Commonwealth of Pennsylvania

PENNSYLVANIA ENERGY DEVELOPMENT AUTHORITY

ANNUAL REPORT

FOR FISCAL YEAR 1986-87

July 1, 1986 - June 30, 1987

Issued
October, 1987

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INTRODUCTION

The Pennsylvania Energy Development Authority's Annual Report for Fiscal Year 1986-87 is presented to the Governor and General Assembly pursuant to the Pennsylvania Energy Development Authority and Emergency Powers Act of 1982, P.L. 1213, No.280. The Annual Report is for the fiscal year that began on July 1, 1986 and ended on June 30, 1987.

The Authority's Annual Report provides detailed information on the fiscal status of the Energy Development Fund. Additionally, this report describes projects awarded allocations in FY 1986-87, as well as projects which received financial assistance in previous fiscal years that either were completed or continued during this period.

The Authority concluded its third year of operation at the close of FY 1986-87. The Board of Directors reports with assurance that it has diligently attempted to further the Authority's mission of providing financial assistance to a wide range of energy projects throughout the Commonwealth during FY 1986-87. In this interval, the Authority provided nearly 2 million dollars to 17 energy development projects. Furthermore, approximately 123 million dollars in Authority revenue bonds were issued to two large cogeneration and small power production facilities. The Authority also supported two of nine successful applicants under the U.S. Department of Energy's Clean Coal Technology Program.

SUMMARY OF FINANCIAL ASSISTANCE FOR ENERGY PROJECTS

The Pennsylvania Energy Development Authority was created to finance energy projects that develop, promote, or efficiently use Pennsylvania's indigenous resources. As established in the Energy Development Plan adopted by the Board of Directors, the primary goals of the Authority are:

- To increase Pennsylvania coal production;
- To increase use of renewable fuels;
- To increase energy efficiency; and
- To maximize the use of other available federal, local and/or private financial resources.

The Authority has developed a multi-faceted financial assistance program to achieve these goals. This program includes grants, venture capital, loans, loan guarantees and revenue bond financing.

The Authority's approach to providing opportunities for financial assistance is (1) to develop a comprehensive Financial Assistance Program Prospectus and application package; and (2) to establish application deadlines throughout the fiscal year. During FY 1986-87, five application deadlines were designated: August 14, October 9, December 11, February 12, and April 9. Application deadlines and financial assistance opportunities were presented in the Pennsylvania Bulletin on July 5, 1986.

The Program Prospectus approved by the Board of Directors established the criteria and constraints for review of applications and allocation of financial assistance. The primary constraint focused on the location of projects - they must be conducted entirely or largely within Pennsylvania. Key criteria used by the Board to make allocation decisions were:

1. Technology Related - potential economic competitiveness, need, and environmental impact;

2. Financial Related - matching funds, need, and cost versus benefits; and

3. Project Related - applicant qualifications, research methodology, and project objectives.

Since the inception of the Authority, 58 projects have received financial assistance totaling nearly 5.8 million dollars. However, due to allocation rescindments as a result of undeveloped projects, the Authority has actually contributed approximately 5.3 million dollars to 54 projects.

Authority projects are separable into five categories: Clean Coal Technology, Anthracite Development, Bituminous Coal Development, General Coal Development and Non-Coal. As illustrated in Figure 1, 33% of the Authority's projects have focused on technologies that make coal a cleaner fuel. Non-coal projects comprise the second largest number of projects, with anthracite and bituminous coal development projects a close third. Monetarily, the Authority has allocated the most funds, 1.9 million dollars or 35% of its total allocation, to Clean Coal Technology. Allocations to coal projects equal 4.6 million dollars, or 86% of the Authority's energy development effort (Figure 2).

An important objective of the Authority, essential to maximizing energy development activity, is leveraging limited Authority funds with monies from other sources; these sources include private industry, utilities, universities, non-profit groups, and federal funding agencies. The Authority has had success in this regard as highlighted in Figures 3 and 4.

Since FY 1984-85, the Authority has participated in energy development projects totaling nearly 15 million dollars, with 10 million dollars being derived from other funding sources (Figure 3). On a percentage basis, cash contributions from contractors and co-participants increased two-fold from FY 1984-85 to FY 1986-87 (Figure 4).

For FY 1986-87, the categorical distribution of new coal projects (Figure 5) exhibited a similar pattern to the distribution for FY 1984-87 (Figure 1), if the Bituminous Coal Development and General Coal Development categories were merged in Figure 1. Comparison of the monetary distribution of projects funded in FY 1986-87 versus projects funded between FY 1984-85 and FY 1986-87 (Figure 6 versus Figure 2) shows the allocation to Non-Coal projects in FY 1986-87 was reduced four-fold. This reduction is primarily due to small appropriation of funds to the Non-Coal energy development category and lack of meritorious applications.

In FY 1986-87, a total of $1,974,809 was allocated by the Authority to match a total of roughly 4.5 million dollars from contractors and co-participants (Figure 3).

The Authority has embarked on several initiatives that should benefit Pennsylvania's energy industry. For example, during FY 1986-87, the Authority allocated nearly $200,000 to develop and implement a technical assistance program to encourage electric utilities in the mid-Atlantic and northeastern states to use Pennsylvania's low volatile bituminous coal resources. At the close of FY 1986-87, the Authority's contractors had secured one utility's commitment to participate, with other prospects seriously considering involvement in the low volatile project. This project's importance relates to the hundreds of thousands of tons of coal that would be used if only a few coal-fired utility plants were to meet emission requirements through use of low-volatile coal.

In the pollution control area, the Authority provided $500,000 to the Pennsylvania Electric Company to match nearly 3.7 million dollars from private industrial sources for introduction of new emission control technologies at two existing power plants. At the Seward Plant in Indiana County, equipment was installed on a boiler exhaust duct to remove sulfur from the post-combustion gas stream, prior to its release into the atmosphere. At the Homer City Plant also in Indiana County, new burner technology will be adapted to an existing boiler to inhibit creation of nitrogen oxides. These projects represent the Authority's first major involvement in projects with Pennsylvania utilities to address advancements in pollution control technologies.

Concerning promotion of renewable resources, the Authority allocated $58,068 to two projects in FY 1986-87. In Schuylkill County, a project was undertaken to demonstrate a wood waste combustion and heat recovery system in a wood products plant. Additionally, a biothermal composting greenhouse demonstration in southeastern Pennsylvania received an allocation.

In addition to provision of research, development and demonstration grants, the Authority fostered two large-scale energy production projects in FY 1986-87. On December 18, 1986, the Authority concluded a revenue bond transaction that provided $123,250,000 to two cogeneration and small power production facilities. In Clarion County's Piney Township, Babcock and Wilcox Company (B&W) will construct a 26 megawatt electric power plant that will employ 150 workers during peak construction, and 23 workers during plant operation. Southeast of this facility, at the Cambria County Industrial Park, B&W will develop the Ebensburg Project that will produce 52 megawatts of electrical power, employ 250 workers during peak construction and, when completed, require 30 workers to run the plant. Both plants will be fueled by wastes from either active or abandoned bituminous coal mining operations, corporately consuming approximately 460,000 tons of refuse annually. Consequently, the Clarion and Ebensburg Projects will contribute significantly to improving the environment of the region where they are located.

Table 1 provides synoptic data for Authority projects. For discussion of Authority projects, both those completed in Fiscal Year 1986-87 and those in progress during this period, refer to Appendices A and B respectively. Table 2 presents summary information about the Authority's three revenue bond projects.

FISCAL STATUS

The Authority ended FY 1986-87 with a net available balance of $937,131. Though the Authority has total assets of $3,638,424.25, $2,597,993.43 are committed to Authority projects, but not yet spent.

For FY 1986-87, costs of administration, including personnel, operating and fixed assets expenses, totaled $211,651. However, the Authority received $272,685 in interest from funds invested by the State Treasurer. The Board is pleased to report the Authority's operations imposed no costs to taxpayers, and the full amount of Commonwealth funds was available for the Authority's Financial Assistance Program.

Summaries of the Authority's fiscal status are presented in Tables 3, 4 and 5. These statements were prepared by the Comptroller's Office, Commonwealth of Pennsylvania.

TABLE 1

PEDA FUNDED PROJECTS SUMMARY

Proj. No.	Contractor	Purpose	Proj. Cat.	PEDA All.	All. Type	Stat.
84002	PA Coal Min. Assn.	Improve Bituminous Marketability	BD	411,000	G	I
84003	Francis Miller	Coal Prep. Tech. Seminars	BD	16,500	G	C
84006	PA Coke Tech., Inc.	Improve Non-Recovery Coking Process	BD	67,965	G	C
84007	Anthracite Ind. Assn.	Anthracite Mktg. and Demonstrations	AD	453,780	G	C
84016	Lehigh University	Improve Coking via Ionic Hydrogen.	CC	25,000	G	I
84017	Lehigh University	Fluidized Bed Coal Cleaning	CC	80,530	G	I
84020	Coal Tech Corp.	Adv. Cyclone Combustor - Stage II	CC	150,000	G	C
84024	Erie School Dist.	Enhanced Natural Gas Recovery	NC	37,500	V	C
84025	Johnstown Corp.	Coal & Coal-MSW Cogen. Feasibility	NC	28,715	G	C
84026	St. Francis College	Coal and MSW Cogen. Feasibility	NC	7,500	G	C
84034	Coun. for Lab. & Ind.	Conservation Improvements	NC	15,000	G	C
84035	Ad Peary Vo-Tech Sch	Cogeneration Feasibility	NC	6,287	G	R
84038	CDA Int., Inc.	Hosp. Oper. Rm. Energy Conservation	NC	35,000	G	I
84041	Bellefield Plant	Cogeneration Feasibility	NC	21,000	G	C
84042	BCR Nat. Lab.	Reactive Gas CDS - Phase I	CC	120,241	G	C
84043	BCR Nat. Lab.	Reichert Spiral Evaluation	CC	50,000	G	I
84044	Williams & Broome	Hydroelectric Power Barge Demo.	NC	200,000	V	C
84047	Enerco Associates	Pyrolysis of Waste Tires	NC	302,268	V	C
84049	Allegheny Elec. Coop.	Energy Storage in Buildings	NC	35,000	G	R
84050	Control Techtronics	Advanced Combustion Controller Demo	NC	15,000	G	C
84060	Babcock & Wilcox Co.	CWF Conversion, Open Hearth Furnace	BD	69,000	V	R
85003	Antrim Mining Co.	FBC Power Plant Feasibility	BD	10,000	G	C
85004	Norton Hambleton Inc.	Reverse Column Flotation CDS	CC	200,000	V	I
85005	Penn. State Univ.	CDS via Steam/Methane Pyrolysis	CC	35,000	G	I
85006	R.A. Systems	Water Jet Assisted Coal Shearer	BD	27,000	V	I
85007	SEDA-Coun. of Gov.	Primer on Domestic Anthracite Use	AD	29,000	G	C
85009	PA Coal Min. Assn.	Low-Vol in Util. Boil. - Ph. I	BD	58,783	G	I
85010	Anthracite Ind. Assn.	Anthracite Mktg. and Conversions	AD	259,380	G	I
85011	Cont. Cogen. Corp.	Anthracite Gasification	AD	35,000	G	I
85015	Hess & Fisher Eng.	Acid Mine Drainage Control	BD	31,475	G	I
85016	Univ. of Pittsburgh	Liquid CO2 CDS	CC	84,908	G	I
85020	SEDA-Coun. of Gov.	Conversion Feasibility	AD	10,000	G	C
85024	Kipin Ind., Inc.	Coal and Waste Co-Processing	BD	200,000	V	I
85025	Meadville Ind. Comm.	Cogeneration Feasibility	BD	10,000	G	C
85026	PA Coke Tech., Inc.	Non-Recovery Coke Production	CC	350,000	G	R
85027	Coal Tech Corp.	Adv. Cyclone Combustor - Stage III	CC	200,000	G	I
85028	Penn. State Univ.	SO2 Sorbent Evaluation	CC	25,000	G	I
85030	EXPORTech Co., Inc.	Magnetic CDS - Phase I	CC	15,934	G	C
85031	Lehigh University	Microbial CDS	CC	50,000	G	I
85032	Penn. State Univ.	Surface Mining Software Development	BD	43,447	G	I
85035	Anth & Comm Dev Inst	Anthracite Operators' Assistance	AD	154,685	G	I

TABLE 1
(Continued)

PEDA FUNDED PROJECTS SUMMARY

Proj. No.	Contractor	Purpose	Proj. Cat.	PEDA All.	All. Type	Stat.
86002	BCR Nat. Lab.	Reactive Gas CDS - Phase II	CC	114,983	G	I
86004	Univ. of Pittsburgh	Controlled Burnout of Refuse Piles	GC	149,931	G	D
86006	Penn. State Univ.	Mechanical CDS Efficiency	CC	33,727	G	I
86007	BCRNL/FURI	Low-Vol in Util. Boil. - Ph. II	GC	198,340	G	I
86008	PA Electric Co.	Low NOx Burner Demonstration	CC	400,000	G	D
86009	PA Electric Co.	CZD Sulfur Reduction Demonstration	CC	100,000	G	I
86014	BCR Nat. Lab.	Ultrasonic Dewatering of Coal	GC	40,367	G	I
86018	Anthracite Ind. Assn.	Anthracite Mktg. and Conversions	AD	210,500	G	I
86022	Heyl & Patterson Inc.	Micro-Bubble Flotation CDS	CC	150,000	V	I
86026	BCR Nat. Lab.	Coal/Biomass Pyrolysis	GC	73,255	G	I
86028	Anthracite Ind. Assn.	Anthracite Trade Show	AD	26,505	G	I
86031	Humenick Wood Prod.	Wood Waste Combustion & Heat. Sys.	NC	24,108	G	I
86033	GRASP	Biothermal Composting Greenhouse	NC	33,960	V	D
86035	Econ Dev Coun NE PA	Anthracite Development & Promotion	AD	15,810	G	I
86041	PA Anth. Dev. Corp.	Anth. Explor. with Radio Imaging	AD	30,000	V	I
86043	Penn. State Univ.	Acid Mine Drainage Model	GC	142,175	G	D
86046	EXPORTech Co., Inc.	Magnetic CDS - Phase II	CC	18,996	V	D

Key AD: Anthracite Development, BD: Bituminous Coal Development, C: Complete, CC: Clean Coal Technology, CDS: Coal Desulfurization, D: Draft Contract, G: Grant, GC: General Coal Development, I: In Progress, NC: Non-Coal Development, R: Rescinded, V: Venture Capital

TABLE 2

PEDA REVENUE BOND PROJECTS

Project Number	Name	Developer	Rev. Bond Issue
84061	Humboldt Energy Center	Continental Cogen. Corp.	39,000,000
85033	Clarion Project	Babcock & Wilcox Co.	45,650,000
85034	Ebensburg Project	Babcock & Wilcox Co.	77,600,000
		Total	$162,250,000

TABLE 3

PENNSYLVANIA ENERGY DEVELOPMENT AUTHORITY

BALANCE SHEET

JUNE 30, 1987

ASSETS

Cash		$ 2,424.25
Short Term Investments		3,636,000.00
Accrued Interest Receivables - Investments		0.00
TOTAL ASSETS		$3,638,424.25

LIABILITIES & NET WORTH

LIABILITIES			
Accounts Payable			$ 0.00
NET WORTH			
General Fund Appropriations	$ 6,000,000.00		
Grant Disbursements	(2,667,812.69)		
		$3,332,187.31	
Net Earnings from Operations		306,236.94	
			$3,638,424.25
TOTAL LIABILITIES AND NET WORTH			$3,638,424.25

TABLE 4

PENNSYLVANIA ENERGY DEVELOPMENT AUTHORITY

COMPARATIVE STATEMENT OF FUNDS AVAILABLE

FOR THE TWELVE MONTH PERIOD
ENDING JUNE 30

	1986		1987		
TOTAL AVAILABLE FUNDS - July 1		$3,470,686		$3,386,750	
RECEIPTS					
Transfer from General Fund	$1,300,000		$1,300,000		
Interest on Securities	260,370		272,685		
Commitment Fees	25,000		50,000		
Application Fees	2,200		3,350		
Venture Cap. - Repayments	0		1,054		
Reimb. - Oper. Expenditures	0		5,000		
Total Receipts		$1,587,570		$1,632,089	
AVAILABLE FOR DISBURSEMENT		$5,058,256		$5,018,839	
DISBURSEMENTS					
Grants/Venture Capital	$1,452,059		$1,168,763		
Operating Expenses	219,448		211,651		
Total Disbursements		$1,671,507		$1,380,414	
GROSS FUNDS AVAILABLE		$3,386,749		$3,638,424	(a)
COMMITMENTS					
Grants/Venture Capital	$2,278,854		$2,597,993		
Operating	118,300		103,300		
Total Commitments		$2,397,154		$2,701,293	(b)
NET FUNDS AVAILABLE		$ 989,595		$ 937,131	(c)

(a) Cash - $2,424; Investments - 3,636,000
(b) Grants committed for future disbursements
(c) Unexpended/uncommitted funds at close of fiscal year

TABLE 5

PENNSYLVANIA ENERGY DEVELOPMENT AUTHORITY

RECONCILIATION OF COMMITMENTS

JUNE 30, 1987

M.E.	Contractor	Commitments	Disbursements	Balance
484-002	PA Coal Mining Assn.	$ 411,000.00	$ 378,432.82	$ 32,567.18
484-016	Lehigh University	25,000.00	23,960.48	1,039.52
484-017	Lehigh University	80,530.00	45,119.05	35,410.95
484-020	Coal Tech Corp.	150,000.00	146,720.75	3,279.25
484-038	CDA Int., Inc.	35,000.00	29,994.76	5,005.24
484-043	BCR National Lab.	50,000.00	19,601.85	30,398.15
485-004	Norton, Hambleton Inc.	200,000.00	87,514.00	112,486.00
485-005	Penn State University	35,000.00	16,766.59	18,233.41
485-006	R.A. Systems	27,000.00	5,361.00	21,639.00
485-007	SEDA-COG	29,000.00	29,000.00	0.00
485-009	PA Coal Mining Assn.	58,783.00	29,692.83	29,090.17
485-011	Cont. Cogen. Corp.	35,000.00	18,245.00	16,755.00
485-015	Hess & Fisher Eng.	31,475.00	11,886.50	19,588.50
485-016	Univ. of Pittsburgh	34,961.00	15,708.87	19,252.13
*485-016	Univ. of Pittsburgh	49,947.00		49,947.00
485-010	Anthracite Ind. Assn.	259,380.00	185,168.98	74,211.02
485-024	Kipin Industries, Inc.	200,000.00	57,786.32	142,213.68
485-027	Coal Tech Corp.	200,000.00	7,856.45	192,143.55
485-028	Penn State University	25,000.00	11,920.63	13,079.37
485-031	Lehigh University	50,000.00	575.82	49,424.18
485-032	Penn State University	43,447.00		43,447.00
485-035	Wilkes College	125,000.00	47,010.49	77,989.51
*485-035	Wilkes College	29,685.00		29,685.00
486-002	BCR National Lab.	114,983.00	63,633.55	51,349.45
486-004	Univ. of Pittsburgh	149,931.00		149,931.00
486-006	Penn State University	33,727.00		33,727.00
486-007	BCR National Lab.	198,340.00		198,340.00
*486-008	PA Electric Co.	400,000.00		400,000.00
486-009	PA Electric Co.	100,000.00		100,000.00
486-014	BCR National Lab.	40,367.00		40,367.00
486-018	Anthracite Ind. Assn.	210,500.00	117,914.83	92,585.17
486-022	Heyl & Patterson Inc.	150,000.00		150,000.00
486-026	BCR National Lab.	73,255.00		73,255.00
486-028	Anthracite Ind. Assn.	26,505.00		26,505.00
486-031	Humenick Wood Prod.	24,108.00		24,108.00
486-033	GRASP	33,960.00		33,960.00
486-035	EDCNP	15,810.00		15,810.00
486-041	PA Anth. Dev. Corp.	30,000.00		30,000.00
486-043	Penn State University	142,175.00		142,175.00
486-046	EXPORTech Co., Inc.	18,996.00		18,996.00
	Total	$3,947,865.00	$1,349,871.57	$2,597,993.43

* Grant Commitments - Unencumbered

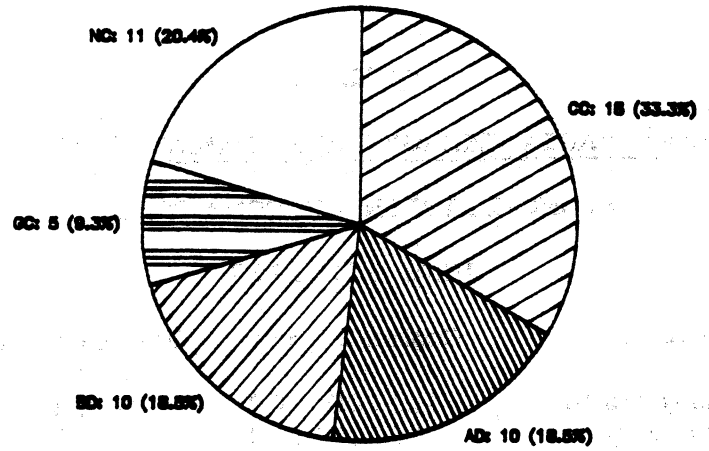

Figure 1. Categorical Distribution of PEDA Projects, for Fiscal Years 1984-87 (AD: Anthracite Development, BD: Bituminous Coal Development, CC: Clean Coal Technology, GC: General Coal Development, NC: Non-Coal)

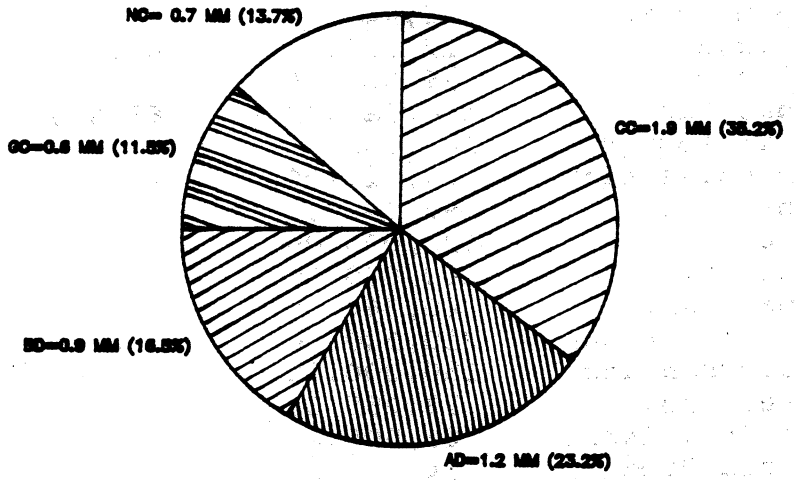

Figure 2. Monetary Distribution of PEDA Projects, for Fiscal Years 1984-87 (AD: Anthracite Development, BD: Bituminous Coal Development, CC: Clean Coal Technology, GC: General Coal Development, NC: Non-Coal)

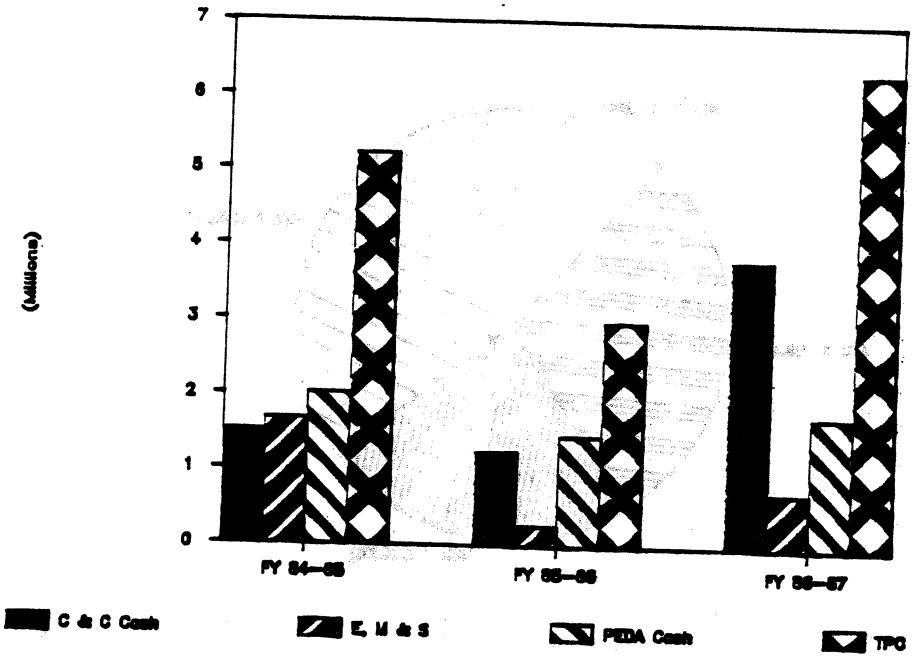

Figure 3. Distribution of PEDA Project Costs, in Millions of Dollars, by Fiscal Year (C & C Cash: Contractor and Co-participant Contributions; E, M & S: Equipment, Material and Services Value; PEDA Cash: Actual or Projected Authority Contributions; TPC: Actual or Projected Total Project Cost)

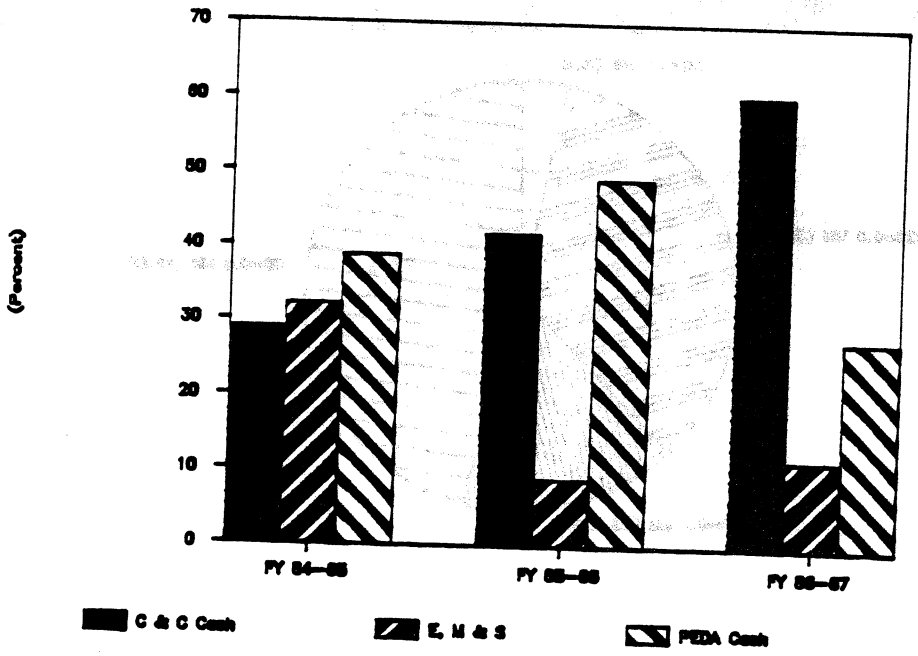

Figure 4. Distribution of PEDA Project Costs, on a Percentage Basis, by Fiscal Year (C & C Cash: Contractor and Co-participant Contributions; E, M & S: Equipment, Material and Services Value; PEDA Cash: Actual or Projected Authority Contributions)

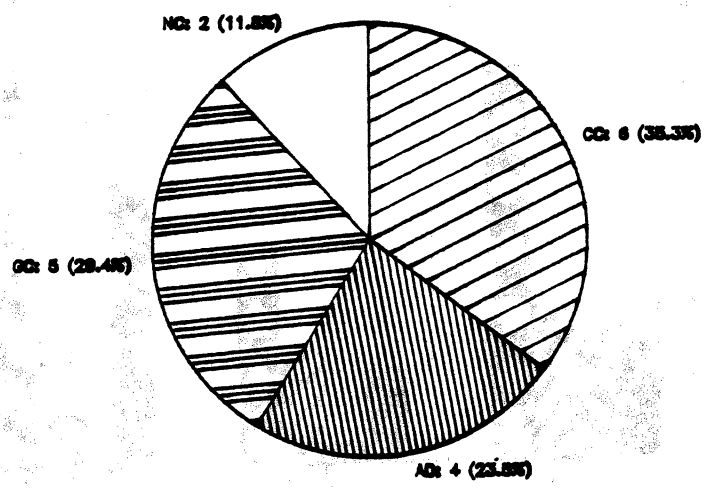

Figure 5. Categorical Distribution of PEDA Projects, for Fiscal Year 1986-87 (AD: Anthracite Development, BD: Bituminous Coal Development, CC: Clean Coal Technology, GC: General Coal Development, NC: Non-Coal)

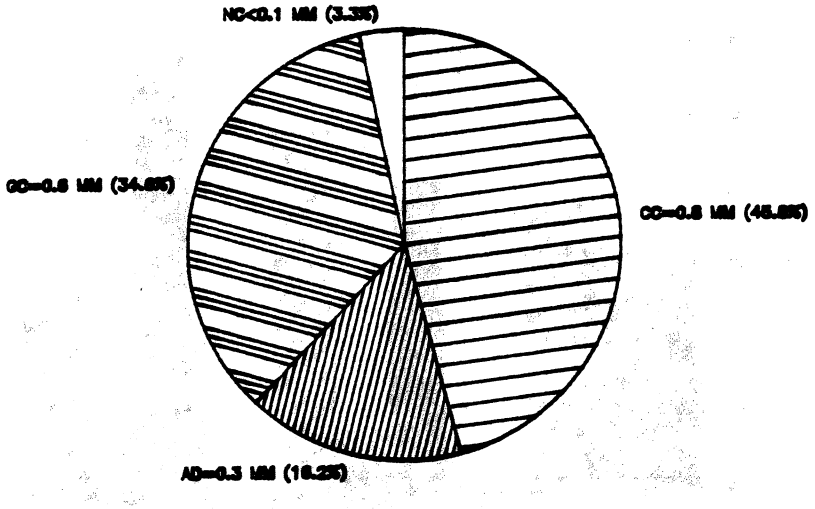

Figure 6. Monetary Distribution of PEDA Projects, for Fiscal Year 1986-87 (AD: Anthracite Development, BD: Bituminous Coal Development, CC: Clean Coal Technology, GC: General Coal Development, NC: Non-Coal)

APPENDIX A

PEDA PROJECTS COMPLETED IN FISCAL YEAR 1986-87

Project No. 84020: Coal Tech Corporation is involved in a three-phase project to develop, on a commercial scale, an air-cooled, cyclone coal combustor for application to the conversion of oil or gas-fired boilers to coal. This combustor is designed to retain enough ash to allow its use in oil or gas-designed boilers, and to reduce NO_x and SO_2 emissions to levels that meet or exceed the Environmental Protection Agency's New Source Performance Standards. PEDA is a financial co-participant in Phases II and III of Coal Tech Corporations's combustor project.

Phase I is complete. During Phase I, a 30 MM BTU/hr combustor was designed and partially fabricated. Phase II is also complete. During Phase II, combustor fabrication was finished, the combustor was installed on a 23 MM BTU/hr, D-frame package boiler, and two parametric tests with a total duration of 40 hours were performed using coal-water slurry as fuel. The key result from Phase II is the combustor operated as designed, particularly the critical air cooling and slag tap sections that were the most novel and previously untested innovations.

Please refer to Project No. 85027 in Appendix B for information on Phase III of Coal Tech Corporation's project.

Project No. 84042: BCR National Laboratory is engaged in a two-phase research project aimed at removing sulfur from coal through exposure to oxidants. The major accomplishment from Phase I was development of a unique method for oxidizing sulfur with ozone, under essentially ambient conditions. Under similar conditions, neither oxygen nor air is as effective as ozone. Experiments were executed with pure pyrite to understand the kinetics of the pyrite/ozone reaction in aqueous suspension. Three quantities were found influential in oxidation of pyrite: pH, time and temperature. A factorial experiment showed pH is the major variable affecting oxidation of pyrite. Exposure of pyrite to ozone at pH of 1 for 240 minutes, at temperatures between 30 deg C and 80 deg C, yielded virtually complete pyrite oxidation.

Please refer to Project No. 86002 in Appendix B for information on Phase II of BCR National Laboratory's project.

Project No. 85007: SEDA-Council of Governments' primer, "Anthracite for Heating Homes and Businesses," has been distributed throughout the northeastern United States. The categorical distribution of 46,775 of 50,000 total booklets is: Pennsylvania state agencies and anthracite interest groups, 35,550; energy agencies in Delaware, Maine, Maryland, New Hampshire, New York, Ohio, Rhode Island and West Virginia, 4,550; anthracite related businesses in Pennsylvania, New Jersey and New York, 6,200; and individual requests, 475.

Project No. 85020: This feasibility study, conducted under the auspices of SEDA-Council of Governments, determined the practicality and financial advisability of converting oil-fired or electric resistance heating systems to coal. These systems are in schools belonging to Selinsgrove School District. The study included: (1) conceptual layout of an anthracite stoker/boiler, (2) resolution of the practicality of converting existing oil and/or electric resistance equipment to hydronic equipment fired with anthracite, and (3) estimation of the conversion's impact on electric utility rates.

The study focused on four buildings: Selinsgrove High School, Selinsgrove Middle School, Selinsgrove Elementary School and Jackson-Penn Elementary School. Conversion of Jackson-Penn Elementary School's heating system proved impractical both legally and economically. Extension of a steam line from the High School's coal-fired heating system to Selinsgrove Elementary School is practical; however, based on 1986 construction and energy costs, simple payback exceeds five years. A new coal-fired boiler plant in the Middle School is constrained by three factors that caused abandonment of more extensive investigation: space limitations, economy of scale and aesthetics.

The concept finally selected to convert partially the Middle School to coal-fired heating was extension of an underground hydronic line from the High School to the Middle School mechanical room. This modification would reduce winter consumption of electricity by 50% and alleviate discomfort experienced by people that use the Middle School. The 1986 financial estimate for this project was: construction, $113,700; net annual savings, $13,800; simple payback period, 8.2 years. Favorable changes in policy by the local utility would result in an increase in net annual savings to $37,000. Accordingly, the simple payback period would fall to three years and place higher priority on the partial conversion of the Middle School's heating system.

Project No. 85025: Meadville Area Industrial Commission, through a subcontracted engineering firm, investigated the feasibility of renovating and operating the Avtex Fibers facility's power plant in Meadville, Pennsylvania. Factors considered were the technical viability, operational constraints, and costs associated with reactivating the power plant.

The power plant's steam generating system consists of four pulverized coal-fired boilers, and one gas-fired boiler. Each coal boiler has dedicated coal crushing, bunkering and pulverizing equipment. Steam from the boilers is fed into three turbine generator sets with an electrical output capacity of 15 MW, in 5 MW increments. Current equipment limits power sales to a utility to 6 MW.

Power production capacity versus cost to bring it on line figures are (as of April, 1987): 15 MW, $5,200,000; 10 MW, $3,420,000; and 5 MW, $1,320,000. The facility can produce 98,000 lb/hr of 15 psig steam. Discounting steam use in the power plant, 50,000 lb/hr of 15 psig steam are available for sale. With all three viable boilers operating, up to 120,000 lb/hr of 400 psig steam are available.

Environmental and safety considerations will require significant attention. Either new or rebuilt wastewater treatment facilities are needed to process effluent from the power plant. Critical issues involved in the facility's renovation will be safe removal and disposal of asbestos. Fly ash will have to be removed from the site and disposed of in a landfill, at an estimated cost of $8-30/ton. The most cost effective approach may be to contract with the power plant's coal supplier(s) for fly ash disposal in their mines (cost estimate is $8/ton or less). Bottom ash can legally be given to a municipality for use as an anti-skid material. Air permits should not be difficult to obtain; the boilers have electrostatic precipitators that are operable and in good condition.

Project No. 85030: EXPORTech Company, Incorporated revisited Open Gradient Magnetic Separation (OGMS) as a dry process to clean Pennsylvania coal. Results from laboratory tests of Lower Kittanning bituminous coal from Clearfield County show OGMS clean coal product characteristics are comparable to those attained in commercial wet cleaning of this coal using Deister tables and froth flotation. Magnetic treatment of 30x0 topsize Lower Kittanning coal containing 17.35% ash and 4.56% total sulfur yielded clean coal product containing 9.59% ash and 2.02% total sulfur, with 81% weight recovery and 88% BTU recovery. Laboratory results also indicate EXPORTech Co., Inc.'s technique has potential to treat coal particles coarser than 30 mesh (the topsize studied). This separation technique was effective in separating ash and sulfur from coal to a lower limit of 100 microns.

Please refer to Project No. 86046 in Appendix B for information on EXPORTech's latest coal desulfurization project employing OGMS.

APPENDIX B

PEDA PROJECTS IN PROGRESS

Project No. 84002: Pennsylvania Coal Mining Association's bituminous coal marketability improvement project has three major phases: (I) to define the market potential for Pennsylvania bituminous coals; (II) to develop correlations between explored coal quality and mined coal quality; and (III) to establish a coal resource database for use by the coal industry, utilities and other interested parties that includes an automated procedure for matching coal suppliers with potential consumers.

Phase I, documentation of the market potential for existing and improved (i.e., better cleaned) Pennsylvania bituminous coals, is complete. Major elements of Phase I were: (1) survey of coal characteristics for Pennsylvania's bituminous coal fields on a seam-by-seam basis; (2) survey of market coal quality specifications, especially industrial, utility and foreign markets; (3) assessment of the ability of Pennsylvania bituminous coals to meet market specifications using current or advanced coal cleaning techniques; (4) overall "mines-to-market" economic assessment (a) to evaluate the potential of each seam (by county) to serve individual markets, and (b) to establish the potential for expanded market opportunities through coal beneficiation.

General conclusions from Phase I are:

- Significant new markets can be obtained economically through application of present coal preparation technologies.
- Low volatile coals show the greatest potential for meeting low sulfur (less than 1%) markets, with minimum cleaning.
- Costs associated with advanced coal cleaning are not competitive for upgrading coal quality for today's markets.
- Utility and industrial coal users represent the greatest potential for growth in Pennsylvania coal sales.
- Metallurgical or coking coal opportunities are greatest among companies without major captive coal supplies.
- Metallurgical markets represent the greatest potential for export sales.

Phase II is the research-oriented aspect of this project. Phase II objectives are: (1) to develop correlations between explored coal quality and mined coal quality, (2) to develop a predictive model for projecting coal characteristics from core hole and

channel sample analyses via geostatistics, and (3) to validate statistically the preceding predictive model.

The product from Phase II will be a geostatistical tool that a mine operator, geologist or property owner can use to predict in-place coal characteristics. This facility will enable one to obtain specific coal quality values, with error estimates. Based on the quality and distribution of input data, results will reflect regional to site-specific coal quality. A good predictive or correlating technique would enable a producer to select coal properties for development that meet desired demand specifications. This would reduce risks associated with mine development and long-term contract commitments. Predictive capability could enable a more feasible and reliable determination of coal cleaning requirements, production costs and product quality.

The final phase of this project involves creation of a computerized coal resource database for use by the coal industry, utilities and other interested parties. This database will incorporate and synthesize information compiled and/or generated in Phases I and II. The database will include coal characteristics, washability data, mining costs, market potential information, transportation data and mine data.

Currently, the database does contain an automated procedure to match coal suppliers with potential consumers. Available functions in this supply/demand system are (1) matching captured utility feedstock specifications to Pennsylvania bituminous coal seams; (2) matching input utility feedstock specifications to Pennsylvania bituminous coal seams; (3) listing captured power plant feedstock specifications; (4) listing future purchase plans for utilities on file; (5) matching coal seam quality (county basis) to feedstock specification of power plants, with no costs; (6) matching coal seam quality (county basis) to feedstock specifications of power plants, with estimated target mining costs; (7) matching input coal quality to captured feedstock specifications of power plants, without costs; and (8) matching input coal quality to captured power plant feedstock specifications, with estimated target mining costs.

Although programming for remote access is just nearing completion, requests are already being received from enterprises desiring to use the database. Applications of the database by these companies have included: matching coal quality (raw and cleaned) to market specifications, determination of cost competitiveness to selected markets, justification of a coal property acquisition, assessment of the quality of available coal seams for siting a centralized coal cleaning plant, and analysis of inherent moisture content of several coal seams in a given county.

Ultimately, the computerized coal resource database will be available for outside use through PCMA, Pennsylvania State University and the Pennsylvania Energy Office. The database is a valuable marketing aid, providing producers and consumers of Pennsylvania bituminous coal with a tool to target both coal quality and quantity.

Project No. 84016: Lehigh University is conducting research on ionic hydrogenation, a process to beneficiate coal and increase its fluidity for coking. Ionic hydrogenation is a selective chemical reaction that splits bonds between aromatic carbon, and sulfur and oxygen. Though this process has never been applied to coal, it should remove some organic sulfur from coal and convert remaining organic sulfur to a form which will be lost as H_2S on pyrolysis. Cleavage of C-S and C-O bonds should also lead to a more fluid, better coking coal.

Completed experiments indicate coal desulfurization and increased fluidity via ionic hydrogenation are attainable only with low rank Pennsylvania bituminous coals. However, significant desulfurization occurs with BF_3:H_2O, though this acid system destroys coking properties. Room temperature treatment of bituminous coal with BF_3:H_2O for one hour resulted in removal of 33% of the sample's total sulfur content. Research continues on the nature of removed sulfur and what effects BF_3:H_2O has on coal.

Project No. 84017: Fluidized bed coal cleaning at Lehigh University involves material separation by density. Crushed run-of-mine Pennsylvania bituminous coal is introduced into a fluidized bed chamber, atop a layer of magnetite. At conditions close to minimum bubbling velocity, solids stratify in the vessel. Specifically, clean coal segregates at the top of the bed, while pyrite becomes distributed throughout the bed. Material is removed from the bed in layers, yielding clean coal, middling and reject fractions; magnetite is recovered from the coal with a magnetic separator.

Coal beneficiation experiments investigated the effects of superficial gas velocity, magnetite particle size and coal-to-magnetite fuel weight ratio on pyritic sulfur removal efficiency. Single-stage cleaning yielded marked reductions in pyritic sulfur content (as much as 50% at 70 weight percent coal yield); multi-stage processing of selected coal fractions resulted in additional beneficiation. Initial results suggest this dry coal cleaning technique may be more economical than conventional wet cleaning techniques such as concentrating tables and cyclones.

Project No. 84038: CDA International, Inc. is testing a retrofittable, microprocessor controlled HVAC system that it has

developed for operating rooms in hospitals. Projections by CDA suggest $25,000/yr savings at a typical site through reducing ventilation during unoccupied times, while maintaining code compliance. Lock Haven Hospital is the site for this project.

Project objectives are:

1. To verify calculated energy savings of modified hospital operating room HVAC systems, through air volume reduction during unoccupied periods using intelligent control systems;

2. To compile results through quantitative analysis of traditional hospital operating room HVAC design versus energy conscious design modifications; and,

3. To present results and design methods in a manner usable by designers and hospital administrators, through seminars and publications.

Initial monitoring results show CDA's modified HVAC system is exceeding estimated savings.

Project No. 84043: BCR National Laboratory's two-phase project to demonstrate the Reichert spiral for coal beneficiation is at a standstill. Phase I of this project involved obtaining a co-sponsor that would supply matching funds for Phase II, an in-plant demonstration. Though several companies expressed interest, none agreed to sharing demonstration costs. Therefore, the project objective, namely, field demonstration of the Reichert spiral, was not achieved.

The primary reason no demonstration site could be secured is sufficient data are now available that show the Reichert spiral is a viable coal cleaning method. This development obviated the need for a demonstration to prove the Reichert spiral's efficacy.

Project No. 85004: Norton, Hambleton Inc. (NHI) is under contract to demonstrate Reverse Column Flotation (RCF), an advanced physical coal cleaning process. RCF employs column flotation cells to perform a two stage separation of coal from ash, and pyrite from coal. The demonstration calls for a 5 ton/hr circuit, to be installed at a coal preparation plant in western Pennsylvania.

Objectives of the RCF project are:

1. To determine the technical and economic feasibility of pyritic sulfur reduction of a Pennsylvania bituminous coal, on a site-specific basis;

2. To examine the effects of various in-plant operating parameters on the RCF process; and,

3. To develop a database, from an extensive sampling program and a well instrumented demonstration facility, to enable dynamic modeling of the system, and to develop the design and engineering data necessary for a full-scale commercial installation.

Laboratory studies by NHI have shown RCF can produce a cleaner coal product than two stage pyrite depression using sodium metabisulfite. On Upper Freeport Seam coal from Allegheny County, pyritic sulfur reductions of nearly 50% were attained, with BTU recoveries greater than 90%. On an emissions basis, this result translates to an SO_2 reduction of roughly 27%, reducing the coal's lbs SO_2/MMBTU content from 2.56 to 1.86. Ash reductions in excess of 40% were also achieved.

Project No. 85005: Research to develop a new process to reduce coal's sulfur content is in progress at Pennsylvania State University. The process involves low temperature pyrolysis of coal using steam/methane mixtures. This treatment should selectively remove sulfur through reaction with hydrogen, while suppressing coal gasification.

Well-characterized char has been the medium subjected to experimental study. Chars treated with steam/methane mixtures have been analyzed for sulfur reduction, gasification, specific surface area, reactivity and pore size distribution as functions of temperature, gas composition, and in cases, time of exposure. Results reveal this chemical process can desulfurize coal, to a limited extent, without appreciable gasification and structural change to carbon.

Project No. 85006: R.A. Systems is trying to develop a cutting drum with built-in pressure intensifier for water-jet assisted cutting on a longwall shearer. A pressure intensifier located in the cutting drum, and powered by it, solves the current technical problem of distributing high pressure water to the cutting drum of coal winning machines. Water-jet assisted cutting significantly reduces the mechanical forces on cutting tools and enhances mine safety by dramatically lowering dust levels in underground mines.

Project objectives are:

1. To solve technical problems through bench testing of selected components to assess the feasibility of intensifying pressure in a cutting drum;

2. To build a cutting drum equipped with a water pressure intensifier that is retrofittable on existing longwall shearers.

3. To determine optimum parameters (e.g. water pressure) for the drum from step 2, with surface tests.

4. To install the modified cutting drum on a shearer and use it to excise coal from a longwall face.

Currently, the cutting drum with built in pressure intensifier has been designed, and parts ordered for its construction. These parts should be tested, and a drum fabricated, by October 1, 1987. Surface testing of the modified cutting drum should occur in October, 1987.

Project No. 85009: Pennsylvania Coal Mining Association and BCR National Laboratory are engaged in a two-phase project to introduce low volatile Pennsylvania bituminous coal into utility boilers. Phase I objectives are: (1) to make utilities aware of the availability of Pennsylvania low volatile coal for use in boilers; (2) to document low volatile coal experiences and concerns in a digest of helpful information, testing standards and technical knowledge, for reference by potential users of low volatile bituminous coal; and (3) to obtain input from interested utility hosts.

Presently, subcontractors involved in this project are making presentations to utilities to secure their commitment for the first segment of Phase II.

For discussion of Phase II of this project, please refer to Project No. 86007 in this appendix.

Project No. 85010: The Anthracite Industry Association (AIA) has spearheaded several projects to promote anthracite as a clean, efficient, dependable and modern fuel source. AIA promotes anthracite in three ways: marketing, demonstration/conversions, and technical assistance/education.

Communications media such as newspapers, trade journals, radio and television, as well as dedicated trade shows, brochures, newsletters and videotapes, have been used to convey the advantages of anthracite, especially as a heating fuel for homes and light industry. More than six million persons have been exposed to the anthracite "message."

Under AIA's demonstration/conversion program, the heating systems in seven different-sized buildings have been converted to anthracite. These conversions are generating case histories on cost savings that are being used to bolster the marketing phase.

Dallastown Area High School, near York, Pennsylvania, an AIA heating system conversion site, received an award for energy innovation from the U.S. Department of Energy.

The technical assistance/education component has addressed the questions and concerns of heating decision makers, both in the public and private sectors, interested in anthracite as a heating fuel.

Specific activities under Project No. 85010 have been:

- Execution of a publicity campaign through broadcast media and newsletters.
- Provision of responses to inquiries regarding anthracite stemming from the above publicity campaign.
- Conduct of an Anthracite Trade Show.
- Provision of technical support to the marketing program.
- Provision of technical support to parties interested in using anthracite-fired systems to meet their heating needs.

Project No. 85011: Continental Cogeneration Corporation (CCC) is conducting a project aimed at increasing the efficiency and commercial feasibility of making producer gas from anthracite refuse.

The technical objectives of this effort are:

1. To survey all possible sources of anthracite waste;
2. To fire a range of anthracite refuse in full scale gasification tests, and characterize problem causing processes;
3. To develop advanced analytical techniques to predict gasification problems and compare them with full scale test results;
4. To correlate data from objectives 1-3 to develop quality control and operating parameters that will ensure economic and trouble free operation; and,
5. To identify fuel ash constituents to obtain an ash disposal permit.

Objectives 1, 2, 3 and 5 have been met. CCC has taken options on two waste piles; three waste fuels were tested at full scale; a bench scale gasification unit has been developed and used to test

gasification performance of anthracite refuse with calorific values from 3,000 to 10,000 BTU/lb; and fuel ash from gasification has been approved for sale as an anti-skid material.

Project No. 85015: The engineering firm of Hess & Fisher is evaluating alternative sediment and erosion control methods. This study's main objective is to obtain quantifiable data to provide regulatory agencies with documentation to justify use of innovative sediment control techniques. Results from this study will be disseminated to Pennsylvania's surface mining industry.

All sediment control structures and data collection devices have been installed. A major storm in June washed out monitoring stations, curtailing data acquisition. Nonetheless, initial data analysis indicates the innovative ripped zone area yields considerably less sediment than the area with conventional ditches (average Total Suspended Solids of 30 mg/l versus 63 mg/l).

Project No. 85016: The University of Pittsburgh's liquid CO_2 (LICADO) coal cleaning study is in its second phase. The LICADO process, invented by the University of Pittsburgh, uses liquid CO_2 as a medium to beneficiate ultra-fine coal (-200 mesh).

Phase I work focused on the mechanism of the LICADO process and its effectiveness in producing clean coal product. Phase I experiments were conducted in a batch reactor. Salient results from Phase I work are: (1) change of coal/water slurry concentration (from 3% to 17%) has only a minor effect on clean coal ash content and product yield; (2) clean coal quality is favored by using a low liquid CO_2 injection rate, without significantly decreasing product yield or BTU recovery; (3) mixing in the water phases improves product yield (BTU recovery), while mixing in the liquid CO_2 phase has an opposite effect on yield; and (4) significant sulfur reduction occurs during the cleaning process, for example, Pennsylvania's Upper Freeport bituminous coal containing 23.4% ash and 1.30% total sulfur was cleaned to a product containing 3.8% ash and 0.74% total sulfur, with 75% BTU recovery and minimal moisture content in single-stage processing.

Phase II studies will use a continuous contact unit to examine factors that affect clean coal product quality and yield as a function of operating conditions, and to provide a database for commercial development of the LICADO process. Phase II will involve three tasks: equipment development, testing of continuous operation, and engineering and economic analysis.

Project No. 85024: Kipin Industries, Incorporated (KII) has developed the technology to combine liquid and solid hydrocarbon wastes such as tar and oil sludge with other waste materials or

low-grade coal to produce a marketable commodity. The purpose of KII's project is to characterize waste materials and to evaluate to what extent they can be combined with coal to form acceptable feedstocks for coal-fired boilers.

Project objectives are:

1. To determine to what extent coal can act as a base for various wastes such as municipal garbage, organic acid sludges, trash/debris, tires, paint and resins, chemicals, railroad ties/wood, oil spill absorbants, sewage sludge and plastic;

2. To determine which products and blends from step 1 are best suited for stoker or pulverized coal boilers (handling characteristics, product and ash characteristics, and emission effects will be considered);

3. To determine which blends of processed waste oils can be shipped to coal mines for coal upgrading; and,

4. To evaluate if equipment can be installed at a power plant or industrial facility that permits waste-to-fuel processing for either on-site use or shipping to consumers.

Presently, construction and purchase of coal/waste co-processing equipment for this demonstration are virtually complete. The site to operate this mobile facility is under negotiation.

Project No. 85027: Coal Tech Corporation was a successful applicant in the first round of the U.S. Department of Energy's Clean Coal Technology Program for support of Phase III of its advanced cyclone combustor project (please refer to Project No. 84020 in Appendix A for information on Phases I and II). Phase III will involve modification of the combustor to consume dry, pulverized coal. Approximately 900 hours of tests are slated for Phase III.

Additionally, Coal Tech Corporation is seeking funds for additional tests with coal-water fuels, with emphasis on fuel-rich combustion and SO_2 and NO_x control.

Project No. 85028: Pennsylvania State University is assessing performance of different limestones and dolomites (sorbents) in reducing SO_2 emissions during atmospheric fluidized bed combustion (AFBC) of Pennsylvania high sulfur bituminous coal. Based on this objective, effects of sorbent residence time, sorbent particle size, and bed temperature on sulfur capture efficiency are being investigated for different sorbents.

Results show several sorbent properties can be used to select suitable sorbents for AFBC applications. Balance between large pore diameter and high surface area is prerequisite to achieving high calcium utilization. The rate at which pore blockage occurs depends on the impurity level within the sorbent's structure. From this standpoint, impure sorbents are better than high purity limestones for reducing SO_2 emissions from fluidized bed combustors.

Project No. 85031: Lehigh University is engaged in fundamental research on bioprocessing of coal. The focus of this inquiry is to establish and evaluate the potential of Sulfolobus acidocaldarius as a means of removal of the organically bound sulfur in coal.

The technical objectives of the research are:

1. To demonstrate definitively that S. acidocaldarius is capable of non-destructive desulfurization of dibenzothiophene (DBT - an organic compound containing sulfur);

2. To measure stoichiometrically the specific product(s) formed during step 1;

3. To determine the role of permeability in the efficiency of DBT degradation;

4. To evaluate the role of cell aggregation and attachment in DBT degradation; and,

5. To initiate testing of the above parameters with coal.

Growth experiments indicated S. acidocaldarius can grow with glucose as its sole carbon source at the same rate and to the same extent as S. acidocaldarius grown on sucrose. This observation is contrary to the original description of the organism's metabolic capacities.

Extensive plating of soil samples contaminated with coal and fuel oils was conducted. Plates with microbial colonies were sprayed with an aerosol of ether plus DBT. Following incubation, the plates were examined for evidence of oxidation of a carbon ring of DBT and(or) desulfurization of DBT. This examination revealed numerous organisms with the capacity to transform DBT, with or without desulfurization.

Project No. 85032: Thousands of acres of abandoned coal mined lands occur in Pennsylvania. The estimated cost to reclaim these lands is 15 billion dollars. One way to deal with orphaned mined lands is to provide an incentive for the active coal mining

industry to remine some of these areas. Credit for water quality and land improvements by operations, at no governmental expense, is one such incentive. Consistent with this approach is the need to reduce an operator's liability for preexisting discharges that may be improved by remining.

This project's purpose is to develop a procedure to lessen an operator's liability for preexisting discharges. One necessary aspect of this procedure is the ability to predict cost and productivity for competitive surface mine schemes on remining sites.

Specifically, investigators at Pennsylvania State University (PSU), are modifying PSU's computerized Open Pit Materials Handling Simulator (OPMHS) and Surface Coal Mine Cost Model. These programs will be integrated into a surface mining simulation package that will operate on a microcomputer.

Currently, the first draft of the "user friendly" input program has been written for both the OPMHS and Cost Model. The Cost Model is being revised. Both programs have been altered to run on a microcomputer and downloaded from their mainframe host to the project's microcomputer system.

Project No. 85035: The Anthracite and Community Development Institute of Wilkes College is helping small and medium-sized anthracite operations in northeastern Pennsylvania. The Coal Operators Assistance Program provides marketing and technical help, advice on compliance with state and federal mining regulations, and financial counseling.

Specific activities engaged during this project have included:

- Marketing and(or) technical assistance in international trade development, government supply contract procurement, and residential heating system conversions;
- Compilation of an Anthracite Producers Directory;
- Aid in meeting state and federal mining regulations;
- Help with financing and bonding problems; and
- Conduct of training seminars and workshops.

Project No. 86002: Phase II of BCR National Laboratory's reactive gas coal desulfurization project continues examination of pyrite/ozone kinetics begun in Phase I (for additional details on Phase I of this work, please refer to Project No. 84042 in Appendix A). In addition to the previously studied variables (pH, time, temperature), variables including sample size consist,

particle surface area and surface characteristics will be assessed. The primary goal of Phase II is optimization of pyrite/ozone reaction conditions. Studies of coal-derived pyrite and run-of-mine coal to determine their susceptibility to reactive gas desulfurization are a secondary goal.

Project No. 86004: The University of Pittsburgh is involved in a project focused on energy production from controlled burnout of coal refuse piles in Pennsylvania. Burnout Control is an engineered technique using ventilation and suction to accelerate combustion of a waste coal pile until extinction. These refuse deposits possess calorific values ranging between 2,000 and 6,000 BTU/lb; they are both an unused potential energy source and an environmental hazard. Laboratory research will include characterization and evaluation of properties of coal waste piles in Pennsylvania for suitability to Burnout Control, and correlation of thermal energy potential to properties of waste coal piles.

Project objectives are:

1. To provide the basic knowledge required for selection of suitable coal refuse sites within Pennsylvania for energy production via Burnout Control;

2. To provide a basic understanding of potential emissions necessary for preliminary design of environmental control technology and development of environmental permits; and,

3. To establish commercialization criteria for Burnout Control to serve as guidelines for sampling for laboratory studies and commercial energy development.

Commercialization criteria for minimum pile size to be considered have been established. Design and construction of the laboratory apparatus to investigate the Burnout Control technique have been initiated.

Project No. 86006: Pennsylvania State University is investigating the sulfur removal efficiency of C & K Coal Company's Piney Tipple. This coal preparation facility processes high-pyrite coal from the Upper and Lower Clarion seams.

The procedure being employed to evaluate the Piney Tipple is:

1. Characterization of the sulfur forms, high temperature ash, total sulfur, and distribution of pyrite size and morphology in the Upper and Lower Clarion seams.

2. Determination of the modes of occurrence of pyritic sulfur in cleaned Upper and Lower Clarion seam coals.

3. Evaluation of the efficiency of the washing procedure at the Piney Tipple.

4. Recommendation of changes (if any) to the washing procedure at the Piney Tipple that might produce a cleaner coal product.

Steps 1 and 2 are well under way.

Project No. 86007: As described under Project No. 85009 in this appendix, Pennsylvania Coal Mining Association and BCR National Laboratory are executing a two-phase project to introduce low volatile Pennsylvania bituminous coal into utility boilers.

Upon procurement of at least one utility's commitment (the goal of Phase I, see above reference), the first segment of Phase II is to address the utility's concerns through systems analysis, laboratory characterization of low volatile bituminous coals, development of standard laboratory tests, laboratory combustion analysis and satisfaction of safety requirements. The second segment of Phase II, again pending a utility's commitment, consists of utility-hosted demonstration burns using low volatile Pennsylvania bituminous coals as fuel.

Project No. 86008: Pennsylvania Electric Company is in the initial stage of a project to demonstrate a low NO_x burner at its Homer City generating station in Indiana County, Pennsylvania. This demonstration is part of a program sponsored by the Electric Power Research Institute to evaluate the performance of low NO_x burner systems. The low NO_x burner will be retrofitted to a pre-1971 New Source Performance Standards boiler. Comparisons between data obtained before, immediately after, and well after burner conversion will accurately and conclusively describe performance of the selected low NO_x burner system.

Low NO_x burners appear to be the simplest and cheapest means of achieving significant NO_x reductions in emissions from utility boilers.

Project No. 86009: Pennsylvania Electric Company is currently conducting a project to demonstrate and optimize the Confined Zone Dispersion (CZD) process, an SO_2 reduction strategy, on one-half of the flue gas emanating from its 130 MW coal-fired furnace at Seward Generating Station. CZD has the potential to reduce SO_2 emissions by 50% to 70% from their present level at this power plant. CZD is inexpensively retrofittable to existing coal-fired boilers and can remove large quantities of gaseous SO_2, using humidification and a lime reagent alone; an existing electrostatic precipitator (ESP) serves as the collector of spent reagent. Additionally, humidification and cooling of the flue

gas likely will improve collection performance of the ESP. Information obtained from this project will help in optimization of a full-scale CZD system, and will quantify expected performance when this desulfurization system is operated in different modes.

Installation and start-up of all test equipment are finished; atomization tests of several injection nozzle, orifice, and fitting combinations have been completed. A water injection test series has begun with the goal of achieving a flue gas temperature reduction of 100 deg F, without jeopardizing operation of the boiler system with ash deposits or unduly moist ash in the electrostatic precipitator collection hoppers.

Project No. 86014: BCR National Laboratory is investigating and developing an enhanced technique to dewater clean coal slurries emanating from coal beneficiation processes. This technique employs ultrasonic energy to increase the filtration rate in a vacuum disc filter.

The objectives of this research are:

1. To evaluate the application of ultrasonics for improving dewatering of clean coal slurries in a laboratory setting;

2. To investigate the structure of the filter cake to determine the cause of the improved dewatering;

3. To evaluate use of ultrasonics on a laboratory scale, continuous, single disc vacuum filter; and

4. To determine the benefit of retrofitting a unit into existing Pennsylvania coal preparation plants, including economics and environmental impact.

Project No. 86018: General discussion of Anthracite Industry Association's effort to promote anthracite are presented under Project No. 85010 in this appendix.

Specific activities associated with Project No. 86018 are:

- Production of a video sales presentation.
- Placement of radio news spots.
- Conduct of preliminary tasks for the Second Annual Anthracite Trade Show.
- Placement of trade journal advertisements.

APPENDIX B
(Continued)

Project No. 86022: Heyl & Patterson, Inc. is evaluating the amenability of the HeylPat-Miller Flotation System to micro-bubble flotation. Micro-bubble flotation is an advanced physical process for cleaning fine coal. Substantial improvements must be made in fine coal flotation selectivity if micro-bubble flotation is to perform effectively on Pennsylvania coal.

Project objectives are:

1. To establish the aeration capacity of the HeylPat-Miller aerator at various pressures and flows up to 60 psig inlet pressure;

2. To modify the inlet design of the aerator and to determine aeration capability with various inlet configurations and apex orifice sizes;

3. To quantify the bubble size distribution under the most attractive designs from steps 1 and 2;

4. To compare the size of bubbles from the modified flotation system to the size of bubbles generated under standard flotation conditions; and,

5. To test a Pennsylvania coal under standard and micro-bubble flotation conditions, using a standard frothing agent, and to compare results in terms of product yield and product quality for five size fractions of that coal.

The test flotation system has been erected in the Heyl & Patterson Pilot Plant, the short term test program developed, and requested patents received.

Project No. 86026: BCR National Laboratory has initiated a project ultimately aimed at employing currently idle coke ovens to pyrolyze solid combustible waste and coal to produce enhanced BTU products for subsequent energy production as well as other usable materials.

Project objectives are:

1. To research and develop systems that combine various inexpensive Pennsylvania coals (e.g. high-sulfur bituminous coals, bituminous coal waste, anthracite refuse) and combustible solid waste into refuse derived fuels (RDF);

2. To conduct energy balance studies on the RDF from step 1 in a bench-scale coke oven;

3. To complete bench-scale tests on selected RDF from step 2 for production modeling purposes; and,

4. To evaluate test data and systems development information to ascertain technical and economic merit of this coal/waste co-processing concept.

Progress has been made on gas sampling analysis and gas sampling design, two integral components for studying gases evolved from RDF pyrolysis. Fabrication of gas collection vessels is under way.

Project No. 86028: General discussion of Anthracite Industry Association's effort to promote anthracite is presented under Project No. 85010 in this appendix.

This project's purpose was to conduct the Second Annual Anthracite Trade Show.

Project No. 86031: Humenick Wood Products is installing an innovative wood waste burning and heat exchange system in its manufacturing plant. This system will enable (1) heating of the Humenicks factory with a system fueled by internally generated wood waste, and (2) heat recovery from fumes currently vented to the atmosphere.

Equipment procurement and structural modifications for this demonstration are in progress.

Project No. 86033: Grass Roots Alliance for a Solar Pennsylvania is developing the prototype commercial application of the Biothermal Composting Greenhouse. This greenhouse uses innovative biomass technology to generate heat. Furthermore, carbon dioxide and moisture are also captured in the composting process, thereby reducing fertilizer and irrigation costs. This technology is retrofittable to existing commercial greenhouses.

This project will demonstrate the energy efficiency, reliability, cost effectiveness and commercial viability of biothermal energy technology, and promote its use.

Negotiations for a site and business partner are in progress.

Project No. 86035: The Economic Development Council of Northeastern Pennsylvania (EDCNP) has embarked on a project to furnish technical assistance to small producers and exporters seeking to market anthracite to Korea and other Far Eastern countries. EDCNP will perform two tasks:

1. Review existing specifications of the Korean anthracite market and make recommendations on reasonable specifications that are consistent with this market; and,

2. Sample and analyze some major anthracite silt ponds, culm banks and processed anthracite, and offer recommendations to achieve effective quality control. This task will include evaluation of the mixing ratio of different anthracite and anthracite waste feeds to meet calorific value requirements, and assessment of mixing methods to insure uniform quality.

Project No. 86041: A project to explore for anthracite with a modern geophysical tool has recently been initiated by the Pennsylvania Anthracite Development Corporation. Radio imaging will be tested as a method to detect anthracite, to determine its in-place characteristics and to delineate its lateral extent.

Project No. 86043: Pennsylvania State University recently initiated a project to develop a statistical model to predict acid mine drainage (AMD) from proposed coal mining sites. The goal is to produce a model that predicts AMD more accurately than current methods.

The AMD model will be based on the correlative behavior between the amount and reactivity of pyrite in coal, the amount and form of carbonate components in overburden, and leachate data gathered from simulated weathering experiments. Three tasks comprise the project: (1) overburden characterization via (a) quantitative phase characterization based upon x-ray diffraction analysis, (b) grain-size distribution measurement of pyrite grains in selected samples with computer-controlled scanning electron microscopy, and (c) quantification of the reactivity and amount of pyrite and carbonate minerals by evolved gas analysis; (2) simulated weathering (leaching) experiments to study rates and quantities of acid production; and (3) development of a predictive model based upon data collected from Tasks 1 and 2.

Project No. 86046: EXPORTech Company, Incorporated's latest project continues its initial inquiry, under Project No. 85030 (see Appendix A), into Open Gradient Magnetic Separation (OGMS) as a physical coal cleaning method. In this project, EXPORTech Co., Inc. seeks to extend its earlier work by beneficiating Lower Kittanning coal with 8 mesh topsize. The ability to beneficiate larger sizes of coal is integral to commercialization of OGMS as a beneficiation process.