energy Project – Unit 1

Participant
MEP-I LLC
(Excelsior Energy, Inc.)

Additional Team Members
ConocoPhillips — technology holder

Fluor Enterprises — EPC

Location
Taconite, Itasca County, MN or Hoyt Lakes, St. Louis County, MN

Technology
Next generation ConocoPhillips E-Gas™ gasifier applied in an integrated gasification combined-cycle (IGCC) mode

Capacity
Up to 600 MWe (net); 4,731 tons of coal/day input

Coal
PRB subbituminous (preferred)

Illinois Basin #6 bituminous

Project Funding

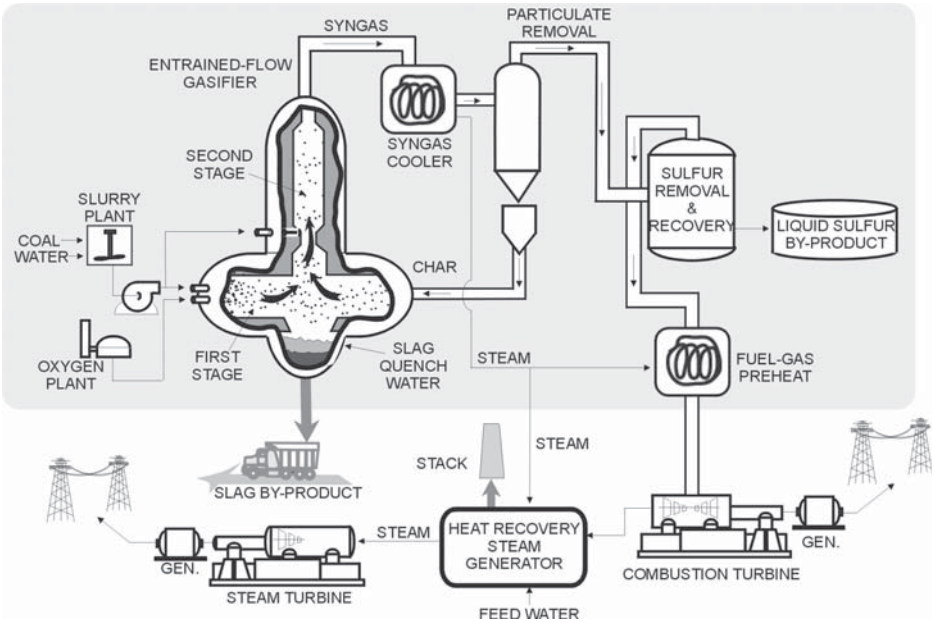
Total	$2,155,680,783	100%
DOE	36,000,000	1.7
Participant	2,119,680,783	98.3

CCPI-2

Advanced Power Systems

IGCC ■ CFB □

Hybrid □ Adv Comb □



Objectives

Demonstrate: double the generating capacity of the Wabash River Coal Gasification Repowering Project; advanced full-slurry quench (FSQ) multiple-train gasifier system having 90 percent or better operational availability; first-of-a-kind (U.S.) integrated air separations unit; greater feedstock flexibility; emission levels for criteria pollutants and mercury equal to or below those of the lowest emission rates for utility-scale, coal-based generation fueled by similar feedstocks; carbon dioxide emissions 15 to 20 percent lower than the current average for U.S. coal-based power plants fueled by similar feedstocks; design heat rate of about 8,600 Btu/kilowatt-hour when using bituminous coal; and a standard replicable design configuration with a sound basis for providing firm installed cost information for future commercialization.

Technology/Project Description

The project will demonstrate the next-generation ConocoPhillips E-Gas™ technology in up to a 600-MWe integrated gasification combined-cycle (IGCC) application. The IGCC design will incorporate findings from a comprehensive Value Improving Practices (VIP) process applied by an industry forum to improve cost and performance based on the predecessor Wabash River Coal Gasification Repowering Project. The ConocoPhillips E-Gas™ gasifier features an oxygen-blown, continuous-slagging, two-stage entrained-flow process. Coal is slurried, combined with 95 percent pure oxygen from an air separation unit, and injected into a first stage gasifier, which operates at 2,600 °F and 400 pounds per square inch gage (psig) pressure. In the first stage, the coal slurry undergoes a partial oxidation reaction at temperatures high enough to bring the coal's ash above its melting point. The fluid ash falls through a tap hole at the bottom of the first stage into a water quench, forming an inert vitreous slag. The synthesis gas formed in the first stage flows to a second stage where additional coal slurry is injected. The coal undergoes pyrolysis in an endothermic reaction with the hot gas, enhancing the synthesis gas heating value and improving efficiency. The synthesis gas leaving the gasifier will be cooled and the heat will be used to gen-

Project Duration 81 Months	Period of Operation 12 Months	Status/Schedule *Estimated date

erate steam. Particulate matter will be removed from the cooled gas (probably in a two-stage dry process) and processed through state-of-the-art sulfur removal and recovery systems prior to combustion in advanced gas turbines. Heat from the gas turbines and steam from the syngas loop will be used to raise steam for the steam turbine.

Benefits

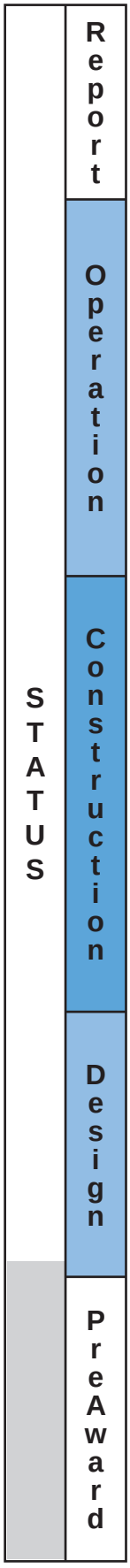
ConocoPhillips E-Gas™ technology established its potential for providing clean energy at competitive costs in the successful demonstration at Global Energy's Wabash River Generating Station. The Mesaba project is designed to validate that potential and move the technology into commercialization by demonstrating a commercial E-Gas™ IGCC design configuration emerging from a comprehensive analysis of the Wabash plant. Following the Wabash Demonstration, a VIP process (a formal industry process applying nine separate practices) was applied to examine lessons learned from the Wabash demonstration, identify options to improve cost and performance, and optimize design for a commercial plant configuration. The process engaged operating and maintenance personnel at the Wabash plant, E-Gas™ gasifier experts, and a top architectural and engineering firm. Nearly 300 value engineering ideas were considered. The Mesaba project will implement the commercial design configuration coming out of the VIP process and subsequent research and development.

Status/Accomplishments

The project was one of four projects selected under the second round of the Clean Coal Power Initiative (CCPI), which received 13 applications for financial assistance.

Two Public Scoping Meetings for preparation of an Environmental Impact Statement (EIS) were conducted on October 25–26, 2005. The Public Scoping Meetings were conducted near the two potential sites. One meeting was held at the Tacomite Community Center, Tacomite, Minnesota, and the other meeting was held at the Hoyt Lakes Arena, Hoyt Lakes, Minnesota.

The project was awarded on May 19, 2006. Final project development and initial design activities are under way.



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Clean Coal Fuels

Advanced Coal Conversion Process Demonstration

Demonstration Operations Complete

Participant

Western SynCoal LLC (formerly Rosebud SynCoal Partnership; a subsidiary of Montana Power Company's Energy Supply Division)

Additional Team Members

None

Location

Colstrip, Rosebud County, MT (adjacent to Western Energy Company's Rosebud Mine)

Technology

Western SynCoal LLC's Advanced Coal Conversion Process for upgrading low-rank subbituminous and lignite coals

Plant Capacity/ Production

45 tons/hr of SynCoal® product

Coal

Powder River Basin subbituminous (Rosebud Mine), 0.5–1.5% sulfur, plus tests of other subbituminous coals and lignites

Project Funding

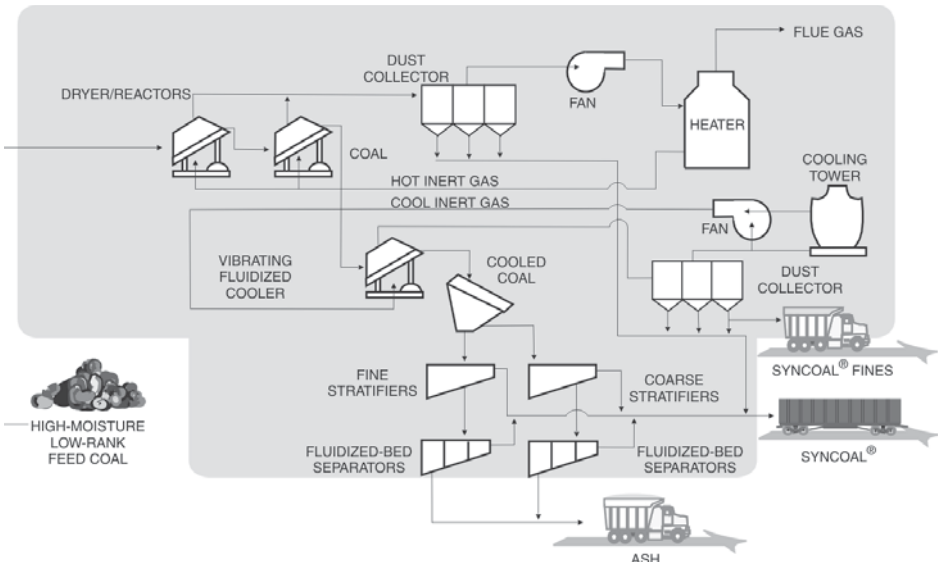
Total	$105,700,000	100%
DOE	43,125,000	41
Participant	62,575,000	59

CCTDP

Clean Coal Fuels

Upgrading ■

Conversion □



Objectives

To demonstrate Western SynCoal LLC's Advanced Coal Conversion Process (ACCP) to produce SynCoal®, a stable coal product having a moisture content as low as 1 percent, sulfur content as low as 0.3 percent, and heating value up to 12,000 Btu/lb.

Technology/Project Description

The ACCP demonstrated in this project consists of thermal processing coupled with physical cleaning to upgrade high-moisture, low-rank coals to a SynCoal® product having high heating values and low sulfur contents. In the ACCP, the raw coal is screened and fed to a vibratory fluidized-bed reactor where surface moisture is removed by heating with hot combustion gas. Coal exits this reactor at a temperature slightly higher than that required to evaporate water, and flows to a second vibratory reactor where the coal is heated to nearly 600 °F. This temperature is sufficient to remove chemically bound water, carboxyl groups, and volatile sulfur compounds. In addition, a small amount of tar is released, partially sealing the dried product. Particle shrinkage causes fracturing, destroys moisture reaction sites, and liberates the ash-forming mineral matter.

The coal then is cooled to less than 150 °F by contact with an inert gas in a vibrating fluidized-bed cooler. The cooled coal is sized and fed to deep-bed stratifiers, where air pressure and vibration separate mineral matter including much of the pyrite from the coal, thereby reducing the sulfur content of the product. The low-specific-gravity fractions are sent to a product conveyor, while heavier fractions go to fluidized-bed separators for additional ash removal. The fines handling system consolidates the coal fines that are produced throughout the ACCP facility. The fines are gathered by screw conveyors and transported by drag conveyors to a bulk cooling system.

Project Duration 129 Months	Period of Operation 108 Months	Status/Schedule *Estimated date

Benefits

ACCP technology offers a means of converting vast low-rank western subbituminous and lignite coal reserves to high-energy-density, low-sulfur, low-ash fuels capable of enhancing boiler efficiency and reducing sulfur emissions. Increasing energy density of western coals also has the potential to significantly reduce transportation costs, assuming stability of the processed coals can be achieved, *i.e.*, control spontaneous combustion. Western coals typically cost less to mine than eastern coals because they reside in thick seams amenable to surface mining, whereas eastern bituminous coals are typically mined by underground methods. Thus, western coals start with a cost advantage that may be retained in distant markets if ACCP objectives were met. The consistent quality and high carbon and volatile content make the SynCoal® product: (1) an excellent fuel supplement to resolve flame stability and slagging/fouling problems experienced by boilers using raw low-rank coals, and to reduce sulfur emissions from plants using relatively high sulfur content coals; (2) a superior fuel for direct-fired applications, offering good ignition and a stable flame in cement and asphalt production, particularly when blended with petroleum coke; and (3) a good reducing agent for some metallurgical processing applications.

Status/Accomplishments

Project operations ceased in June 2001, with the purchase of Montana Power (including Western SynCoal LLC) by Westmoreland Mining LLC. The final report has been issued and can be found on the Clean Coal Technology Compendium Web site at *www.netl.doe.gov/technologies/coalpower/cctc/cctc_main.htm*.

Results Summary

Operational

- During the life of the project, over 2.9 million tons of coal were processed to produce over 1.9 million tons of SynCoal® product shipped to a variety of customers.
- The SynCoal® product was very close to the design basis product chemically, but fell short of physical performance specifications with regard to resistance to spontaneous combustion and dust emissions upon handling.

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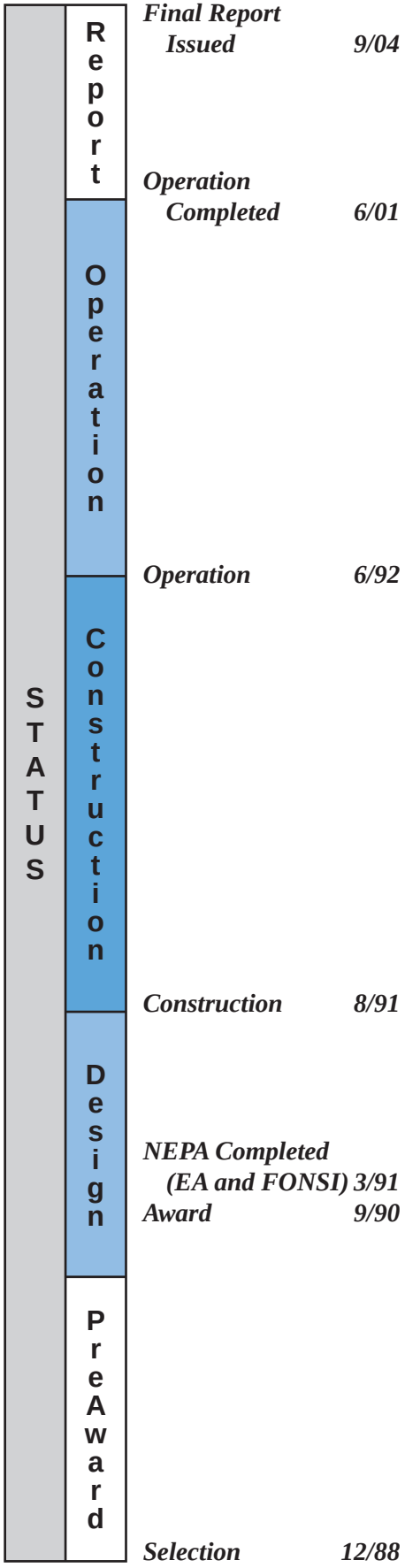


Western SynCoal's® Advanced Coal Conversion Process.

- The SynCoal® product quality remained essentially constant for the life of the project.
- A water-based anionic polymer dust stabilization enhancement (DSE) product was applied to suppress dust emissions in SynCoal® handling and shipment, and to provide a heat sink to temporarily suppress spontaneous combustion. More extensive stability processes were investigated showing that stability could be achieved, but the required re-hydration and oxidation were costly and degraded the product.
- Test burns of 50 percent DSE-conditioned SynCoal®/raw Rosebud Mine coal blends at the 160-MW J.E. Corette power plant in Billings, Montana reduced SO_2 emissions 12 percent, and increased boiler efficiency 1 percent; a similar 79 percent/21 percent SynCoal®/raw coal blend reduced SO_2 emissions 23 percent, increased boiler efficiency 1.5 percent, and de-slagged the boiler, resulting in a 3-MW boost in power output.
- ACCP upgraded 6,800 Btu/lb North Dakota lignite (having 36 percent moisture and sulfur equivalent to 3.0 lbs of $SO_2/10^6$ Btu) to a 10,500–10,700 Btu/lb SynCoal® product (with 47–48 percent less sulfur and 7–27 percent less ash).
- Burning of the North Dakota lignite-derived SynCoal® product in the 250-MW Milton R. Young Power Station Unit 1 cyclone-fired boiler near Center, Montana resulted in release of slag buildup, a 13 percent reduction in boiler air flow requirement, an increase in boiler efficiency from 82 percent to 86 percent, and a 123 Btu/kWh increase in heat rate.
- SynCoal® heat inputs of 15–16.6 percent to Colstrip Energy Limited Partners Unit No. 2 boiler increased power output by an average 3.7 percent, increased heat rate 85 Btu/kWh, reduced SO_2 emissions 8 percent, and reduced NO_x emissions 19 percent.
- In direct-fired cement and lime kiln applications, SynCoal® enhanced flame stability, improved product, and increased process efficiency.
- As a green sand binder additive in metal casting, SynCoal® served as a reducing agent and improved the "peel" quality of the casting.

Environmental

- The ACCP SynCoal® plant experienced no problems in meeting Federal, State, and local permitted emission limits.
- The SynCoal® product proved to be an effective fuel in enhancing efficiencies of both boilers and direct-fired industrial applications, and in reducing sulfur emissions in applications using baseline fuels with relatively high sulfur contents.

Economic

- Capital costs of $39 million were estimated for a 100 ton/hour reference plant design that integrates ACCP into a power plant, relies upon the plant for process energy requirements, and neither cleans nor stabilizes the SynCoal® product.

Project Summary

Exhibit 3-6 provides an operational performance summary of the ACCP plant. Availability suffered in the early stages from stability problems experienced with the SynCoal® product. Spontaneous combustion problems limited storage and forced plant shutdowns when limits were reached. Also, SynCoal® produced during startup and

shutdown did not meet specifications and was rejected, which caused early production to fall short of the 2/3 of a ton of SynCoal® per ton of raw coal objective. After finding the means to extend storage, and finding clients for the SynCoal®, availability approached design targets of 75 percent and production goals were met. The SynCoal® product quality remained essentially constant for the life of the project.

In addition to stability problems, the SynCoal® product suffered from fugitive dust emissions when handled, as dust particles released upon impact had no receptive surfaces on which to adhere. After extensive research, a water-based anionic polymer dust stabilization enhancement (DSE) product was identified that suppressed dust emissions in SynCoal® handling and shipment, and provided a heat sink to temporarily suppress spontaneous combustion.

The DSE approach expanded test burn and special use possibilities, the results of which are summarized in the preceding Results Summary. In utility applications, efficiency was the primary benefit, which in turn reduced emissions, with direct sulfur reduction occurring in plants using relatively high sulfur baseline coals. In direct-fired applications, flame stability resulting from the product content and consistent quality was the primary benefit, which impacted product quality and process efficiency. In metal casting, SynCoal® proved to be an effective additive for molds.

More extensive stability processes were investigated, which included re-hydration and oxidation. While stability is achievable, the cost to build and operate such a process is not insignificant and the product is degraded.

Permitting an ACCP SynCoal® plant does not appear to be a problem, and the most likely application seems to be integrated with a power plant to take advantage of available heat and ash handling and to avoid expensive stability processing and added product ash removal. The estimated capital cost of a 100 ton/hour ACCP plant integrated into a power station is $39 million.

Coal feed system to ACCP to produce SynCoal®.

Exhibit 3-6
ACCP Annual Production Rates

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
Raw Coal Processed (tons)	28,686	157,421	370,789	479,621	370,389	395,450	163,272	419,296	441,380	112,931	2,939,240
Availability (%)	18	53	65	78	65	66	28	70	73	54	58
Forced Outage Rate (%)	70	40	26	13	21	26	8	15	14	35	23
Avg. Feed Rate (ton/hr)	21.1	34	64.7	70.1	64.4	68.0	66.0	68.4	69.0	73.1	63.3
SynCoal® Shipped (tons)	5,566	57,528	205,447	315,688	238,766	413,175	97,574	268,650	291,604	86,281	1,980,279

Gilberton Coal-to-Clean Fuels and Power Co-Production Project

CCPI-1

Clean Coal Fuels
Upgrading ☐
Conversion ■

Participant
WMPI PTY., LLC

Additional Team Members
Nexant, Inc. — engineering support

Shell Global Solutions B.V., U.S. — technology partner

Unde GmbH. — gasification technology supplier

SASOL Technology Ltd. — Fischer-Tropsch (FT) technology supplier

Location
Gilberton, Schuylkill County, PA

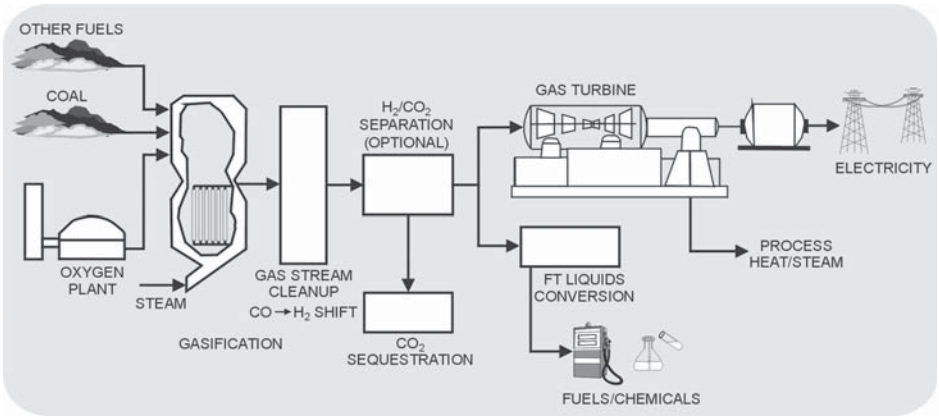
Technology
Shell oxygen-blown, entrained-bed gasifier and SASOL FT liquefaction technology

Project Capacity/ Production
4,700 tons/day of coal waste to produce 41 MW of power and 5,000 barrels/day of clean liquid transportation fuel

Coal
Anthracite culm

Project Funding

Total	$612,480,000	100%
DOE	100,000,000	16
Participant	512,480,000	84



Objectives
To demonstrate gasification of 4,700 tons/day of coal waste to produce 41 MW of power and 5,000 barrels/day of clean liquid transportation fuel, including high-cetane diesel fuel and naphtha that contain no sulfur or aromatics.

Technology/Project Description
The project will demonstrate conversion of 4,700 tons/day of coal waste from abandoned anthracite culm piles into 41 MW of electric power and over 5,000 barrels per day of ultra-clean transportation fuels. In doing so, over 1.0 million tons/year of coal waste will be removed that would otherwise contribute to contamination of watersheds through leaching of minerals and acid water formation. In the conversion process, coal waste is fed to a Shell oxygen-blown, entrained-bed gasifier that applies heat and pressure, transforms the ash constituent of the coal waste into an inert vitreous slag, and converts the hydrocarbon and sulfur constituents primarily into carbon monoxide (CO), hydrogen (H_2), carbonyl sulfide (COS), and hydrogen sulfide (H_2S). This raw synthesis gas is cleaned in a patented Rectisol™ process, which removes nearly all of the COS and H_2S. Clean synthesis gas (CO and H_2) is either shifted by the addition of steam to carbon dioxide (CO_2) and H_2 for separation, or used directly for power generation and liquid fuel production. Power is generated in a gas turbine, which in turn provides process heat and steam for a SASOL slurry-phase Fischer-Tropsch (FT) reactor. The SASOL FT reactor produces high-cetane diesel fuel and naphtha that contain no sulfur or aromatics. Naphtha can either be upgraded to a high-octane, clean-burning reformulated gasoline or used as sulfur-free on-board reforming feed for fuel cell-powered vehicles.

Project Duration	Period of Operation	Status/Schedule
TBD	*TBD*	*Estimated date

Benefits

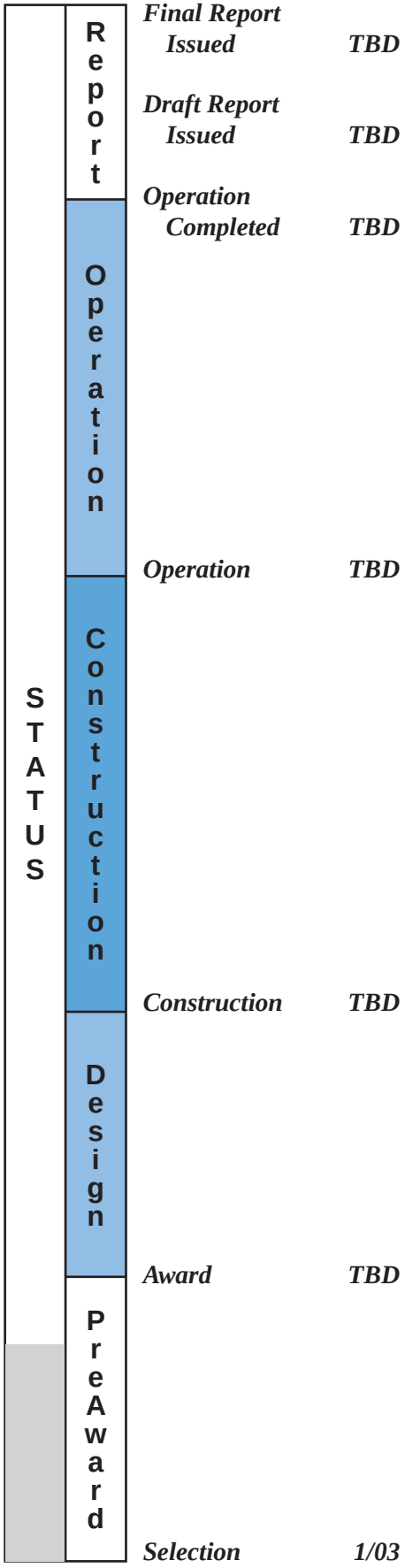
This project addresses a long-standing environmental issue associated with vast abandoned coal waste piles while providing a sorely needed alternative source of high-grade, ultra-clean transportation fuels. Well over a billion tons of coal waste resides in Pennsylvania, Illinois, West Virginia, and Ohio. With successful demonstration of project technologies, coal waste that has threatened major watersheds may become low-cost feedstock to help fuel our nation's transportation fleet and contribute to energy independence. This project will process about 1.0 million tons per year of coal waste materials from the Gilberton site. If successful, this technology could be applied in many regions of the country where coal wastes currently are stockpiled, and significantly reduce waste disposal activities from operating coal mines. The FT transportation fuels produced can be used for a variety of high-end fuel applications, and being virtually free of sulfur, nitrogen, and aromatics, are superior to their conventional petroleum counterparts in both end-use and environmental properties. Their characteristics translate into reduced sulfur, nitrogen oxides (NO_x), particulate matter, hydrocarbon, and CO emissions. The process scheme is very flexible, allowing use of a broad range of feedstock (coal, coal waste, petroleum coke, biomass, and blends thereof), and facilitating carbon separation/capture for sequestration by keeping CO_2 streams concentrated. If successful, this project is of sufficient scale to reduce technical, business, and financial risks, clearing the way for subsequent applications.

Status/Accomplishments

This project was selected for award on January 8, 2003. Negotiations are proceeding toward award of a cooperative agreement. A Memorandum of Understanding (MOU) was signed with SASOL to commence negotiations for the use of SASOL's FT technology in the proposed project. On September 29, 2005, Governor Rendell announced that the State of Pennsylvania is entering into an agreement to buy the fuel products from the project.

The Public Scoping Meeting for preparation of an Environmental Impact Statement (EIS) was held on May 5, 2003. Public hearings on the draft EIS were held on January 9, 2006, in Shenandoah, PA and on January 10, 2006, in Pottsville, PA.

WMPI is holding discussions with team members to resolve issues that are delaying the award of the project.



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Increasing Power Plant Efficiency – Lignite Fuel Enhancement

CCPI-1

Clean Coal Fuels

Upgrading ■

Conversion □

Participant
Great River Energy (GRE)

Additional Team Members
Electric Power Research Institute — collaborator

Lehigh University — collaborator

Barr Engineering — lignite handling

Falkirk Mining and Couteau Properties — lignite coal supplier

Location
Underwood, McLean County, ND (GRE's Coal Creek Station)

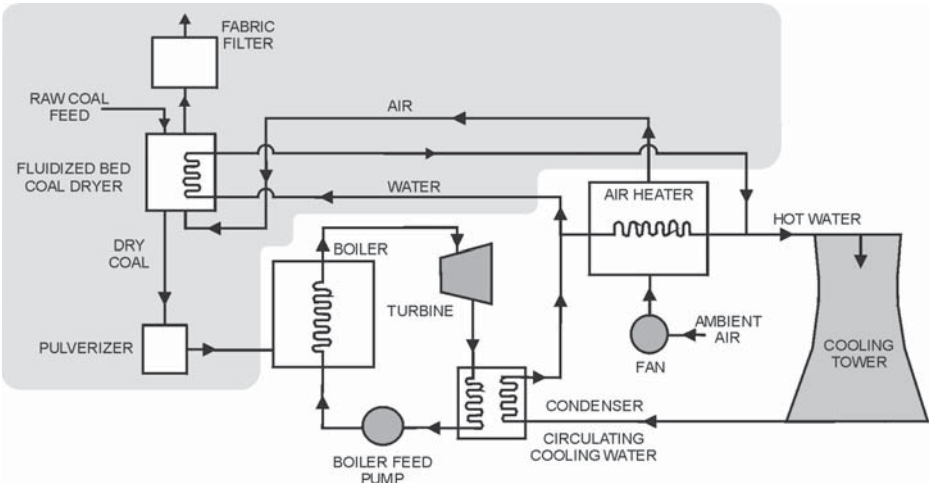
Technology
GRE's waste-heat dryer for low-rank coals

Project Capacity/ Production
546 MW

Coal
Lignite

Project Funding

Total	$31,512,215	100%
DOE	13,518,737	43
Participant	17,993,478	57



Objectives

To demonstrate a 25 percent reduction in lignite moisture content (from 40 percent moisture to 30 percent moisture in this application) using plant waste heat; and to optimize and assess plant operation on dried coal to quantify benefits.

Technology/Project Description

The project demonstrates Great River Energy's (GRE) waste-heat dryer for low-rank coals on a 546-MW tangentially fired boiler at the Coal Creek Station using North Dakota lignite that has approximately 40 percent moisture content. In phase 1 of a two-phased effort, GRE is to build and operate a full-scale dryer module capable of producing one-fourth of the dry lignite requirement for the plant. In phase 2, which follows successful operation of the first dryer, GRE is to replicate the first dryer to provide sufficient dryer capacity to fully fuel the 546-MW unit, and to optimize plant operation on dried lignite and evaluate performance. The full boiler dryer system uses plant cooling water as the major heating medium. Water drawn from the cooling tower captures heat from the steam condenser in the boiler circuit, raising the temperature to about 120 °F. The heated water is routed to an air heater and to a fluidized-bed coal dryer before returning to the plant cooling water circuit. Ambient air is heated in the air heater to about 105 °F and subsequently used as the fluidizing media in the fluidized-bed dryer to provide heat along with the 120 °F water from the condenser. In practice, a two-stage dryer is used to enhance heat transfer.

Benefits

This technology uses heat (that would otherwise be lost out the stack) to upgrade the low-rank coal feedstock, thereby enhancing plant efficiency and performance. The high moisture content in low-rank coals significantly increases plant heat rates and reduces efficiency by requiring application of heat generated during combustion to vaporize large amounts of water in coal. This heat of vaporization represents a heat loss because it does not contribute to power generation. Moreover, high-moisture content coals can contribute to corrosion of ductwork, and place an energy penalty on fans that move the vaporized water and pulverizers that process the moisture in the coal. GRE's upgrading process improves plant

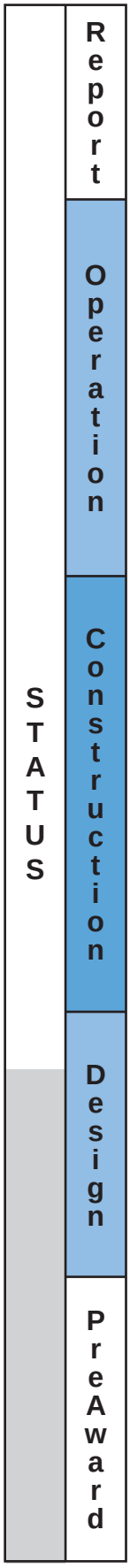
Project Duration 54 Months	Period of Operation 8 Months	Status/Schedule *Estimated date (phase 2)

economics and reduces plant heat loss (decreases heat rate), increases efficiency, and thereby reduces emissions of carbon dioxide (CO_2), mercury, nitrogen oxides (NO_x), sulfur dioxide (SO_2), and particulate matter (PM) per unit of energy produced. This technology has potential application to more than 100 gigawatts of domestic coal-fired capacity that currently uses low-rank coals.

Status/Accomplishments

The National Environmental Policy Act (NEPA) requirement was met with an Environmental Assessment (EA) and issuance of a Finding of No Significant Impact (FONSI) on January 16, 2004. A cooperative agreement was awarded July 9, 2004.

Major components of the prototype dryer for phase 1 of the project were delivered to the plant site in July 2005, and a ribbon cutting event for the project was held on August 9, 2005. Integration of the prototype dryer components, installations of conveyors, and final electrical and mechanical connections were completed. After completing startup and commissioning, around-the-clock operations of the prototype dryer and data collection began in March 2006. Initial data show that with just one pulverizer using dried coal, boiler efficiency increased 0.3 percentage points; sulfur oxide emissions fell 2.0 percent; nitrogen oxide emissions decreased 8.5 percent; and carbon dioxide emissions decreased 0.34 percent. GRE has conducted capacity tests with throughputs ranging up to 105 tons per hour, about 93 percent of the dryer capacity. Following successful operation of the first dryer, phase 2 of the project will provide completion of design, construction, and operation of dryer capacity for the full plant. GRE has initiated phase 2 activities in September 2006.



Final Report Issued	*6/09**
Draft Report Issued	*3/09**
Operation Completed	*12/08**
Operation	*4/08**
Construction	*4/07**
Award	*7/04*
NEPA Completed (EA and FONSI)	*1/04*
Selection	*1/03*

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Industrial Applications

Advanced Multi-Product Coal Utilization By-Product Processing Plant

Participant

University of Kentucky Research Foundation Center for Applied Energy Research (CAER)

Additional Team Members

Kentucky Utilities (a subsidiary of LG&E Corporation) — host

CEMEX USA — commercialization partner

Location

Ghent, Carroll County, KY (Kentucky Utilities' Ghent Power Station)

Technology

CAER's hydraulic classification and froth flotation beneficiation process (Fast Float™)

Project Capacity/ Production

197,500 tons/yr of high quality marketable products from coal ash

Coal

Pittsburgh bituminous

Project Funding

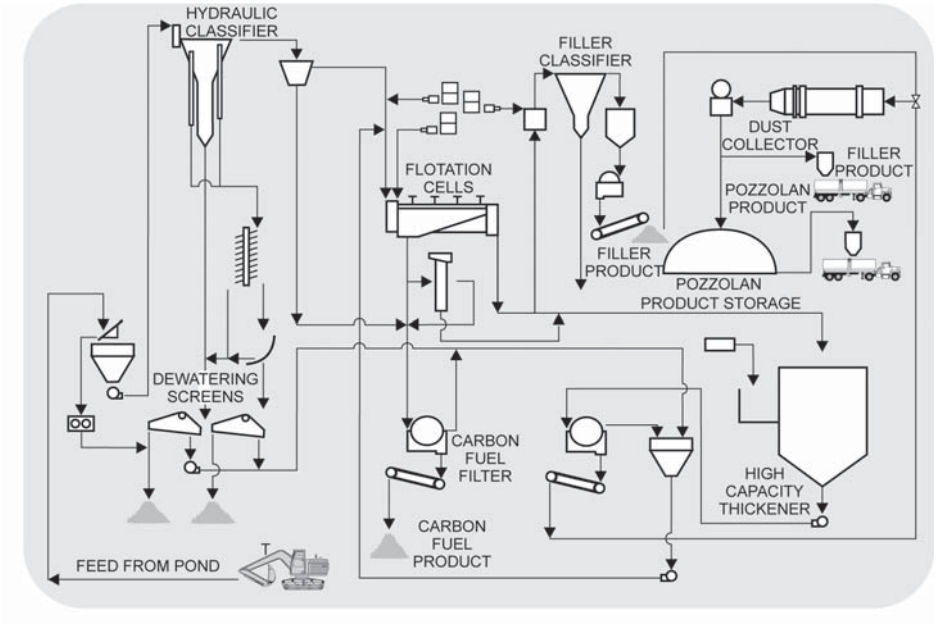
Total	$8,979,544	100%
DOE	4,480,793	50
Participant	4,498,751	50

CCPI-1

Industrial Applications

Direct Coal Use ☐

By-Product Use ■



Objective

To demonstrate that the coal utilization by-product (CUB) beneficiation process developed by the University of Kentucky Research Foundation's Center for Applied Energy Research (CAER) can convert nearly the entire CUB produced by the Ghent Power Station into a variety of useful products, including:

156,000 tons/yr of high quality, cementious pozzolan;

16,000 tons/yr of high grade, lightweight aggregate;

16,000 tons/yr of graded fill sand;

1,500 tons/yr of high quality polymeric fill; and

8,000 tons/yr of recycled carbon fuel.

Technology/Project Description

The project will utilize the CAER beneficiation process technology that is based on hydraulic classification and froth flotation (Fast Float™). Raw coal ash feed will be reclaimed from the Ghent Power Station's ash storage ponds. The feed enters a hydraulic classifier where material is separated into two basic sizes — a -200 mesh fine size and a +200 mesh coarse size. Coarse materials enter spiral concentrators that classify (separate by size and weight) and concentrate the incoming material into a lightweight aggregate suitable for masonry block, graded fill sand, and a coarse carbon fuel. The -200 mesh fine material is treated with a patented reagent before entering froth flotation cells where fine carbon is separated, leaving a stream of pozzolan material. The bulk of the pozzolan stream is subsequently concentrated and dried to produce a high-quality substitute for Portland cement. A fraction of the pozzolan stream is further processed hydraulically to produce a 9- to 4-micron size material for use as a polymer additive or other filler applications.

Project Duration 56 Months	Period of Operation 12 Months	Status/Schedule *Estimated date

Benefits

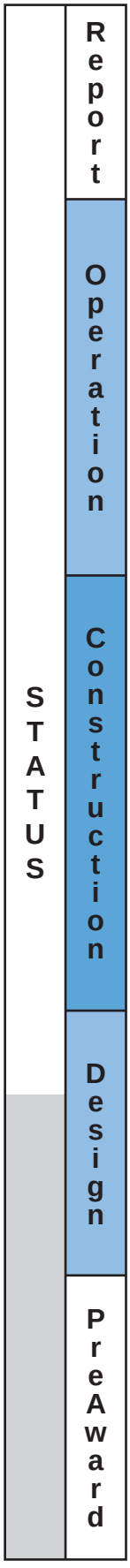
Each year the U.S. electric utility industry generates about 100 million tons of CUB, including flyash, scrubber sludge, and bottom ash. Currently, less than one-third of these waste products are used. The remainder is disposed of in impoundments or in landfills. Greater reuse of CUB can offset future land use and minimize the production of greenhouse gases. Portland cement manufacturing releases approximately 1 ton of CO_2 per ton of cement produced, equating to an annual emission rate of approximately 47 million tons. The CAER benefication process produces a high-quality pozzolan that can be used at higher cement substitution levels in concrete (*i.e.*, 30 percent versus 20 percent). The demonstration project alone is targeted to produce 156,000 tons/yr of high-quality pozzolan. This increased utilization rate represents a significant greenhouse gas avoidance potential.

Status/Accomplishments

The National Environmental Policy Act (NEPA) requirement was met with an Environmental Assessment (EA) and a Finding of No Significant Impact (FONSI) in November 2004. The project was awarded a cooperative agreement in November 2004.

Ash pond core sampling, analysis, and mapping have been completed. Results indicate the pond volume exceeds 200 million cubic feet and contains more than 7 million tons of ash. In May 2005, it was decided that the demonstration project will be fed entirely from the ash pond as opposed to directly from the power station.

A mobile field system is being operated at Ghent to evaluate unit processing configurations and to process about 140 tons of material for product evaluation. CAER has conducted parametric tests on the primary and secondary classifiers, and has evaluated a series of retention times and dispersant dosages on the secondary classifier to produce an ultra-fine ash product. Composite bulk quantities of processed ash have been generated from each of the process configurations evaluated. The composite products have been characterized in terms of their grade, chemistry, and processing cost, and are being assessed for their use as a cement replacement in mortar and concrete mix designs.



Final Report Issued	*12/09**
Draft Report Issued	*9/09**
Operation Completed	*6/09**
Operation	*7/08**
Construction	*7/07**
Award	*11/04*
NEPA Completed (EA and FONSI)	*11/04*
Selection	*1/03*

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Commercial Demonstration of the Manufactured Aggregate Processing Technology Utilizing Spray Dryer Ash

Participant
Universal Aggregates, LLC

Additional Team Members
P.J. Dick, Inc. — project management and construction

SynAggs, LLC — marketing

Location
King George County, VA (Birchwood Power Facility)

Technology
Universal Aggregate's manufacturing process for conversion of spray dryer solid residue into construction-grade aggregate

Plant Capacity/ Production
150,000 tons/year of lightweight aggregate

Coal
Bituminous, 0.9% sulfur

Project Funding

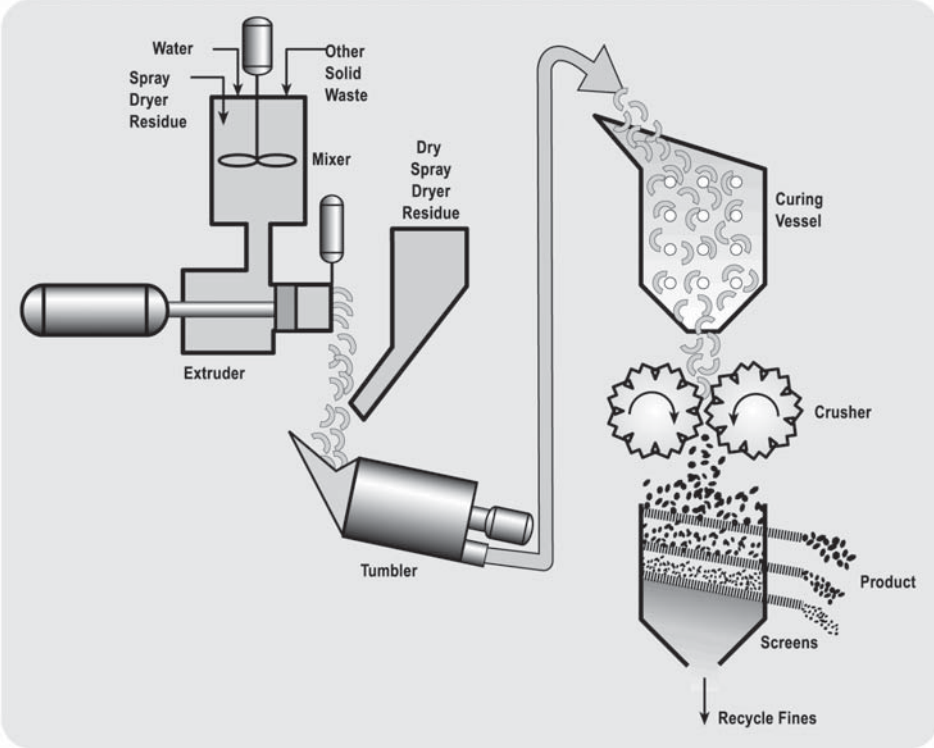
Total	$19,581,734	100%
DOE	7,224,000	37
Participant	12,357,734	63

PPII

Industrial Applications

Direct Coal Use ☐

By-Product Use ■



Objectives

To demonstrate conversion of 115,000 tons/year of spray dryer solid residue into 150,000 tons/year of lightweight aggregate meeting or exceeding American Society for Testing and Materials (ASTM) specifications for commercial construction-grade products, such as masonry blocks or lightweight concrete, including compressive strength.

Technology/Project Description

The project demonstrates conversion of spray dryer solid residue and other solid wastes from the 250-MW Birchwood Power Facility into construction-grade lightweight aggregate applicable to masonry block, lightweight concrete, or asphalt paving material. In the process, residue from the spray dryer and other solid wastes from the power plant are blended in a mixer (pug mill) with water to produce a uniform granular material. The loose, moist material then is fed to an extruder that intensifies mixing by shearing the material as it is forced through holes in a metal die to form wet "green" pellets. The green pellets are tumbled with additional dry spray dryer residue, embedding the residue into the pellets. The pellets are dried and hardened in a curing vessel specially designed to allow the solids to flow continuously, avoiding choke points and impediments that could hang up the material. After curing, the hardened pellets are crushed and screened to specification, then stockpiled for sale as manufactured aggregates. Once consistent operation is achieved, the Universal Aggregates manufacturing process at the Birchwood Power Facility will produce 150,000 tons of aggregate a year.

Benefits

As new environmental standards take effect, power companies are expected to install more scrubbers, including spray dryer technology like that applied at the

Project Duration 50 Months	Period of Operation 31 Months	Status/Schedule *Estimated date

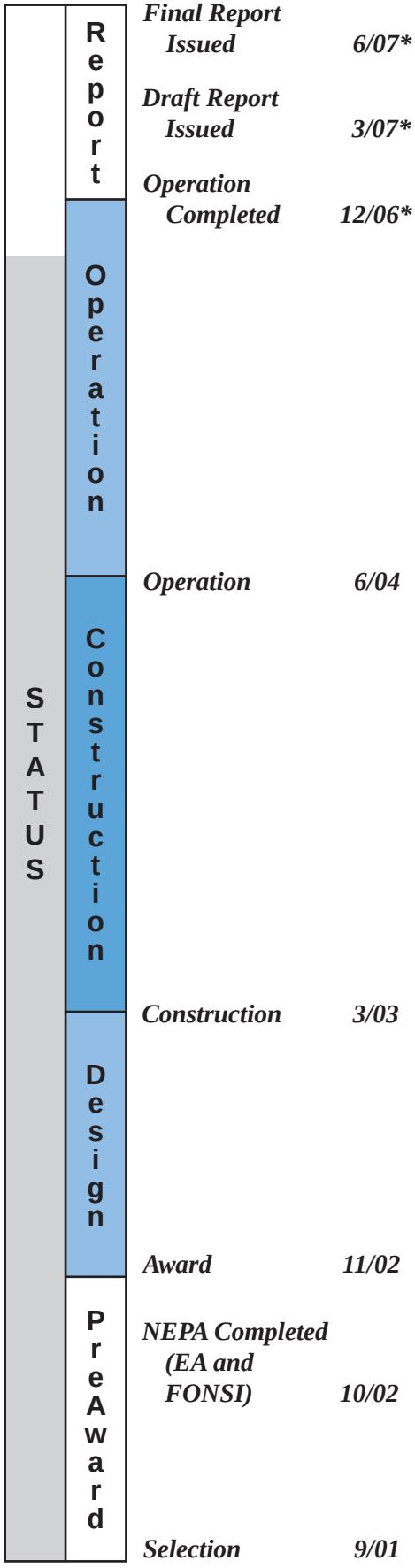
Birchwood Power Facility. While air quality will improve, scrubber waste tonnage inevitably will increase, placing greater burdens on landfills and increasing waste disposal costs. Of the 28 million tons of scrubber residue produced annually today by coal-fired plants, only about 30 percent is reused and most of that is from wet scrubbers. Providing the means to convert dry scrubber residue to salable by-products is deemed crucial by many in the power industry who believe that, as additional scrubbing is required, dry scrubbers will be the technology of choice. There currently are 21 spray dryer facilities operating in the United States that produce an adequate amount of spray dryer residue to economically justify the installation of a lightweight aggregate manufacturing facility. The construction aggregate market in the United States is estimated to be about 2 billion tons annually.

Status/Accomplishments

On November 14, 2002, a cooperative agreement was awarded. The National Environmental Policy Act (NEPA) requirement was met with an Environmental Assessment (EA) and a Finding of No Significant Impact (FONSI) on October 2, 2002.

Universal Aggregates is working through control of process parameters, refinements to chemical compositions, and equipment modifications in an effort to achieve steady-state operation. Retention times and water sprays in the pug mill had to be adjusted. Variations in calcium hydroxide levels in spray dryer residue have required installation of a secondary lime slaker. Universal Aggregates is performing various parametric tests to determine a suitable admixture capable of stiffening the extruded material. The tests include various combinations of sand, bottom ash, and recycled embedding material.

While improvements have been realized with the extruder, problems continue with components of the curing vessel, dust collection, and the ash transfer system. The plant has not been able to consistently operate in a fully integrated mode. Modifications to improve operation continue. Some of the modifications to improve operation include: changes to the curing vessel rotary feed and delivery chute arrangement; fabrication and installation of a dust collection system at the base of the curing vessel; changes to the ash feed system; installation of a recirculating system for the curing vessel; and a new centralized baghouse that replaced two smaller units.



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Western Greenbrier Co-Production Demonstration Project

Participant
Western Greenbrier Co-Generation (WGC), LLC

Additional Team Members
Alstom Power, Inc. — technology supplier

Hazen Research, Inc. — technology supplier

Midway Environmental Associates — technology supplier

Location
Rainelle, Greenbrier County, WV

Technology
Alstom Power fluidized-bed combustion

Project Capacity/ Production
100 MW (net) electric power and steam for district heating, alkaline ash for remediation, and co-production of structural bricks or other marketable materials

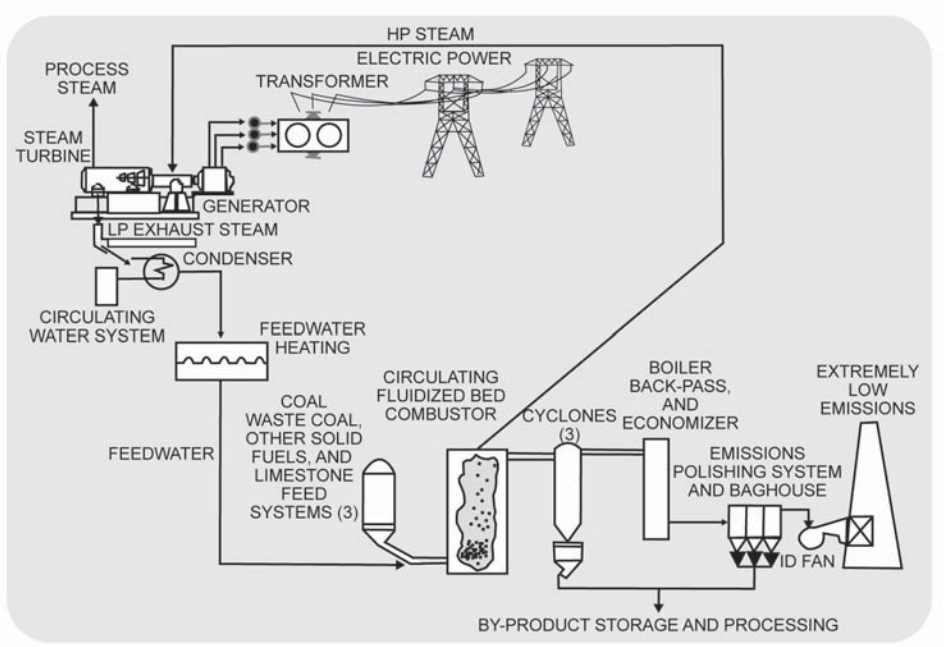
Coal
4,000 tons/day of bituminous waste coal

Project Funding

Total	$214,983,758	100%
DOE	107,491,879	50
Participant	107,491,879	50

CCPI-1

Industrial Applications
Direct Coal Use ☐
By-Product Use ■



Objectives
To demonstrate advanced circulating fluidized-bed (CFB) combustion technology in the co-production of 100 MW (net) electric power and steam, and marketable ash by-products using bituminous waste coal as the primary feedstock; to use residual steam from the steam turbine for industrial use and district heating; and to apply alkaline ash from the CFB to remediate acid water formation in waste coal impoundments.

Technology/Project Description
The project applies advanced CFB technology to convert approximately 4,000 tons/day of coal mining waste materials ("gob") into 100 MW (net) of electricity. Also, up to 20,000 pounds/hour of steam/hot water for industrial use and district heating can be generated. Initially, about 10 percent of the ash generated will be used to produce a salable by-product, and about 800 tons/day will be used for remediation of acid water formation. The CFB power plant will be an anchor tenant in a planned, environmentally balanced industrial park (Eco-Park). The advanced CFB incorporates an inverted cyclone separator and mid-support structure designs to reduce assembly time (6–8 weeks), lower material costs (60 percent less structural steel tonnage), and provide a smaller footprint (30–40 percent) than conventional designs. Waste coal and limestone are simultaneously fed to the CFB, which raises steam by passing water through water walls lining the CFB. The limestone removes the bulk of the sulfur in the coal feedstock, and the solids are entrained and re-circulated via the cyclone separators to enhance limestone and carbon utilization. An economizer located downstream of the cyclones recovers additional heat from the flue gas. Selective non-catalytic reduction (SNCR), flash dryer absorber, and a baghouse provide additional control of nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter (PM), and mercury. Steam from the CFB boiler drives a nominal 100-MW (net) steam turbine. Also, a portion of the steam can be used for ash by-product processing while hot water supplies district heating to tenants in the Eco-Park. Bottom ash and a small portion of the fly ash are collected and returned to the source of the

Project Duration 80 Months	Period of Operation 12 Months	Status/Schedule *Estimated date

feedstock. The mildly alkaline nature of the ash assists in neutralizing the acid runoff from the waste pile, alleviating a significant environmental problem. Some of the fly ash is processed and used for production of salable materials, including cements and aggregates.

Benefits

The project is a model of industrial ecology at its best, applying advanced technology to: (1) generate energy from wastes, alleviating an environmental problem; (2) maximize energy generated and associated efficiency; (3) produce salable by-products, enhancing plant economics; and (4) produce remediation by-products, enabling significant land reclamation. West Virginia alone has over 400 million tons of waste coal in abandoned mine dump sites, or "gob piles." Water coming in contact with these gob piles becomes highly acidic, absorbs minerals, and contaminates streams and rivers. Successful integration of project technologies and approaches can serve as a model for regions around the world interested in remediation of similar refuse sites.

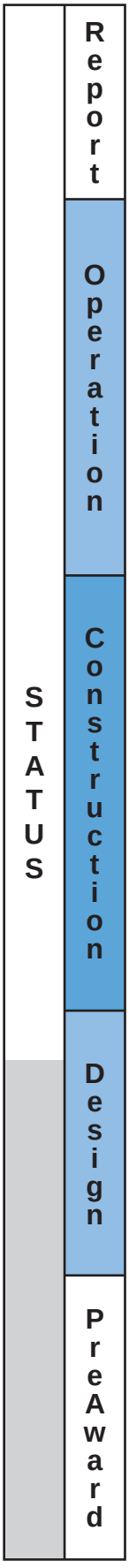
Status/Accomplishments

On April 29, 2004, the project was awarded a cooperative agreement. In June 2003, the National Environmental Policy Act (NEPA) process was launched with a public scoping meeting to define the requirements for an Environmental Impact Statement (EIS).

Alstom Power combusted about 150 tons of Anjean waste coal and 50 tons of the Greenbrier Valley limestone at its test facility to obtain furnace design parameters and to provide representative ash to Hazen Research for by-product development and qualification testing.

Western Greenbrier (WGC) is currently working to finalize the project agreements for product sales, financing, construction, and plant operations.

WGC has made a request to DOE to extend Phase I, project definition until April 30, 2007.



Final Report Issued	*10/11**
Draft Report Issued	*3/11**
Operation Completed	*12/10**
Operation	*12/09**
Construction	*5/07**
Award	*4/04*
NEPA Launched	*6/03*
Selection	*1/03*

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Appendix A. Historical Perspective, Legislative History, and Public Laws

CCTDP Historical Perspective

There were a number of key events that prompted creation of the Clean Coal Technology Demonstration Program (CCTDP) and impacted its focus over the course of the five solicitations. The roots of the CCTDP can be traced to the acid rain debates of the early 1980s, culminating in U.S. and Canadian envoys recommending a five-year, $5 billion U.S. effort to curb precursors to acid rain formation — sulfur dioxide (SO_2) and nitrogen oxides (NO_x). This recommendation was adopted and became a presidential initiative in March 1987.

As a part of the response to the recommendations of the *Special Envoys on Acid Rain* in April 1987, the President directed the Secretary of Energy to establish a panel to advise the President on innovative clean coal technology activities. This panel was the Innovative Control Technology Advisory Panel. As a part of the panel's activities, the state and federal incentive subcommittee prepared a report, *Report to the Secretary of Energy Concerning Commercialization Incentives*, that addressed actions that States could take to provide incentives for demonstrating and deploying clean coal technologies. The panel determined that demonstration and deployment should be managed through both State and federal initiatives.

In the same time frame, the Vice President's Task Force on Regulatory Relief (later referred to as the Presidential Task Force on Regulatory Relief) was established. Among other things, the task force was asked to examine incentives and disincentives for the commercial realization of new clean coal technologies. The task force also examined cost-effective emissions reduction measures that might be inhibited by various federal, state, and local regulations. The task force recommended that preference be given to projects located in states that offer certain regulatory incentives to encourage such technologies. This recommendation was accepted and became part of the project selection considerations beginning with CCTDP Round II.

Initial CCTDP emphasis was on controlling SO_2 and NO_x emissions from existing coal-based power generators. Approaches demonstrated through the program were coal processing to produce clean fuels, combustion modification to control emissions, postcombustion cleanup of flue gas, and repowering with advanced power generation systems. These early efforts (projects resulting from the first three solicitations) produced a suite of cost-effective compliance options available today to address acid rain concerns.

As the CCTDP evolved, work began on drafting what was to become the Clean Air Act Amendments of 1990 (CAAA). Through a dialog with the U.S. Environmental Protection Agency (EPA) and Congress, the program was able to remain responsive to shifts in environmental emphasis. Also, projects in place enabled CAAA architects to have access to real-time data on emission control capabilities while structuring proposed acid rain regulations under Title IV of the CAAA.

Aside from acid rain, there was an emerging issue in the area of hazardous air pollutants (HAPs), also referred to as air toxics. Title III of the CAAA listed 189 airborne compounds subject to control, including trace elements and volatile and semi-volatile compounds. To assess the impacts on coal-based power generation, CCTDP projects were leveraged to obtain data through an integrated effort among the U.S. Department of Energy (DOE), EPA, the Electric Power Research Institute (EPRI), and the Utility Air Regulatory Group. Through this effort, concerns about HAPs relative to coal-based power generation have been significantly mitigated, enabling focus on but a few flue gas constituents. Also, because NO_x is a precursor to ozone formation, the presence of NO_x in ozone nonattainment areas, even at low levels, became an issue. This precipitated action in the CCTDP to include technologies capable of deep NO_x reduction in the portfolio of technologies being sought.

In the course of the last two solicitations of the CCTDP, a number of energy and environmental considerations combined to change the emphasis toward seeking high-efficiency, very low-emission power generation technology. Energy demand projections in the United States showed the need for continued reliance on coal-based power generation, with significant growth required into the 21st century. The CAAA, however, capped SO_2 emissions at year 2000 levels, and NO_x continued to receive increased attention relative to ozone nonattainment. Furthermore, particulate emissions were coming under increased scrutiny because of correlations with lung disorders and the tendency for toxic compounds to adhere to particulate matter. Added to these concerns was the growing concern over global warming, and more specifically, the carbon dioxide (CO_2) produced from burning fossil fuels. Coal became a primary target because of its high carbon-to-hydrogen ratio relative to natural gas, resulting in somewhat higher CO_2 emissions per unit of energy produced. However, coal is the fuel of choice (if not necessity)

for many developing countries where projected growth in electric power generation is the greatest. The path chosen to respond to these considerations was to pursue advanced power generation systems that could provide major enhancements in efficiency and control SO_2, NO_x, and particulates without introducing external parasitic control devices. (Increased efficiency translates to less coal consumption per unit of energy produced.) As a result, a number of advanced power generation projects were undertaken, representing pioneer efforts recognized throughout the world.

CCTDP Legislative History

The legislation authorizing the CCTDP is found in Public Law 98-473, Joint Resolution Making Continuing Appropriations for Fiscal Year (FY) 1985 and for Other Purposes. Title I set aside $750 million of the congressionally rescinded $5.375 billion of the Synthetic Fuels Corporation into a special U.S. Treasury account entitled the "Clean Coal Technology Reserve." This account was dedicated to "conducting cost-shared clean coal technology projects for the construction and operation of facilities to demonstrate the feasibility of future commercial applications of such technology." Title III of this act directed the Secretary of Energy to solicit statements of interest in and proposals for clean coal projects. In keeping with this mandate, DOE issued a program announcement, which resulted in the receipt of 176 proposals representing both domestic and international projects with a total estimated cost in excess of $8 billion.

After this significant initial expression of interest in clean coal demonstration projects, Public Law 99-190, enacted December 1985, appropriated $400 million to conduct cost-shared demonstration projects. Of the total appropriated funds, approximately $387 million was made available for cost-shared projects to be selected through a competitive solicitation, or Program Opportunity Notice (PON), referred to as CCTDP-I. (The remaining funds were required for program direction and the legislatively mandated Small Business Innovation Research Program [SBIR] and Small Business Technology Transfer Program [STTR].)

In a manner similar to the initiation of CCTDP-I, Congress again directed DOE to solicit information from the private sector in the Department of the Interior and Related Agencies Appropriations Act for FY1987 (Public Law 99-591, enacted October 30, 1986). The information received was to be used to establish the level of potential industrial interest in another solicitation, this time involving clean coal technologies capable of retrofitting, repowering, or modernizing existing facilities. Projects were to be cost-shared, with industry sharing at least 50 percent of the cost. As a result of the solicitation, a total of 39 expressions of interest were received by DOE in January 1987.

On March 18, 1987, the President announced the endorsement of the recommendations of the Special Envoys on Acid Rain, including a $2.5 billion government share of funding for industry/government demonstrations of innovative control technology over a five-year period. The Secretary of Energy stated that the Department would ask Congress for an additional $350 million in FY1988 and an advanced appropriation of $500 million in FY1989. Additional appropriations of $500 million would be requested in fiscal years 1990, 1991, and 1992. This request was made by the President on April 4, 1987.

Public Law 100-202, enacted December 22, 1987, as amended by Public Law 100-446, appropriated a total of $575 million to conduct CCTDP-II. About $536 million was for projects, with the remainder for program direction and the SBIR and STTR programs.

The Department of the Interior and Related Agencies Appropriations Act for FY1989 (Public Law 100-446, enacted September 27, 1988) provided $575 million for necessary expenses associated with clean coal technology demonstrations in the CCTDP-III solicitation. Of the total funding, about $546 million was made available for cost-sharing projects, with the remainder for program direction and the SBIR and STTR programs. The act continued the requirement that proposals must demonstrate technologies capable of retrofitting or repowering existing facilities. The statute also authorized the use of Tennessee Valley Authority power program funds as a source of nonfederal cost-sharing, except if provided by annual appropriations acts. In addition, funds borrowed by Rural Electrification Administration (now Rural Utilities Service) electric cooperatives from the Federal Financing Bank became eligible as cost-sharing in the CCTDP-III solicitation, except if provided by annual appropriations.

In the Department of the Interior and Related Agencies Appropriations Act of 1990 (Public Law 101-121, enacted October 23, 1989), Congress provided $600 million for the CCTDP-IV solicitation. CCTDP-IV, according to the act, "shall demonstrate technologies capable of replacing, retrofitting, or repowering existing facilities and shall be subject to all provisos contained under this head in Public Laws 99-190, 100-202 and 100-446 as amended by this Act." About $563 million was made available for federal cofunding of projects selected in CCTDP-IV, with the remainder for program direction and the SBIR and STTR programs.

In Public Law 101-121, enacted October 23, 1989, Congress also provided $600 million for the CCTDP-V solicitation. CCTDP-V, according to the act, "shall be subject to all provisos

Exhibit A-1
CCTDP Legislative History (Funding Only)

Public Law	Date Enacted	CCTDP Round	Program Funding	Implementation Provisions
98-473	10/12/84	Initiation of CCTDP informational solicitation	Rescinded $750 million of $5.375 billion from the Energy Security Reserve (Synthetic Fuels Corporation) to be deposited in a U.S. Treasury Department account entitled "Clean Coal Technology Reserve" for conducting cost-shared clean coal technologies (CCT) projects for the construction and operation of facilities to demonstrate the feasibility for future commercial application of such technology, without fiscal year limitation, subject to subsequent annual appropriation.	Title III required publication of a notice soliciting statements of interest in and proposals for projects employing emerging CCTs. A report to Congress was required no later than 4/15/85.
99-88	8/15/85	CCTDP-I	Deferred $1.6 million for obligation until 10/1/85.	Conference Report (H. Rep. 99-236) concurred with CCT project guidelines contained in Senate Report 99-82, with certain modifications.
99-190	12/19/85	CCTDP-I	Conference Report (H. Rep. 99-450) agreed to a $400-million CCTDP as described under the U.S. Treasury Department Energy Security Reserve, with the request for proposals to be for the full $400 million.	Required a PON (CCTDP-I) to be issued and projects to be selected no later than 8/1/86. Project cost-sharing provisions were detailed.
99-591	10/30/86	Second informational solicitation	(Contained no funding provisions for CCTDP.)	Title II required publication of a notice soliciting statements of interest in, and informational proposals for projects employing emerging CCTs capable of retrofitting, repowering, or modernizing existing facilities. A report to Congress was required no later than 3/6/87.
100-202	12/22/87	CCTDP-II	Appropriated $50 million for FY beginning 10/1/87 until expended and $525 million for FY beginning 10/1/88 until expended.	Required a request for proposals (CCTDP-II) to be issued no later than 60 days following enactment, for emerging CCTs capable of retrofitting or repowering existing facilities. Extended project selection from 120 days to 160 days after receipt of proposals. Provided for cost-sharing of preaward costs for preparation and submission of environmental data upon signing of the cooperative agreement. Conference Report (H. Rep. 100-498) provided that project cost-sharing funds be made available to nonutility as well as utility applications. No funds were made available for new, stand-alone applications. H. Rep. Report 100-171 and Senate Report 100-165 outlined provisions for participant to repay government contributions.
100-446	9/27/88	CCTDP-III	Made available $575 million on 10/1/89 until expended. Pub. L. 100-202 was amended by striking $525 million and inserting $190 million for FY beginning 10/1/88 until expended, $135 million for fiscal year beginning 10/1/89 until expended, and $200 million for FY beginning 10/1/90 until expended, provided that outlays for FY89 resulting from use of funds appropriated under Pub. L. 100-202, as amended, did not exceed $15.5 million.	Request for proposals (CCTDP-III) to be issued by 5/1/89 for emerging CCTs capable of retrofitting or repowering existing facilities. Proposals were to be due 120 days after issuance of the PON; projects were to be selected no later than 120 days after receipt of proposals. Funds borrowed by REA electric cooperatives from the Federal Financing Bank were made eligible as cost-sharing. Funds derived by the Tennessee Valley Authority from its power program were deemed allowable as cost-sharing except if provided by annual appropriations acts.
101-45	6/30/89	CCTDP-III	Funds appropriated for FY1989 were made available for a third solicitation.	Project selections for the third solicitation were to be made not later than 1/1/90.
101-121	10/23/89	CCTDP-IV & CCTDP-V	Made available $600 million on 10/1/90 until expended and for $600 million on 10/1/91 until expended. Pub. L. 100-446 was amended by striking $575 million and inserting $450 million to be made available on 10/1/89 until expended and $125 million to be made available on 10/1/90. Unobligated balances excess to the needs of the procurement for which they originally were made available may be applied to other procurements for which requests for proposals had not yet been issued, except that no supplemental, backup, or contingent selection of projects could be made over and above the projects originally selected.	Two solicitations (CCTDP-IV and CCTDP-V) to be issued, one each appropriation, to demonstrate technologies capable of replacing, retrofitting, or repowering existing facilities, subject to all provisos contained in Pub. L. 99-190, 100-202, and 100-446 as amended. The PON (CCTDP-IV) using funds becoming available on 10/1/90 was to be issued by 6/1/90, with selections made by 2/1/91. The PON (CCTDP-V) using funds becoming available on 10/1/91 was to be issued no later than 9/1/91, with selections made by 5/1/92.

Exhibit A-1 (continued)
CCTDP Legislative History (Funding Only)

Public Law	Date Enacted	CCTDP Round	Program Funding	Implementation Provisions
101-164	11/21/89	CCTDP-IV & CCTDP-V	Appropriation for FY1990 was amended by striking $450 million and inserting $419 million and by striking $125 million and inserting $156 million.	Solicitations could not be conducted prior to ability to obligate funds. Repayment provisions for CCTDP-IV and CCTDP-V were to be the same as for CCTDP-III.
101-302	5/25/90	CCTDP-IV & CCTDP-V	Obligation of funds previously appropriated for CCTDP-IV and was deferred until 9/1/91.	
101-512	11/5/90	CCTDP-IV & CCTDP-V	Pub. L. 101-121 was amended by striking $600 million made available on 10/1/90 until expended and $600 million made available on 10/1/91 until expended and inserting $600 million made available as follows: $35 million on 9/1/91, $315 million on 10/1/91, and $250 million on 10/1/92, all sums remaining until expended, for use in conjunction with a separate general request for proposals, and $600 million made available as follows: $150 million on 10/1/91, $225 million on 10/1/92, and $225 million on 10/1/93, all sums remaining until expended, for use with a separate general request for proposals.	The CCTDP-IV solicitation was to be issued not later than 2/1/91. The CCTDP-V PON was to be issued not later than 3/1/92. Project selections were to be made within eight months of PON's issuance. Repayment provisions were to be the same as for CCTDP-III. Provisions were included to provide protections for trade secrets and proprietary information. Conference Report (H. Rep. 101-971) recommends changes to program policy factors.
102-154	11/13/91	CCTDP-V	Pub. L. 102-512 was amended by striking $150 million on 10/1/91 and $225 million on 10/1/92 and inserting $100 million on 10/1/91 and $275 million on 10/1/92.	The CCTDP-V PON was delayed to not later than 7/6/92, with selection to be made within 10 months (extended by two months). The PON was to be for projects that advance significantly the efficiency and environmental performance of coal-using technologies and be applicable to either new or existing facilities. Conference Report (H. Rep. 102-256) stated expectations that the CCTDP-V solicitation would be conducted under the same general types of criteria as CCTDP-IV, principally modified only to (1) include the wider range of eligible technologies or applications; (2) adjust technical criteria to consider allowable development activities, strengthen criteria for nonutility demonstrations, and adjust commercial performance criteria for additional facilities and technologies with regard to aspects of general energy efficiency and environmental performance; and (3) clarify and strengthen cost and finance criteria, particularly with regard to development activities. Funding was allowed for project-specific development activities for process performance definition, component design verification, materials selection, and evaluation of alternative designs on a cost-shared basis up to a limit of 10 percent of the government share of project cost. Development activities eligible for cost-sharing included limited modifications to existing facilities for project-related testing but not construction of new facilities.
102-381	10/5/92		Pub. L. 101-512 was amended by striking $250 million on 10/1/92 and inserting $150 million on 10/1/93 and $100 million on 10/1/94; and by striking $275 million on 10/1/92 and $225 million on 10/1/93 and inserting $250 million on 10/1/93 and $250 million on 10/1/94.	
102-486	10/24/92		(Contained no funding provisions for CCTDP.)	Section 1301—Coal RD&D and Commercial Applications Programs (Title XIII; Subtitle A) authorized DOE to conduct programs for RD&D and commercial applications of coal-based technologies. Secretary of Energy was directed to submit to Congress (1) a report that included, among other things, recommendations regarding the manner in which the cost-sharing demonstrations conducted pursuant to the Clean Coal Program (Pub. L. 98-473) might be modified and extended in order to ensure the timely demonstration of advanced coal-based technologies and (2) periodic status reports on the development of advanced coal-based technologies and RD&D and commercial application attributes.

Exhibit A-1 (continued)
CCTDP Legislative History (Funding Only)

Public Law	Date Enacted	CCTDP Round	Program Funding	Implementation Provisions
103-138	11/11/93		Pub. L. 101-512 was amended by striking $150 million on 10/1/93 and $100 million on 10/1/94 and inserting $100 million on 10/1/93, $100 million on 10/1/94, and $50 million on 10/1/95; and by striking $250 million on 10/1/93 and $250 million on 10/1/94 and inserting $125 million on 10/1/93, $275 million on 10/1/94, and $100 million on 10/1/95.	
103-332	9/30/94		Pub. L. 101-512 was amended by striking $100 million on 10/1/94 and $50 million on 10/1/95 and inserting $18 million on 10/1/94, $100 million on 10/1/95, and $32 million on 10/1/96; and by striking $275 million on 10/1/94 and $100 million on 10/1/95 and inserting $19.121 million on 10/1/94, $100 million on 10/1/95, and $255.879 million on 10/1/96.	An amount not to exceed $18 million available in FY1995 may be used for administrative oversight of the CCTDP.
104-6	4/10/95		Of funds available for obligation in FY1996, $50 million was rescinded. Of the funds to be made available for obligation in FY97, $150 million was rescinded.	
104-134[a]	4/26/96			Conference Report (H. Rep. 104-402 to accompany H.R. 1977) allowed for the use of up to $18 million in CCTDP funds for program administration.
104-208[b]	9/30/96		Conference Report (H. Rep. 104-863 to accompany H.R. 3610) noted rescission of $123 million for FY1997 or prior years.	House and Senate committees did not object to use of up to $16 million in available funds for administration of the CCTDP in FY1997 (H. Rep. 104-625 and Senate 104-319 to accompany H.R. 3662).
105-18	6/12/97		Of funds made available for obligation in FY1997 or prior years, $17 million was rescinded.	
105-83	11/14/97		Of funds made available for obligation in FY1997 or priors, $101 million was rescinded.	
105-277	10/21/98		Of funds made available for obligation in prior years, $40 million was deferred.	Conference Report allowed $14.9 million in CCTDP funds for program administration.
106-113	11/29/99		Of funds made available for obligation in prior years, $156 million was deferred. $38,000 was rescinded as a result of the general reduction.	Conference Report did not object to the use of up to $14.4 million in CCTDP funds for program administration.
106-291	10/11/00		Of funds made available for obligation in prior years, $67 million was deferred. Another $95 million was transferred to the Power Plant Improvement Initiative.	Conference Report (H. Rep. 106–406) did not object to the use of up to $14.4 million in CCTDP funds for program administration.
107-63	11/5/01		Of the funds made available for obligation in prior years, $40,000,000 was deferred.	
108-7	2/20/03		Of the funds made available for obligation in prior years, $87,000,000 was deferred.	
108-108	11/10/03		Of the funds made available for obligation in prior years, $97,000,000 was deferred and $88,000,000 rescinded.	
108-447	12/8/04		Of the funds made available for obligation in prior years, $257,000,000 was deferred.	
109-103	11/19/05		Of funds made available for obligation in prior years, $257,000,000 was deferred and $20,000,000 rescinded.	

[a] H.R. 3019, which became Pub. L. 104-134, replaced H.R. 1977.
[b] H.R. 3610, which became Pub. L. 104-208, replaced H.R. 3662.

contained under this head in Public Laws 99-190, 100-202 and 100-446 as amended by this Act." Approximately $568 million was made available for federal cofunding of projects to be selected in this solicitation, with the remainder again for program direction and the SBIR and STTR programs.

Subsequent acts (Public Laws 101-164, 101-302, 101-512, and 102-154) modified the schedule for issuing CCTDP-IV and/or CCTDP-V PONs and selecting projects. In Public Law 101-512, Congress directed DOE to issue the PON for CCTDP-IV not later than February 1, 1991, with selections to be made within 8 months. In Public Law 102-154, Congress directed DOE to issue the CCTDP-V PON not later than July 6, 1992, with selections to be made within 10 months. This later act also directed that CCTDP-V proposals should advance significantly the efficiency and environmental performance of coal-using technologies and be applicable to either new or existing facilities.

Public Laws 101-164, 101-302, 101-512, 103-138, and 103-332 adjusted the rate at which funds were to be made available to the program.

The CCTDP funds have been further adjusted through sequestering requirements of the Gramm-Rudman-Hollings Deficit Reduction Act as well as recisions. Sequestering reduced CCTDP appropriations as follows:

- $2,028 was sequestered from the $575 million appropriated by Public Law 100-446, as amended by Public Law 101-164.
- $455 was sequestered from the $1.2 billion appropriated by Public Law 101-121, as amended by Public Laws 101-512, 102-154, 102-381, 103-138, 103-332, 104-6, 104-208, and 105-18.

Recisions have reduced CCTDP appropriations as follows:

- $200 million was rescinded by Public Law 104-6.
- $123 million was rescinded by Public Law 104-208.
- $17 million was rescinded by Public Law 105-18.
- $101 million was rescinded by Public Law 105-83.
- $38,000 was rescinded by Public Law 106-113 (general reduction).
- $88 million was rescinded by Public Law 108-108.

In 1998, $40 million of the CCTDP funds were deferred by Public Law 105-277. Funds were to be restored over a three year period beginning October 1, 1999. Again in 1999, Congress deferred program funds. In Public Law 106-113, Congress deferred $156,000,000 until October 1, 2000. And in Public Law 107-63, Congress deferred $40,000,000 until October 1, 2002. In 2003, in Public Law 108-7, Congress deferred $87,000,000 until October 1, 2003. In Public Law 108-108, Congress deferred $97,000,000 until October 1, 2004 and in Public Law 108-447 Congress deferred $257,000,000 until October 1, 2005. In Public Law 109-103, Congress deferred $257,000,000 and rescinded $20,000,000.

Exhibit A-1 lists all the key legislation relating to the CCTDP and provides a summary of provisions relating to program funding as well as program implementation. At the end of this appendix are funding provisions excerpted from appropriations and other relevant funding-related acts.

PPII Historical Perspective

The roots of this program lie in the blackouts and brownouts of 1999 and 2000. The Power Plant Improvement Initiative (PPII) is an outgrowth of congressional direction provided in FY 2001 appropriations to DOE's fossil energy research program. Funding was added for the program following increasing concerns over the adequacy of the nation's power supplies. Several parts of the United States, including the West Coast and parts of the Northeast, had experienced rolling blackouts and brownouts in the previous two years caused in large part by sharp rises in demand for electricity and lagging construction of new power plants.

Eligible projects include technologies that boost the efficiencies of currently operating power plants — generating more megawatts from the same amount of fuel — or that lower emissions and allow plants to stay in operation in compliance with environmental standards. The program was also open to technologies that improve the economics and overall performance of coal-fired power plants.

Private sector proposers must at least match the government funding. Proposed technologies must be mature enough to be commercialized within the next few years, and the cost-shared demonstrations must be large enough to show that the technology is viable for commercial use.

PPII Legislative History

The legislation authorizing PPII is found in Public Law 106-291, Department of the Interior and Related Agen-

Exhibit A-2
PPII Legislative History

Public Law	Date Enacted	Program Funding	Implementation Provisions
106-291	10/11/00	Made available $95,000,000 derived by transfer from funds appropriated in prior years from the CCTDP for a general request for proposals for the commercial scale demonstration of technologies to assure the reliability of the Nation's energy supply from existing and new electric generating facilities for which the Department of Energy upon review may provide financial assistance awards.	
107-63	11/5/01	Provided that funds excess to the needs of the Power Plant Improvement Initiative procurement provided for in Public Law 106-291 shall be made available for the Clean Coal Power Initiative provided for in Public Law 107-63.	

cies Appropriations Act, 2001. Under the act, $95,000,000 was transferred from funds appropriated in prior years under the CCTDP and made available for a general request for proposals for the commercial-scale demonstration of technologies to assure the reliability of the nation's energy supply from existing and new electric generating facilities. The funds provided were to be spent only in accordance with the provisions governing the use of funds contained in the CCTDP under which they were originally appropriated. Provisions for recoupment are identical to CCTDP-III except that repayments from the sale or licensing of technologies shall be from both domestic and foreign transactions, and the repayments are retained for future projects. Congress provided that any project approved under PPII shall be considered a Clean Coal Technology Demonstration Project, for the purposes of Chapters 51, 52, and 60 of title 40 of the Code of Federal Regulations.

In Public Law 107-63, Congress provided that funds in excess of the needs of the PPII procurement be made available for the Clean Coal Power Initiative (CCPI).

Exhibit A-2 lists all the key legislation relating to PPII and provides a summary of provisions relating to program funding as well as program implementation.

CCPI Historical Perspective

The CCPI was designed to respond to tighter air emission standards, the growth in electricity consumption, and emerging new technologies. With emerging air emission regulations dealing with ozone, particulate matter, and mercury, new technologies are needed to provide consistent, reliable, low-cost energy while meeting these standards. Electricity demand is forecasted to increase by 45 percent over the next 20 years. The rising growth rate will require the construction of more than 1,300 new power plants. Driven by the rise in the digital economy, higher quality electricity is in greater demand than ever before. New technologies coming from the computer revolution are playing an ever-increasing role in the development of new power plant technologies. Neural networks and artificial intelligence can be used to fine-tune operations and increase efficiency at coal-fired power plants. New environmental control technologies could reduce fine particulates and mercury to previously unattainable levels. To meet the challenges of tighter air emission standards, the growth in electricity consumption, and emerging new technologies, Congress appropriated funds for CCPI.

CCPI Legislative History

The legislation authorizing CCPI is found in Public Law 107-63, Department of Interior and Related Agencies Appropriations Act for FY02. Under the act, $150,000,000 was made available for a request for proposals for a Clean Coal Power Initiative providing for competitively awarded research, development, and demonstration projects to reduce the barriers to continued and expanded coal use. Congress specified that no CCPI project could be selected for which sufficient funding was not available to provide for the total project.

Exhibit A-3
CCPI Legislative History

Public Law	Date Enacted	Program Funding	Implementation Provisions
107-63	11/5/01	Made available $150,000,000, after coordination with the private sector, for a request for proposals for a Clean Coal Power Initiative providing for competitively-awarded research, development, and demonstration projects to reduce the barriers to continued and expanded coal use 107-63. Provided that funds excess to the needs of the Power Plant Improvement Initiative procurement provided for in Public Law 106-291 shall be made available for the Clean Coal Power Initiative provided for in Public Law 107-63.	No project may be selected for which sufficient funding is not available to provide for the total project. Funds shall be expended in accordance with the provisions governing the use of funds contained under the heading "Clean Coal Technology" in prior appropriations. Provisions for repayment of government contributions to individual projects in an amount up to the government contribution including repayments from sale and licensing of technologies from both domestic and foreign transactions. Repayments shall be retained by DOE for future coal-related research, development and demonstration projects. Any technology selected under this program shall be considered a Clean Coal Technology, and any project selected under this program shall be considered a Clean Coal Technology Project, for the purposes of *42 U.S.C. 7651n*, and Chapters 51, 52, and 60 of title 40 of the Code of Federal Regulations.
108-7	2/20/03	Made available $150,000,000, after coordination with the private sector, for a request for proposals for a Clean Coal Power Initiative providing for competitively-awarded research, development, and demonstration projects to reduce the barriers to continued and expanded coal use.	Comparable to prior years.

Exhibit A-3 (continued)
CCPI Legislative History

Public Law	Date Enacted	Program Funding	Implementation Provisions
108-108	11/10/03	Made an additional $172,000,000 available for CCPI.	Comparable to prior years.
108-447	12/8/04	Made an additional $50,000,000 available for CCPI.	Comparable to prior years.
109-103	11/19/05	Made an additional $50,000,000 available for CCPI.	Comparable to prior years.

Also, funds are to be expended in accordance with the provisions governing the use of funds contained under the heading "Clean Coal Technology" in prior appropriations.

Congress specified certain changes to the repayment provisions. Specifically, DOE could include provisions for repayment of government contributions to individual projects in an amount up to the government contribution to the project on terms and conditions that are acceptable to DOE, including repayments from sale and licensing of technologies from both domestic and foreign transactions. (In the CCTDP, repayment had been limited to domestic transactions.) Also, repayments are being retained by DOE for future coal-related research, development, and demonstration projects.

As with PPII, Congress specified that any technology selected under CCPI shall be considered a "Clean Coal Technology," and any project selected under CCPI shall be considered a "Clean Coal Technology Project," for the purposes of *42 U.S.C. 7651n*, and Chapters 51, 52, and 60 of title 40 of the Code of Federal Regulations.

In 2003, Congress appropriated another $150,000,000 for CCPI in Public Law 108-7. There were no changes in the implementing provisions. Again in 2003 under Public 108-108 Congress made an additional $172,000,000 available for CCPI. In 2004, Congress appropriated another $50,000,000 for CCPI in Public Law 108-447. In 2005, Congress appropriated $50,000,000 for CCPI in Public Law 109-103 for use in a third solicitation to be offered at a later date.

Exhibit A-3 lists all key legislation relating to CCPI and provides a summary of provisions relating to program implementation. Following this section are funding provisions excerpted from appropriations.

Public Laws — CCTDP, PPII, and CCPI

Public Law 99-190

Public Law 99-190, 99 Stat. 1251 (1985)

Clean Coal Technology

Within 60 days following enactment of this Act [Dec. 19, 1985] the Secretary of Energy shall, pursuant to the Federal Nonnuclear Energy Research and Development Act of 1974 *(42 U.S.C. 5901, et seq.*), issue a general request for proposals for clean coal technology projects for which the Secretary of Energy upon review may provide financial assistance awards. Proposals for clean coal technology projects under this section shall be submitted to the Department of Energy within 60 days after issuance of the general request for proposals. The Secretary of Energy shall make any project selections no later than August 1, 1986: Provided, That the Secretary may vest fee title or other property interests acquired under cost-shared clean coal technology agreements in any entity, including the United States: *Provided further*, That the Secretary shall not finance more than 50 per centum of the total costs of a project as estimated by the Secretary as of the date of award of financial assistance: *Provided further*, That cost-sharing by project sponsors is required in each of the design, construction, and operating phases proposed to be included in a project: *Provided further*, That financial assistance for costs in excess of those estimated as of the date of award of original financial assistance may not be provided in excess of the proportion of costs borne by the Government in the original agreement and only up to 25 per centum of the original financial assistance: Provided further, That revenues or royalties from prospective operation of projects beyond the time considered in the award of financial assistance, or proceeds from prospective sale of the assets of the project, or revenues or royalties from replication of technology in future projects or plants are not cost-sharing for the purposes of this appropriation: Provided further, That other appropriated Federal funds are not cost-sharing for the purposes of this appropriation: Provided further, That existing facilities, equipment, and supplies, or previously expended research or development funds are not cost-sharing for the purposes of this appropriation, except as amortized, depreciated, or expensed in normal business practice.

Conference Report (H.R. Conf. Rep. No. 450, 99th Cong., 1st Sess. [1985])

Clean Coal Technology

The managers have agreed to a $400,000,000 Clean Coal Technology

program as described under the Department of the Treasury, Energy Security Reserve. Bill language is included which provides for the selection of projects no later than August 1, 1986. Within that period, a general request for proposals must be issued within 60 days and proposals must be submitted to the Department within 60 days after issuance of the general request for proposals. Language is also included allowing the Secretary of Energy to vest title in interests acquired under agreements in any entity, including the United States, and delineating cost-sharing requirements. Funds for these activities and projects are made available to the Clean Coal Technology program in the Energy Security program.

It is the intent of the managers that contributions in the form of facilities and equipment be considered only to the extent that they would be amortized, depreciated or expensed in normal business practice. Normal business practice shall be determined by the Secretary and is not necessarily the practice of any single proposer. Property which has been fully depreciated would not receive any cost-sharing value except to the extent that it has been in continuous use by the proposer during the calendar year immediately preceding the enactment of this Act. For this property, a fair use value for the life of the project may be assigned. Property offered as a cost-share by the proposer that is currently being depreciated would be limited in its cost-share value to the depreciation claimed during the life of the demonstration project. Furthermore, in determining normal business practice, the Secretary should not accept valuation for property sold, transferred, exchanged, or otherwise manipulated to acquire a new basis for depreciation purposes or to establish a rental value in circumstances which would amount to a transaction for the mere purpose of participating in this program.

The managers agree that, with respect to cost-sharing, tax implications of proposals and tax advantages available to individual proposers should not be considered in determining the percentage of Federal cost-sharing. This is consistent with current and historical practices in Department of Energy procurements.

It is the intent of the managers that there be full and open competition and that the solicitation be open to all markets utilizing the entire coal resource base. However, projects should be limited to the use of United States mined coal as the feedstock and demonstration sites should be located within the United States.

The managers agree that no more than $1,500,000 shall be available in FY86 and $2,000,000 each year thereafter for contracting, travel and ancillary costs of the program, and that manpower costs are to be funded under the fossil energy research and development program.

The managers direct the Department, after projects are selected, to provide a comprehensive report to the Congress on proposals received.

The managers also expect the request for proposals to be the full $400,000,000 program, and not only for the first $100,000,000 available in fiscal year 1986.

Public Law 100-202

Public Law 100-202, 101 Stat. 1329-1 (1987)

Clean Coal Technology

For necessary expenses of, and associated with, Clean Coal Technology demonstrations pursuant to 42 U.S.C. 5901 *et seq.*, $50,000,000 are appropriated for the fiscal year beginning October 1, 1987, and shall remain available until expended, and $525,000,000 are appropriated for the fiscal year beginning October 1, 1988, and shall remain available until expended.

No later than sixty days following enactment of this Act, the Secretary of Energy shall, pursuant to the Federal Nonnuclear Energy Research and Development Act of 1974 (42 U.S.C. 5901 *et seq.*), Issue a general request for proposals for emerging clean coal technologies which are capable of retrofitting or repowering existing facilities, for which the Secretary of Energy upon review may provide financial assistance awards. Proposals under this section shall be submitted to the Department of Energy no later than ninety days after issuance of the general request for proposals required herein, and the Secretary of Energy shall make any project selections no later than one hundred and sixty days after receipt of proposal: *Provided*, That projects selected are subject to all provisos contained under this head in Public Law 99-190: Provided further, That pre-award costs incurred by project sponsors after selection and before signing an agreement are allowable to the extent that they are related to (1) the preparation of material requested by the Department of Energy and identified as required for the negotiation; or (2) the preparation and submission of environmental data requested by the Department of Energy to complete National Environmental Policy Act requirements for the projects: Provided further, That pre-award costs are to be reimbursed only upon signing of the project agreement and only in the same ratio as the cost-sharing for the total project: Provided further, That reports on projects selected by the Secretary of Energy pursuant to authority granted under the heading "Clean coal technology" in the Department of the Interior and Related Agencies Appropriations Act, 1986, as contained in Public Law 99-190, which are received by the Speaker of the House of Representatives and the President of the Senate prior to the end of the first session of the 100th Congress shall be deemed to have met the criteria in the third proviso of the fourth paragraph under the heading "Administrative provision, Department of Energy" in the Department of the Interior and Related Agencies Appropriations Act, 1986, as contained in Public Law 99-190, upon

expiration of 30 calendar days from receipt of the report by the Speaker of the House of Representatives and the President of the Senate.

Conference Report (H.R. Conf. Rep. No. 498, 100th Cong., 1st Sess. [1987])

Clean Coal Technology

Appropriates $575,000,000 for clean coal technology instead of $350,000,000 as proposed by the House and $850,000,000 as proposed by the Senate. The comparison by year is as follows:

Bill language, proposed by the House, which would have prohibited using grants has been deleted. The managers agree that project funding is expected to be based on cooperative agreements, but that grants might be applicable to support work also funded from this account.

The managers agree to deleted Senate language providing personnel floors for Clean Coal Technology. The managers further agree that the budget estimates for personnel and contract support are to be followed. The agreement included 58 new positions above current employment floors for the fossil energy organization and 30 positions within the floors. Out of clean coal technology funds, up to $3,980,000 is for fiscal year 1988 personnel-related costs and up to $16,520,000 is for all contract costs needed to make project selections and complete negotiations for both clean coal procurements. Contract costs necessary to monitor approved projects should be requested in the fiscal year 1989 budget. Increases above to those amount are subject to reprogramming procedures. No funds other than personnel related costs for the 30 positions included in the program direction are to be provided from the fossil energy research and development account.

The length of time for selection of projects by the Secretary of Energy has been extended from 120 days to 160 days based on experience from the original clean coal procurement. Once projects have been selected the Secretary should establish project milestones and guidelines for project negotiations in order to expedite the negotiation process to the extent feasible.

The managers agree that the funds provided are available for non-utility applications as well as for utility applications.

The managers agree that no funds are provided for the demonstration of clean coal technologies which are intended solely for new, stand alone, applications. The Senate had proposed up to 25% of the funds be available for this purpose.

Bill language has been included which provides that reports on projects selected in the first round of clean coal procurements that are received before the end of the first session of the 100th Congress will satisfy reporting requirements 30 calendar days after receipt by Congress. This provision applies to a maximum of two project reports.

Public Law 100-446

Public Law 100-446, 102 Stat. 1774 (1988)

Clean Coal Technology

For necessary expenses of, and associated with, Clean Coal Technology demonstrations pursuant to 42 U.S.C. 5901 *et seq.*, $575,000,000 shall be made available on October 1, 1989, and shall remain available until expended: *Provided*, That projects selected pursuant to a general request for proposals issued pursuant to this appropriation shall demonstrate technologies capable of retrofitting or repowering existing facilities and shall be subject to all provisions contained under this head in Public Laws 99-190 and 100-202 as amended by this Act.

The first paragraph under this head in Public Law 100-202 is amended by striking "and $525,000,000 are appropriated for the fiscal year beginning October 1, 1988" and inserting "$190,000,000 are appropriated for the fiscal year beginning October 1, 1988, and shall remain available until expended, $135,000,000 are appropriated for the fiscal year beginning October 1, 1989, and shall remain available until expended, and $200,000,000 are appropriated for the fiscal year beginning October 1, 1990": Provided, That outlays in fiscal year 1989 resulting from the use of funds appropriated under this head in Public Law 100-202, as amended by this Act, may not exceed $15,500,000: Provided further, That these actions are taken pursuant to section 202(b)(1) of Public Law 100-119 (2 U.S.C. 909).

For the purposes of the sixth proviso under this head in Public Laws 99-190, funds derived by the Tennessee Valley Authority from its power program are hereafter not to be precluded from qualifying as all or part of any cost-sharing requirement, except to the extent that such funds are provided by annual appropriations Acts: Provided, That unexpended balances of funds made available in the "Energy Security Reserve" account in the Treasury for the Clean Coal Technology Program by the Department of the Interior and Related Agencies Appropriations Acts, 1986, as contained in section 101(d) of Public Law 99-190, shall be merged with this account: Provided further, That for the purposes of the sixth proviso in Public Law 99-190 under this heading, funds provided under section 306 of Public Law 93-32 shall be considered non-Federal: Provided further, That reports on projects selected by the Secretary of Energy pursuant to authority granted under the heading "Clean coal technology" in the Department of the Interior and Related Agencies Appropriations Act, 1986, as contained in Public Law 99-190, which are received by the Speaker of the House of Representatives and the President of the Senate prior to the end of the second

session of the 100th Congress shall be deemed to have met the criteria in the third proviso of the fourth paragraph under the heading "Administrative Provisions, Department Energy" in the Department of the Interior and Related Agencies Appropriations Act, 1986, as contained in Public Law 99-190, upon expiration of 30 calendar days from receipt of the report by the Speaker of the House of Representatives and the President of the Senate.

Conference Report (H.R. Conf. Rep. No. 862, 100th Cong., 2nd Sess. [1988])

Clean Coal Technology

Amendment No. 131: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of the Senate with an amendment as follows:

In lieu of the matter proposed by said amendment insert the following: For necessary expenses of, and associated with, Clean Coal Technology demonstrations pursuant to 42 U.S.C. 5901 et seq., $575,000,000 shall be made available on October 1, 1989, and shall remain available until expended: Provided, That projects selected pursuant to a general request for proposals issued pursuant to this appropriation shall demonstrate technologies capable of retrofitting or repowering existing facilities and shall be subject to all provisos contained under this head in Public Laws 99-190 and 100-202 as amended by this Act.

The managers on the part of the Senate will move to concur in the amendment of the House to the amendment of the Senate. The amendment provides $575,000,000 in fiscal year 1990 for a third Clean Coal Technology procurement as proposed by the Senate, and clarifies that the procurement is for retrofit and repowering technologies and is subject to the cost-sharing provisions of the previous two procurements.

The managers agree that a request for proposals should be issued by May 1, 1989, with proposals due no later than 120 days after issuance of the request for proposals, and that the Secretary of Energy should make project selections no later than 120 days after receipt of proposals.

Amendment No. 132: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of the Senate with an amendment as follows:

Restore the matter stricken by said amendment, amended to read as follows: The first paragraph under this head in Public Law 100-202 is amended by striking "and $525,000,000 are appropriated for the fiscal year beginning October 1, 1988" and inserting "$190,000,000 are appropriated for the fiscal year beginning October 1, 1988, and shall remain available until expended, $135,000,000 are appropriated for the fiscal year beginning October 1, 1989, and shall remain available until expended, and $200,000,000 are appropriated for the fiscal year beginning October 1, 1990": Provided, That outlays in FY89 resulting from the use of funds appropriated under this head in Public Law 100-202, as amended by this Act, may not exceed $15,500,000: Provided further, That these actions are taken pursuant to section 202(b)(1) of Public Law 100-119 (2 U.S.C. 909).

The managers on the part of the Senate will move to concur in the amendment of the House to the amendment of the Senate. The amendment changes the availability of $525,000,000 originally made available for fiscal year 1989 in Public Law 100-202 by making $190,000,000 available in 1989, $135,000,000 available in 1990, and $200,000,000 available in 1991 and also provides an outlay ceiling in fiscal year 1989. The House had proposed $100,000,000 in fiscal year 1989, $225,000,000 in fiscal year 1990, and $200,000,000 in fiscal year 1989, $225,000,000 in fiscal year 1990, and $200,000,000 in fiscal year 1991, and the Senate struck the House language.

Both of these changes are necessary because of budget allocation constraints, but neither action has an effect on the execution of the Clean Coal program, or on the Congress' overall support for the program, as is evidenced by additional appropriations provided for a third procurement of technologies.

The managers agree that administrative contract expenses may be incurred up to the budget level of $9,820,000, but caution that close control of such expenditures is necessary to assure that the outlay ceiling provided will be sufficient to cover project costs.

Amendment No. 133: Modifies public law citation as proposed by the Senate.

Amendment No. 134: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of the Senate which clarifies that funds borrowed by REA Electric Cooperatives from the Federal Financing Bank are eligible as cost-sharing in the clean coal technology program.

Amendment No. 135: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of the Senate which specifies clean coal projects may proceed 30 calendar days after receipt by Congress of required reports, provided the reports are received prior to the end of the 100th Congress.

Public Law 101-45

Public Law 101-45, 103 Stat. 97 (1989)

Clean Coal Technology

Notwithstanding any other provision of law, funds originally appropriated

under this head in the Department of the Interior and Related Agencies Appropriations Act, 1989, shall be available for a third solicitation of clean coal technology demonstration projects, which projects are to be selected by the Department not later than January 1, 1990.

Public Law 101-121

Public Law 101-121, 103 Stat. 701 (1989)

Clean Coal Technology

For necessary expenses of, and associated with, Clean Coal Technology demonstrations pursuant to 42 U.S.C. 5901 *et seq.*, $600,000,000 shall be made available on October 1, 1990, and shall remain available until expended, and $600,000,000 shall be made available on October 1, 1991, and shall remain available until expended: Provided, That projects selected pursuant to a separate general request for proposals issued pursuant to each of these appropriations shall demonstrate technologies capable of replacing, retrofitting or repowering existing facilities and shall be subject to all provisos contained under this head in Public Laws 99-190, 100-202, and 100-446 as amended by this Act: *Provided further,* That the general request for proposals using funds becoming available on October 1, 1990, under this paragraph shall be issued no later than June 1, 1990, and projects resulting from such a solicitation must be selected no later than February 1, 1991: Provided further, That the general request for proposals using funds becoming available on October 1, 1991, under this paragraph shall be issued no later than September 1, 1991, and projects resulting from such a solicitation must be selected no later than May 1, 1992.

The first paragraph under this head in Public Law 100-446 is amended by striking "$575,000,000 shall be made available on October 1, 1989" and inserting "$450,000,000 shall be made available on October 1, 1989, and shall remain available until expended, and $125,000,000 shall be made available on October 1, 1990": Provided, That these actions are taken pursuant to section 202(b)(1) of Public Law 100-119 (2 U.S.C. 909).

With regard to funds made available under this head in this and previous appropriations Acts, unobligated balances excess to the needs of the procurement for which they originally were made available may be applied to other procurements for which requests for proposals have not yet been issued: Provided, That for all procurements for which project selections have not been made as of the date of enactment of this Act no supplemental, backup, or contingent selection of projects shall be made over and above projects originally selected for negotiation and utilization of available funds: Provided further, That reports on projects selected by the Secretary of Energy pursuant to authority granted under this heading which are received by the Speaker of the House of Representatives and the President of the Senate less than 30 legislative days prior to the end of the first session of the 101st Congress shall be deemed to have met the criteria in the third proviso of the fourth paragraph under the heading "Administrative provisions, Department of Energy" in the Department of the Interior and Related Agencies Appropriations Act, 1986, as contained in Public Law 99-190, upon expiration of 30 calendar days from receipt of the report by the Speaker of the House of Representatives and the President of the Senate or at the end of the session, whichever occurs later.

Conference Report (H.R. Conf. Rep. No. 264, 101st Cong., 1st Sess. [1989])

Clean Coal Technology

Amendment No. 112: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of he Senate which adds the word "replacing" to the definition of clean coal technology. The managers agree that the inclusion of "replacing" for clean coal IV and V is intended to cover the complete replacement of an existing facility if because of design or site specific limitations, repowering or retrofitting of the plant is not a desirable option.

Amendment No. 113: Appropriates $450,000,000 for fiscal year 1990 for clean coal technology instead of $500,000,000 as proposed by the House and $325,000,000 as proposed by the Senate. This appropriation along with $125,000,000 provided for fiscal year 1991 in Amendment 114 fully funds the third round of clean coal technology projects. The managers agree that additional manpower is required, particularly at the Department's Energy Technology Centers, in order to manage adequately the increased workload from the accumulation of active clean coal technology projects and the inclusion of additional procurements in this bill. Although a legislative floor is not included, the managers agree that at least eighty personnel will be required in addition to the approximately thirty FTE's now included in the fossil energy research and development appropriation. The managers agree further that funds from the fossil energy research and development appropriation should not be used to pay the cost of more than the equivalent FTE's paid under that account in fiscal year 1989.

Amendment No. 114: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of the Senate with an amendment as follows:

In lieu of the matter stricken and inserted by said amendment, insert: and shall remain available until expended, and $125,0000,000.

The managers on the part of the Senate will move to concur in the amendment

of the House to the amendment of the Senate. The amendment provides $125,000,000 in fiscal year 1991 for the third clean coal technology procurement instead of $75,000,000 as proposed by the House and $100,000,000 as proposed by the Senate.

Amendment No 115: Deletes Senate proposed appropriation of $150,000,000 for fiscal year 1992 for clean coal technology. The House proposed no such appropriation.

Amendment No. 116: Restores House language stricken by the Senate which prohibits the use of supplemental, back-up, or contingent project selections in clean coal technology procurements.

Amendment No. 117: Restores the word "further" stricken by the Senate.

Public Law 101-164

Public Law 101-164, 103 Stat. 1109 (1989)

Clean Coal Technology

The second paragraph under this head contained in the Act making appropriations for the Department of the Interior and Related Agencies for the fiscal year ending September 30, 1990, is amended by striking "$450,000,000" and inserting "$419,000,000" and by striking "$125,000,000" and inserting "$156,000,000."

Conference Report (H.R. Conf. Rep. No. 315, 101st Cong.) 1st Sess. [1989])

The managers have agreed to reduce the funds appropriated by the Energy and Water Development Appropriations Act for Fiscal Year 1990 (Public Law 101-101) for the "Nuclear Waste Disposal Fund" by $46,000,000. This reduction will make funds available for the drug prevention effort.

The managers have agreed to reductions to the Interior and Related Agencies Appropriations Act for Fiscal Year 1990 (Public Law 101-121) in order to accommodate additional drug related appropriations.

The reductions are in three areas. The new budget authority for Clean Coal Technology of $450,000,000 for fiscal year 1990 is reduced by $31,000,000 with this same amount added to the advance appropriation for fiscal year 1991. With this change the new amount for fiscal year 1990 is $419,000,000 while fiscal year 1991 increases to $156,000,000. The second area of change is the imposition of an outlay ceiling on Strategic Petroleum Reserve oil acquisition. Outlays will be reduced from an estimated $169,945,000 to $147,125,000 and will decrease the fill rate from approximately 50,000 barrels per day to approximately 46,000 or 47,000 barrels per day. The third reduction relates to the Pennsylvania Avenue Development Corporation. The borrowing authority is reduced from $5,000,000 to $100,000.

The conference agreement includes bill language reducing the amount of funds transferred from trust funds to the Health Care Financing Administration Program Management account by $32,000,000 from $1,917,172,000 to $18,851,712,000. This reduction, along with the outlays reserved from the regular 1990 Labor, Health and Human Services, and Education appropriations bill, will be sufficient to support the subcommittee's share of the cost of anti-drug abuse funding. The conferees intend that the reduction in trust fund transfers be associated with activities to implement catastrophic health insurance, where funding needs may be diminished.

Public Law 101-302

Public Law 101-302, 104 Stat. 213 (1990)

Clean Coal Technology

Funds previously appropriated under this head for clean coal technology solicitations to be issued no later than June 1, 1990, and no later than September 1, 1991, respectively, shall not be obligated until September 1, 1991: Provided, That the aforementioned solicitations shall not be conducted prior to the ability to obligate these funds: *Provided further*, That pursuant to section 202(b) of the Balanced Budget and Emergency Deficit Control Reaffirmation Act of 1987, this action is a necessary (but secondary) result of a significant policy change: *Provided further,* That for the clean coal solicitations identified herein, provisions included for the repayment of government contributions to individual projects shall be identical to those included in the Program Opportunity Notice for Clean Coal Technology III (CCTDP-III) Demonstration Projects (solicitation number DE-PSO1-89 FE 61825), issued by the Department of Energy on May 1, 1989.

Conference Report (H.R. Conf. Rep. No. 493, 101st Cong., 2nd Sess. [1990])

Clean Coal Technology

Amendment No. 89: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of the senate with an amendment as follows:

In lieu of the matter proposed by said amendment insert:

Department of Energy Clean Coal Technology

Funds previously appropriated under this head for clean coal technology solicitations to be issued no later than June 1, 1990, and no later than September 1, 1991, respectively, shall not be obligated until September 1, 1991: Provided, That the aforementioned solicitations shall not be conducted prior to the ability to obligate these funds: Provided further, That pursuant to section 202 (b) of the Balanced Budget and Emergency Deficit Control reaffirmation/Act of 1987 this action is

a necessary (but secondary) result of a significant policy change: Provided further, That for the clean coal solicitations identified herein, provisions included for the repayment of government contributions to individual projects shall be identical to those included in the PON for Clean Coal Technology III (CCTDP-III) Demonstration Projects (solicitation number DE-PS01-89 FE 61825), issued by the Department of Energy on May 1, 1989.

The managers on the part of the Senate will move to concur in the amendment of the House to the amendment of the Senate.

The amendment delays the fourth and fifth clean coal technology solicitations as proposed by the Senate and specifies that, when issued, these solicitations must use repayment provisions used successfully in the third solicitation. This provision was included in the House introduced bill (H.R. 4828) and modifies a Senate amendment to the original Dire Emergency Supplemental.

The managers agree that changes to the clean air bill, proposed by a House authorizing committee, that would modify the Clean Coal Technology program must be resolved before a reasonable solicitation can be issued. The proposed delay will allow such resolution.

The managers have added language to ensure that provisions dealing with the repayment of government provided funds will remain the same as the third round of procurements. These provisions were developed over a four year period based on experience of previous procurements and negotiations, and input from industrial participants, Congress, and the managers of the program. They appear to be working well.

Based on the long-term experience, and the clear fact that implementation of this type of technology will become even more important with passage of clean air legislation, the managers reject proposals put forth by the Department of Energy to increase rates substantially. Such proposals, while they might increase the recovery of government-provided funds over periods of up to 20 years, might also act as a deterrent to industrial participation in the program, which is already over 50 percent cost-shared by industry. The purpose of the program is to accelerate the introduction of clean uses of coal in a more efficient manner in compliance with stringent new air quality standards, not the provision of investment returns to the Government at the expense of nascent markets.

Public Law 101-512

Public Law 101-512, 104 Stat. 1915 (1990)

Clean Coal Technology

The first paragraph under this head in Public Law 101-121 is amended by striking "$600,000,000 shall be made available on October 1, 1990, and shall remain available until expended, and $600,000,000 shall be made available on October 1, 1991, and shall remain available until expended" and inserting "$600,000,000 shall be made available as follows: $35,000,000 on September 1, 1991, $315,000,000 on October 1, 1991, and $250,000,000 on October 1, 1992, all such sums to remain available until expended for use in conjunction with a separate general request for proposals, and $600,000,000 shall be made available as follows: $150,000,000 on October 1, 1991, $225,000,000 on October 1, 1992, and $225,000,000 on October 1, 1993, all such sums to remain available until expended for use in conjunction with a separate general request for proposals": *Provided*, That these actions are taken pursuant to section 202(b)(1) of Public Law 100-119 (2 U.S.C. 909): *Provided further*, That a fourth general request for proposals shall be issued not later than February 1, 1991, and a fifth general request for proposals shall be issued not later than March 1, 1992: *Provided further*, That project proposals resulting from such solicitations shall be selected not later than eight months after the date of the general request for proposals: *Provided further*, That for clean coal solicitations required herein, provisions included for the repayment of government contributions to individual projects shall be identical to those included in the PON for Clean Coal Technology III (CCTDP-III) Demonstration Projects (solicitation number DE-PS01-89 FE 61825), issued by the Department of Energy on May 1, 1989: Provided further, That funds provided under this head in this or any other appropriations Act shall be expended only in accordance with the provisions governing the use of such funds contained under this head in this or any other appropriations Act.

With regard to funds made available under this head in this and previous appropriations Acts, unobligated balances excess to the needs of the procurement for which they originally were made available may be applied to other procurements for use on projects for which cooperative agreements are in place, within the limitations and proportions of Government financing increases currently allowed by law: Provided, That the Department of Energy, for a period of up to five (5) years after completion of the operations phase of a cooperative agreement may provide appropriate protections, including exemptions from subchapter II of chapter 5 of title 5, United States Code, against the dissemination of information that results from demonstration activities conducted under the Clean Coal Technology Program and that would be a trade secret or commercial or financial information that is privileged or confidential if the information had been obtained from and first produced by a non-Federal party participating in a Clean Coal Technology project: provided further, That, in addition to the full-time permanent Federal employ-

ees specified in section 303 of Public Law 97-257, as amended, no less than 90 full-time Federal employees shall be assigned to the Assistant Secretary for Fossil Energy for carrying out the programs under this head using funds available under this head in this and any other appropriations Act and of which 35 shall be for PETC and 30 shall be for METC: Provided further, That reports on projects selected by the Secretary of Energy pursuant to authority granted under this heading which are received by the Speaker of the House of Representatives and the President of the Senate less than 30 legislative days prior to the end of the second session of the 101st Congress shall be deemed to have met the criteria in the third proviso of the fourth paragraph under the heading "administrative provisions, Department of Energy" in the Department of the Interior and Related Agencies Appropriations Act, 1986, as contained in Public Law 99-190, upon expiration of 30 calendar days from receipt of the report by the Speaker of the House of Representatives and the President of the Senate or at the end of the session, whichever occurs later.

Conference Report (H.R. Conf. Rep. No. 971, 101st Cong., 2nd Sess. [1990])

Clean Coal Technology

Amendment No. 142: Provides $35,000,000 for clean coal technology on September 1, 1991 as proposed by the House instead of $100,000,000 as proposed by the Senate. This amendment and Amendment No. 143 shift the availability of $65,000,000 from fiscal year 1991 to fiscal year 1992.

Amendment No. 143: Provides $315,000,000 for clean coal technology on October 1, 1991 as proposed by the House instead of $250,000,000 as proposed by the Senate. This amendment and Amendment No. 142 shift the availability of $65,000,000 from fiscal year 1991 to fiscal year 1992.

Amendment No. 144: Provides dates for two solicitations for clean coal technology as proposed by the Senate. The date for CCTDP-IV is amended to February 1, 1991 from January 1, 1991. The date for CCTDP-V is not changed from the Senate date of March 1, 1992.

The managers have agreed to a February 1, 1991 date for the next solicitation to enable the Department to publish a draft solicitation for comment by interested parties. It is expected that there will be changes to evaluation criteria and other factors that make it imperative that potential proposers have an opportunity to comment on the content of the solicitation.

The managers urge the Department to include potential benefits to remote, import-dependent sites as a program policy factor in evaluating proposals. The Department should also consider projects which can provide multiple fuel resource options for regions which are more than seventy-five percent dependent on one fuel form for total energy requirements.

Amendment No. 145: Requires selection of projects within eight months of the requests for proposals required by Amendment No. 144 as proposed by the Senate. The House had no such provision.

Amendment No. 146: Requires repayment of government contributions to projects under conditions identical to the most recent clean coal solicitation as proposed by the Senate. The House had no such provision.

Amendment No. 147: Provides that funds for clean coal technology may be expended only under conditions contained in appropriations Acts. The Senate language had prohibited geographic restrictions on the expenditure of funds. The House had no such provision. The managers direct that no preferential consideration be given to any project referenced explicitly or implicitly in other legislation.

The managers agree to delete bill language dealing with geographic restrictions based on such restrictions being deleted from clean air legislation.

Amendment No. 148: Earmarks employees to two fossil energy technology centers as proposed by the Senate. The House had no such provision. The managers agree that the earmarks for PETC and METC are minimum levels and may be increased as necessary.

The managers agree that no more than the current 30 full-time equivalent positions from fossil energy research and development may be used in the clean coal program in fiscal year 1991.

Public Law 102-154

Public Law 102-154, 105 Stat. 990 (1991)

Clean Coal Technology

The first paragraph under this head in Public Law 101-512 is amended by striking the phrase "$150,000,000 on October 1, 1991, $225,000,000 on October 1, 1992" and inserting "$100,000,000 on October 1, 1991, $275,000,000 on October 1, 1992."

Notwithstanding the issuance date for the fifth general request for proposals under this head in Public Law 101-512, such request for proposals shall be issued not later than July 6, 1992, and notwithstanding the proviso under this head in Public Law 101-512 regarding the time interval for selection of proposals resulting from such solicitation, project proposals resulting from the fifth general request for proposals shall be selected not later than ten months after the issuance date of the fifth general request for proposals: *Provided,* That hereafter the fifth general request for proposals shall be subject to all provisos contained under this head in previous appropriations Acts unless amended by this Act.

Notwithstanding the provisos under this head in previous appropriations Acts, projects selected pursuant to the fifth general request for proposals shall advance significantly the efficiency and environmental performance of coal-using technologies and be applicable to either new or existing facilities: Provided, That budget periods may be used in lieu of design, construction, and operating phases for cost-sharing calculations: Provided further, That the Secretary shall not finance more than 50 per centum of the total costs of any budget period: Provided further, That project specific development activities for process performance definition, component design verification, materials selection, and evaluation of alternative designs may be funded on a cost-shared basis up to a limit of 10 per centum of the Government's share of project cost: Provided further, That development activities eligible for cost-sharing may include limited modifications to existing facilities for project related testing but do not include construction of new facilities.

With regard to funds made available under this head in this and previous appropriations Acts, unobligated balances excess to the needs of the procurement for which they originally were made available may be applied to other procurements for use on projects for which cooperative agreements are in place, within the limitations and proportions of Government financing increases currently allowed by law: Provided, That hereafter, the Department of Energy, for a period of up to five years after completion of the operations phase of a cooperative agreement may provide appropriate protections, including exemptions from subchapter II of chapter 5 of title 5, United States Code, against the dissemination of information that results from demonstration activities conducted under the Clean Coal Technology Program and that would be a trade secret or commercial or financial information that is privileged or confidential if the information had been obtained from and first produced by a non-Federal party participating in a Clean Coal Technology project: Provided further, That hereafter, in addition to the full-time permanent Federal employees specified in section 303 of Public Law 97-257, as amended, no less than 90 full-time Federal employees shall be assigned to the Assistant Secretary for Fossil Energy for carrying out the programs under this head using funds available under this head in this and any other appropriations Act and of which not less than 35 shall be for PETC and not less than 30 shall be for METC: Provided further, That hereafter reports on projects selected by the Secretary of Energy pursuant to authority granted under this heading which are received by the Speaker of the House of Representatives and the President of the Senate less than 30 legislative days prior to the end of each session of Congress shall be deemed to have met the criteria in the third proviso of the fourth paragraph under the heading "Administrative provisions, Department of Energy" in the Department of the Interior and Related Agencies Appropriations Act, 1986, as contained in Public Law 99-190, upon expiration of 30 calendar days from receipt of the report by the Speaker of the House of Representatives and the President of the Senate or at the end of the session, whichever occurs later.

Conference Report (H.R. Conf. Rep. No. 256, 102nd Cong., 1st Sess. [1991])

Clean Coal Technology

Amendment No. 165: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of the Senate with an amendment as follows:

In lieu of the matter stricken and inserted by said amendment insert:

Notwithstanding the issuance date for the fifth general request for proposals under this head in Public Law 101-512, such request for proposals shall be issued not later than July 6, 1992, and notwithstanding the proviso under this head in Public Law 101-512 regarding the time interval for selection of proposals resulting from such solicitation, project proposals resulting from the fifth general request for proposals shall be selected not later than ten months after the issuance date of the fifth general request for proposals: Provided, That hereafter the fifth general request for proposals.

The managers on the part of the Senate will move to concur in the amendment of the House to the amendment of the Senate.

The amendment changes the issuance date for the fifth general request for proposals to July 6, 1992 instead of March 1, 1992 as proposed by the House and August 10, 1992 as proposed by the Senate and the allowable length of time from issuance of the request for proposals to selection of projects to ten months. The amendment also deletes Senate proposed bill language pertaining to a sixth general request for proposals as discussed below.

The managers agree that the additional two months in the procurement process for the fifth round of proposals should include an additional month to allow for the preparation of proposals by the private sector, and up to an additional month for Department of Energy review and evaluation of proposals when compared to the process for the fourth round.

The managers have agreed to delete bill language regarding a sixth round of proposals, but agree that funding will be provided for a sixth round based on unobligated and unneeded amounts that may become available from the first five rounds. The report from the Secretary on available funds, which was originally in the Senate amendment, is still

a requirement and such report should be submitted to the House and Senate Committees on Appropriations not later than May 1, 1994. Based on that report, the funding, dates and conditions for the sixth round will be included in the fiscal year 1995 appropriation.

The managers expect that the fifth solicitation will be conducted under the same general types of criteria as the fourth solicitation principally modified only (1) to include the wider range of eligible technologies or applications; (2) to adjust technical criteria to consider allowable development activities, to strengthen criteria for non-utility demonstrations, and to adjust commercial performance criteria for additional facilities and technologies with regard to aspects of general energy efficiency and environmental performance; and (3) to clarify and strengthen cost and finance criteria particularly with regard to development activities.

Amendment No. 166: Restores House language deleted by the Senate which refers to a fifth general request for proposals. The Senate proposed language dealing with both a fifth and a sixth round.

Amendment No. 167: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of the Senate which directs the Secretary of Energy to reobligate up to $44,000,000 from the fourth round of Clean Coal Technology proposals to a proposal ranked highest in its specific technology category by the Source Evaluation Board if other than the highest ranking project in that category was selected originally by the Secretary, and if such funds become unobligated and are sufficient to fund such projects. This amendment would earmark such funds, if they become available, to a specific project not chosen in the Department of Energy selection process for the fourth round of Clean Coal Technology.

Amendment No. 168: Technical amendment which deletes House proposed punctuation and numbering as proposed by the Senate.

Amendment No. 169: Deletes House proposed language which made unobligated funds available for procurements for which requests for proposals have not been issued.

Amendment No. 170: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of the Senate which adds "not less than" to employment floor language for PETC as proposed by the Senate. The House had no such language.

Amendment No. 171: Reported in technical disagreement. The managers on the part of the House will offer a motion to recede and concur in the amendment of the Senate which adds "not less than" to employment floor language for METC as proposed by the Senate. The House had no such language.

Public Law 102-381

Public Law 102-381, 106 Stat. 1374 (1992)

Clean Coal Technology

The first paragraph under this head in Public Law 101-512, as amended, is further amended by striking the phrase "and $250,000,000 on October 1, 1992" and inserting "$150,000,000 on October 1, 1993, and $100,000,000 on October 1, 1994" and by striking the phrase "$275,000,000 on October 1, 1992, and $225,000,000 on October 1, 1993" and inserting "$250,000,000 on October 1, 1993, and $250,000,000 on October 1, 1994"

Public Law 103-138

Public Law 103-138, 107 Stat. 1379 (1993)

Clean Coal Technology

The first paragraph under this head in Public Law 101-512, as amended, is further amended by striking the phrase "$150,000,000 on October 1, 1993, and $100,000,000 on October 1, 1994" and inserting "$100,000,000 on October 1, 1993, $100,000,000 on October 1, 1994, and $50,000,000 on October 1, 1995" and by striking the phrase "$250,000,000 on October 1, 1993, and $250,000,000 on October 1, 1994" and inserting "$125,000,000 on October 1, 1993, $275,000,000 on October 1, 1994, and $100,000,000 on October 1, 1995"

Public Law 103-332

Public Law 103-332, 108 Stat. 2499 (1994)

Clean Coal Technology

The first paragraph under this head in Public Law 101-512, as amended, is further amended by striking the phrase "$100,000,000 on October 1, 1994, and $50,000,000 on October 1, 1995" and inserting "$18,000,000 on October 1, 1994, $100,000,000 on October 1, 1995, and $32,000,000 on October 1, 1996"; and by striking the phrase "$275,000,000 on October 1, 1994, and $100,000,000 on October 1, 1995" and inserting "$19,121,000 on October 1, 1994, $100,000,000 on October 1, 1995, and $255,879,000 on October 1, 1996": Provided, That not to exceed $18,000,000 available in fiscal year 1995 may be used for administrative oversight of the Clean Coal Technology program.

Public Law 104-6

Public Law 104-6, 109 Stat. 73 (1995)

Clean Coal Technology (Rescission)

Of the funds made available under this heading for obligation in fiscal year 1996, $50,000,000 are rescinded and of the funds made available under this heading for obligation in fiscal year 1997, $150,000,000 are rescinded: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Public Law 104-134

Conference Report (H.R. Conf. Rep. No. 402, 104th Cong., 1st Sess. [1995])

The managers do not object to the use of up to $18,000,000 in clean coal technology program funds for administration of the clean coal program.

Public Law 104-208

Public Law 104-208, 110 Stat. 3009 (1996)

Clean Coal Technology (Rescission)

Of the funds made available under this heading for obligation in fiscal year 1997 or prior years, $123,000,000 are rescinded: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Conference Report (H.R. Conf. Rep. No. 863, 104th Cong., 2nd Sess., [1996])

Clean Coal Technology (Rescission)

Of the funds made available under this heading for obligation in fiscal year 1997 or prior years, $123,000,000 are rescinded: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Senate Report (S. Rep. No. 319, 104th Cong., 2nd Sess. [1996])

The Committee does not object to the use of up to $16,000,000 in available funds for administration of the clean coal program in fiscal year 1997.

House Report (H.R. Rep. No. 625, 104th Cong., 2nd Sess. [1996])

The Committee does not object to the use of up to $16,000,000 in available funds for administration of the clean coal program in fiscal year 1997.

Public Law 105-18

Public Law 105-18, 111 Stat. 158 (1997)

Clean Coal Technology (Rescission)

Of the funds made available under this heading for obligation in fiscal year 1997 or prior years, $17,000,000 are rescinded: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Public Law 105-83

Public Law 105-83, 111 Stat. 37 (1997)

Of the funds made available under this heading for obligation in fiscal year 1997 or prior years, $101,000,000 are rescinded: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Public Law 105-277

Public Law 105-277, 112 Stat. 2681 (1998)

Clean Coal Technology (Deferral)

Of the funds made available under this heading for obligation in prior years, $10,000,000 of such funds shall not be available until October 1, 1999; $15,000,000 shall not be available until October 1, 2000; and $15,000,000 shall not be available until October 1, 2001: *Provided*, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Conference Report (H.R. Conf. Rep. No. 825, 105th Cong. 2nd Sess. [1998])

Clean Coal Technology

The conference agreement provides for the deferral of $40,000,000 in previously appropriated funds for the clean coal technology program as proposed by the Senate. The House did not propose to defer funding. The Committees agree that $14,900,000 may be used for administration of the clean coal technology program.

Public Law 106-113

Public Law 106-113, 113 Stat. 1501 (1999)

Clean Coal Technology (Deferral)

Of the funds made available under this heading for obligation in prior years, $156,000,000 shall not be available until October 1, 2000: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Conference Report (H.R. Rep. No. 406, 106th Cong., 1st Sess. [1999])

Clean Coal Technology (Deferral)

The conference agreement provides for the deferral of $156,000,000 in previously appropriated funds for the clean coal technology program as proposed by the Senate instead of a deferral of $256,000,000 as proposed by the House. The managers agree that up to $14,400,00 may be used for program direction.

Public Law 106-291

Public Law 106-291, 114 Stat. 922 (2000)

Clean Coal Technology (Deferral)

Of the funds made available under this heading for obligation in prior years, $67,000,000 shall not be available until October 1, 2001: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Fossil Energy Research and Development (including transfers of funds)

For necessary expenses in carrying out fossil energy research and development activities, under the authority of the Department of Energy Organization Act (Public Law 95-91), including the acquisition of interest, including defeasible and equitable interests in any real property or any facility or for plant or facility acquisition or expansion, and for conducting inquiries, technological investigations and research concerning the extraction, processing, use, and disposal of mineral substances without objectionable social and environmental costs (30 U.S.C. 3, 1602, and 1603), performed under the minerals and materials science programs at the Albany Research Center in Oregon $540,653,000, to remain available until expended, of which $12,000,000 for oil technology research shall be derived by transfer from funds appropriated in prior years under the heading "Strategic Petroleum Reserve, SPR Petroleum Account" and of which $95,000,000 shall be derived by transfer from funds appropriated in prior years under the heading "Clean Coal Technology", such funds to be available for a general request for proposals for the commercial-scale demonstration of technologies to assure the reliability of the Nation's energy supply from existing and new electric generating facilities for which the Department of Energy upon review may provide financial assistance awards: Provided, That the request for proposals shall be issued no later than one hundred and twenty days following enactment of this Act, proposals shall be submitted no later than ninety days after the issuance of the request for proposals, and the Department of Energy shall make project selections no later than one hundred and sixty days after the receipt of proposals: Provided further, That no funds are to be obligated for selected proposals prior to September 30, 2001: Provided further, That funds provided shall be expended only in accordance with the provisions governing the use of funds contained under the heading under which they were originally appropriated: Provided further, That provisions for repayment of Government contributions to individual projects shall be identical to those included in the Program Opportunity Notice (Solicitation Number DE-PS01-89FE61825), issued by the Department of Energy on May 1, 1989, except that repayments from sale or licensing of technologies shall be from both domestic and foreign transactions: Provided further, That such repayments shall be deposited in this account to be retained for future projects: Provided further, That any project approved under this program shall be considered a Clean Coal Technology Demonstration Project, for the purposes of Chapters 51, 52, and 60 of title 40 of the Code of Federal Regulations: Provided further, That no part of the sum herein made available shall be used for the field testing of nuclear explosives in the recovery of oil and gas: Provided further, That up to 4 percent of program direction funds available to the National Energy Technology Laboratory may be used to support Department of Energy activities not included in this account.

Public Law 107-63

Public Law 107-63, 115 Stat. 414 (2001)

Clean Coal Technology (Deferral)

Of the funds made available under this heading for obligation in prior years, $40,000,000 shall not be available until October 1, 2002: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Fossil Energy Research and Development (Including Transfer of Funds)

For necessary expenses in carrying out fossil energy research and development activities, under the authority of the Department of Energy Organization Act (Public Law 95-91), including the acquisition of interest, including defeasible and equitable interests in any real property or any facility or for plant or facility acquisition or expansion, and for conducting inquiries, technological investigations and research concerning the extraction, processing, use, and disposal of mineral substances without objectionable social and environmental costs (30 U.S.C. 3, 1602, and 1603), $616,490,000, to remain available until expended, of which $11,000,000 is to begin a 7-year project for construction, renovation, furnishing, and demolition or removal of buildings at National Energy Technology Laboratory facilities in Morgantown, West Virginia and Pittsburgh, Pennsylvania; and for acquisition of lands, and interests therein, in proximity to the National Energy

Technology Laboratory, and of which $33,700,000 shall be derived by transfer from funds appropriated in prior years under the heading 'Clean Coal Technology', and of which $150,000,000 and such sums as may be appropriated in FY03 are to be made available, after coordination with the private sector, for a request for proposals for a Clean Coal Power Initiative providing for competitively-awarded demonstrations of commercial-scale technologies to reduce the barriers to continued and expanded coal use: Provided, That the request for proposals shall be issued no later than 120 days following enactment of this Act, proposals shall be submitted no later than 150 days after the issuance of the request for proposals, and the Department of Energy shall make project selections no later than 160 days after the receipt of proposals: Provided further, That no project may be selected for which sufficient funding is not available to provide for the total project: Provided further, That funds shall be expended in accordance with the provisions governing the use of funds contained under the heading 'Clean Coal Technology' in prior appropriations: Provided further, That the Department may include provisions for repayment of Government contributions to individual projects in an amount up to the Government contribution to the project on terms and conditions that are acceptable to the Department including repayments from sale and licensing of technologies from both domestic and foreign transactions: Provided further, That such repayments shall be retained by the Department for future coal-related research, development and demonstration projects: Provided further, That any technology selected under this program shall be considered a Clean Coal Technology, and any project selected under this program shall be considered a Clean Coal Technology Project, for the purposes of 42 U.S.C. Sec. 7651n, and Chapters 51, 52, and 60 of title 40 of the Code of Federal Regulations: Provided further, That funds excess to the needs of the Power Plant Improvement Initiative procurement provided for under this heading in Public Law 106-291 shall be made available for the Clean Coal Power Initiative provided for under this heading in this Act: Provided further, That no part of the sum herein made available shall be used for the field testing of nuclear explosives in the recovery of oil and gas: Provided further, That up to 4 percent of program direction funds available to the National Energy Technology Laboratory may be used to support Department of Energy activities not included in this account.

Public Law 108-7

Public Law 108-7, 117 Stat. 11 (2003)

Clean Coal Technology (Deferral)

Of the funds made available under this heading for obligation in prior years, $87,000,000 shall not be available until October 1, 2003: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Fossil Energy Research and Development

For necessary expenses in carrying out fossil energy research and development activities, under the authority of the Department of Energy Organization Act (Public Law 95-91), including the acquisition of interest, including defeasible and equitable interests in any real property or any facility or for plant or facility acquisition or expansion, and for conducting inquiries, technological investigations and research concerning the extraction, processing, use, and disposal of mineral substances without objectionable social and environmental costs (30 U.S.C. 3, 1602, and 1603), $624,900,000, to remain available until expended, of which $4,000,000 is to continue a multi-year project for construction, renovation, furnishing, and demolition or removal of buildings at National Energy Technology Laboratory facilities in Morgantown, West Virginia and Pittsburgh, Pennsylvania; and of which $150,000,000 are to be made available, after coordination with the private sector, for a request for proposals for a Clean Coal Power Initiative providing for competitively-awarded research, development, and demonstration projects to reduce the barriers to continued and expanded coal use: Provided, That no project may be selected for which sufficient funding is not available to provide for the total project: Provided further, That funds shall be expended in accordance with the provisions governing the use of funds contained under the heading "Clean Coal Technology" in prior appropriations: Provided further, That the Department may include provisions for repayment of Government contributions to individual projects in an amount up to the Government contribution to the project on terms and conditions that are acceptable to the Department including repayments from sale and licensing of technologies from both domestic and foreign transactions: Provided further, That such repayments shall be retained by the Department for future coal-related research, development and demonstration projects: Provided further, That any technology selected under this program shall be considered a Clean Coal Technology, and any project selected under this program shall be considered a Clean Coal Technology Project, for the purposes of 42 U.S.C. 7651n, and Chapters 51, 52, and 60 of title 40 of the Code of Federal Regulations: Provided further, That no part of the sum herein made available shall be used for the field testing of nuclear explosives in the recovery of oil and gas: Provided further, That up to 4 percent of program direction funds available to the National Energy Technology Laboratory may be used to support Department of Energy activities not included in this account.

Public Law 108-108

Public Law 108-108, 117 Stat. 1241 (2003)

Clean Coal Technology (Deferral and Recision)

Of the funds made available under this heading for obligation in prior years, $97,000,000 shall not be available until October 1, 2004, and $88,000,000 are rescinded: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Fossil Energy Research and Development

For necessary expenses in carrying out fossil energy research and development activities, under the authority of the Department of Energy Organization Act (Public Law 95-91), including the acquisition of interest, including defeasible and equitable interests in any real property or any facility or for plant or facility acquisition or expansion, and for conducting inquiries, technological investigations and research concerning the extraction, processing, use, and disposal of mineral substances without objectionable social and environmental costs (30 U.S.C. 3, 1602, and 1603), $681,163,000, to remain available until expended, of which $4,000,000 is to continue a multi-year project for construction, renovation, furnishing, and demolition or removal of buildings at National Energy Technology Laboratory facilities in Morgantown, West Virginia and Pittsburgh, Pennsylvania; of which not to exceed $536,000 may be utilized for travel and travel-related expenses incurred by the headquarters staff of the Office of Fossil Energy; and of which $172,000,000 are to be made available, after coordination with the private sector, for a request for proposals for a Clean Coal Power Initiative providing for competitively-awarded research, development, and demonstration projects to reduce the barriers to continued and expanded coal use: Provided, That no project may be selected for which sufficient funding is not available to provide for the total project: Provided further, That funds shall be expended in accordance with the provisions governing the use of funds contained under the heading "Clean Coal Technology'' in 42 U.S.C. 5903d: Provided further, That the Department may include provisions for repayment of Government contributions to individual projects in an amount up to the Government contribution to the project on terms and conditions that are acceptable to the Department including repayments from sale and licensing of technologies from both domestic and foreign transactions: Provided further, That such repayments shall be retained by the Department for future coal-related research, development and demonstration projects: Provided further, That any technology selected under this program shall be considered a Clean Coal Technology, and any project selected under this program shall be considered a Clean Coal Technology Project, for the purposes of 42 U.S.C. 7651n, and Chapters 51, 52, and 60 of title 40 of the Code of Federal Regulations: Provided further, That no part of the sum herein made available shall be used for the field testing of nuclear explosives in the recovery of oil and gas: Provided further, That up to 4 percent of program direction funds available to the National Energy Technology Laboratory may be used to support Department of Energy activities not included in this account.

Conference Report (H.R. Conf. Rep. No. 108-330, 108th Cong., 1st Sess. [2003])

Clean Coal Technology (Deferral and Recision)

The conference agreement defers $97,000,000 in clean coal technology funds as proposed by the Senate instead of a deferral of $86,000,000 as proposed by the House. The conference agreement also rescinds $88,000,000 in clean coal technology funds. These funds have been added to the base budget for the fossil energy research and development account where all continuing research programs and associated administrative expenses should be funded. Clean coal technology funds are limited to completing active projects under that program. Once those projects are completed, a separate clean coal technology account will no longer be required.

The managers have not included bill language authorizing the use of clean coal technology funds for the FutureGen program as proposed by the Senate. Funding is included in the fossil energy research and development account for FutureGen. The managers agree that clean coal technology funds should not be transferred to fund ongoing programs in fossil energy research and development. Rather, a rescission of excess clean coal funds should be proposed and, to the extent new and expanded research program funds are required, including funds for FutureGen, they should be budgeted directly in the fossil energy research and development account.

Fossil Energy Research and Development

The conference agreement includes $681,163,000 for fossil energy research and development, instead of $609,290,000 as proposed by the House and $593,514,000 as proposed by the Senate. The conference agreement includes funds for several ongoing programs that were previously funded under the clean coal technology account, funding to begin the FutureGen program, and funding increases for programs that provide critical underpinning for, and are critical for the success of, FutureGen. The increase in funding above the Senate proposed level is offset fully by the rescission of $88 million in clean coal technology funding. The

numerical changes described below are to the House recommended level.

The conference agreement includes increases of $42,000,000 for the clean coal power initiative and $9,000,000 to initiate the FutureGen program. The funds provided for the FutureGen program are contingent on the receipt of a complete program plan that clearly and fully delineates by project and by year the funding for each element of, and milestone associated with, the FutureGen program. This plan should be closely coordinated with industry cooperators and submitted to the House and Senate Committees on Appropriations no later than December 31, 2003. The managers understand the need for a lower cost share for the initial research and planning stages of the FutureGen program, but any demonstration component must include at least a 50 percent industry cost share.

Public Law 108-447

Public Law 108-447, 118 Stat. 2809 (2004)

Clean Coal Technology (Deferral)

Of the funds made available under this heading for obligation in prior years, $257,000,000 shall not be available until October 1, 2005: Provided, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected.

Fossil Energy Research and Development

For necessary expenses in carrying out fossil energy research and development activities, under the authority of the Department of Energy Organization Act (Public Law 95-91), including the acquisition of interest, including defeasible and equitable interests in any real property or any facility or for plant or facility acquisition or expansion, and for conducting inquiries, technological investigations and research concerning the extraction, processing, use, and disposal of mineral substances without objectionable social and environmental costs (30 U.S.C. 3, 1602, and 1603), $579,911,000, to remain available until expended, of which $4,000,000 is to continue a multi-year project for construction, renovation, furnishing, and demolition or removal of buildings at National Energy Technology Laboratory facilities in Morgantown, West Virginia and Pittsburgh, Pennsylvania: Provided, That of the amounts provided, $18,000,000 is to continue a multi-year project coordinated with the private sector for FutureGen, without regard to the terms and conditions applicable to clean coal technology projects: Provided further, That the initial planning and research stages of the FutureGen project shall include a matching requirement from non-Federal sources of at least 20 percent of the costs: Provided further, That any demonstration component of such project shall require a matching requirement from non-Federal sources of at least 50 percent of the costs of the component: Provided further, That of the amounts provided, $50,000,000 is available, after coordination with the private sector, for a request for proposals for a Clean Coal Power Initiative providing for competitively-awarded research, development, and demonstration projects to reduce the barriers to continued and expanded coal use: Provided further, That no project may be selected for which sufficient funding is not available to provide for the total project: Provided further, That funds shall be expended in accordance with the provisions governing the use of funds contained under the heading 'Clean Coal Technology' in 42 U.S.C. 5903d: Provided further, That the Department may include provisions for repayment of Government contributions to individual projects in an amount up to the Government contribution to the project on terms and conditions that are acceptable to the Department including repayments from sale and licensing of technologies from both domestic and foreign transactions: Provided further, That such repayments shall be retained by the Department for future coal-related research, development and demonstration projects: Provided further, That any technology selected under this program shall be considered a Clean Coal Technology, and any project selected under this program shall be considered a Clean Coal Technology Project, for the purposes of 42 U.S.C. 7651n, and chapters 51, 52, and 60 of title 40 of the Code of Federal Regulations: Provided further, That funds shall be expended in accordance with the provisions governing the use of funds contained under the heading 'Clean Coal Technology' in prior appropriations: Provided further, That no part of the sum herein made available shall be used for the field testing of nuclear explosives in the recovery of oil and gas: Provided further, That up to 4 percent of program direction funds available to the National Energy Technology Laboratory may be used to support Department of Energy activities not included in this account.

Conference Report (H.R. Conf. Rep. No. 108-792, 108th Cong. 2nd Sess. [2004])

Clean Coal Technology (Deferral)

The conference agreement defers the availability of $257,000,000 in clean coal technology funds until October 1, 2005, as proposed by the Senate instead of a deferral of $237,000,000 as proposed by the House. The FutureGen program is not funded in this account, as proposed by the House, but is funded in the fossil energy research and development account.

The managers expect the Department to include a table on the FutureGen program, as outlined in the House Report 108-542, in future budget requests for fossil energy research and development account. The managers make no as-

sumptions on the future use of deferred clean coal technology funds.

Fossil Energy Research and Development

The conference agreement provides $579,911,000 for fossil energy research and development instead of $601,875,000 as proposed by the House and $542,529,000 as proposed by the Senate. The changes described below are to the House recommended funding level.

FutureGen — There is an increase of $18,000,000 for the FutureGen power plant initiative.

Clean Coal Power Initiative — There is a decrease of $55,000,000 for the clean coal power initiative.

The managers note that funding will need to be increased substantially in FY06 if the program is to remain on a schedule consistent with the President's clean coal initiative.

Public Law 109-103

Public Law 109-103, 119 Stat. 2247 (2005)

Clean Coal Technology (Deferral and Rescission)

Of the funds made available under this heading for obligation in prior years, $257,000,000 shall not be available until October 1, 2006: *Provided*, That funds made available in previous appropriations Acts shall be made available for any ongoing project regardless of the separate request for proposal under which the project was selected: *Provided further*, That $20,000,000 of uncommitted balances is rescinded.

Fossil Energy Research and Development

For necessary expenses in carrying out fossil energy research and development activities, under the authority of the Department of Energy Organization Act (Public Law 95-91), including the acquisition of interest, including defeasible and equitable interests in any real property or any facility or for plant or facility acquisition or expansion, the hire of passenger motor vehicles, the hire, maintenance, and operation of aircraft, the purchase, repair, and cleaning of uniforms, the reimbursement to the General Services Administration for security guard services, and for conducting inquiries, technological investigations and research concerning the extraction, processing, use, and disposal of mineral substances without objectionable social and environmental costs (30 U.S.C. 3, 1602, and 1603), $597,994,000, to remain available until expended, of which $18,000,000 is to continue a multi-year project coordinated with the private sector for FutureGen, without regard to the terms and conditions applicable to clean coal technological projects: *Provided*, That the initial planning and research stages of the FutureGen project shall include a matching requirement from non-Federal sources of at least 20 percent of the costs: *Provided further*, That any demonstration component of such project shall require a matching requirement from non-Federal sources of at least 50 percent of the costs of the component: *Provided further*, That of the amounts provided, $50,000,000 is available, after coordination with the private sector, for a request for proposals for a Clean Coal Power Initiative providing for competitively-awarded research, development, and demonstration projects to reduce the barriers to continued and expanded coal use: *Provided further*, That no project may be selected for which sufficient funding is not available to provide for the total project: *Provided further*, That funds shall be expended in accordance with the provisions governing the use of funds contained under the heading `Clean Coal Technology' in 42 U.S.C. 5903d as well as those contained under the heading `Clean Coal Technology' in prior appropriations: *Provided further*, That the Department may include provisions for repayment of Government contributions to individual projects in an amount up to the Government contribution to the project on terms and conditions that are acceptable to the Department including repayments from sale and licensing of technologies from both domestic and foreign transactions: *Provided further*, That such repayments shall be retained by the Department for future coal-related research, development and demonstration projects: *Provided further*, That any technology selected under this program shall be considered a Clean Coal Technology, and any project selected under this program shall be considered a Clean Coal Technology Project, for the purposes of 42 U.S.C. 7651n, and chapters 51, 52, and 60 of title 40 of the Code of Federal Regulations: *Provided further*, That no part of the sum herein made available shall be used for the field testing of nuclear explosives in the recovery of oil and gas: *Provided further*, That up to 4 percent of program direction funds available to the National Energy Technology Laboratory may be used to support Department of Energy activities not included in this account: *Provided further*, That for fiscal year 2006 salaries for Federal employees performing research and development activities at the National Energy Technology Laboratory can continue to be funded from program accounts: *Provided further*, That the Secretary of Energy is authorized to accept fees and contributions from public and private sources, to be deposited in a contributed funds account, and prosecute projects using such fees and contributions in cooperation with other Federal, State, or private agencies or concerns: *Provided further*, That revenues and other moneys received by or for the account of the Department of Energy or otherwise generated by sale of products in connection with projects of the Department appropriated under the Fossil Energy Research and Development account

may be retained by the Secretary of Energy, to be available until expended, and used only for plant construction, operation, costs, and payments to cost-sharing entities as provided in appropriate cost-sharing contracts or agreements.

Appendix B. CCTDP Financial History

This appendix provides predominately historical funding and cost information on the nearly completed CCTDP. As of June 30, 2006, there were 33 successfully completed projects. The final active project withdrew prior to completion in March 2006 and is preparing a Final Report of activities performed prior to withdrawal. Exhibit B-1 summarizes the costs associated with the 33 successfully completed projects.

Exhibit B-2 presents the allocation of appropriated CCTDP funds (after adjustment) and the amount available for each solicitation. Additional activities funded by CCTDP appropriations are the Small Business Innovation Research (SBIR) Program, the Small Business Technology Transfer (STTR) Program, and program direction for CCTDP management.

Exhibit B-3, on the following page, depicts the apportionment of appropriated funds to DOE. Funds can be transferred among subprogram budgets to meet project and program needs.

Exhibit B-1

CCTDP Project Costs and Cost-Sharing for Successfully Completed Projects
(Dollars in Thousands)

	Total Project Costs	%	Cost-Share Dollars DOE[b]	Cost-Share Dollars Participants	Cost-Share Percent DOE	Cost-Share Percent Participants
Subprogram						
CCTDP-I	844,363	23	239,640	604,723	28	72
CCTDP-II	318,577	9	139,229	179,348	44	56
CCTDP-III	1,138,741	30	483,665	655,076	42	58
CCTDP-IV	950,429	25	439,063	511,366	46	54
CCTDP-V	0	0	0	0	0	0
Total[a]	3,252,110	100	1,301,597	1,950,513	40	60
Application Category						
Advanced Electric Power Generation	1,978,492	61	814,099	1,164,393	41	59
Environmental Control Devices	620,110	19	252,866	367,244	41	59
Coal Processing for Clean Fuels	431,810	13	192,029	239,781	44	56
Industrial Applications	221,698	7	42,603	179,095	19	81
Total[a]	3,252,110	100	1,301,597	1,950,513	40	60

[a] Totals may not add up to the total figure shown due to rounding.
[b] DOE share does not include $157,189,000 obligated for withdrawn projects and audit expenses.

Exhibit B-2

Relationship Between Appropriations and Subprogram Budgets
(Dollars in Thousands)

Appropriation Enacted	Subprogram	Adjusted Appropriations	SBIR & STTR Budgets[a]	Program Direction Budget	Projects Budget
P.L. 99-190	CCTDP-I	380,600	4,902	144,767	230,931
P.L. 100-202	CCTDP-II	473,776	6,781	32,512	434,483
P.L. 100-446	CCTDP-III	453,298	6,906	22,548	423,844
P.L. 101-121[b]	CCTDP-IV	331,990	7,065	24,990	299,935
P.L. 101-121[b]	CCTDP-V	429,934	5,427	25,000	399,507
Total		2,069,598	31,081	249,817	1,788,700

[a] Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs.
[b] P.L. 101-121 was revised by P.L. 101-512, 102-154, 102-381, 103-138, 103-332, 104-6, 104-208, 105-18, 105-83, 105-277, 106-113, 106-291, 107-63, 108-7, 108-108, 108-447, and 109-103.

Exhibit B-3

Annual CCTDP Funding by Appropriations and Subprogram Budgets
(Dollars in Thousands)

Fiscal Year	1986–97	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total[d]
Adjusted Appropriations[a]												
P.L. 99-190	380,600											380,600
P.L. 100-202	574,997	(101,000)	(40,163)	9,962	14,980	15,000						473,776
P.L. 100-446	574,998			(156,000)	156,000	(33,700)		(185,000)	97,000			453,298
P.L. 101-121[b]	427,000				(162,000)	26,990	(47,000)	87,000				331,990
P.L. 101-121[b]	449,934								(257,000)	(20,000)	257,000	429,934
Total	2,407,529	(101,000)	(40,163)	(146,038)	8,980	8,290	(47,000)	(98,000)	(160,000)	(20,000)	257,000	2,069,598
Subprogram Budgets												
CCTDP-I Projects	318,231	(15,000)	(14,900)	(14,400)	(14,000)	(14,000)	(15,000)					230,931
CCTDP-II Projects	535,704	(101,000)	(40,163)	9,962	14,980	15,000						434,483
CCTDP-III Projects	545,544			(156,000)	156,000	(33,700)		(185,000)	97,000			423,844
CCTDP-IV Projects	394,935				(162,000)	27,000	40,000					299,935
CCTDP-V Projects	419,507						(87,000)	87,000	(257,000)	(20,000)	257,000	399,507
Projects Subtotal	2,213,921	(116,000)	(54,900)	(160,438)	(5,020)	(5,700)	(62,000)	(98,000)	(160,000)	(20,000)	257,000	1,788,700
Program Direction	162,527	15,000	14,900	14,400	14,000	13,990	15,000					249,817
Fossil Energy Subtotal	2,376,448	(101,000)	(40,163)	(146,038)	8,980	8,290	(47,000)	(98,000)	(160,000)	(20,000)	257,000	2,038,517
SBIR & STTR[c]	31,081											31,081
Total[d]	2,407,529	(101,000)	(40,163)	(146,038)	8,980	8,290	(47,000)	(98,000)	(160,000)	(20,000)	257,000	2,069,598

[a] Shown are appropriations less amounts sequestered under the Gramm-Rudman-Hollings Deficit Reduction Act.

[b] Shown is the fiscal year apportionment schedule of P.L. 101-121 as revised by P.L. 101-512, 102-154, 102-381, 103-138, 103-332, 104-6, 104-208, 105-18, 105-83, 105-277, 106-113, 106-291, 107-63, 108-7, 108-108, 108-447, and 109-103.

[c] Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs.

[d] Totals may not appear to add due to rounding.

Exhibit B-4 presents the financial activity of the CCTDP by fiscal year through June 30, 2006. SBIR and STTR funds are not included in Exhibit B-4 as these funds are tracked separately from the CCTDP. The negative Budget Authority values shown in Exhibit B-4 result from the rescission or deferral of funds as required by the annual appropriations bills. The negative obligations in FY03 resulted from the ending of two large projects. Unused funds that were committed to these projects were deobligated and made available for other purposes.

Exhibit B-5 shows the financial status of the CCTDP through June 30, 2006, by subprogram. SBIR and STTR funds are included in this exhibit to account for all funding.

Exhibit B-4

CCTDP Financial Activity by Fiscal Year

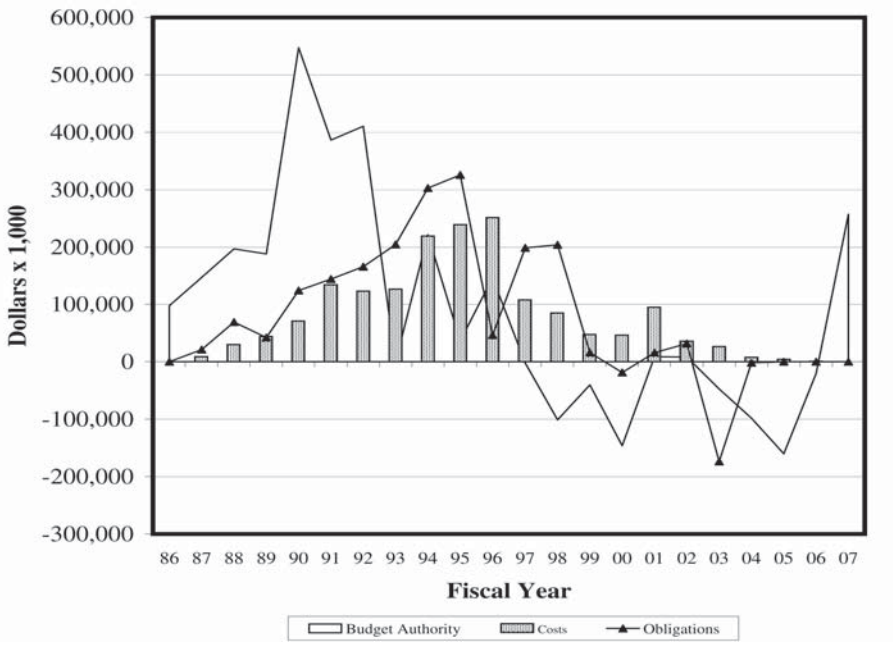

Exhibit B-5

Financial Status of the CCTDP as of June 30, 2006
(Dollars in Thousands)

Subprogram	Appropriations Allocated to Subprogram[b]	Apportioned to Date	Committed to Date	Obligated to Date	Cost to Date
CCTDP-I	230,931	230,931	257,047	257,047	257,047
CCTDP-II	434,483	434,483	165,369	165,369	165,369
CCTDP-III	423,844	423,844	506,012	506,012	506,012
CCTDP-IV	299,935	299,935	477,957	477,957	476,770
CCTDP-V	399,507	142,507	52,401	52,401	48,873
Projects Subtotal	1,788,700	1,531,700	1,458,786	1,458,786	1,454,071
SBIR & STTR[a]	31,081	31,081	31,081	31,081	31,081
Program Direction	249,817	249,817	249,817	249,817	249,342
Total	2,069,598	1,812,598	1,739,684	1,739,684	1,734,494

[a] Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs.

[b] Totals may not appear to add up to the total figure shown due to rounding.

Exhibit B-6 indicates the apportionment sequence as modified by Public Law 109-103. These values represent the amount of budget authority available for the CCTDP.

Exhibit B-6

Apportionment Sequence
(Dollars in Thousands)

FY	Annual	Cumulative
1986	99,400	99,400
1987	149,100	248,500
1988	199,100	447,600
1989	190,000	637,600
1990	554,000	1,191,600
1991	390,995	1,582,595
1992	415,000	1,997,595
1993	0	1,997,595
1994	225,000	2,222,595
1995	37,055	2,259,650
1996	150,000	2,409,650
1997	(2,121)	2,407,529
1998	(101,000)	2,306,529
1999	(40,163)	2,266,366
2000	(146,038)	2,120,328
2001	8,980	2,129,308
2002	8,290	2,137,598
2003	(47,000)	2,090,598
2004	(98,000)	1,992,598
2005	(160,000)	1,832,598
2006	(20,000)	1,812,598
2007	257,000	2,069,598

Appendix C. NEPA Actions and Status for Active Projects

Introduction

Projects under the clean coal technology demonstration programs comply with the procedural requirements of the National Environmental Policy Act (NEPA) and associated regulations promulgated by the Council for Environmental Quality (CEQ) at 40 Code of Federal Regulations (CFR) Parts 1500-1508, and by the U.S. Department of Energy (DOE) at 10 CFR Part 1021.

In carrying out NEPA, DOE examines the environmental aspects of each proposed demonstration project in the evaluation phase of the selection process. Each proposed project is rated against environmental evaluation criteria, which are heavily weighted in the scoring process.

Upon selection, project participants are required to prepare and submit additional environmental information. The detailed site- and project-specific information is used, along with independent information gathered by DOE, as the basis for site-specific NEPA documents that are prepared by DOE for each selected project. These NEPA documents are prepared, considered, and published in full conformance with CEQ and DOE regulations for NEPA compliance. The three possible documents that serve as outcomes of the NEPA process are outlined below.

Categorical Exclusions

"Subpart D — Typical Classes of Actions" of the DOE NEPA regulations provides for categorical exclusions (CX) as a class of actions that DOE has determined do not individually or cumulatively have a significant effect on the human environment.

Environmental Assessments

Environmental Assessments (EA) have the following three functions:

1. To provide sufficient evidence and analysis for determining whether a proposed action requires preparation of an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI);

2. To aid an agency's compliance with NEPA when no EIS is necessary; *i.e.*, to provide an interdisciplinary review of proposed actions, assess potential impacts, and identify better alternatives and mitigation measures; and

3. To facilitate preparation of an EIS when one is necessary.

The content of an EA is determined on a case-by-case basis and depends on the nature of the action. If appropriate, a DOE EA also includes any floodplain or wetlands assessment that has been prepared, and may include analyses needed for other environmental determinations.

If an agency determines on the basis of an EA that it is not necessary to prepare an EIS, a FONSI is issued. CEQ regulations describe the FONSI as a document that briefly presents the reasons why an action will not have significant effect on the human environment and for which an EIS therefore will not be prepared. The FONSI includes the EA, or a summary of it, and notes any other related environmental documents. The CEQ and DOE regulations also provide for notification of the public that a FONSI has been issued. Also, DOE provides copies of the EA and FONSI to the public on request.

Environmental Impact Statements

The primary purpose of an EIS is to serve as an action-forcing device to ensure that the policies and goals defined in NEPA are infused into the programs and actions of the federal government. An EIS contains a full and fair discussion of all significant environmental impacts. The EIS should inform decision-makers and the public of reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment.

The CEQ regulations state that an EIS is to be more than a disclosure document; it is to be used by federal officials in conjunction with other relevant material to plan actions and make decisions. Analysis of alternatives is to encompass those alternatives to be considered by the ultimate decision-maker, including a complete description of the proposed action. In short, the EIS is a means of assessing the environmental impacts of a proposed DOE action (rather than justifying decisions already made), prior to making a decision whether to proceed with the proposed action. Consequently, before a Record of Decision (ROD) is issued, DOE may not take any action that would have an adverse environmental effect or limit the choice of reasonable alternatives.

NEPA Actions and Status

Exhibit C-1 provides the NEPA action taken and the status of that action for each of the active clean coal technology demonstration projects. The projects are presented by program and are listed alphabetically within each program.

Exhibit C-1

NEPA Action and Status

Project	NEPA Action	Status
CCTDP		
Advanced Coal Conversion Process Demonstration	EA	FONSI issued 3/27/91
Clean Coal Diesel Demonstration Project	EA	FONSI issued 6/2/97
JEA Large-Scale CFB Combustion Demonstration Project	EIS	ROD issued 12/7/00
Kentucky Pioneer Energy IGCC Demonstration Project	EIS (Base Project) CX (Fuel Cell)	ROD issued 1/29/03 Completed 1/29/03
PPII		
Achieving NSPS Emission Standards Through Integration of Low-NO_x Burners with an Optimization Plan for Boiler Combustion	EA	FONSI issued 3/11/03
Big Bend Power Station Neural Network-Sootblower Optimization	CX	Completed 6/21/02
Commercial Demonstration of the Manufactured Aggregate Processing Technology Utilizing Spray Dryer Ash	EA	FONSI issued 10/2/02
Demonstration of a Full-Scale Retrofit of the Advanced Hybrid Particulate Collector (Advanced Hybrid™) Technology	EA	FONSI issued 6/11/02
Development of Hybrid FLGR/SNCR/SCR Advanced NO_x Control	N/A	Project withdrawn
Greenidge Multi-Pollutant Control Project	EA	FONSI issued 12/3/04
CCPI-1		
Advanced Multi-Product Coal Utilization By-Product Processing Plant	EA	FONSI issued 10/12/04
Demonstration of Integrated Optimization Software at the Baldwin Energy Complex	CX	Completed 2/18/04
Gilberton Coal-to-Clean Fuels and Power Co-Production Project	EIS	In process
Increasing Power Plant Efficiency – Lignite Fuel Enhancement	EA	FONSI issued 1/6/04
TOXECON Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers	EA	FONSI issued 9/19/03
Western Greenbrier Co-Production Demonstration Project	EIS	In process
CCPI-2		
Airborne Process Commercial Scale Demonstration	N/A	Negotiations ended
Demonstration of a 285-MWe Coal-Based Transport Gasifier	EIS	In process
Mercury Specie and Multi-Pollutant Control	CX	Completed 3/28/05
Mesaba Energy Project – Unit 1	EIS	In process

Appendix D. Acronyms, Abbreviations, and Symbols

¢	cent
°C	degrees Celsius
°F	degrees Fahrenheit
$	dollars (U.S.)
$/kW	dollars per kilowatt
$/ton	dollars per ton
%	percent
®	registered trademark
™	trademark
ACCP	advanced coal conversion process
ACFB	atmospheric circulating fluidized-bed
ADL	Arthur D. Little, Inc.
A/E	architect/engineering
AFBC	atmospheric fluidized-bed combustion
AHPC	Advanced Hybrid Particulate Collector
AI	artificial intelligence
API	application programming interface
ASTM	American Society of Testing Materials
atm	atmosphere(s)
avg.	average
B&W	The Babcock & Wilcox Company
BOP	balance of plant
BSA	by-product storage area
Btu(s)	British thermal unit(s)
Btu/kWh	British thermal units per kilowatt-hour
CAAA	Clean Air Act Amendments of 1990
CAER	Center for Applied Energy Research
CAIR	Clean Air Interstate Rule
CAMR	Clean Air Mercury Rule
CCT	clean coal technology
CCTDP	Clean Coal Technology Demonstration Program
CCTDP-I	First CCTDP solicitation
CCTDP-II	Second CCTDP solicitation
CCTDP-III	Third CCTDP solicitation
CCTDP-IV	Fourth CCTDP solicitation
CCTDP-V	Fifth CCTDP solicitation
CCPI	Clean Coal Power Initiative
CCPI-1	First CCPI solicitation
CCPI-2	Second CCPI solicitation
CD-ROM	Compact disk-read only memory
CDS	circulating dry scrubber
CEM	continuous emissions monitor
CEQ	Council on Environmental Quality
CFB	circulating fluidized-bed
CFBDS	circulating fluidized-bed dry scrubber
CFD	Computational Fluid Dynamics
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
COS	carbonyl sulfide
CSC	convective syngas cooler
CSI	Clear Skies Initiative
CUB	coal utilization by-product(s)
CURC	Coal Utilization Research Council
CWF	coal-water fuel
CX	Categorical Exclusion
DC/AC	direct current/alternating current
DCS	Distributed Control System
DEP	Department of Environmental Protection
DOE	U.S. Department of Energy
DOE/HQ	U.S. Department of Energy Headquarters
DSE	dust stabilization enhancement
EA	Environmental Assessment
EAF	equivalent availability factor
EEC	Environmental Elements Corporation
EIA	U.S. Energy Information Administration
EIS	Environmental Impact Statement
EIV	Environmental Information Volume
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act
EPRI	Electric Power Research Institute
ESP	electrostatic precipitator
FBC	fluidized-bed combustion
FD	forced draft
FE	Office of Fossil Energy
FERC	Federal Energy Regulatory Commission
FFDC	Fabric filter dust collector
FGD	flue gas desulfurization
FLGR	flue-lean gas reburn
FME	Fairbanks Morse Engine
FONSI	finding of no significant impact
FSQ	full-slurry quench
ft, ft^2, ft^3	foot (feet), square feet, cubic feet
FT	Fischer-Tropsch

FWEC	Foster Wheeler Energy Corporation
FY	fiscal year
gal	gallon(s)
gal/ft^3	gallons per cubic foot
GDP	gross domestic product
GHG	greenhouse gases
gob	coal waste used as a fuel
gpm	gallons per minute
gr	grains
GR	gas reburning
GRE	Great River Energy
GW	gigawatt(s)
GWe	gigawatt(s)-electric
H_2	molecular hydrogen
H_2S	hydrogen sulfide
H_2SO_4	sulfuric acid
HAPs	hazardous air pollutants
HCl	hydrogen chloride
HF	hydrofluoric acid
Hg	mercury
HHV	higher heating value
HMI	human-machine interface
HP	high pressure
hr.	hour(s)
HRSG	heat recovery steam generator
ID	induced draft
IGCC	integrated gasification combined-cycle
IGFC	integrated gasification fuel cell
in, in^2, in^3	inch(es), square inch(es), cubic inch(es)
kV	kilovolt
kW	kilowatt(s)
kWh	kilowatt-hour(s)
lb	pound
LHV	lower heating value
LLC	limited liability company
LNB	low-NO_x burner
LOI	loss-on-ignition
LP	low pressure
MACT	maximum achievable control technology
MCFC	molten carbonate fuel cell
MHz	megahertz
mills/kWh	mills per kilowatt-hour
min	minute(s)
mo	month(s)
MOU	Memorandum of Understanding
MSW	municipal solid waste
MW	megawatt(s)
MWe	megawatt(s)-electric
MWt	megawatt(s)-thermal
N_2	molecular nitrogen
N/A	not applicable
NAAQS	National Ambient Air Quality Standards
$NaHCO_3$	sodium bicarbonate
$NaNO_3$	sodium nitrate
NaOH	sodium hydroxide
Na_2CO_3	sodium carbonate
Na_2SO_4	sodium sulfate
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Council
NETL	National Energy Technology Laboratory
NH_3	ammonia
NH_4HCO_3	ammonium bicarbonate
NH_4NO_3	ammonium nitrate
$(NH_4)_2SO_4$	ammonium sulfate
Nm^3	normal cubic meter
NN-ISB	neural network-intelligent sootblowing system
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NSPS	New Source Performance Standards
NSR	New Source Review
O_2	molecular oxygen
O_3	ozone
O&M	operation and maintenance
PC	pulverized coal
PCD	particulate collection device
PCF	pulverized coal-fired
PCFB	pressurized circulating fluidized-bed
Petcoke	petroleum coke
PFBC	pressurized fluidized-bed combustion
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PON	Program Opportunity Notice
PPII	Power Plant Improvement Initiative
PRB	Powder River Basin
ppm	parts per million (mass)
ppmv	parts per million by volume
PSC	Public Service Commission
PSDF	Power Systems Development Facility
psi	pound(s) per square inch
psia	pound(s) per square inch absolute
psig	pound(s) per square inch gauge
Pty	Proprietary
Pub.L.	Public Law
R&D	research and development
RD&D	research, development, and demonstration
RDF	refuse-derived fuel
RFP	request for proposals
ROD	Record of Decision
ROM	run-of-mine
rpm	revolutions per minute
S	sulfur
SAP	sulfuric acid plant

SBIR	Small Business Innovation Research
SCA	site certification application
scf	standard cubic feet
scfm	standard cubic feet per minute
SCR	selective catalytic reduction
SCS	Southern Company Services, Inc.
SDA	spray dryer absorber
SIP	State Implementation Plan
SNCR	selective noncatalytic reduction
SO_2	sulfur dioxide
SO_3	sulfur trioxide
SOFA	separated overfire air
SOFC	solid oxide fuel cell
SOW	statement of work
STTR	Small Business Technology Transfer Programs
syngas	synthetic gas
TBD	to be determined
TRI	Toxics Release Inventory
TVA	Tennessee Valley Authority
UAF	University of Alaska, Fairbanks
U.K.	United Kingdom
UKRF	University of Kentucky Research Foundation
U.S.	United States
VIP	value improving practices
w.c.	water column
w.g.	water gage
WGC	Western Greenbrier Co-Generating LLC
WMPI	Waste Management Processors, Inc.
wt.	weight
yr.	year(s)

State Abbreviations

AK	Alaska
AL	Alabama
AR	Arkansas
AZ	Arizona
CA	California
CO	Colorado
CT	Connecticut
DC	District of Columbia
DE	Delaware
FL	Florida
GA	Georgia
HI	Hawaii
IA	Iowa
ID	Idaho
IL	Illinois
IN	Indiana
KS	Kansas
KY	Kentucky
LA	Louisiana
MA	Massachusetts
MD	Maryland
ME	Maine
MI	Michigan
MN	Minnesota
MO	Missouri
MS	Mississippi
MT	Montana
NC	North Carolina
ND	North Dakota
NE	Nebraska
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NV	Nevada
NY	New York
OH	Ohio
OK	Oklahoma
OR	Oregon
PA	Pennsylvania
PR	Puerto Rico
RI	Rhode Island
SC	South Carolina
SD	South Dakota
TN	Tennessee
TX	Texas
UT	Utah
VA	Virginia
VI	Virgin Islands
VT	Vermont
WA	Washington
WI	Wisconsin
WV	West Virginia
WY	Wyoming

Other

Some companies have adopted an acronym as their corporate names. The following corporate names reflect the former name of the company.

BG/L	British Gas Lurgi
JEA	Jacksonville Electric Authority
KBR	Kellogg Brown & Root, Inc.
KRW	Kellogg Rust Westinghouse

Index of Projects and Participants