
Comprehensive Report to Congress:

**Proposals Received in Response
to the Clean Coal Technology V
Program Opportunity Notice**



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I. EXECUTIVE SUMMARY

This report is a comprehensive overview of all proposals received and the projects that were selected in response to the Program Opportunity Notice (PON) for the Clean Coal Technology V (CCT-V) Demonstration Projects (solicitation number DE-PS01-92FE62647). The Department of Energy (DOE) issued the solicitation on July 6, 1992. Through this PON, DOE solicited proposals to conduct cost-shared Clean Coal Technology (CCT) projects that advance significantly the efficiency and environmental performance of coal-using technologies and that are applicable to either new or existing facilities.

The CCT-V PON was the fifth in a series of five solicitations that were conducted by DOE. This technology development program is jointly funded by government and private industry. It was designed to take the best and most promising of the advanced Clean Coal Technologies and move them into the commercial marketplace. These demonstrations will be at a scale large enough to generate the data necessary for the private sector to judge the potential of the demonstrated technologies and to make informed commercial decisions.

Clean Coal Technology Demonstration Program

The CCT Demonstration Program represents a national commitment of nearly \$6.7 billion by the Government and private sector to demonstrate economic and environmentally sound methods for using coal, the Nation's most abundant energy resource. The Program fosters the energy efficient use of the Nation's vast coal resource base. By doing this, the program contributes significantly to the long term energy security of the United States, furthers the Nation's objective for a cleaner environment, and improves the competitive standing of the United States in the international energy market.

The Program currently consists of five parts, CCT-I through CCT-V. Each part corresponds to a separate solicitation for industry proposed, cost-shared demonstration projects. There are a total of 41 projects currently in the program: eight in CCT-I, 12 in CCT-II, 13 in CCT-III, and eight in CCT-IV. Five additional projects were recently selected under the CCT-V solicitation which is the subject of this report.

Clean Coal Technologies

The term "Clean Coal Technology" refers to a new generation of advanced coal utilization technologies that are environmentally cleaner, more efficient, and less costly than conventional coal-using processes. These new energy and pollution control systems are the products of years of research and development in hundreds of government and private laboratories throughout the world. Commercial demonstration of these technologies is the final development step from the research laboratory to the marketplace.

The common thread running through the many advanced clean coal concepts is the ability to use a variety of domestic coals more efficiently than currently practiced while better protecting the environment. Several of these concepts have the added advantage of boosting an existing power plant's electrical output, possibly forestalling expensive investment in new power generating capacity. Others can be added in modular fashion to match more closely a utility's supply and demand requirements.

Contents of this Report

The subject of this "Comprehensive Report to Congress" is the response to the CCT-V PON. Chapter II presents the CCT-V Projects selected for negotiation leading to award. It also contains an overview of the CCT-V PON and a summary of the proposal evaluation process. Chapter III provides an overview of the technologies and the geographic locations of the proposed projects.

The environmental considerations which are an integral part of the CCT Program are explained in Chapter IV. It outlines the strategy for addressing the requirements of the National Environmental Policy Act (NEPA) as well as the strategy for monitoring and documenting the environmental performance of the demonstration projects during implementation.

Appendix A contains additional project information about each of the 24 proposals submitted.

II. THE CLEAN COAL TECHNOLOGY V PON

On November 13, 1991, Public Law 102-154, the Department of the Interior and Related Agencies Appropriations Act, 1992 (Act), was signed into law. This Act, among other things, provided funds to DOE to conduct cost-shared Clean Coal Technology Projects, for the design, construction, and operation of facilities that "... *shall advance significantly the efficiency and environmental performance of coal-using technologies and be applicable to either new or existing facilities...*" This Act directed DOE to issue the fifth solicitation of the CCT Program no later than July 6, 1992 and specified that selection of Projects for negotiations shall take place "... *not later than ten months after the issuance date for the fifth general request for proposals.*"

The Act, together with Public Law 101-512, made available a total of \$600 million for the fifth general request for Proposals under the Clean Coal Technology Program. Of these monies, \$7.2 million were required to be reprogrammed for the Small Business and Innovative Research Program and \$25.0 million were designated for the Program Direction funds for costs incurred by DOE for implementation of the CCT-V Program. All of the remaining appropriated funds, \$567.8 million were available for Award under the CCT-V PON.

On December 7, 1992, DOE received 24 proposals in response to the CCT-V solicitation. One proposal, which was received after the deadline date, did not qualify under any of the exceptions for late proposals specified in the PON and was thereby not considered in the evaluation process.

The selection of five projects was announced on May 4, 1993 by Secretary of Energy, Hazel R. O'Leary. Immediately following the selection announcement, DOE officials briefed representatives of the selected projects on the negotiation process and emphasized that their full cooperation would be needed to negotiate a Cooperative Agreement within one year. This mandate was established by the Secretary of Energy in a directive (SEN-14-89) issued on December 15, 1989 to streamline the process used to negotiate and approve cooperative agreements for CCT projects.

A chronology of major events related to the CCT-V solicitation is listed in Table 1.

Table 1 - Chronology of Major Events

Public Meeting - Cheyenne, Wyoming	October 30, 1991
Public Meeting - Louisville, Kentucky	November 12, 1991
Pub. L. 102-154 Enacted	November 13, 1991
Designation of PON Drafting Team	November 20, 1991
Source Selection Official Designated	January 22, 1992
Federal Register Notice for Draft PON Published	April 6, 1992
CBD Notice for Draft PON Published	April 6, 1992
Draft PON Issued for Public Comment	April 20, 1992
End of Public Comment Period	May 15, 1992
Final PON Issued	July 6, 1992
Preproposal Conference	August 6, 1992
Preproposal Conference Proceedings Issued	August 14, 1992
Source Evaluation Board Established	August 28, 1992
Additional Questions and Answers Issued	November 16, 1992
Closing Date for Receipt of Proposals	December 7, 1992
Issuance of Public Abstracts	December 8, 1992
Selection of Proposals	May 4, 1993

Public Meetings

DOE convened two public meetings to obtain views, comments and recommendations on the forthcoming CCT-V solicitation. The meetings took place in Cheyenne, Wyoming, on October 30, 1991 and Louisville, Kentucky, on November 12, 1991. Each meeting included a plenary session during which DOE officials made introductory remarks and presented program overviews. Attendees then broke into small discussion groups to explore issues pertaining to the CCT-V solicitation. At the conclusion of the group discussions, attendees reconvened in a closing session which included highlights and recommendations from the group discussions and a question and answer period. Meeting proceedings, including recommendations from the breakout groups, were published.

Issuance of the CCT-V PON

DOE issued the Draft PON for the Clean Coal Technology V solicitation for public comment on April 16, 1992. Notification of the PON availability was published in the Federal Register and Commerce Business Daily on April 6, 1992. The Final PON, released to the public on July 6, 1992, took into consideration the public comments received concerning the Draft PON.

Each person or company on the Source List of the Office of Clean Coal Technology received copies of the Draft and Final PON. This Source List included more than 3,000 companies and organizations that had expressed an interest in the Clean Coal Technology Program. In addition to the parties who requested copies of the previous four solicitations, the Source List contained the names of those who responded to the Federal Register and Commerce Business Daily notices of Availability of the Draft and Final PON for CCT-V as well as those who attended the public meetings held before the Draft PON for CCT-V was issued.

To enable prospective Proposers to gain a better understanding of the objectives of the CCT-V PON, and to provide Proposers with answers in response to written questions that had been submitted regarding the PON, a "Preproposal Conference" was held on August 6, 1992 in Washington, DC. On August 14, 1992, all recipients of the PON and all attendees of the "Preproposal Conference" received the Proceedings from the conference which included the questions and answers received prior to, and at, the conference as well as the registration sheets of the attendees. On November 16, 1992, all prospective Proposers received an additional set of answers to questions regarding the CCT-V PON that were received subsequent to the August 14, 1992 mailing of the Proceedings from the "Preproposal Conference".

The Evaluation Process

In announcing the selection of proposals for negotiation leading to awards, the Source Selection Official (SSO), in his Selection Statement¹, provided an overview of the process used to evaluate the Proposals received. Evaluations were performed by the Source Evaluation Board (SEB). The following is a description of the evaluation process.

Qualification Review

The PON established that a Proposal would need to successfully pass "Qualification" in order to be considered in the "Preliminary Evaluation" phase. The PON informed the prospective Proposers that failure to meet one or more of the "Qualification Criteria" set forth in the PON would result in rejection of the Proposal. The "Qualification Criteria" were stated in the CCT V PON as follows:

- *"The proposed Demonstration Facility must be located in the United States."*
- *"The proposed Demonstration Facility must be designed for and operated with coal. These coals must be from mines located in the United States."*
- *"The Proposer must agree to provide a cost share of at least 50 percent of total allowable Project cost, with at least 50 percent in each of the Budget Periods."*
- *"The Proposer must have access to, and use of, the proposed site of the Demonstration Facility and any proposed alternate site for the duration of the Demonstration Project."*
- *"The proposed Project Team must be identified and firmly committed to fulfilling its proposed role in the Project."*
- *"The Proposer agrees that, if selected, it will submit a "Repayment Agreement" consistent with Section 7.7."*
- *"The Proposal must be signed by a responsible official of the proposing organization authorized to contractually bind the organization to the performance of the Cooperative Agreement in its entirety."*

¹ See Selection of Proposals for Negotiation of Cost Shared Cooperative Agreements for Demonstration of Clean Coal Technologies under Program Opportunity Notice DE-PS01-92FE62647, The Clean Coal Technology V Solicitation, Office of Fossil Energy, signed May 4, 1993, by the Source Selection Official, C. Lowell Miller, Associate Deputy Assistant Secretary for Fossil Energy.

Of the 24 proposals submitted in response to the CCT-V PON, only one proposal did not successfully pass the "Qualification Evaluation" criterion and therefore was not considered for further evaluation.

Preliminary Evaluation

The PON required that a "Preliminary Evaluation" be performed on all proposals that successfully passed the "Qualification Review". In order to be considered in the "Comprehensive Evaluation" phase, a proposal must be consistent with the stated objective of the PON, and must contain sufficient finance, management, technical, cost, and other information in order to enable "Comprehensive Evaluation" described in the solicitation to be performed. Additionally, the proposal must contain an explicit financing plan for the project. All of the remaining 23 proposals passing the "Qualification Review" also passed the "Preliminary Evaluation".

Comprehensive Evaluation

Proposers passing "Preliminary Evaluation" would have their Demonstration Proposal (Volume II), Commercial Concept Proposal (Volume III), and Cost and Finance Proposal (Volume IV) evaluated. The "Comprehensive Evaluation" was performed against criteria in two categories: "Technical Evaluation" and "Cost and Finance Evaluation". During the "Comprehensive Evaluation" of proposals, one Proposer withdrew its proposal from further consideration, leaving 22 Proposals.

Technical Evaluation Criteria

The "Technical Evaluation" criteria were divided into two major categories: (1) "Demonstration Project Factors" used to assess the technical and environmental merit of the Project and the technical and management approaches to execute the Project; and (2) "Commercialization Factors" used to assess the potential of the proposed technology to significantly improve environmental performance and efficiency in new or existing facilities and to achieve wide commercial acceptance. "Commercialization Factors" also assessed the cost effectiveness of the proposed technology against existing technologies.

The "Demonstration Project Factors" were as follows:

- Technical Readiness;
- Adequacy, Appropriateness and Relevance of Demonstration;
- Environmental, Health, Safety, Socioeconomic, and Other Site-Related Aspects; and
- Technical and Management Approaches.

The "Commercialization Factors" were as follows:

- Environmental Performance;
- Energy Efficiency;
- Cost Performance; and
- Commercialization Potential.

Cost and Finance Criteria

The PON specified that the "Cost and Finance" Evaluation would be conducted to determine the reasonableness of the cost estimate for completing the Statement of Work (SOW). This evaluation was also used to assess the capability and commitment to finance the Demonstration Project.

The "Cost and Finance Criteria" were as follows:

- Reasonableness of Cost Estimate;
- Funding of the First Budget Period;
- Funding of the Remaining Budget Periods; and
- Project Team Commitment.

Relative Importance of the Evaluation Criteria

The PON provided that the "Technical Evaluation Criteria" would be three times as important as the "Cost and Finance Evaluation Criteria" and that the "Technical Evaluation Criteria" would be given the following weights:

<u>Demonstration Project Factors</u>	
Technical Readiness	20%
Adequacy, Appropriateness, and Relevance of the Demonstration	15%
EHSS and other Site-Related Aspects	5%
Technical and Management Approaches	<u>10%</u>
SUBTOTAL - Demonstration Project Factors	50%
<u>Commercialization Factors</u>	
Environmental Performance	15%
Energy Efficiency	15%
Cost Performance	10%
Commercialization Potential	<u>10%</u>
SUBTOTAL - Commercialization Factors	<u>50%</u>
TOTAL	<u>100%</u>

The PON further specified that within the "Cost and Finance Criteria" each criterion would be given the following weight:

Reasonableness of the Cost Estimate	15%
Funding of the First Budget Period	35%
Funding of the Remaining Budget Periods	40%
Project Team Commitment	<u>10%</u>
TOTAL	<u>100%</u>

Discussions with Proposers

Given the number of proposals received and the statutory deadline for completing the evaluations and making the selection decision, no written or oral discussions were conducted with any of the proposers.

Program Policy Factors

The Proposers were advised by means of the PON that the following "Program Policy Factors" could be used by the SSO to select a range of projects that would best serve the program objectives:

- *"The desirability of selecting Projects that collectively represent a diversity of methods, technical approaches, and applications."*
- *"The desirability of selecting Projects that collectively utilize a broad range of U.S. coals and are in locations which represent a diversity of EHSS, geographic, and climatic conditions."*

In the "Program Policy Factors," the word "collectively" was meant to include Projects selected in this Clean Coal Technology V solicitation and prior Clean Coal solicitations, as well as, other ongoing demonstrations in the United States.

Other Considerations

The PON provided that in making selections, DOE would consider giving preference to projects located in States for which the rate-making bodies of those States treat the Clean Coal Technologies the same as pollution control projects or technologies. This consideration could be used as a tie-breaker if, after application of the evaluation criteria and the program policy factors, two projects received identical evaluation scores and remained essentially equal in value. This consideration would not be applied if, in doing so, the regional geographic distribution of the projects would be altered significantly.

Compliance With the National Environmental Policy Act (NEPA)

The strategy for compliance with the National Environmental Policy Act (NEPA) of 1969 that was developed for the CCT-I solicitation was continued in CCT-V. It is consistent with the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Parts 1500-1508) and DOE regulations for compliance with NEPA (10 CFR Part 1021). This strategy includes the preparation and publication of a Programmatic Environmental Impact Statement (PEIS) and the report of the SEB on the project specific environmental review of each of the 22 proposals that underwent Comprehensive Evaluation. After selection, DOE will prepare project specific NEPA documentation for each selected Demonstration Project. (See Section IV of this Report.)

No action taken by DOE with regard to any proposal prior to the completion of the site-specific analysis, including award of a Cooperative Agreement, would be considered to be a final decision for purposes of compliance with NEPA.

Programmatic Environmental Impact Statement

On November 3, 1989, DOE issued "Clean Coal Technology Demonstration Program: Final Programmatic Environmental Impact Statement", (DOE/EIS-0146). The EPA announced the availability of this document in a notice published in the Federal Register on November 14, 1989 (54 F.R. 47127). The Record of Decision approving the PEIS was published in the Federal Register on December 14, 1989 (54 F.R. 51313).

The proposed action evaluated in the PEIS was the selection of projects proposed under the Clean Coal Technology Program. The PEIS analysis included an evaluation of environmental consequences of widespread commercialization of successfully demonstrated Clean Coal Technologies.

CCT-V Pre-Selection Project Specific Environmental Review

The second element of the NEPA strategy that was implemented and made available to the SSO was the SEB's Report, "Clean Coal Technology V Pre-Selection Project Specific Environmental Review". This confidential report evaluated the specific environmental, health, safety and socioeconomic (EHSS) effects associated with each of the proposed demonstration projects. The SEB's report summarized the strengths and weaknesses of each proposal relative to the EHSS criteria, discussed any available alternative sites and/or processes, and described potential environmental impacts, mitigation strategies, and permit requirements.

Selection Decision

After considering the evaluation criteria, the Program Policy Factors, and the NEPA strategy as identified in the PON, the SSO selected five projects as best furthering the objectives of the CCT-V PON. These projects are listed in Table 2. Brief summaries follow for each selected project. Fact sheets of all proposals successfully passing Qualification Review are contained in Appendix A.

1. Air Products and Chemicals, Inc.

The participant will design, construct, and operate a cogeneration facility based on a Second Generation Pressurized Fluidized Bed system concept at its chemicals manufacturing facility at Calvert City, Kentucky. This concept integrates a pressurized circulating fluidized bed combustor (PFBC) and pyrolizer to fuel a gas turbine topping cycle and power a steam turbine bottoming cycle. The integration of the pyrolizer, advances in the PFBC, and high efficiency, low NO_x turbine topping combustor improves the performance of the proposed concept when compared to first generation pressurized PFBC technology. The demonstration project will produce electricity and process steam on an existing industrial site. It will replace two, 30 year old, coal fired steam boilers and one gas fired boiler currently used to supply process steam. In spite of increasing the total power produced at the site, SO₂ emissions are projected to decrease significantly with NO_x remaining essentially constant. Particulate matter, CO₂, and CO will also be reduced substantially from levels currently being emitted. The commercial embodiments of the proposed concept include utility power generation, utility repowering, and industrial cogeneration.

2. Centerior Energy Corporation

Centerior Energy Corporation, on behalf of CPICOR Management Company, a joint venture company composed of Centerior Energy Corporation, LTV Steel Company, Inc., and Air Products and Chemicals, Inc., will demonstrate a new industrial process for the production of Clean Power from Integrated Coal/Ore Reduction (CPICOR). CPICOR is a process which is able to produce both power and iron from a wide range of United States coals and iron ores. The facility to be built at LTV Steel Company's Cleveland works will demonstrate the integrated production of hot metal via the COREX[®] direct ironmaking process and the production of electric power from a combined cycle power plant fueled by the export gas from the COREX[®] process. The COREX[®] portion of the process features integrated coal gasification and iron ore reduction to generate iron from a variety of iron ores. This combined approach eliminates the need for separate coke ovens and reduces air emissions when compared with conventional coke oven/blast furnace operations. The excess reducing gas from the iron ore reduction step is used to feed an integrated combined cycle power generation facility. The facility also integrates the operation of an air separation unit which adds to the improved overall efficiency.

3. Duke Energy Corporation

The Camden Clean Energy Partners Limited Partnership, made up of Duke Energy Corporation, General Electric Company, and Air Products and Chemicals, Inc., will design and build an independently-owned 480 megawatt advanced integrated gasification combined cycle power plant in an industrial redevelopment area in Camden, New Jersey. Power from the 480 megawatt plant will be sold to Public Service Electric & Gas Company through an anticipated power sales agreement. The Camden Clean Energy Project will demonstrate the British Gas/Lurgi fixed-bed oxygen-blown gasifier technology in which coal is gasified (the project will use high sulfur coal from West Virginia) to produce a clean gas that is combusted in advanced gas turbines. Turbine exhaust will be used to produce steam to drive a steam turbine in a second cycle. These two "combined" cycles will make the integrated gasification combined cycle (IGCC) plant up to 20 percent more efficient than a conventional coal plant, while minimizing levels of SO₂, NO_x, and particulates to levels well below the most stringent environmental standards. The project will also include a first-time demonstration of a molten carbonate fuel cell, which will be operated with a portion -- enough to produce 2.5 megawatts of power -- of the clean coal gases.

4. Easton Utilities and Arthur D. Little, Inc.

Easton Utilities, Cooper Energy Services, and Arthur D. Little have teamed to build a two-stationary diesel engine power system that will add 14-megawatts of power to the existing 25MW at Easton's Plant Number Two in Easton, Maryland. The diesels, fired by a coal water slurry (CWS), will be operated as part of a combined cycle power plant, with exhaust from the engines passing through a heat recovery boiler to produce steam for

a steam turbine. The diesel system is expected to achieve 45 percent efficiency in this demonstration, with larger systems expected to attain 48 percent efficiencies. NO_x emissions will be controlled by a selective catalytic reduction unit. A dry flue gas scrubber and baghouse will control SO₂ and particulates, respectively. The system will use coal-water slurry produced from Ohio coal by a two-stage coal cleaning and slurring process. Power from the project will serve the Town of Easton and the DELMARVA power grid. Emissions from these two CWS-fired diesel generators are projected to be substantially less than the comparably sized units at the site currently fired with heavy fuel oil. The 10-100 megawatt capacity range of the technology is targeted at small utility (municipalities) and industry cogeneration systems.

5. Pennsylvania Electric Company

Pennsylvania Electric Company will repower one of the existing 47 megawatt steam turbines at its Warren Station on the Allegheny River in Warren County, Pennsylvania, with the addition of an externally-fueled gas turbine, resulting in a combined cycle power plant. The externally fired system is centered around a ceramic heat exchanger -- capable of withstanding the high firing temperatures of modern gas turbines -- and an atmospheric combustor which replace the conventional combustion system. Because the gas turbine operates on indirectly heated clean air, the gas path is never exposed to corrosive elements in the fuel. The new gas turbine will generate 18.3 megawatts, for a combined total net plant output of 62.4 megawatts. The repowered unit's efficiency will be a 28.6 percent improvement over the existing unit. Air quality at the site will be improved as a result of substantial reductions in SO₂, NO_x, particulate, and volatile organic compounds from the repowered unit. Other team members include Black & Veatch and Hague International.

Table 2 CLEAN COAL TECHNOLOGY V PROJECTS SELECTED BY DOE

<u>Proposer</u>	<u>Technical Approach</u>	<u>Project Location</u>
Air Products & Chemicals	Electric Power Generation; second generation Pressurized Fluid Bed Combustion	Calvert City, Kentucky
Centerior	Electric Power Generation; cogeneration of hot iron metal and power by gasification	Cleveland, Ohio
Duke Energy Company	Electric Power Generation; Integrated Gasification Combined Cycle, the British Gas/Lurgi oxygen blown slagging gasifier; fuel cell using a slip stream from gasifier	Camden, New Jersey
Easton Utilities and Arthur D. Little	Electric Power Generation; Direct combustion of coal/water slurry in a diesel	Easton, Maryland
Pennsylvania Electric Power Company	Electric Power Generation; externally fired system using ceramic Heat exchanger	Warren, Pennsylvania

III. DESCRIPTIONS OF CCT-V PROPOSALS RECEIVED

Twenty-four proposals were received in response to the CCT-V PON. The proposals exhibited substantial diversity in terms of technologies, project size and duration, geographic distribution, type of coal used, as well as environmental and commercialization characteristics. One Proposer, Dakota Gasification Company, withdrew its proposal during the evaluation leaving 23 proposals. The following discussion provides an overview of the technologies and geographic distribution of the Proposals received. This discussion provides only limited information on the characteristics of each Proposal. The reader is referred to Appendix A for summary descriptions of each proposed project.

Technologies Proposed

The Projects proposed can generally be assigned to one of four technology types. These include: Electric Power Generation; Industrial Processes; New Fuel Forms Production; and Other. The number of Proposals received in each category are shown in Table 3.

**Table 3 DISTRIBUTION OF PROPOSALS BY
TECHNOLOGY**

<u>Technology</u>	<u>Number of Proposals</u>
Electric Power Generation	14
Industrial Processes	3
New Fuel Forms	5
Other	1

Table 4 identifies the Proposer, technology and technical approach associated with each Proposal.

Table 4 PROPOSED TECHNICAL APPROACHES BY TECHNOLOGY

Technology	Proposer	Technical Approach
Electric Power Generation	Air Products and Chemicals, Inc.	Advanced Pressurized Circulating Fluidized Bed
	Airpol, Inc.	Direct, Coal-fired, Combined Cycle Turbine
	The Babcock & Wilcox Company	Advanced Pressurized Fluidized Bed
	Duke Energy Corp.	Advanced Integrated Gasification Combined Cycle With Carbonate Fuel Cell
	Easton Utilities and Arthur D. Little, Inc.	Coal Fueled Diesel Combined Cycle
	Energotechnology Corp. and ABB Energy Ventures, Inc.	Integrated, Advanced Steam Conditions, Coal Fired Power Plant
	Energy Resources and Logistics	Natural Gas Diesels, PC Coal Fired Boiler
	Leas Industrial Associated	Integrated, Gasification Combined Cycle to Co-Produce Liquid Fuels and Power
	MHD Development Corporation	Coal-fired magnetohydrodynamic generating facility
	Midwest Power Systems, Inc.	Advanced, pressurized circulating fluidized bed

Table 4 (continued)

Technology	Proposer	Technical Approach
Electric Power Generation	M-C Power Corporation	Fuel Cell Demonstration Utilizing Coal Gas
	Pennsylvania Electric Company	Externally Fired Combined Cycle
	Tennessee Valley Authority	Integrated Gasification Combined Cycle With Fertilizer Production
	University of Minnesota	Pressurized Fluidized Bed Combustor and an Atmospheric Fluidized Bed Combustor
Industrial Processes	Centerior Energy	Integrated Iron Ore Reduction With Power Generation
	Lin Technologies, Inc.	Fluidized Lime Reactor
	ThermoChem, Inc.	Pulse Stabilized Atmospheric Fluidized Bed Combustor to Produce Steam
New Fuel Forms Production	Amax Coal West, Inc.	Coal Drying and Briquetting
	Amax Coal Company - Midwest	Integrated Coal Cleaning and Drying

Table 4 (continued)

Technology	Proposer	Technical Approach
	Char-Fuels Associates Limited Partnership	Coal Refining
	West Virginia CLC Corporation	Coal Liquids, Char and Coke Mild Gasification
	Calderon Energy Company	Liquid Fuels and Power

Other	Mohawk-Environmental Services	Not specified in Public Abstract
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Geographic Distribution

The geographic location of each of the 23 Proposed Projects is shown in Table 5.

Table 5 GEOGRAPHIC LOCATIONS OF PROPOSED PROJECT SITES

State	Proposer	Project Site
Alabama	Tennessee Valley Authority*	Cherokee, Colbert County
	Tennessee Valley Authority*	Kogers Island, Colbert County
Delaware	Energotechnology Corp. & ABB Energy Ventures, Inc.*	Claymont, New Castle County
Illinois	Amax Coal Company - Midwest	Keensburg, Wabash County
Indiana	Lin Technologies, Inc.*	Richmond
	M-C Power Corp.	West Terre Haute, Vigo County
	Leas Industrial Associates	Mount Vernon, Posey County
Iowa	Midwest Power Systems, Inc.	Pleasant Hill, Polk County
Kentucky	Tennessee Valley Authority*	Hickman, Fulton County
	Air Products & Chemicals, Inc.	Calvert City, Marshall County

Table 5 (continued)

State	Proposer	Project Site
Maryland	Airpoi, Inc.	Hagerstown, Washington County
	Easton Utilities & Arthur D. Little, Inc.*	Easton, Talbot County
Minnesota	University of Minnesota	Minneapolis, Hennepin County
Montana	MHD Development Corp.	Butte, Yellowstone County
New Jersey	Duke Energy Corp.	Camden, Camden County
North Dakota	The Babcock & Wilcox Company	Center, Oliver County
Ohio	Centerior Energy Corp.	Cleveland, Cuyahoga County
	Calderon Energy Company	Bowling Green, Wood County
	Easton Utilities & Arthur D. Little, Inc.*	Sugarcreek, Tuscaramus County
	Lin Technologies, Inc.*	Columbus, Franklin County

Table 5 (continued)

State	Proposer	Project Site
Pennsylvania	Pennsylvania Electric Company	Warren, Warren County
South Carolina	ThermoChem, Inc.	Clemson, Pickens County
Tennessee	Tennessee Valley Authority*	Memphis, Shelby County
	Tennessee Valley Authority*	Tiptonville, Lake County
Unknown	Mohawk	
West Virginia	West Virginia CLC Corp.*	Alloy
	West Virginia CLC Corp.*	Princeton
	Energy Resources and Logistics	Greenbrier, White Sulfur Springs
	Energotechnology Corp. & ABB Energy Ventures, Inc.*	Nicholas, Kanawha and Clay Counties
Wyoming	Char-Fuels Associates Limited Partnership	Glenrock, Converse County
	Amax Coal West, Inc.	Gillette, Eagle Butte Mine

* - Indicates more than one proposed project site.

IV. ENVIRONMENTAL CONSIDERATIONS

The Clean Coal Technology Demonstration Program has a strong environmental orientation. A number of approaches have been implemented to keep environmental considerations an integral part of Clean Coal Demonstrations. These approaches involve two kinds of environmental activities. One involves the National Environmental Policy Act (NEPA) to satisfy the statutory requirements of DOE and the other involves monitoring environmental and health impacts and performance over the lifetime of the project. These two types of activities are explained below.

NEPA Strategy

The overall strategy implemented to achieve compliance with NEPA includes both programmatic and project specific environmental impact considerations, during and subsequent to the selection process. These have ensured that environmental factors are fully evaluated and integrated into the decision-making process in order to satisfy DOE's NEPA responsibilities.

Proposers were required to submit both programmatic and project-specific environmental data as part of the proposal. DOE evaluated the environmental data and analyses submitted as part of the review process. Major elements of the NEPA strategy are summarized below.

Programmatic Environmental Impact Statement

DOE has prepared a Programmatic Environmental Impact Statement (PEIS) on the Clean Coal Technology Demonstration Program. The final PEIS was published on November 3, 1989, drawing upon a draft PEIS published in June 1989, and the Programmatic Environmental Impact Analysis completed for the CCT-II solicitation and published in September 1988. Comments on the scope of the PEIS were sought in a Federal Register notice dated February 7, 1989. The PEIS evaluates two alternatives: "no action," which assumes the CCT Program is not continued and conventional coal-fired technologies with conventional flue gas desulfurization controls continue to be used; and a "proposed action," alternative which assumes that CCT Program projects are selected for funding and successfully demonstrated with technologies entering widespread commercialization by the year 2010. The analyses of environmental consequences focuses on changes to four emissions of concern: SO₂, NO_x, CO₂, and solid wastes. An upper bound of change to each of these four parameters was estimated for each of 22 generic Clean Coal Technologies separately, assuming full penetration of potential markets.

DOE received comments on the draft PEIS and subsequently provided them in an appendix to the final document. The text of the final PEIS was modified where appropriate. After the required 30-day waiting period following issuance of the final PEIS, a Record of Decision to proceed with the CCT Program was published in the Federal Register on December 14, 1989 (54 FR 51313).

Project-Specific Environmental Review

For proposals that underwent comprehensive evaluation, DOE prepared a project-specific environmental review of material pertinent to selection. The reviews summarized the strengths and weaknesses of each proposal against the Environmental Evaluation criterion, including (1) adequacy and appropriateness of proposed approaches for meeting or exceeding all environmental, health, safety, and socioeconomic (EHSS) requirements and minimizing potentially adverse EHSS impacts of the Proposed Demonstration Project, and (2) the suitability, quality, and adequacy of the site(s) and/or facility(ies) for the Proposed Demonstration Project. Due to the confidential content of this document, it is not available to the public.

Post-Selection NEPA Review

Upon award of federal financial assistance, Proposers are required to submit additional environmental information in the form of an Environmental Information Volume (EIV) as specified in Appendix J of the CCT-V PON. This detailed site and project-specific information is to be used, along with independent information gathered by DOE, as the basis for site-specific NEPA documents to be prepared by DOE for each selected project. Such NEPA documents are to be prepared, considered, and published in full conformance with the Council on Environmental Quality's (CEQ) NEPA regulations in advance of a decision by DOE to share costs beyond preliminary design.

Federal funds from the Clean Coal Technology Demonstration Program cannot be provided for construction, operation, and/or dismantlement until, following completion of the NEPA review process, a determination has been made to proceed with the particular project.

Environmental Monitoring Review

DOE views the development of an information base for the assessment of environmental impacts to be an important component for future commercialization of the demonstration project. Environmental monitoring should identify the environmental constraints and/or

advantages of potential commercial versions of the demonstrated technology. In addition, environmental monitoring may be necessary to detect any environmental and health problems requiring remedial actions, and to confirm the performance of environmental mitigation measures implemented as part of the project. Towards these ends, DOE requires that the participant (i.e., selected proposer) perform a broad range of monitoring activities related to potential environmental and health impacts of the project and technology.

Monitoring activities are documented in the form of an Environmental Monitoring Plan (EMP). Guidelines for the preparation of the EMP were presented in Appendix N of the CCT-V solicitation. The EMP is developed in consultation with, and subsequently approved, by DOE. It is subject to revision and updating as the project progresses. The EMP is described below.

Environmental Monitoring Plan

DOE requires the Participant to complete an EMP and to address two classes of monitoring activity: Compliance Monitoring and Supplemental Monitoring.

Compliance Monitoring is required by other agencies of Federal, State and Local Government (other than DOE) to satisfy statutes, regulations, and terms of leases, permits, grants, and other requirements. The EMP documents the extent of compliance monitoring activities, provides for reporting of relevant results to DOE, and shows their relationship to monitoring activities to meet the objectives of Supplemental Monitoring.

Supplemental monitoring is required in addition to Compliance Monitoring to establish the environmental characteristics and potential impacts of the Clean Coal Technology and associated facilities, processes and activities. This monitoring is intended to satisfy two objectives: (1) to develop the information base for identification, assessment, and mitigation of environmental problems associated with the replication of the technology; and (2) to identify and confirm environmental impacts and performance predicted in the NEPA documentation.

The EMP contains the following information:

- **EMP Purpose and Scope**--Definition of the overall approach to the monitoring and measurement activities.
- **Project/Process Description**--Technology description, process flow diagrams, process and discharge streams, and pollution control systems.

-
- **Compliance Monitoring**--Identification of permits, conditions of permits, and monitoring requirements of permits in terms of type of monitoring (source, ambient, etc.) and timing.
 - **Supplemental Environmental Impact Monitoring**--Specific monitoring plans to identify and confirm selected environmental impacts and predicted performance. The parameters that establish process operating conditions and determine environmental characteristics can be defined.
 - **Integration of Compliance and Supplemental Monitoring Activities**--A break down of specific monitoring activities by project phases and monitoring media to avoid redundancy in the monitoring. This section of the EMP should contain tables to show the parameters to be monitored, the stream/sampling point identification, the frequency of sampling, and the value to be reported (e.g., maximum/minimum, range).
 - **Data Management and Reporting**--Description of the data management system to be used, reporting schedule, report contents and format, and types of analyses (e.g., heat and material balances, trace element distribution, pollution control equipment performance).

APPENDIX A - FACT SHEETS FOR PROJECTS

Proposal:

Proposer:

PROPOSAL FACT SHEET

Proposal: 2
Proposer: AirPol, Inc.
Proposal Title: Compact, Clean, Coal-Fired, Combined Cycle Turbine (C5T)
Technology Category: Electric Power Generation

Proposal Summary:

This is a direct coal fired turbine combined cycle power system based on the Westinghouse 251B12 utility turbine with a nominal output of 57 MW on coal. Coal is burned in a two stage, rich-quench-lean combustion system for NOx minimization. The hot gas cleanup system consists of a regenerable zinc titanate/ DSRP system for sulfur removal/recovery and ceramic tube candle and/or tube filters for particulate removal. A single pressure steam bottoming cycle is used to extract waste heat from the turbine exhaust and from portions of the coal combustion system.

Size: 100 MW
Demo Coal: Pittsburgh #8

Project Location: No site selected

Project Duration: 84 months

Project Cost: \$227,432,332

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 10,676,882 (50.0%)	\$ 10,676,882 (50.0%)	\$ 21,353,764
Bud. Per. 2	96,759,721 (50.0%)	96,759,721 (50.0%)	193,519,443
Bud. Per. 3	<u>6,279,562 (50.0%)</u>	<u>6,279,562 (50.0%)</u>	<u>12,559,125</u>
TOTAL	\$113,716,166 (50.0%)	\$113,716,166 (50.0%)	\$227,432,332

Team Members: AirPol, Inc.
Allison Gas Turbine Div. GM
Falcon United Ltd.
Westinghouse Electric Corp.

PROPOSAL FACT SHEET

Proposal: 3
Proposer: Amax Coal Co. - Midwest
Proposal Title: Wabash Mine Integrated Coal Cleaning and Drying (ICCD) Project
Technology Category: New Fuel Forms

Proposal Summary:

The proposed project is to design, construct, and operate an advanced physical coal beneficiation circuit. The advanced circuit will process 1632 tons coal per day, and it will be retrofitted to an existing conventional coal cleaning plant that processes 18,000 tons coal per day from the Wabash mine, where it is sited.

Project Location: Keensburg, Illinois

Project Duration: 48 months

Project Cost: \$74,876,534

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Phase 1	\$ 2,376,069 (50.0%)	\$ 2,376,069 (50.0%)	\$ 4,752,139
Phase 2	\$ 17,047,718 (50.0%)	\$ 17,047,718 (50.0%)	\$ 34,095,435
Phase 3	<u>\$ 18,014,480 (50.0%)</u>	<u>\$ 18,014,480 (50.0%)</u>	<u>\$ 36,028,960</u>
TOTAL	\$ 37,438,267 (50.0%)	\$ 37,438,267 (50.0%)	\$ 74,876,534

Project Team Members: Amax Research & Development, Inc.
Roberts & Schaefer Co.
Virginia Polytechnic Institute and State University

PROPOSAL FACT SHEET

Proposal: 4
Proposer: Amax Coal West, Inc.
Proposal Title: HiCal Briquetting Project
Technology Category: New Fuel Forms

Proposal Summary:

Steam drying of Powder River Basin coal in a fluidized bed processing unit with subsequent binderless briquetting in a steam environment. The resulting fuel will be testing for shipping, handling, storage and finally used in a full scale test burn at a utility site.

Size: 75 TPH
 Demo Coal: Roland/Smith seams Powder River Basin

Project Location: Eagle Butte Mine, Gillette, WY
 McDonough Station, GA

Project Duration: 74 months

Project Cost: \$425,850,506

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 3,241,454 (50.0%)	\$ 3,241,454 (50.0%)	\$ 6,482,908
Bud. Per. 2	23,906,969 (50.0%)	23,906,969 (50.0%)	47,813,938
Bud. Per. 3	<u>17,803,510 (50.0%)</u>	<u>17,803,510 (50.0%)</u>	<u>35,607,019</u>
TOTAL	\$44,951,933 (50.0%)	\$44,951,933 (50.0%)	\$89,903,865

Team Members: Amax Coal West, Inc.
 Koppern Equipment, Inc.
 Southern Company Services, Inc.
 Stone and Webster

PROPOSAL FACT SHEET

Proposal: 6
Proposer: Babcock & Wilcox
Proposal Title: IGPFB Demonstration Project
Technology Category: Electric Power Generation
Proposal Summary:

This project integrates a PFBC and a PFBG; there are parallel power systems; the PFBC and the PFBG have their own compressors and combustors; both use in-bed sorbents for sulfur capture. The systems are integrated through the use of the PFBC as a carbon burnout unit and sulfur sink for the PFBG, and both share a common steam turbine/generator set. The proposed hot gas desulfurization unit for the gasification system is a 2 stage fluidized bed ZnTi reactor with a riser regenerator. A specially built turboexpander/compressor is required to boost the air pressure to the PFBG. The hot particulate removal systems include cyclones and ACTF's. The system is designed to permit the PFBC to operate without the PFBG.

Size: 162 MW
 Demo Coal: North Dakota Lignite
 High Sulfur Eastern Bituminous

Project Location: Milton R. Young Station, Center, ND

Project Duration: 68 months

Project Cost: \$425,850,506

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 18,738,875 (50.0%)	\$ 18,738,875 (50.0%)	\$ 37,477,750
Bud. Per. 2	170,953,056 (47.9%)	185,673,302 (52.1%)	356,626,358
Bud. Per. 3	<u>23,233,322 (73.2%)</u>	<u>8,513,076 (26.8%)</u>	<u>31,746,398</u>
TOTAL	\$212,925,253 (50.0%)	\$212,925,253 (50.0%)	\$425,850,506

Team Members: B&W
 Minnesota Power
 Minnkota Power Cooperative
 BNI Coal, Inc.
 Sargent & Lundy
 Energy and Environmental Research Center
 Argonne National Laboratory

PROPOSAL FACT SHEET

Proposal: 7
Proposer: Calderon Energy Company
Proposal Title: Greenfield Facilities Projected for Future Energy Needs Which Are Also Capable of Repowering Existing Facilities

Technology Category: New Fuel Form

Proposal Summary:

The proposed project is to design, construct, test and operate a liquid fuel/IGCC facility for the coproduction of liquid methanol and electricity. The process includes pyrolysis of coal and shredded tires, gasification of the resultant char to provide a fuel gas ("lean gas") for electric power generation. The cracked "rich gas" would be used as a feed for methanol synthesis. The product gases are treated by a proprietary hot gas cleanup process devised by the Proposer. The project, as configured, would coproduce 80 MW of power using the lean gas, and 400 tons per day of liquid methanol using the richer gas. The feed rate to the plant is 984 tons per day of coal, as well as 84 tons per day of shredded tires. Other marketable by-products include sulfur and slag.

Project Location: City of Bowling Green, Wood County, Ohio.

Project Duration: 75 months

Project Cost: \$285 million

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 935,000	\$ 898,000	\$ 1,833,000
Remaining Bud. Per.	<u>144,534,000</u>	<u>138,866,000</u>	<u>283,400,000</u>
TOTAL	\$145,469,000	\$139,764,000	\$285,233,000

Project Team Members: City of Bowling Green, OH
Wood County, OH
Ohio Valley Coal Company
United Engineers
Alliance Machine Company
Kickham Boiler and Engineering, Inc.

PROPOSAL FACT SHEET

Proposal: 8

Proposer: Centerior Energy Corporation

Proposal Title: Clean Power From Integrated Coal/Ore Reduction (COREX®) - CPICOR

Technology Category: Industrial

Proposal Summary:

The proposed project is to design, construct, and operate a cogeneration facility for the production of iron and power. The COREX® portion of the process features integrated coal gasification and iron ore reduction to generate iron from a variety of iron ores. This combined approach eliminates the need for separate coke ovens and reduces air emissions when compared with conventional coke oven/blast furnace operations. The excess reducing gas from the iron ore reduction step is used to feed an integrated combined cycle power generation facility. The facility also integrates the operation of an air separation unit which adds to the improved overall efficiency.

Project Location: Cleveland, Ohio

Project Duration: 84 months

Project Cost: \$825,092,000

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 6,424,000 (62.2%)	\$ 3,902,000 (37.8%)	\$ 10,326,000
Bud. Per. 2	585,864,000 (81.7%)	131,100,000 (18.3%)	716,964,000
Bud. Per. 3	<u>82,802,000 (84.7%)</u>	<u>15,000,000 (15.3%)</u>	<u>97,802,000</u>
TOTAL	\$675,090,000 (81.8%)	\$150,002,000 (18.2%)	\$825,092,000

Project Team Members: LTV Steel Company
 Deutsche Voest-Alpine Industrieanlagenbau GmbH
 Air Products and Chemicals, Inc.
 Electric Power Research Institute

PROPOSAL FACT SHEET

Proposal: 9
Proposer: Char-Fuels Associates Limited Partnership
Proposal Title: Charfuel Coal Refining Project
Technology Category: New Fuel Forms

Proposal Summary:

The proposed project is to design, construct, and operate a Charfuel coal refining facility. The process is based on thermally hydrocracking coal using internally generated hydrogen. As described, the process produces a boiler grade fuel from a mixture of coal char, water, coal tar, and methanol. A variety of other products can also be produced depending upon the specific plant configuration. They include, methanol, number 2 fuel oil substitute, sulfur, ammonia, BTX, naphtha, MTBE, and carbon dioxide. The proposed facility will process 150 tons per day of coal. It will only produce char and light oil. A commercial embodiment of the concept would process 10,000 tons per day.

Proposal Location: Glenrock, Convers County, WY

Project Duration: 36 months

Project Cost: \$26,253,958

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 1,876,979. (50%)	\$ 1,876,979. (50%)	\$ 3,753,958.
Bud. Per. 2	6,899,404. (50%)	6,899,404. (50%)	13,798,809.
Bud. Per. 3	<u>4,350,595. (50%)</u>	<u>4,350,595. (50%)</u>	<u>8,701,191.</u>
TOTAL	\$13,126,979. (50%)	\$13,126,979. (50%)	\$26,253,958.

Project Team Members: Babcock & Wilcox
Stone & Webster Engineering Corporation
Tennessee Valley Authority
Radian Corporation

PROPOSAL FACT SHEET

Proposal: 11
Proposer: Duke Energy Corp.
Proposal Title: Camden Clean Energy Demonstration Project
Technology Category: Electric Power Generation
Proposal Summary:

This is a commercial scale Integrated Gasification Combined Cycle (IGCC) power plant and a small scale Molten Carbonate Fuel Cell (MCFC) plant. The 480 MW IGCC (two 240 MW trains) plant consists of a gasification island, a power island, an integrated air separation unit, a liquid CO₂ facility, and balance of plant. The Integrated Air Separation Unit (IASU) is Air Products elevated pressure unit using the gas turbine compressor for the first stage compression. The gasifier is a BG/Lurgi slagger with cold gas cleanup (Purisol). The turbines are GE 7F's. The 2.5 MW MCFC plant is based on the ERC MCFC; it does not have a steam bottoming cycle. The liquid CO₂ facility is not included in the scope of the Demonstration Project.

Size: 480 MW
Demo Coal: High Sulfur Eastern Bituminous

Project Location: Pavonia Industrial Area, Camden, NJ

Project Duration: 81 months

Project Cost: \$779,950,000 (based on one 240 MW IGCC train and 2.5 MW fuel cell)

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 12,590,000 (75.0%)	\$ 4,170,000 (25.0%)	\$ 16,760,000
Bud. Per. 2	494,640,000 (75.0%)	165,570,000 (25.0%)	660,210,000
Bud. Per. 3	<u>77,720,000 (75.0%)</u>	<u>25,260,000 (25.0%)</u>	<u>102,980,000</u>
TOTAL	\$584,950,000 (75.0%)	\$195,000,000 (25.0%)	\$779,950,000

Team Members: Duke Energy Corp
 General Electric Co.
 Air Products & Chemicals, Inc.
 Fuel Cell Engineering

PROPOSAL FACT SHEET

Proposal: 12

Proposer: Easton Utilities and Arthur D. Little, Inc

Proposal Title: Demonstration of Clean Coal Diesel Technology at Easton Utilities

Technology Category: Electric Power Generation

Proposal Summary:

This project will design, construct and operate a 14 MW combined cycle power generating facility using two, 6.3 MW coal fueled diesel engines for the topping cycle and a small steam turbine bottoming cycle. Integrating the highly efficient coal fueled diesel engines with state of the art emission control technology results in a system concept which, in sizes less than 50 to 100 MW, is highly efficient and cleaner than conventional coal fueled technology. The engines will be fueled with a 2% ash coal water slurry. Its preparation, using conventional coal grinding technology, is included with the project, but is not part of the technology envelop. Commercial embodiment of the technology includes small utility power systems and industrial cogeneration systems.

Project Location: Easton, Talbot County, MD (Power Plant)
Sugar creek, Tuscarawas County, OH. (Coal Prep Plant)

Project Duration: 72 months

Project Cost: \$37,309,516

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 1,200,000 (50%)	\$ 1,200,000 (50%)	\$ 2,400,000
Bud. Per. 2	13,400,000 (50%)	13,400,000 (50%)	26,800,000
Bud. Per. 3	<u>4,050,000 (50%)</u>	<u>4,050,000 (50%)</u>	<u>8,100,000</u>
TOTAL	\$18,650,000 (50%)	\$18,650,000 (50%)	\$37,300,000

Project Team Members: Cooper Energy Services
CQ, Inc
Miller Mining

PROPOSAL FACT SHEET

Proposal: 13

Proposer: Energotechnology Corporation

Proposal Title: Integrated, Advanced Steam Conditions, Power Plant (IAPP)
Demonstration Project

Technology Category: Electric Power Generation

Proposal Summary:

The proposed project is to design, construct, and operate a 300 MWe advanced steam condition, novel configuration power plant at a green field site in Claymont, Delaware. The novel technology includes a coal cleaning plant, a conventional pulverized coal fired boiler with advanced steam conditions including double reheat, a fluid bed combustor to burn the waste stream from the coal cleaning step, and a single stream turbine/generator.

Project Location: Claymont, Delaware

Project Duration: 72 months

Project Cost: \$549,430,000

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Phase 1	\$ 19,556,000 (68.4%)	\$ 9,035,000 (31.6%)	\$ 28,591,000
Phase 2	332,321,000 (68.4%)	153,529,000 (31.6%)	\$485,850,000
Phase 3	<u>23,666,000 (68.4%)</u>	<u>10,934,000 (31.6%)</u>	<u>\$ 34,600,000</u>
TOTAL	\$375,543,000 (68.4%)	\$173,498,000 (31.6%)	\$549,041,000

Project Team Members: ABB Energy Ventures
CQ Inc.

PROPOSAL FACT SHEET

Proposal: 14
Proposer: Energy Resources and Logistics
Proposal Title: Greenbrier Clean Coal Project
Technology Category: Electric Power Generation

Proposal Summary:

The proposed project is to design, construct, and operate a combined cycle cogeneration plant at the Greenbrier Hotel in White Sulphur Springs, WV. The 25 MWe plant will employ natural gas fueled diesels, the exhaust from which will provide vitiated air for a boiler firing powdered coal. The plant will provide steam for the hotel and export power.

Project Location: White Sulphur Springs, West Virginia

Project Duration: 56 months

Project Cost: \$48,818,319

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Phase 1	\$ 1,606,096 (50.0%)	\$1,606,096 (50.0%)	\$ 3,212,192
Phase 2	19,780,164 (66.9%)	9,780,164 (33.1%)	\$29,560,328
Phase 3	<u>8,022,900 (50.0%)</u>	<u>8,022,900 (50.0%)</u>	<u>\$16,045,799</u>
TOTAL	\$29,409,160 (60.2%)	\$19,409,160 (39.8%)	\$48,818,319

Project Team Members: Energy Resources & Logistics
Wartsila Diesel
Sithe Energies, Inc.

PROPOSAL FACT SHEET

Proposal: 15
Proposer: Leas Industrial Associates
Proposal Title: 225 BTU Clean Coal Gas for Gasifier without Use of
Manufactured Oxygen

Technology Category: New Fuel Form

Proposal Summary:

The project will design, construct, and operate a 500 ton per day air-blown gasification facility to produce a medium-Btu gas (225 Btu/scf). The technology is based on a complex, multiple zone fluid-bed reactor using CaO for sulfur capture and a circulated reagent to produce a carbon intermediary. As described the demonstration project will produce coal gas and a variety of by-products, including sulfur, calcium sulfide, and ash. Larger (2000 ton per day) commercial embodiments include the production of a synthetic coal from the carbon intermediary.

Proposal Location: Mount Vernon, IN

Project Duration: 30 Months

Project Cost: \$30,000,000

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 0.	\$ 0.	\$ 0.
Bud. Per. 2	12,500,000. (50%)	12,500,000. (50%)	25,000,000.
Bud. Per. 3	<u>2,500,000. (50%)</u>	<u>2,500,000. (50%)</u>	<u>5,000,000.</u>
TOTAL	\$17,500,000. (50%)	\$17,500,000. (50%)	\$30,000,000.

Proposal states the all design activities are completed, therefore, no cost will be incurred during the first budget period.

Project Team Members:

PROPOSAL FACT SHEET

Proposal: 16
Proposer: Lin Technologies, Inc.
Proposal Title: Lin SO₂/NO_x Removal and Waste Utilization Process
Technology Category: Industrial

Proposal Summary:

The proposed project is to design, construct, and operate a device for post combustion flue gas cleaning using lime particles in a fluid bed. Removal of both SO₂ and NO_x is claimed. The device will employ a 3 MW slip stream from a coal fired utility boiler operated by Richmond Power and Light.

Project Location: Richmond, Indiana
Project Duration: 30 months
Project Cost: \$5,679,700

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Phase 1	\$ 532,600 (63.0%)	\$ 312,600 (37.0%)	\$ 845,200
Phase 2	1,626,000 (50.9%)	1,566,000 (49.1%)	3,192,000
Phase 3	<u>1,055,500 (64.3%)</u>	<u>587,000 (35.7%)</u>	<u>1,642,500</u>
TOTAL	\$ 3,214,100 (56.6%)	\$ 2,465,600 (43.4%)	\$ 5,679,700

Project Team Members: ThermoChem, Inc.
Clemson University
Duke/Fluor Daniel
MTCI, Inc.
Babcock & Wilcox

PROPOSAL FACT SHEET

Proposal: 17
Proposer: MHD Development Corporation
Proposal Title: Billings MHD Demonstration Project
Technology Category: Electric Power Generation
Proposal Summary:

The proposed project is to design, construct, and operate a 77 MWe power plant employing a magnetohydrodynamic (MHD) topping cycle and a steam Rankine bottoming cycle. This greenfield plant will be sited next to an existing power plant on the Yellowstone River.

Project Location: Billings, Montana

Project Duration: 91 months

Project Cost: \$520,006,435

I. Funding by Budget Period

	<u>Proposer</u>	<u>DOE</u>	<u>Total for Budget Periods</u>
Bud. Per. 1	\$ 20,525,000 (51.4%)	\$ 19,402,000 (48.6%)	\$ 39,927,000
Remain. Bud. Per.	<u>278,727,000 (58.1%)</u>	<u>201,352,000 (41.9%)</u>	<u>480,079,000</u>
TOTAL	\$299,252,000 (57.5%)	\$220,754,000 (42.5%)	\$520,006,000

II. Funding by Phase

	<u>Proposer</u>	<u>DOE</u>	<u>Total for Phases</u>
Phase 1			\$ 92,754,000
Phase 2			323,539,000
Phase 3			<u>103,713,000</u>
TOTAL	\$299,252,000 (57.5%)	\$220,754,000 (42.5%)	\$520,006,000

Project Team Members: Montana Power Co.
 Gilbert/Commonwealth, Inc.
 TRW, Inc.
 Textron Defense System
 Westinghouse Electric Corp.
 Babcock & Wilcox
 Univ. Tenn. Space Institute
 MSE, Inc.

PROPOSAL FACT SHEET

Proposal: 18
Proposer: Midwest Power Systems Inc.
Proposal Title: Des Moines Energy Center Advanced PCFB Demonstration Project

Technology Category: Electric Power Generation

Proposal Summary:

The project will design, construct, and operate a 140 Mw combined cycle electric generating facility based on a Second Generation Pressurized Fluidized Bed system concept. This concept integrates a pressurized circulating fluidized bed combustor (FBC) and pyrolizer to fuel a gas turbine topping cycle and power a steam turbine bottoming cycle. The integration of the pyrolizer, advances in FBC design, and high efficiency, low NOx turbine topping combustor improves the performance of the proposed concept when compared to first generation pressurized FBC technology. The commercial embodiments of the proposed concept include utility power generation in facilities as large as 600 Mw and in repowering applications.

Proposal Location: Pleasant Hill, Polk County, IA

Project Duration: 89 months

Project Cost: \$309,696,000

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 4,734,284 (51%)	\$ 4,593,716 (49%)	\$ 9,238,000
Bud. Per. 2	11,957,895 (51%)	11,721,105 (49%)	23,679,000
Bud. Per. 3	115,565,715 (51%)	113,277,285 (49%)	228,843,000
Bud. Per. 4	<u>38,276,800 (80%)</u>	<u>9,569,200 (20%)</u>	<u>47,846,000</u>
TOTAL	\$170,534,694 (55%)	\$139,161,306 (45%)	\$309,696,000

Project Team Members: Pyropower Corporation
Black & Veatch
Westinghouse Electric Corporation

PROPOSAL FACT SHEET

Proposal: 20
Proposer: M-C Power Corporation
Proposal Title: Fuel Cell Demonstration on Coal gas at Wabash River Facility
Technology Category: Electric Power Generation

Proposal Summary:

The proposed project is to design, construct and operate a nominal 1 MW fuel cell power plant on coal gas at PSI Energy's Wabash River Generating Station. The fuel cell will take a slip stream of syngas from the Destec coal gasification repowering project. The purpose of this demonstration is to evaluate the performance and durability of M-C Powers IMHEX fuel cell when operating on syngas. The present design is based on a self-contained plant with minimum interface with the Integrated Gasifier combined cycle plant. The only imports to the demonstration plant are the fuel gases, demineralized water, fire protection supply, and electrical services. The exports from the plant will be electrical power, wastewater and plant exhausts. The "normal" project operating period is scheduled at 12 months, during which period the availability of the Destec gasifier is estimated at 75%. The fuel cell power plant will also incorporate the capability to operate on natural gas.

Project Location: Wabash River Facility - West Terre Haute, Indiana

Project Duration: 48 months

Project Cost: \$42,576,000

	<u>Proposer</u>	<u>DOE</u>	<u>Total for Budget Periods</u>
Bud. Per. 1	\$ 4,693,000	\$ 4,693,000	\$ 9,386,000
Remaining Bud. Per.	<u>16,595,000</u>	<u>16,595,000</u>	<u>33,190,000</u>
TOTAL	\$21,288,000	\$21,288,000	\$42,576,000

Project Team Members: PSI Energy
Sargent and Lundy
Bechtel
GRI
IHI

PROPOSAL FACT SHEET

Proposal: 21

Proposer: Pennsylvania Electric Com.

Proposal Title: Warren Station EFCC Demonstration Project

Technology Category: Electric Power Generation

Proposal Summary:

This project involves the repowering of an existing 47 MW boiler by use of an externally fired combined cycle system (EFCC). Pulverized coal is fed to an off-based, staged, slagging combustor; the combustor exhaust passes through the shell side of a large ceramic heat exchanger (CerHx), through the integrated steam recovery generator, and then is cleaned using standard flue gas cleaning technologies. Compressed air passes through the tube side of the CerHx and then is expanded in a clean gas turbine and then is used as preheated air for the combustor.

Size: 62 MW
Demo Coal: Bituminous - Clarion and Butler Counties, PA
 Low-Vol Coal - Clearfield and Center Co., PA

Project Location: Warren Station, Warren Co., PA

Project Duration: 60 months

Project Cost: \$146,438,000

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Bud. Per. 1	\$ 1,780,000 (52.0%)	\$ 1,646,000 (48.0%)	\$ 3,426,000
Bud. Per. 2	12,800,000 (50.0%)	12,800,000 (50.0%)	25,600,000
Bud. Per. 3	39,820,000 (50.0%)	39,820,000 (50.0%)	79,640,000
Bud. Per. 4	<u>19,083,000 (50.0%)</u>	<u>19,083,000 (50.0%)</u>	<u>38,166,000</u>
TOTAL	\$73,483,000 (50.0%)	\$73,349,000 (50.0%)	\$146,832,000

Team Members: Pennsylvania Electric Co. (Penelec)
 Black & Veatch
 Hague International

PROPOSAL FACT SHEET

Proposal: 22

Proposer: Tennessee Valley Authority (TVA)

Proposal Title: Coproduction Demonstration Project (Coproduction of Electricity and Fertilizer)

Technology Category: Electric Power Generation

Proposal Summary:

TVA proposes to design, construct, and operate an IGCC/Fertilizer Co-production Demonstration Project. The Project will include Shell's advanced dry-feed coal gasification technology, fully integrated into a combined cycle unit and fertilizer plant. The combined cycle will use an advanced high temperature combustion turbine supplied by General Electric. The plant, as proposed, will be commercially sized (maximum capacity 265 MW), fully capable of operating at the rated power capacity, and also designed to produce 188 MW of electricity and 1,100 tons per day of fertilizer simultaneously. The coal feed rate is 2,500 tons per day. Other marketable by-products include liquid sulfur, slag and fly ash. The fertilizer production unit costs are included in TVA's estimate of project costs.

Project Location: To be determined among five prospective sites located in Alabama, Kentucky and Tennessee

Project Duration: 102 months

Project Cost: \$782,578,000

	<u>Proposer</u>	<u>DOE</u>	<u>Total for Budget Periods</u>
Bud. Per. 1	\$ 48,360,000	\$ 16,380,000	\$ 64,740,000
Remaining Bud. Per.	<u>536,218,000</u>	<u>181,620,000</u>	<u>717,838,000</u>
TOTAL	\$584,578,000	\$198,000,000	\$782,578,000

Project Team Members: Shell Synthetic Fuels
General Electric
Bechtel

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PROPOSAL FACT SHEET

Proposal: 23
Proposer: ThermoChem, Inc.
Proposal Title: Pulse Stabilized Fluidized Bed Combustor
Technology Category: Industrial

Proposal Summary:

The proposed project is to design, construct, and operate an atmospheric fluidized bed boiler fitted with a novel pulse combustor. The AFB boiler will provide up to 200,000 lb steam/hour to Clemson University by combustion of 240 tons coal/day.

Project Location: Clemson, South Carolina

Project Duration: 48 months

Project Cost: \$29,317,673

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Phase 1	\$ 3,128,703 (50.0%)	\$ 3,128,703 (50.0%)	\$ 6,257,405
Phase 2	6,319,528 (50.0%)	6,319,528 (50.0%)	\$ 12,639,055
Phase 3	<u>5,210,607 (50.0%)</u>	<u>5,210,607 (50.0%)</u>	<u>\$ 10,421,213</u>
TOTAL	\$ 14,658,836 (50.0%)	\$ 14,658,836 (50.0%)	\$ 29,317,673

Project Team Members: ThermoChem, Inc.
Clemson University
Duke/Fluor Daniel
MTCI, Inc.
Babcock & Wilcox

PROPOSAL FACT SHEET

Proposal: 24
Proposer: University of Minnesota
Proposal Title: University of Minnesota Power Efficiency Project
Technology Category: Electric Power Generation/Industrial Process

Proposal Summary:

The proposed project is to design, construct, test and operate a High Efficiency Integrated Combined Cycle ("HEICC") facility for the cogeneration of electricity and steam to meet the load and heating/air conditioning requirements of the University's Minneapolis campus. The process includes partial conversion of energy from coal in a carbonizer to produce a LHV gas to power a gas turbine and the remaining coal energy in the form of char being combusted in an ACFB to produce steam for power generation and steam requirements. The low Btu gas is passed through a high temperature/high pressure particulate filtration system and an alkali getter before being combusted in the gas turbine. Particulates from the filtration step are fed into a char transfer vessel and routed to the boiler along with the char. The project, as configured, would generate 21 MW from the gas turbine generator, 13 MW from the steam cycle and 400,000 pounds per hour of superheated steam to the campus. The coal feed rate would be 35 tons per operating hour.

Project Location: Southeast Plant on the Minneapolis campus of University of Minnesota

Project Duration: 78 months

Project Cost: \$242 million

	<u>Proposer</u>	<u>DOE</u>	<u>Total for Budget Periods</u>
Bud. Per. 1	\$ 3,855,000	\$ 3,855,000	\$ 7,710,000
Remaining Bud. Per.	<u>117,001,000</u>	<u>117,001,000</u>	<u>234,002,000</u>
TOTAL	\$120,856,000	\$120,856,000	\$241,712,000

Project Team Members: Foster Wheeler
Westinghouse Electric Corporation

PROPOSAL FACT SHEET

Proposal: 25
Proposer: West Virginia CLC Corporation
Proposal Title: Demonstration of Coal Liquids, Char and Coke (CLC) Mild Gasification Process
Technology Category: New Fuel Form

Proposal Summary:

This project uses a mild gasification technology developed by one of the Team Members to coproduce coke, char and coal liquids. This continuous, contained process upgrades coal into three distinct new fuel forms of enhanced value. It promises much improved environmental performance over current technologies leading to the same products.

Project Location: Princeton, West Virginia

Project Duration: 60 months

Project Cost: \$40,000,000

	<u>Proposer</u>	<u>DOE</u>	<u>Total</u>
Phase 1	\$ 8,056,500 (50%)	\$ 8,056,500 (50%)	\$16,113,000
Phase 2	9,088,000 (50%)	9,088,000 (50%)	19,166,000
Phase 3	<u>2,361,500 (50%)</u>	<u>2,361,500 (50%)</u>	<u>4,721,000</u>
TOTAL	\$20,000,000 (50%)	\$20,000,000 (50%)	\$40,000,000

Project Team Members: Coal Technology Corporation
Norfolk Southern Corporation
Elkem Metals Company
Koppers Industries