



1993-94 ANNUAL REPORT

July 1, 1993 - June 30, 1994





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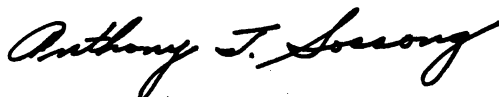
MESSAGE FROM THE CHAIRMAN AND DIRECTOR

With the end of the 1993-94 fiscal year, the Pennsylvania Energy Development Authority (PEDA) will have concluded a decade of providing research opportunities in Pennsylvania. The theme of this Annual Report -- A Decade of Research Opportunities -- conveys the success of a state agency that has supported a wide variety of research projects conducted by Pennsylvania universities, non-profit organizations and private industries. It has been a decade of change for this state's energy industry. From the evolution of the independent power producing industry to the dramatic changes associated with the adoption of various state and federal environmental legislation, from the challenges of the coal industry to maintain its importance in the energy picture to a renewed interest in energy efficiency and renewable technologies -- PEDA has charted a course to support important research focused on new technologies and the technical issues surrounding them.

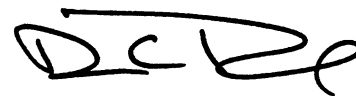
PEDA has consistently attempted to maximize the use of state funds to support research activities and to leverage additional dollars for the benefit of the energy industry and the state's economy. Since its inception, PEDA has contributed over \$12.9 million to 131 energy projects worth more than \$55 million. In addition, the total interest accrued to the Energy Development Fund has more than supported all the operational cost required to conduct the business of PEDA. PEDA is a public corporation that has been run efficiently to the benefit of the taxpayers and the energy industry of Pennsylvania.

It is very important to recognize and to thank the many Pennsylvanians who have contributed considerable time and expertise to PEDA's operation. To the many members of the Board of Directors -- your commitment has been outstanding. To the members of the Technical Advisory Committee -- your participation has been dedicated and technically superb. To the little recognized staff of the Board members -- your involvement has been essential to operating PEDA. PEDA could not have worked for a decade without the support of all these participants.

To conclude this decade, this Annual Report is submitted to the Governor and General Assembly pursuant to the Pennsylvania Energy Development Authority and Emergency Powers Act of 1982, P.L. 1213, 280. As this state approaches a new century, the twenty-first, it should recognize the importance of energy research to the economic and environmental well being of the Commonwealth. Research will be essential to the development of new technologies, to sustaining our economy, and to the resolution of environmental issues in the years ahead.



Anthony T. Sossong
Chairman



Dane C. Bickley
Director

A DECADE OF RESEARCH OPPORTUNITIES

"PEDA's support has been and continues to be very instrumental in expanding the markets for the NOXSO Process including exporting this Pennsylvania technology overseas."

Dr. L. G. Neal, President of NOXSO Corporation

"PEDA has provided GRASP with a framework in which to test our theories and to conduct further research into approaches to residential energy conservation. Adoption of these approaches could lead to significant energy savings for Pennsylvania residents."

Mary Mikus, Executive Director, GRASP

"Development of the LICADO process for fine coal beneficiation exemplifies the success of PEDA's assistance program in promoting new technologies for clean use of coal - the most abundant indigenous energy source of the Commonwealth of Pennsylvania and this nation."

Dr. Shaio-Hung Chiang, Whiteford Professor of Chemical Engineering, University of Pittsburgh

"PEDA's broad experience and commitment to fostering beneficial application of advanced technologies was simply invaluable to the Piney Creek power plant."

Tyrone Christy, Project Manager for MidAtlantic Energy

"The Babcock & Wilcox Company is proud to be affiliated with the Ebensburg Power Company as one of its several facilities in the Commonwealth of Pennsylvania. The outstanding support of the Pennsylvania Energy Development Authority, other state agencies and many state and local officials made it possible to develop and build this project which contributes to both environmental improvement and economic development in Western Pennsylvania."

J.J. Stewart, President and Chief Operating Officer of Babcock and Wilcox Company

"The ability to burn clean fine coal economically and in an environmentally acceptable manner is important to the continuing use of Pennsylvania coal as a utility fuel. Maintaining a competitive coal and utility industry in Pennsylvania is vital to the economic well being of the State. The successful use of this technology (PEDA project on coal water fuels) will mark a significant step toward that objective."

J.G. Herbein, Vice President - Generation, Pennsylvania Electric Company

"With the success of this research (PEDA's alkaline addition mining project) will come the possibility to mine vast energy resources currently not available for permitting in Central Pennsylvania. Demonstrating feasibility of mining the Lower Kittanning coal deposits, currently not allowed in Clearfield County, will increase the employment of skilled labor throughout this coal region of the state."

Alan Walker, President of Al Hamilton Contracting Company

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BOARD OF DIRECTORS

Lawrence B. Abrams III, Esquire
Rhoads & Sinon
Harrisburg

Jeffrey S. Craig
Pittsburgh

Thomas P. Gordon, Ph.D.
Gordon Terminal Service Company
Pittsburgh

Virginia Brown
Philadelphia

Honorable Arthur A. Davis
Secretary of Environmental Resources
Harrisburg

Honorable Andrew T. Greenberg
Secretary of Commerce
Harrisburg

James H. Cawley, Esquire
LeBoeuf, Lamb, Greene & MacRae
Harrisburg

Medard Gabel
The World Game
Philadelphia

Honorable James J. Rhoades
Senate of Pennsylvania
Mahanoy City

Honorable Sarah W. Hargrove
Secretary of Banking
Harrisburg

Irwin A. Popowsky, Esquire
Consumer Advocate
Harrisburg

Anthony T. Sossong, Chairman
Reitz Coal Company
Windber

Honorable William R. Lloyd, Jr.
Pennsylvania House of Representatives
Somerset

Honorable David Rolka
Public Utility Commission
Harrisburg

Alfred A. Slowik
General Public Utilities
Johnstown

Peter T. Luckie, Ph.D.
Associate Dean for Research
Pennsylvania State University

Honorable Samuel E. Rohrer
Pennsylvania House of Representatives
Reading

Honorable William Stewart
Senate of Pennsylvania
Johnstown

Honorable Boyd E. Wolff
Secretary of Agriculture
Harrisburg

TECHNICAL ADVISORY COMMITTEE

Thomas Bradish, Director
Research and Development
Pennsylvania Electric Company
Johnstown

Martin Campfield, CPag
GRO-MOR Plant Food Company
Leola

James T. Cobb, Jr., Ph.D., Director
Energy Resources Program
University of Pittsburgh
Pittsburgh

Frederick P. DeWeese, President
Carbon Sales, Inc.
Wilkes-Barre

Gilbert M. Freedman
Allegheny Electric Cooperative, Inc.
Harrisburg

Robert P. Johnson, Manager
Energy Utilization Research
Pennsylvania Power & Light Company
Allentown

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Research and Development
Consolidation Coal Company
Library

Robert Kobet, AIA
Energy Design Associates
Harmony

Andy Lau
Penn State Harrisburg
Middletown

David Martin
Gilberton Power Company
Frackville

Edward K. Levy, Ph.D., Director
Energy Research Center
Lehigh University
Bethlehem

Harold G. Lorsch, Ph.D., Director
Center for Insulation Technology
Drexel University
Philadelphia

John E. Notestein, Senior Scientist
US Department of Energy
Morgantown Energy Technology Center
Morgantown, West Virginia

Tad R. Potter
Pittsburgh Coalbed Methane Forum
Pittsburgh

Thomas A. Sarkus, Esquire
US Department of Energy
Pittsburgh Energy Technology Center
Pittsburgh

PEDA STAFF

Dane C. Bickley Director

Joseph J. Garbacik Program Manager

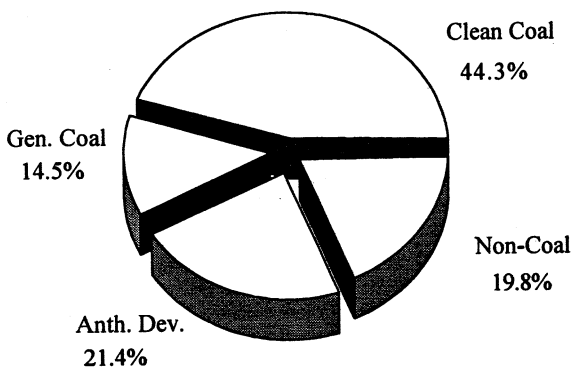
Billie E. Ramsey, Esquire Counsel

Toni J. Mears Assistant Secretary
to the Board

THE RESEARCH AGENDA

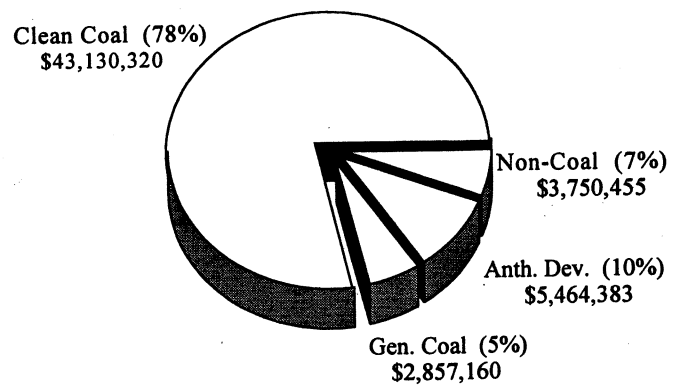
Through a decade of operation, PEDa has provided research opportunities for private industry, universities, and non-profit corporations throughout Pennsylvania. It has been the primary state organization to support energy research projects: projects that have advanced clean air through emission reduction and coal preparation technologies, reduced energy consumption through improved conservation methods, utilized waste materials to improve the environment and produce useful power, improved agricultural practices that reduce energy usage and many others. Over the past 10 years, PEDa has allocated \$12,940,342 to 131 research projects. PEDa's allocations have contributed a fraction of the total project cost, more than \$55 million. That means that for every dollar PEDa has invested in research, an additional four dollars has been invested by private and local or federal government sources. These dollars not only generate research benefits but they also make a considerable contribution to economic activity and environmental improvements.

CATEGORICAL DISTRIBUTION OF PROJECTS (through ten years of program operation)



Research directed at developing clean coal technologies has consistently been the object of PEDa's funding. Fifty-eight projects totalling \$6,752,193 have focused on making coal a cleaner fuel. Other research dollars have been contributed to anthracite development, other coal related research and renewable and energy conservation projects. (See Charts for distribution of Total Cost and Project Types.)

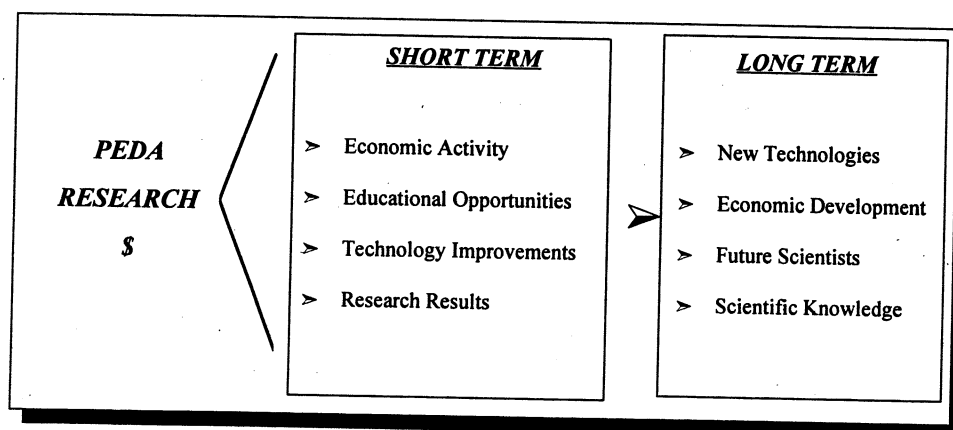
TOTAL COST (through ten years of program operation)



The level of research activity in Pennsylvania supported and managed by PEDa continued to decline. During FY 92-93, PEDa staff managed 54 research projects. That number has been reduced to 43 during FY 93-94. Project management is an important part of PEDa's responsibilities. Careful monitoring of project activities assists greatly in the beneficial use of the projects' research results. For a listing of projects and a summary of each PEDa project see Tables 1, 2, 3, and 4 and Appendices A, B, and C.

THE RESEARCH AGENDA

The purpose of government supported research is manifold. In the near term it can address technological problems that will show immediate results. In the mid term it can address technology development areas that can be characterized as improvements to existing technologies, or advancements that bring new technologies to focus on current problems or better efficiencies. It can also promote basic science that, at sometime in the future, show direct links to the development of new technologies. Research can be associated with many timeframes. Ultimately its importance centers on making life easier, improving our health and the environment, and generating economic activity. Several of PEDAs current projects that exemplify these research goals are highlighted below.



On June 21, 1994, the summer solstice, PEDA and Penn State Harrisburg dedicated a photovoltaic charging station for electric cars. This

"This college has a growing record of applied research which benefits Pennsylvania's businesses and its people. Professor Lau's project (PEDA's solar carport project) is a shining example of how we meet our mission as Penn State's metropolitan college. In addition, the project directly benefits the students both in their educational experience and in the broader exposure of many non-technical students to this environmentally sensitive emerging technology."

Howard Sachs, Associate Dean for Research and Graduate Studies,
Penn State - Harrisburg

project involves the development of an innovative approach to recharging electric vehicles used as commuter cars in Pennsylvania. Photovoltaic panels are mounted on a carport. If installed in work locations, electric vehicle commuter range could be doubled thus reducing daytime electrical demand. The use of electric vehicles will dramatically reduce air pollution, particularly in urban areas, and, also assist in reducing this nation's dependence on foreign oil. In November, 1993 the system began producing power from the seasonally adjustable panels. During the year the system should provide one-half the electric car's power requirement. Testing will continue for one year and will be directed at characterizing system performance through four seasons. It is expected that this kind of research will advance this nation's efforts to find alternatives to oil to fuel its transportation system.

THE RESEARCH AGENDA

"The successful demonstration of this technology (PEDA project on coal water fuels) will be a classic win-win situation. We will be creating jobs by burning Pennsylvania coal with less emissions at a reduced cost."

T. J. Bradish, Manager - Research and Development,
Pennsylvania Electric Company

Another dedication of significance to Pennsylvania's energy and environmental community occurred on November 1, 1993 when the Pennsylvania Electric Company culminated several years of research and development by dedicating its coal water slurry project. Sponsored primarily by PEDA, the project consisted of a series of combustion tests on a utility scale boiler at the Seward Power Plant in western Pennsylvania. The combustion tests co-fired coal water slurry and conventional pulverized coal in the boiler. The coal water slurry fuel was prepared at the coal water slurry pilot plant, another PEDA-sponsored research project, located at the Homer City Power Plant. The test results were favorable from the reduction in NO_x emissions to the overall boiler performance. Another very important aspect of this project is exploring the utilization of waste coal ponds as the

chief source of the fines for the coal water fuel. During FY 93-94, PEDA initiated a new project with the Pennsylvania Electric Company and Pennsylvania State University to go out into the field to evaluate silt ponds and to conduct additional combustion test of the silt pond materials. The overall outcome of these projects could be an improvement in Pennsylvania's environment through the reclamation of these ponds and the generation of a low cost fuel for electric power production.

At Dravo Lime Company in Pittsburgh, two PEDA-sponsored research projects are nearing completion. They could significantly affect the operation of a sulfur emissions reduction technology for coal-fired power plants, commonly called scrubbers. First, Dravo Lime Company is developing a technology called ThioNO_x, an integrated technology to simultaneously remove SO₂ /NO_x /air toxics at Dravo Lime Company's Research Center. In this process, the SO₂ is taken out by a wet scrubber using magnesium-enhanced lime slurry. The NO_x is extracted from the scrubber liquor by adding a metal chelate. The air toxics are removed using sulfur-based compounds. The other research project involves developing a process to generate alpha-gypsum directly from a coal-fired

TABLE 1: PEDA REVENUE BOND PROJECTS

Project Number	Name	Developer	Revenue Bond Issue Amount
84-061	Humboldt Energy Center	Continental Energy Associates	\$ 39,000,000
85-033	Piney Creek Project	MidAtlantic Energy Group	45,650,000
85-034	Ebensburg Power Company	Babcock & Wilcox Company	77,600,000
87-048	Ebensburg Power Company	Babcock & Wilcox Company	4,400,000

THE RESEARCH AGENDA

power plant's scrubber system waste. By developing a commercial use for scrubber waste, landfilling requirements will be reduced. The pilot facility for this technology is located at the Bruce Mansfield Generating Station in western Pennsylvania. Both projects have the potential for commercial development and could make a major contribution toward improving air quality and reducing the demand for waste disposal at power plants nationwide.

During FY 93-94, PEDa continued its effort to sustain a viable research program for the Commonwealth of Pennsylvania. For three years PEDa has not received appropriations explicitly designated for research projects. However, PEDa has been able to generate funds necessary to conduct a modest research program during those years. In FY 93-94 PEDa allocated \$452,010 to eight research projects totaling \$602,266. The eight projects are:

- * **University of Pittsburgh**, a \$68,340 grant to conduct laboratory scale tests of fixed-bed granulated absorbers to control mercury emissions in power plants;
- * **Pennsylvania State University**, (1) a \$23,803 grant to develop a method for optimizing ventilation air control for buildings served by Variable Air Volume control systems; (2) a \$75,000 grant to evaluate methods to inject flyash from the Conemaugh Generating Station into a Florence Mining Company mine; (3) a \$60,000 grant to continue developing a method to produce graphite or carbon materials from Pennsylvania anthracite; and (4) a \$35,070 grant to establish an industry-

accepted method for evaluating sorbents for their performance in fluidized bed technology systems;

- * **Carnegie Mellon Research Institute**, a \$72,585 grant to develop methods for enhancing the production of medium BTU gas from landfills;
- * **Lehigh University**, a \$70,898, grant to apply a previously developed coal cleaning technology to the separation of carbon from other materials in the flyash from power plants; and
- * **EXPORTech Company, Inc.**, a \$46,314 venture capital grant to continue its work in developing a technology to separate iron pyrite and other minerals from the internal circulating load of a coal pulverizer using dry magnetic separation technology.

These projects were selected from a total of 34 applications requesting \$2,256,553 in financial assistance with total project costs of \$3,076,077. Reviewing the last three fiscal years, PEDa received 101 applications requesting over \$9.4 million. However, PEDa was only able to provide financial support to 33 (about one-third) of these projects totalling just under \$2.5 million.

At the close of FY 93-94, the 26 unfunded applications were, at the direction of PEDa's board of directors, being re-reviewed for possible future consideration by the board to utilize any remaining dollars in the Energy Development Fund.

THE RESEARCH AGENDA

TABLE 2: PEDA RD&D PROJECTS COMPLETED DURING FY 1993-94
(These projects are detailed in Appendix A)

Project Number	Recipient	Purpose	Total Cost	PEDA Share
487-010	Pennsylvania Electric Company	Coal-Water Slurry Combustion Testing	\$ 262,777	\$ 172,500
883-4034	Drexel University	Refuse Derived Fuel Combustion Tests	171,780	107,054
893-4002	Pennsylvania Electric Company	Confined Zone Dispersion Demo.	8,510,200	750,000
893-4016	Pennsylvania State University	Sorbent Performance Study	246,926	219,810
893-4018	Pennsylvania State University	Oil Well Brine Treatment Study	160,000	144,000
893-4029	University of Pittsburgh	Cyclonic Agglomeration Coal Cleaning	234,405	157,633
9003-3004	GE Transportation Systems	Coal-Water Slurry Fueled Locomotive	2,084,043	100,000
9003-4008	Pennsylvania Electric Company	Coal-Water Slurry Pilot Plant	376,880	249,380
9003-4022	Lehigh University	Flue Gas Cleanup w/Zeolite	81,795	71,795
9003-4029	Pennsylvania State University	Recovery of Low Ash Anthra. Tailings	94,727	85,227
9103-4001	Lehigh University	Aromatic Structures of Coal	60,000	48,000
9103-4010	Drexel University	Heating Efficiency of Heat Pumps	85,300	58,568
9103-4019	Pennsylvania State University	Production of Graphite from Anthracite	74,844	59,875
9103-4023	Pennsylvania State University	Effects of Moisture in Coal Combustion	86,654	69,323

TABLE 3: PEDA RD&D PROJECTS IN PROGRESS DURING FY 1993-94
(These projects are detailed in Appendix B)

Project Number	Recipient	Purpose	Total Cost	PEDA Share
863-4008	Pennsylvania Electric Company	Low NO _x Burner Demonstration	\$4,600,000	\$ 400,000
893-4014	Pennsylvania State University	Alkaline Addition Study	280,000	250,000
9103-1001	Pennsylvania State University	High Performance Anthracite Boiler	353,257	210,863
9103-4006	University of Pittsburgh	Taylor-Vortex Column in Coal Cleaning	50,000	40,000
9103-4014	Pennsylvania State University	Electric Car Solar Charging Station	47,199	37,759
9103-4017	Pennsylvania State University	Oil and Gas Production Enhancement	79,942	79,942
9103-4021	Pennsylvania State University	Analysis of DC Mine Trolley Systems	43,771	35,017
9103-4024	Pennsylvania State University	Multi-Faceted Fine Coal Cleaning	100,000	80,000

Continued on page 8

THE RESEARCH AGENDA

TABLE 3: PEDA RD&D PROJECTS IN PROGRESS DURING FY 1993-94 (Continued)
(These projects are detailed in Appendix B)

Project Number	Recipient	Purpose	Total Cost	PEDA Share
9103-4031	Pennsylvania Electric Company	Coal-Water Slurry Utility Test Burn	560,000	178,400
9103-4035	Pennsylvania State University	Pa. Limestone Eval. for Wet FGD	265,445	152,356
9103-3036	Lehigh University	Improve Erosion Resistance in CFBs	195,398	124,318
9103-3039	Viking Systems International	Coal/Gas Reburn for NO _x Reduction	194,718	107,774
9103-4042	Cambria Cogen Company	Bituminous Silt in CFB Boilers	199,737	127,789
9103-4043	GRASP	Duct Leakage Evaluation	87,000	59,160
9203-4009	Pennsylvania State University	Characterization of Pond Fines as CWS	80,000	50,000
9203-3010	NOXSO Corporation	Removal of SO ₂ & NO _x from Flue Gas	62,500	50,000
9203-4013	Lehigh University	SO ₂ Concentration - Flue Gas Clean-Up	59,990	47,992
9203-4015	GRASP	Energy Savings from Duct Repair	73,935	49,935
9203-3018	Dravo Lime Company	Removal of SO ₂ /NO _x /Air Toxics	117,858	40,000
9203-3019	Dravo Lime Company	Utilization of FGD Waste for Gypsum	157,977	40,000

TABLE 4: PEDA RD&D PROJECTS AWARDED DURING FY 1993-94
(These projects are detailed in Appendix C)

Project Number	Recipient	Purpose	Total Cost	PEDA Share
9303-4007	University of Pittsburgh	Adsorption Tech. for Mercury Control	\$101,103	\$ 68,340
9303-3016	EXPORTech Company, Inc.	Magnetic Separation for Coal Cleaning	57,894	46,314
9303-4017	Pennsylvania State University	Real-Time Optimization for Vent. Controls	29,803	23,803
9303-4018	Pennsylvania State University	Fly Ash Injection for AMD Treatment	115,000	75,000
9303-4019	Pennsylvania State University	High Quality Carbon/Graphite from Anth.	75,000	60,000
9303-4020	Pennsylvania State University	Sorbent Performance Methodology	43,837	35,070
9303-4025	Carnegie Mellon Research Inst.	Landfill Gas Energy Development	90,731	72,585
9303-4030	Lehigh University	Fly Ash Beneficiation using D-CoP	88,898	70,898

FINANCIAL SUMMARY

TABLE 5: BALANCE SHEET
JUNE 30, 1994

ASSETS	
Cash	
Short Term Investments	\$ 695.40
Accrued Interest Receivable	1,982,000.00
	<u>6,978.26</u>
TOTAL ASSETS	1,989,673.66
LIABILITIES & FUND BALANCE	
LIABILITIES	
	0.00
FUND BALANCES	
Reserved	
Grants/Venture Capital Commitments	
Encumbered	1,751,512.46
Unencumbered	0.00
Operating Encumbrances	24,729.49
Undesignated	<u>213,431.71</u>
TOTAL FUND BALANCES	<u>1,989,673.66</u>

At the conclusion of FY 93-94 the Authority had \$213,431.71 in net funds available. This reflects an increase of \$125,049.88 when compared to FY 92-93. However, it is important to note that during FY 93-94 a refund from the General Fund in the amount of \$40,809.35 was reimbursed back to the Energy Development Fund. The state appropriation for both FY 92-93 and FY 93-94 was \$300,000, down considerably from the \$1.5 million appropriated in FY 90-91.

As of June 30, 1994, the fund balance for the Authority was \$1,989,673.66. Of these dollars, a total of \$1,776,241.95 was committed to new and existing research projects as well as operating costs for the Authority. The total operating expenses for the Authority during FY 93-94 was \$189,594.10.

This is a reduction of \$61,293.19 from the previous fiscal year and \$101,079.19 less from two years ago.

During FY 93-94, the Authority's interest payments on investments totaled \$92,235.30. This figure is down \$42,983.73 from FY 92-93. Further, the present year's interest is \$220,159.73 lower than two years ago. This is primarily due to the reduction in interest rates as well as a reduction of the total dollars in the Energy Development Fund on which interest accrues. However, in comparing the total revenues generated by the Authority, exclusive of state appropriated dollars, to total operating expenses the Authority continued to cover its operational expenses without cost to the taxpayers in Pennsylvania.

FINANCIAL SUMMARY

Summaries of the Authority's fiscal status are provided in Tables 5, 6, and 7. The financial information was prepared by the Comptroller's Office of the Commonwealth of Pennsylvania. It is subject to minor changes as revised information becomes available subsequent to the conclusion of the fiscal year.

With the significant reduction in state appropriations and the reduced Energy Development Fund balance, the Authority will begin FY 94-95

with very limited financial resources. Although the balance of funds available at year's end exceed the previous fiscal year, the Board of Directors, at its April 14, 1994 meeting, voted to offer the unsuccessful applicants from the FY 93-94 solicitation an opportunity for their applications to be reconsidered for funding. And, with the proposed FY 94-95 appropriation for PEDA at the \$300,000, it is unlikely that a general solicitation for energy research in Pennsylvania will be offered for FY 94-95.

**TABLE 6: STATEMENT OF REVENUES AND EXPENDITURES
JUNE 30, 1994**

REVENUES	
Interest on Investments	\$ 92,235.30
Application Fees	3,400.00
Commitment Fees	0.00
Venture Capital Repayments	0.00
Miscellaneous Revenue	<u>0.00</u>
TOTAL REVENUES	95,635.30
EXPENDITURES	
Grants/Venture Capital	1,094,847.41
Operating Expenses	<u>189,594.10</u>
TOTAL EXPENDITURES	1,284,441.51
Revenues Over/(Under) Expenditures	(1,188,806.21)
Other Financing Sources:	
Transfer from General Fund	300,000.00
Refund from General Fund	40,809.35
REVENUE AND OTHER FINANCING SOURCES	
OVER/(UNDER) EXPENDITURES	(847,996.86)
FUND BALANCE, JULY 1, 1993	<u>2,837,670.52</u>
FUND BALANCE, JUNE 30, 1994	\$1,989,673.66

FINANCIAL SUMMARY

**TABLE 7: COMPARATIVE STATEMENT OF FUNDS AVAILABLE
FOR THE TWELVE MONTH PERIOD ENDING JUNE 30**

	<u>1993</u>	<u>1994</u>
TOTAL AVAILABLE FUNDS - July 1	\$ 3,997,440	\$ 2,837,671
RECEIPTS		
Transfer from General Fund	\$ 300,000	\$ 300,000
Interest on Investments	135,219	92,235
Refund from General Fund	0	40,809
Application Fees	2,100	3400
Commitment Fees	0	0
Venture Capital Repayments	165	0
Miscellaneous	<u>0</u>	<u>0</u>
TOTAL RECEIPTS	\$ <u>437,484</u>	\$ <u>436,444</u>
AVAILABLE FOR DISBURSEMENT	\$ 4,434,924	\$ 3,274,115
DISBURSEMENTS		
Grants/Venture Capital	\$ 1,346,367	\$ 1,094,847
Operating Expenses	<u>250,887</u>	<u>189,594</u>
TOTAL DISBURSEMENTS	\$ <u>1,597,254</u>	\$ <u>1,284,441</u>
GROSS FUNDS AVAILABLE	\$ 2,837,670	\$ 1,989,674
COMMITMENTS		
Grants/Venture Capital	\$ 2,743,633	\$ 1,751,512
Operating	<u>5,656</u>	<u>24,729</u>
TOTAL COMMITMENTS	\$ <u>2,749,289</u>	\$ <u>1,776,241</u>
NET FUNDS AVAILABLE	\$ 88,381	\$ 213,433

The following is a list of projects that were completed during FY 1993-94. Contact PEDA at 717-783-9981 for further information on these projects. For the projects identified with an asterisk (), copies of the final reports are on file at PEDA and are available through the State Library System.*

DREXEL UNIVERSITY**"Refuse Derived Fuel Combustion Tests and Pilot Plant Program" (Project # 883-4034)***

This project included two major tasks: 1) perform laboratory studies to characterize the devolatilization dynamics of a broad range of refuse derived fuel (RDF) pellets and fluff samples; and, 2) perform an industrial pilot plant scale combustion study to determine the performance of the RDF pellets in a circulating fluidized bed combustor. This project was conducted to develop technology for the implementation of processed municipal solid waste as an energy producing fuel.

DREXEL UNIVERSITY**"Improving the Heating Efficiency of Air-Source Heat Pumps" (Project # 9103-4010)***

This project investigated the use of desiccants to remove moisture from the air stream that passes over the outdoor heat exchanger coils of heat pumps. The prevention of frost buildup will reduce the thermal insulation and blockage effects of the frost and therefore enhance the energy efficiency of the heat pumps. Since the use of electric air source heat pumps are becoming increasingly common in Pennsylvania, this research could result in substantial energy savings and have a significant impact on electrical energy use in the state.

EXPORTECH COMPANY, INC.**"Magnetic Separation of Pyritic Sulfur at the Pulverizer at Coal-Fired Plants" (Project # 9203-3012)***

The purpose of this project was to examine whether it was technically feasible to significantly lower the as-fired sulfur content of Pennsylvania bituminous coal by dry magnetic separation of the mineral reject from a roller mill pulverizer. The dry magnetic separation technology is based on the principle that coal has magnetic properties different from the mineral impurities surrounding it. The project investigated the possibility of incorporating the dry magnetic separation technology into the pulverizers at a coal-fired power plant.

GE TRANSPORTATION SYSTEMS**"Coal-Water Slurry Fueled Diesel Electric Locomotive Technology Development" (Project # 9003-3004)***

This concluded the fourth year for this project to develop a coal-water slurry fueled diesel electric locomotive. This six-year, \$22 million venture was co-funded by the U.S. Department of Energy, New York State Energy Research and Development Authority, and Norfolk Southern Railroad. This phase investigated the environmental control aspects of the locomotive's operation.

LEHIGH UNIVERSITY**"A Simplified Method for Concentrating SO₂ for Flue Gas Cleanup" (Project # 9003-4022)***

This project was a continued investigation into the use of mordenite, a zeolite, as a sorbent for controlling SO₂ and NO_x emissions. This project set out to establish the optimum operating conditions and limits of a SO₂ concentration and collection, and mordenite regeneration processes. The technology developed as a result of this project would be incorporated into a flue gas

cleanup system for coal-fired boilers. However, it is anticipated that, when developed, this process could also be utilized on oil-fired systems as well.

LEHIGH UNIVERSITY

"Reactivity of Aromatic Structures in Pennsylvania Coals" (Project # 9103-4001)

This project was an investigation into a method of characterizing Pennsylvania bituminous coals by the chemical reactivity of the aromatic systems in the coal. The N-O infra-red stretching frequency of NO⁺ complexes with aromatic systems in coals will be used to determine the ionization potential of those aromatic systems. The project has long range possibilities as a tool for screening coals.

PENNSYLVANIA ELECTRIC COMPANY

"Coal-Water Slurry Fuel Co-Firing Test Burn" (Project # 487-010)*

The purpose of this project was to show the technical feasibility of co-firing coal-water slurry (CWS) fuel and coal in pulverized coal (PC) utility boilers. The project involves firing CWS at pilot and demonstration scales. In addition to the PEDA, project participants included Pennsylvania Electric Company, New York State Electric and Gas Company, Jim Walter Resources, Pennsylvania State University, Management and Technical Services, and CLI Corporation. The project was comprised of four phases, (1) CWS Formulation and Characterization, (2) Combustion Behavior of CWS fuels, (3) Combustion Behavior when Co-firing CWS and PC and, (4) CWS Demonstration Tests.

PENNSYLVANIA ELECTRIC COMPANY

"Confined Zone Dispersion (CZD) Flue Gas Desulfurization Demonstration Program" (Project # 893-4002)*

The project demonstrated a new process to remove sulfur and nitrogen pollutants from the flue gas leaving coal-fired boilers. The Pennsylvania Electric

Company hosted the site for a demonstration of Bechtel Corporation's confined zone dispersion process at its Seward Station electrical generating facility located near Johnstown, Pennsylvania.

PENNSYLVANIA ELECTRIC COMPANY

"Coal-Water Slurry Pilot Plant" (Project # 9003-4008)*

This project involved the construction of a three-ton-per-hour fine coal cleaning and coal water slurry (CWS) pilot plant at Pennsylvania Electric Company's Homer City Coal Preparation Plant. The pilot plant produces CWS from the reject circuit of the cleaning plant so that tests can be conducted to determine the optimum CWS which can be produced from fine coals at the Homer City Plant.

PENNSYLVANIA STATE UNIVERSITY

"Sorbent Performance Project" (Project # 893-4016)*

The purpose of this project was to maximize the cost effectiveness of air quality compliance in circulating fluidized bed (CFB) combustion power plants using Pennsylvania sorbent products. This was accomplished by using sorbent evaluation techniques developed to provide calcium utilization efficiency data that sorbent suppliers and customers can use to evaluate within the context of cost. Both sorbent supplier and CFB power plant operators will derive the technical benefits of this program.

PENNSYLVANIA STATE UNIVERSITY

"Oil Production Enhancement through a Standardized Brine Treatment" (Project # 893-4018)

Under this project, extensive field testing was performed on the treatment of various brines produced from oil reservoirs throughout the state. Previous

research at Penn State resulted in a benchscale model of a brine treatment method and some initial testing. The effectiveness of the treatment method and the effects of temperature changes will be tested on at least five different brines. The testing procedure followed recommendations of the Department of Environmental Resources. A database has been developed which will result in a software package to assist in designing appropriately scaled treatment systems in the field.

PENNSYLVANIA STATE UNIVERSITY

"Recovery of Low Ash Carbon Products from Anthracite Preparation Tailings"
(Project # 9003-4029)*

This project focused on recovering and marketing tailings from existing anthracite coal preparation plants for use in the carbon market. These tailings have the potential, if recovered, to yield a very low ash (less than 3%) anthracite product. The laboratory work involved examining tailings streams from six active anthracite preparation plants for the presence of low ash fines and determining whether these fines can be recovered effectively using froth flotation or multiple staged water-only cyclones.

PENNSYLVANIA STATE UNIVERSITY

"Novel Approach to Production of Graphite from Anthracite" (Project # 9103-4019)

This project investigated the conversion of anthracite to graphite. The project was based on a theoretical approach on treating the anthracite with a mixture of dihydrophenanthrene and phenanthrene. The dihydrophenanthrene is used to provide a source of donatable hydrogen to intercept crosslink formation between aromatic structures while the phenanthrene should provide the aromatic fluid medium to disrupt the electronic interactions between aromatic structures. Currently, petroleum coke is used as the filler constituent in the manufacture of graphite.

PENNSYLVANIA STATE UNIVERSITY

"The Role of Moisture in the Combustion of Coal on Stokers" (Project # 9103-4023)

This project investigated the tempering process, adding water to coal to aid in combustion. This project was a result of an earlier PEDA project which investigated anthracite/bituminous coal blends. This project looked to determine the mechanism of the tempering process, elucidate the role of moisture in the ignition process, determine the relative importance of the change in the physical condition of the fuel bed (bed density) upon tempering, and identify the chemical reaction that occurs within the bed during the combustion of tempered coal and blends.

UNIVERSITY OF PITTSBURGH

"Development of a Cyclonic Agglomerator for Fine Coal Cleaning" (Project # 893-4029)*

This project was conducted to develop an improved fine coal cleaning method based on the application of cyclonic separation to selective agglomeration processes. This project resulted in the laboratory-scale development and testing of a cyclonic agglomeration system which could provide an effective technology for fine coal cleaning, making major Pennsylvania coal reserves more environmentally acceptable and commercially marketable to utility and other users.

The following is a list of projects that were active and ongoing throughout FY 1993-94. Contact PEDA at 717-783-9981 for further information on these projects.

CAMBRIA COGEN COMPANY

"Demonstration Project to Utilize Pennsylvania Bituminous Silt as Circulating Fluidized Bed Boiler Fuel" (Project # 9103-4042)

The objectives of this project are to conduct an engineering and economic evaluation of seven technologies to determine which technology has the greatest potential to enable the use of ultra fine bituminous coal refuse material or silt as fuel for circulating fluidized bed (CFB) boilers, to demonstrate the selected technology using a 100 ton prepared sample and conducting a test burn in a commercial CFB boiler, and demonstrating the use of the processed fuel in place of CFB premium fuel to verify combustion efficiency and emissions control performance.

DRAVO LIME COMPANY

"Development of the ThioNO_x Process for the Simultaneous Removal of SO₂, NO_x, and Air Toxins from Flue Gas" (Project #9203-3018)

The overall project objective of this project is the development of the ThioNO_x Process, an integrated technology that simultaneously removes SO₂, NO_x, and air toxins in the forms of heavy metals from the flue gas of coal-fired boilers. A bench scale unit will be tested with the results used to define process parameters for larger scale testing. An economic analysis will also be conducted on the technology. The technology holds promise for boilers currently burning high sulfur Pennsylvania coals.

DRAVO LIME COMPANY

"The Conversion of Flue Gas Desulfurization Scrubber Waste to Alpha Hemi-Hydrate Gypsum" (Project #9203-3019)

The objective of this project is to conduct tests and to demonstrate the feasibility of converting scrubber sludge, a waste product from flue gas desulfurization scrubber systems, to a high quality, high strength gypsum product, alpha hemi-hydrate gypsum. The project will entail the design, construction, testing and operation of a skid mounted pilot facility that will process one gallon of scrubber waste per minute. Potential benefits are a reduction in waste disposal costs and decreased landfill needs for those power plants burning high sulfur Pennsylvania coals with scrubbers.

GRASS ROOTS ALLIANCE FOR A

SOLAR PENNSYLVANIA (GRASP)

"Measuring Energy Savings as a Result of Identifying and Treating Duct Leakage in Residential Homes" (Project # 9203-4015)

The purpose of this study is to demonstrate the energy savings impact of repairing duct leakage in Pennsylvania's housing stock in order to provide homeowners and utility companies with reliable data for selecting cost-effective energy retrofit technologies. A sample of homes will be monitored for this study.

GRASS ROOTS ALLIANCE FOR A

SOLAR PENNSYLVANIA (GRASP)

"Duct Leakage Research Project" (Project # 9103-4043)

Under this project, GRASP is analyzing the extent of the problem of duct leakage in homes in Southeastern Pennsylvania. The air leakage rates in a sample of houses are being measured in order to develop diagnostic and treatment approaches for fixing this duct

leakage. GRASP will also implement a pilot program using these techniques in another sample of houses, analyze the results, develop training materials for replicating the work and disseminate the results through presentations at conferences, workshops and seminars.

LEHIGH UNIVERSITY

"Selection Criteria for Components with Weld Overlay Erosion Protection in Fluidized Bed Combustion Systems" (Project # 9103-4036)

The purpose of this project is to investigate the erosive properties of weld overlay boiler tube coatings in an effort to extend boiler tube life. The project builds on an earlier PEDA-funded project which developed an experimental methodology for characterizing erosive materials in a circulating fluidized bed (CFB) boiler environment. CFB boilers are in use at numerous coal waste fired co-generation facilities in Pennsylvania.

LEHIGH UNIVERSITY

"A Test and Demonstration Unit for Concentrating SO₂ from Flue Gas" (Project # 9203-4013)

The objective of this project is to design, to construct, and to test a bench scale continuous unit for concentrating SO₂ in flue gas. The highly concentrated and purified SO₂ can be removed and recovered as a sulfur bearing product. Once the SO₂ is removed, the system will be regenerated. The unit will also be used to design scaled up versions of the unit as well as serving as a demonstration unit.

NOXSO CORPORATION

"Sorbent Powder Regeneration in the NOXSO Flue Gas Treatment Process: An Experimental Study and Economic Evaluation" (Project # 9203-3010)

This project is a continuation of earlier research funded by PEDA into the use of a sorbent powder in the

NOXSO Process. This research will investigate the regeneration phase of the process to determine the optimum sorbent powder regeneration conditions including an economic evaluation comparing the use of the powder with the current technology, the use of sorbent beads.

PENNSYLVANIA ELECTRIC COMPANY

"Low NO_x Burner Demonstration - Homer City Unit #2" (Project # 863-4008)

This project is a demonstration of the Low NO_x burner technology at the 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. These burners 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 assess 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 emission reductions in utility boilers.

PENNSYLVANIA ELECTRIC COMPANY

"Coal-Water Slurry Test Burn at Seward Station" (Project # 9103-4031)

Under this project, combustion tests of coal-water slurry (CWS) fuels are being conducted in Unit 12 of Pennsylvania Electric Company's Seward Station generating plant. The project will utilize CWS prepared at the Homer City Coal Preparation Plant. The test program includes an engineering and design phase during which time burner selection and location of the burners in the boiler will be finalized.

PENNSYLVANIA STATE UNIVERSITY

"A Controlled Study of the Effect of Alkaline Addition to Surface Mine Overburden: Kauffman Mine Demonstration" (Project # 893-4014)

This project will analyze the chemical effects of alkaline addition to mining overburden in the neutralization of acid mine drainage from a surface coal mine. This project will directly observe and measure the use of alkaline addition over an extended period of time in an operating surface mine demonstration site, the Kauffman mining operation in Clearfield County, and investigate the cause of differences between observed water quality and calculated quality, in order to develop improved procedures for preventing acid drainage.

PENNSYLVANIA STATE UNIVERSITY

"High Performance Anthracite Commercial Boiler Design" (Project # 9103-1001)

This project is to design and to construct a highly efficient, convenient anthracite-fired boiler system for the commercial and light industrial markets. The boiler is in the size range of 2 to 20 MMBtu/hr. The conceptual design incorporates the integration of a water-cooled furnace with a steel firetube boiler. The thrust of this program is to develop and demonstrate a shop-assembled anthracite boiler, based on a mass produced gas/oil boiler design, requiring a minimum of installation effort and expense.

PENNSYLVANIA STATE UNIVERSITY

"Wellbore Hydraulics Optimization Studies in Air Drilling for the Enhancement of Oil and Gas Production" (Project # 9103-4017)

This project involves conducting fundamental and applied research to foster a better understanding of the hydraulics associated with air drilling and well control operations for the enhanced production of oil and gas wells. The project will provide the drilling community with scientifically-based predictive capabilities of well-bore hydraulics.

PENNSYLVANIA STATE UNIVERSITY

"Research and Development of a Photovoltaic-Powered Charging Station for an Electric Car" (Project # 9103-4014)

This project is directed at developing, designing, constructing, and testing a photovoltaic (PV) powered charging station for an electric vehicle. Its objectives include improving the knowledge base in PV technology by utilizing the latest PV and related electronic equipment; providing hands on experience for both faculty and students from various disciplines; and spurring commercial development of both the electric vehicle and the charging station.

PENNSYLVANIA STATE UNIVERSITY

"Elimination of Trolley-Related Fires in Underground Coal Mines" (Project # 9103-4021)

This project is to conduct research and to demonstrate the technical feasibility and practicality of a method of detecting electrical faults in an underground mine's direct current trolley system. The research will be conducted through extensive laboratory and in-mine experiments at two Pennsylvania coal mines. The data will be analyzed and used to demonstrate the technical feasibility, economic viability, and simplicity of the proposed detection method.

PENNSYLVANIA STATE UNIVERSITY

"An Integration of Centrifugal, Flotation, and Solid/Liquid Separations as a Novel Approach to Fine Coal Cleaning" (Project # 9103-4024)

This project is investigating several unit operations that are key to the successful operation of an integrated fine-coal cleaning circuit. This multi-faceted approach allows several critical areas to be examined, offering the potential of a greater overall process improvement that would be applicable to a wider range of coals than a single process development. The areas of

study include centrifugal dense-medium circuits, and solid-liquid separation of coal and refuse products.

PENNSYLVANIA STATE UNIVERSITY**"Evaluation of Pennsylvania Limestone and Dolomite Products for Feedstock for Wet Flue Gas Desulfurization Systems" (Project # 9103-4035)**

The purpose of this project is to evaluate Pennsylvania limestones and dolomites for use in wet flue gas desulfurization (FGD) applications. FGD is one of several utility alternatives for meeting Clean Air Act compliance levels. The stones will be evaluated to determine their sulfur dioxide capture ability, limestone utilization, and limestone dissolution.

PENNSYLVANIA STATE UNIVERSITY**"Formulation of Coal Pond Fines as Coal-Water Slurry Fuels and Their Combustion Characteristics" (Project # 9203-4009)**

This research is aimed at investigating the use of coal fines from waste coal ponds in the development of coal-water slurry fuel. Several coal ponds will be sampled, analyzed for cleanability and washability, and evaluated on their combustion performance. The use of coal pond fines for coal-water slurry fuels is a possible alternative to disposal of the fines, offering both an economic and environmental benefit.

UNIVERSITY OF PITTSBURGH**"Development of a Taylor-Vortex Column for Fine Coal Cleaning" (Project # 9103-4006)**

The objective of this project is to develop a novel, simple and effective device for fine coal cleaning, based on the concept of Taylor vortices formation in rotating concentric cylinders. This project would provide for: (1) the design and construction of a novel Taylor-Vortex column; (2) conducting hydrodynamic tests; (3) conducting conventional flotation tests as a comparison with those obtained by the Taylor-Vortex column; and (4) performing statistical analysis of experimental data. The thrust of the project is to determine the feasibility of the process.

VIKING SYSTEMS INTERNATIONAL**"Coal NO_x Reduction by INO_xulation" (Project #9103-3039)**

The purpose of this project is to test a method of reducing NO_x emissions in coal-fired burners. The method has been patented and proven effective in reducing NO_x in burners firing gas and liquid fuel oils. Emissions are reduced by recirculating stack gases into selected zones of the burner. The proof-of-concept tests will be conducted in a 500,000 Btu/hr. combustion test facility. If successful, this project could lead to a commercial demonstration.

The following is a list of projects that were awarded during FY 1993-94. These projects were approved by the Board of Directors at their meeting on April 14, 1994. Contact PEDA at 717-783-9981 for further information on these projects.

**CARNEGIE MELLON RESEARCH
INSTITUTE**

**"Landfill Gas Energy Development Project"
(Project # 9303-4025)**

The specific objective of this research project is to develop environmentally accepted methods for enhancing landfill gas production rate which is a prerequisite for economic utilization of landfill gas for energy production. This laboratory initiative will examine several parameters that potentially affect the landfill gas production rate, including waste moisture content, nutrient levels, leachate recycle, transport of materials within the landfill and facilitation of gas removal.

EXPORTECH COMPANY, INC.

**"Magnetic Separation of Pyritic Sulfur at the
Pulverizer at Coal-Fired Power Plants"
(Project # 9303-3016)**

The purpose of this project is to continue the work of an earlier research project funded by PEDA into investigating the technical feasibility of separating iron pyrite and other minerals from the internal load of a coal pulverizer by dry magnetic separation. This present research effort will focus on modifying the pilot scale pulverizer to increase its sampling capabilities by increasing the number of sampling ports.

LEHIGH UNIVERSITY

**"Feasibility of Fly Ash Beneficiation using the Dry
Coal Purifier (D-CoP™) Process"
(Project # 9303-4030)**

This project will examine the feasibility of utilizing a derivative of the D-CoP™ process for separating unburned carbon from the fly ash of pulverized coal-fired utility boilers. The process uses a continuous operating fluidized bed particle separator to segregate the fly ash into carbon-rich and carbon-lean streams. This laboratory effort will involve fly ash characterization, fluidization measurements, particle segregation studies and solids flow study. Benefits include the potential to use a now-considered waste material in an environmentally accepted manner.

PENNSYLVANIA STATE UNIVERSITY

**"Real-Time Optimization of Ventilation Control to
Minimize Energy Consumption in Variable Air
Volume Systems" (Project # 9303-4017)**

The objective of this research project is to determine the variables which will result in the optimization of ventilation air control for buildings served with Variable Air Volume control systems. This type of control system exists in over half of all commercial buildings. The results of this project could lead to further research that could be the routine solution to the problem of maintaining healthy buildings while also operating the building mechanical systems with minimal energy consumption and demand.

PENNSYLVANIA STATE UNIVERSITY

**"Evaluation of Techniques for the Disposal of Fly Ash
from the Conemaugh Generating Station into an
Underground Mine for In-Situ Treatment of Acid
Mine Drainage (Project # 9303-4018)**

This project will evaluate techniques for injecting fly ash from the coal-fired utility boilers of the

Conemaugh Generating Station into abandoned underground mine openings on the site of the Florence Mine located adjacent to the generating station in Western Pennsylvania. The objectives of this research is to develop new technology that will be utilized by the Pennsylvania energy industry in a two-fold manner: (1) to remediate acid mine drainage, and (2) to utilize waste material from coal combustion in an environmentally beneficial manner.

PENNSYLVANIA STATE UNIVERSITY

"Producing High-Quality Carbon or Graphite Materials from Anthracite by Catalytic Graphitization" (Project # 9303-4019)

The research to be conducted under this project will examine a novel approach for conversion of Pennsylvania anthracites to graphite or carbon materials. By using a process known as catalytic graphitization, the anthracite is converted to filler material to be used in the making of the final carbon products. The objective of this effort is to compare the properties of the manufactured product with that of the commercially available materials.

PENNSYLVANIA STATE UNIVERSITY

"Implementation and Commercialization of a Sorbent Performance Evaluation Methodology and Technology Transfer" (Project # 9303-4020)

The purpose of this project is to ensure that results obtained from previous PEDA/Pennsylvania State University research is transferred to those Pennsylvania industries that can economically benefit from this information and better utilize Pennsylvania's resources. Specifically, this project will look to develop a technique by which a relative indicator of sorbent performance can be measured for Pennsylvania limestones and dolostones, leading to the establishment of an industry-accepted method for evaluating sorbents for their performance in atmospheric pressure circulating fluidized bed combustors.

UNIVERSITY OF PITTSBURGH

"Granular Activated Carbon Adsorption Technology for Mercury Emissions Control" (Project # 9303-4007)

The proposed research will evaluate pertinent design and operational parameters to enable the successful application of the granular activated carbon adsorption technology for controlling mercury emissions. These parameters include: (1) adsorption capacity of activated carbon for mercury under various process conditions; (2) optimal empty bed contact time and activated carbon particle size with respect to carbon utilization rate and pressure drop across the carbon bed; (3) interference of other compounds in the vapor-phase with mercury removal mechanism; and (4) scale-up procedure for correlating the performance of both the laboratory- and pilot-scale adsorbers.