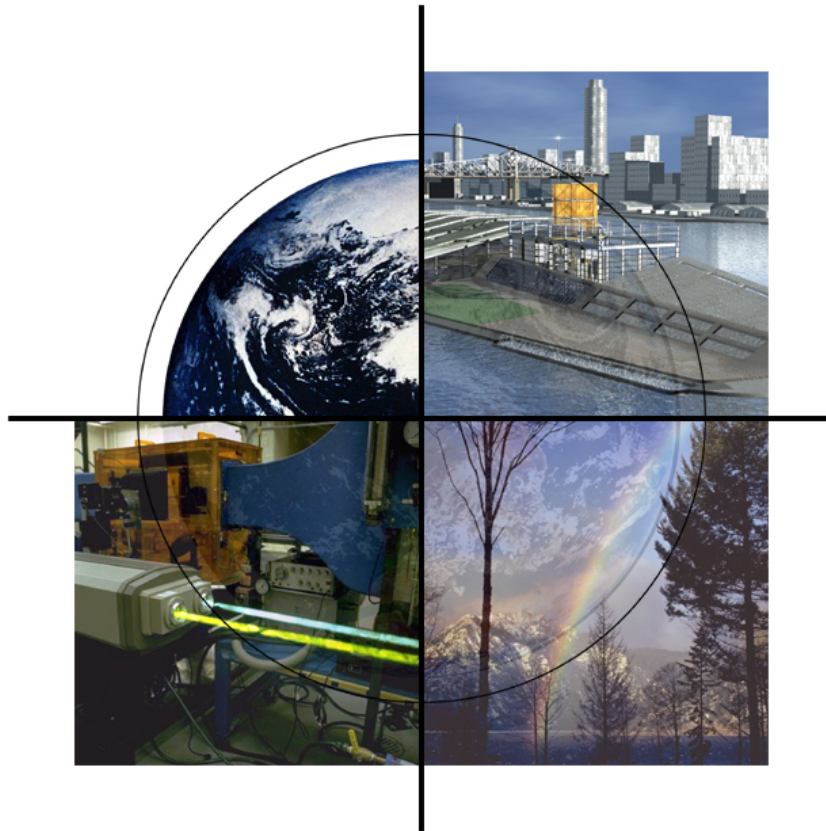


UCR and HBCU/OMI Research Programs



**UCR/HBCU/ Program
Review Meeting**

**Pittsburgh, PA
June 5-6, 2007**

**Robert R. Romanosky, Technology Manager
National Energy Technology Laboratory**



National Energy Technology Laboratory

- **Only DOE national lab dedicated to fossil energy**
 - Fossil fuels provide 85% of U.S. energy supply
- **One lab, five locations, one management structure**
- **1,200 Federal and support-contractor employees**
- **Research spans fundamental science to technology demonstrations**



Alaska



Oklahoma



Oregon



Pennsylvania

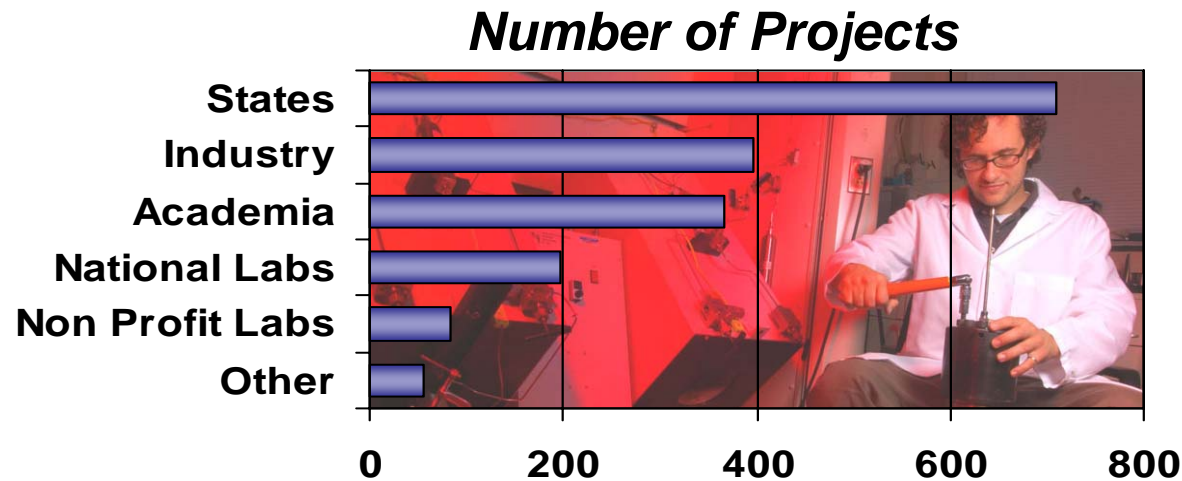


West Virginia



NETL Implements and Manages Extramural RD&D

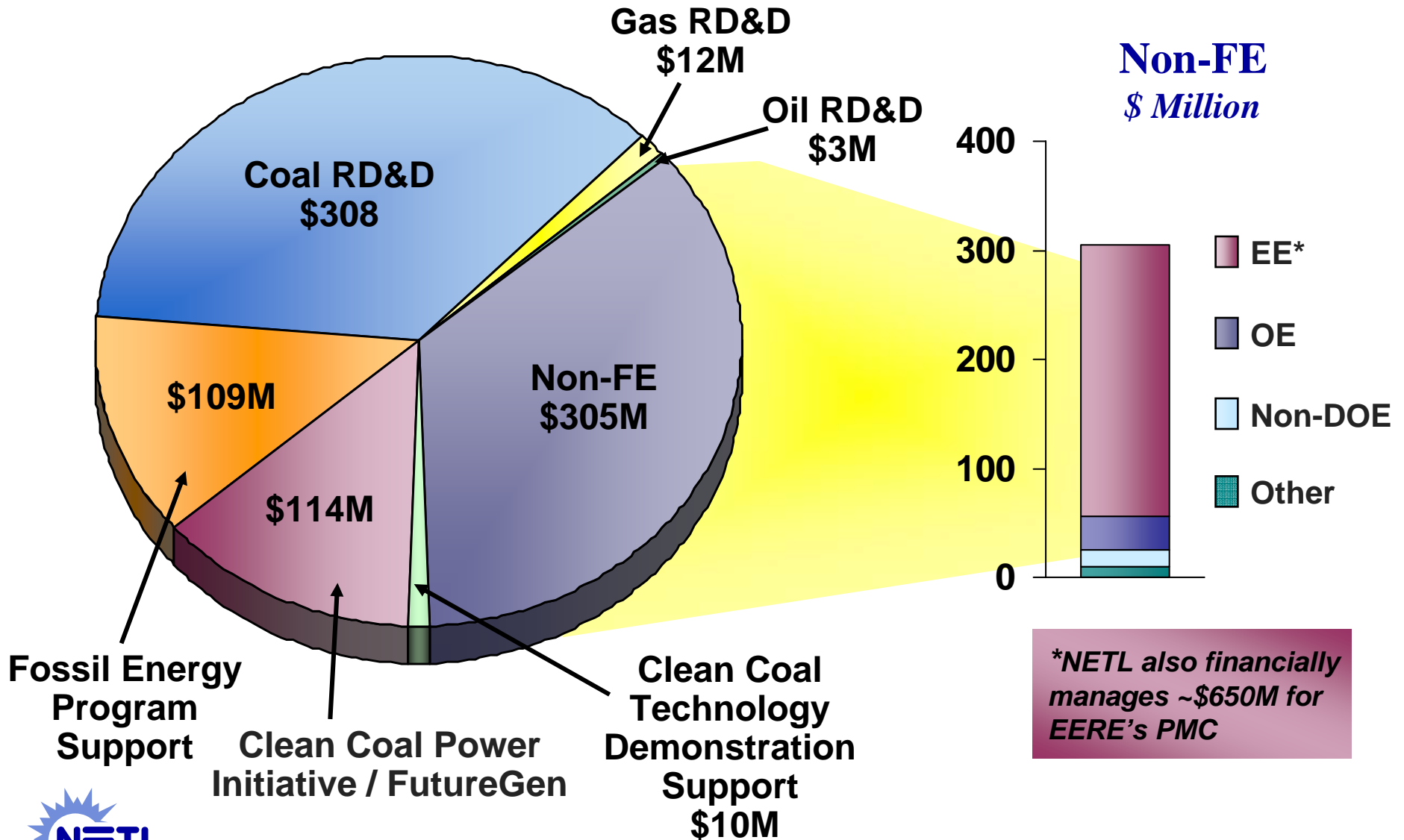
- Over 1,800 research and deployment activities in U.S. and more than 40 foreign countries
- Total award value over \$9 billion
- Private sector cost-sharing over \$5 billion
 - Leverages DOE funding
 - Accomplishes mission through commercialization
 - Ensures relevance



Updated 11/13/2006

Descriptor - include initials, /org#/date

NETL FY 2007 Budget: \$861 Million

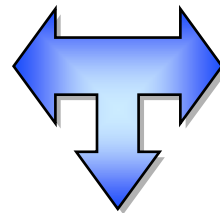
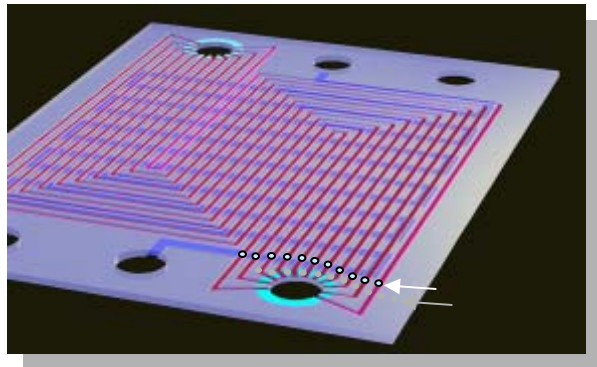


Advanced Research

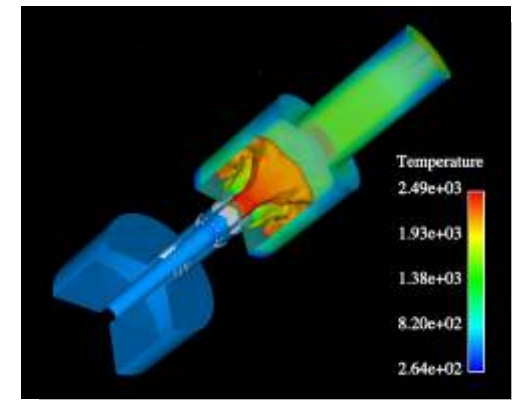
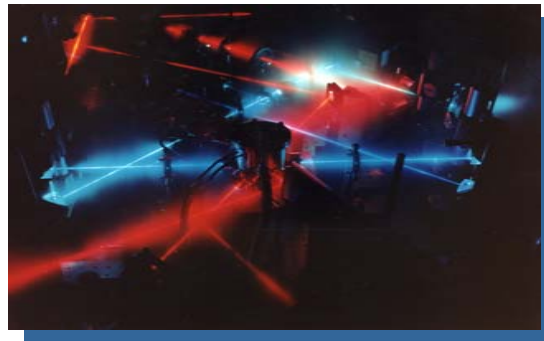
Mission

Extend state of knowledge in fossil energy technology by supporting development and deployment of innovative systems capable of improving efficiency and environmental performance while reducing costs

Bridge the gap between fundamental and applied technologies



Reflective of industry needs and responsible for driving new technologies

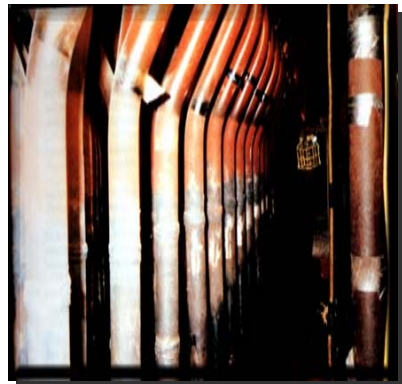


Develop technologies that address critical needs in Fossil Energy Programs



AR Focus and Goals

Essential and enabling technology development program for Advanced Power Systems

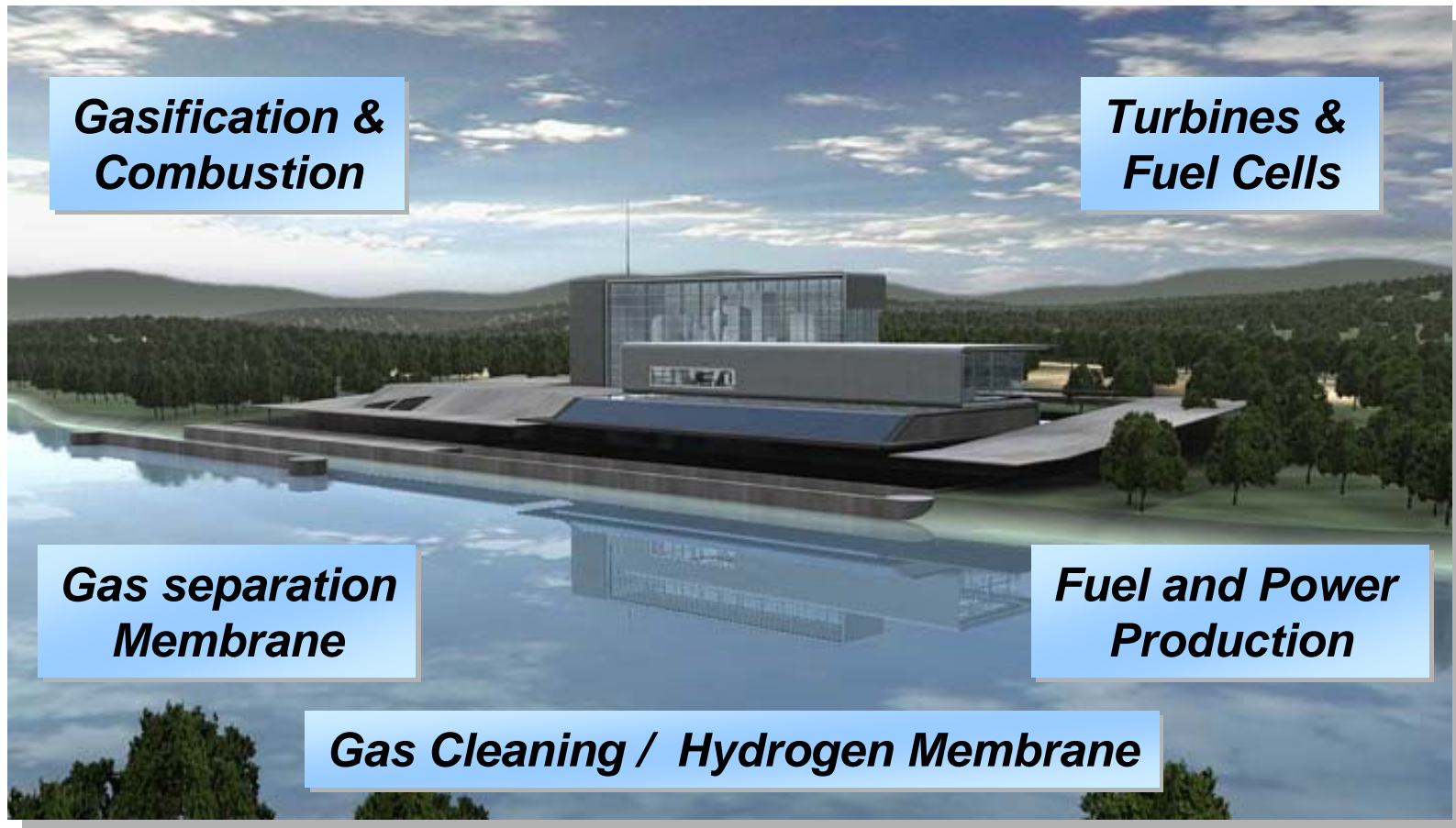


- Unique mix of programs and technology developments that are critical and crosscutting technologies
- Challenged with identifying novel technologies that address key technology barriers
- Focused technology efforts are contributing to deployment of feasible technologies in the 5-15 year timeframe as well as contribution to the FutureGen Initiative
- Enhances individual subprograms by range of collaborations and developers and integrated technology efforts



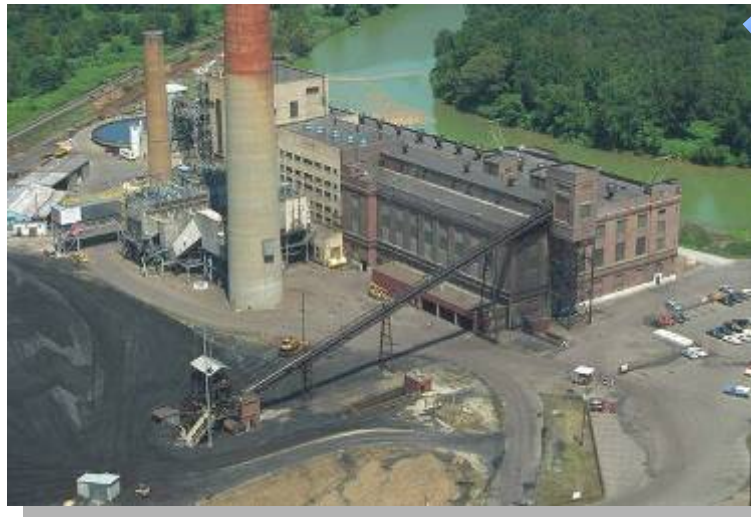
Program Strategic Performance Goal

By 2010, develop a suite of enabling technologies that support the goal of zero emission energy (FutureGen) systems through Advanced Research cross-cutting programs.



Technology Challenges

- Zero emissions
- Integrated systems
- Controllable and reliable designs
- Tight tolerances & operating margins
- High temperatures & pressures



Mid 20th Century Plants

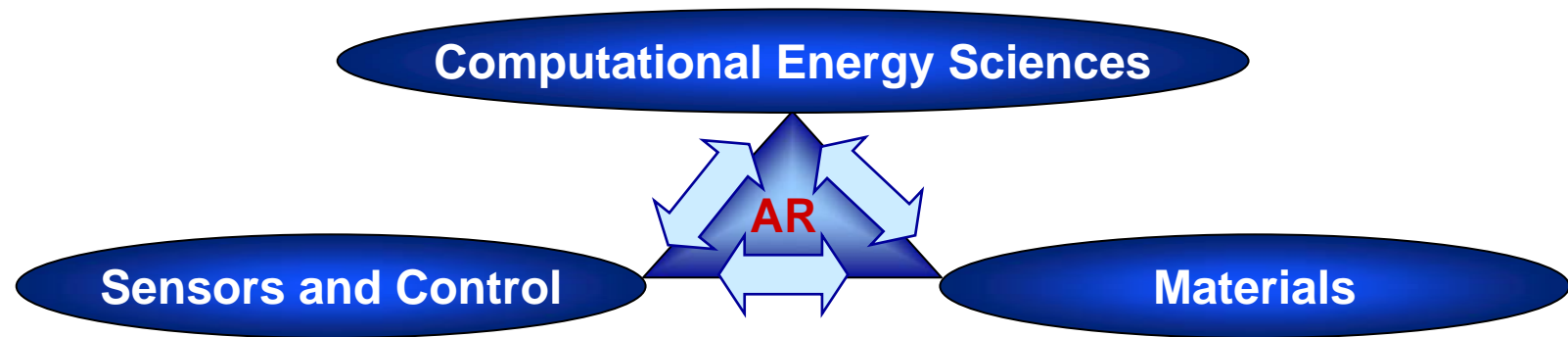
Near/Zero Emission Advanced Power Generation System



- Plant design
- Process modeling and control
- Operations monitoring (efficiency, emission, equipment)
- Dynamic and transient mode management
- Structural, separation, coatings, and sensing materials for harsh environmental



Realignment of AR Technology Focus



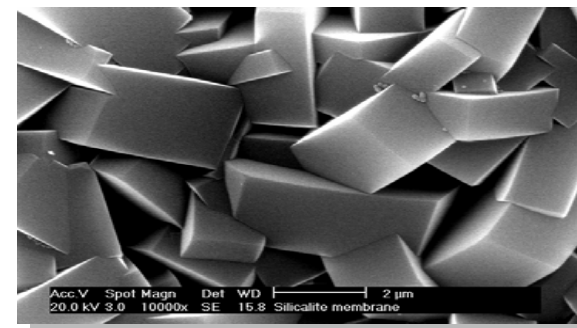
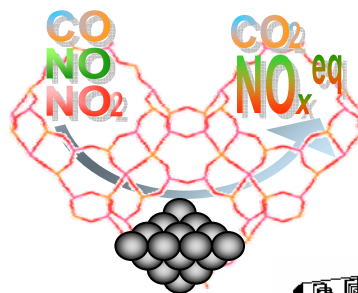
- Essential and enabling technology development programs for the Strategic Center for Coal and Power R&D
- Focused effort will contribute to deployment of feasible technologies in the 5-15 year timeframe as well as contribution to the FutureGen Initiative
- Enhancement of individual subprograms by expanding collaboration, range of developers, and integrated technology efforts



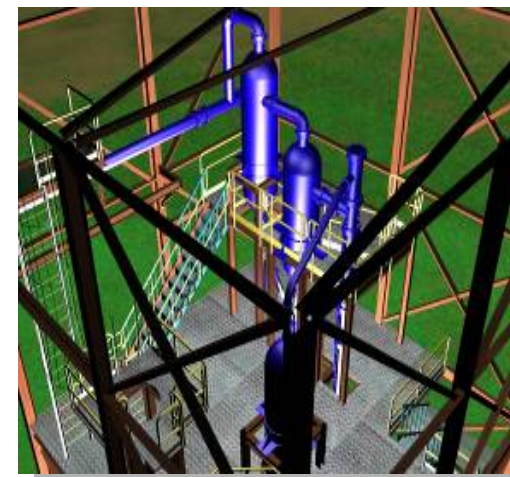
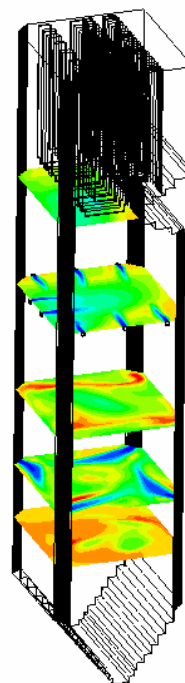
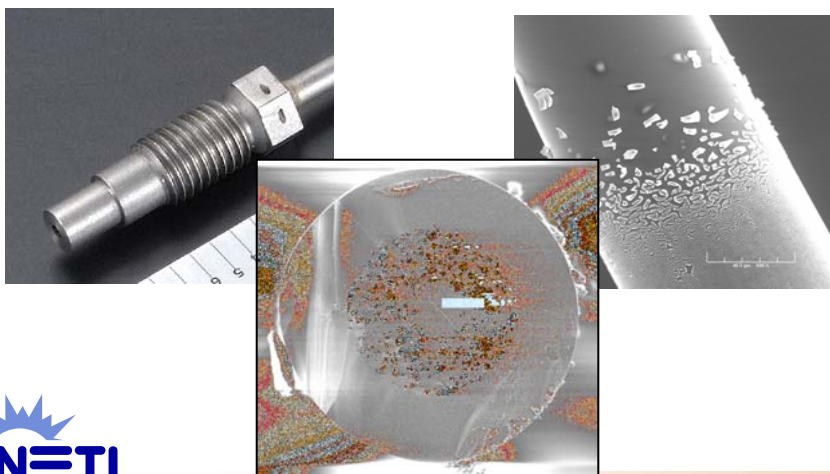
Advanced Research Crosscutting Technologies



Materials



Instrumentation, Sensors, & Controls



Computational Energy Sciences

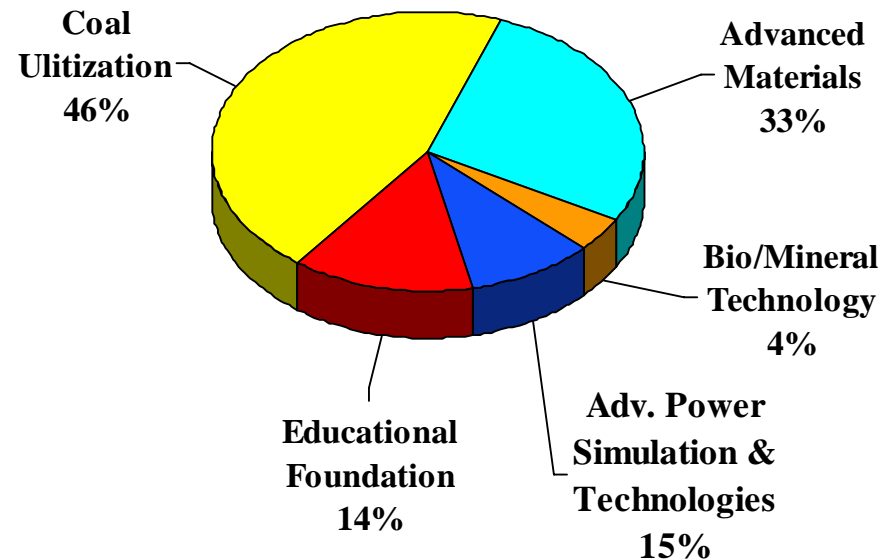


Advanced Research Program

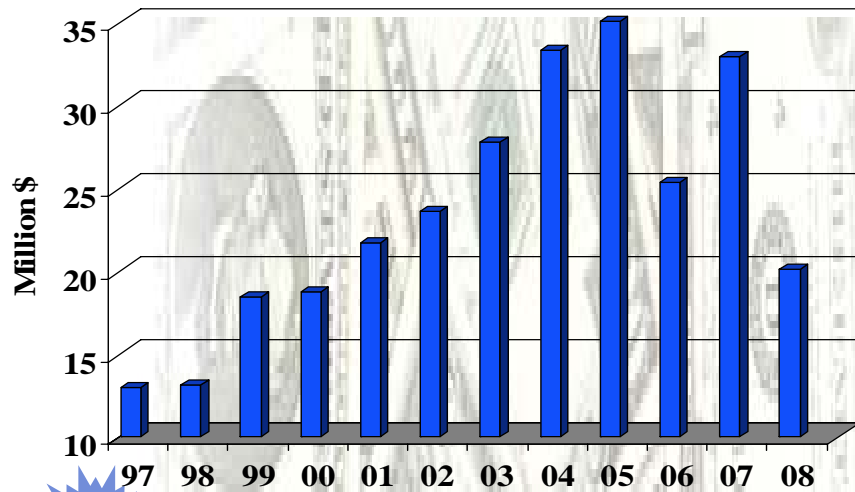
Projects by Organization

• Industry	8
• University	89
• National Laboratories	36
• Non-Profit	3
Total	136

FY07 Budget Allocation



Annual Budget



FY07 Funding Breakout

Coal Utilization Sciences	12407
Advanced Materials	7533
Bioprocessing	1148
Computational Energy Systems	2578
University Coal Research	2755
Historically Black Colleges and Universities	984



University Coal Research Program

Three specific goals:

- Sustain a national university program of research in energy and environmental science and engineering related to coal that focuses on innovative and fundamental investigations pertinent to coal conversion and utilization;
- Provide a future supply of coal scientists and engineers through research exposure in coal technologies while advancing the science of clean energy from coal; and
- Improve our fundamental scientific and technical understanding of chemical and physical processes involved in the conversion and utilization of coal, one of our nation's most abundant natural resources and by-products from coal processing.



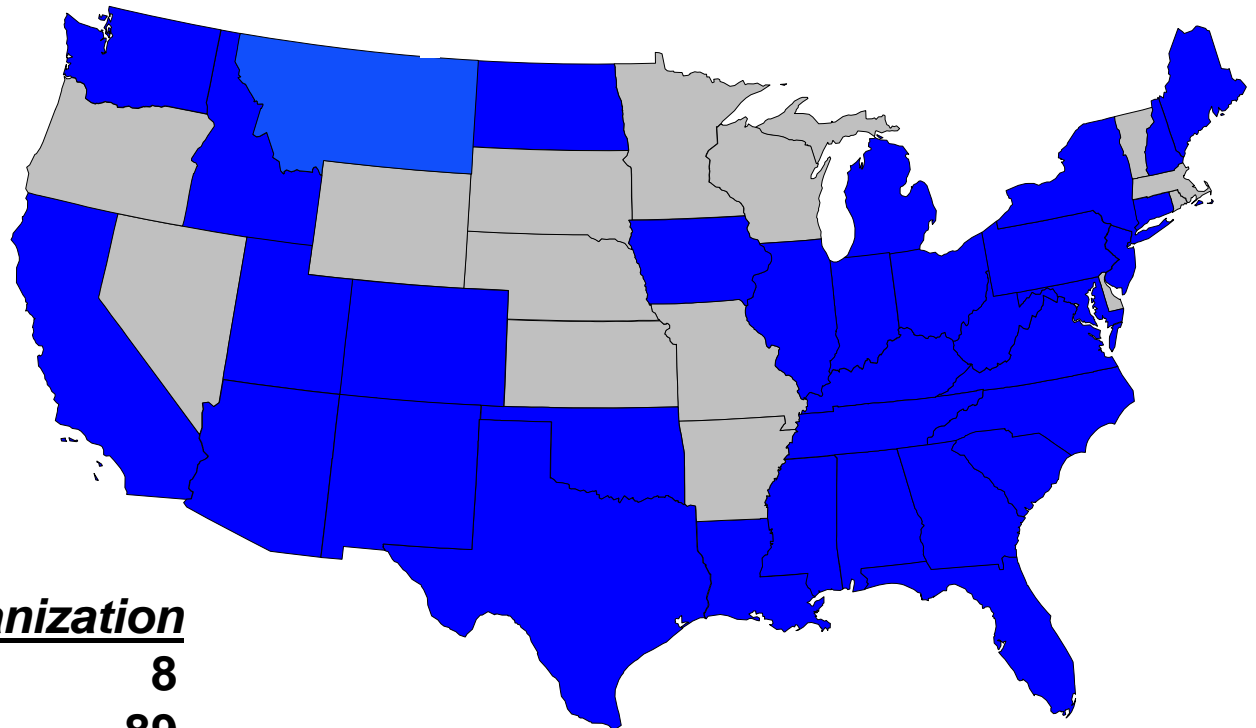
Historically Black Colleges & Universities/ Other Minority Institutions (HBCU/OMI)

The HBCU/OMI Program emphasizes improving energy/environmental capabilities in advanced coal, oil, gas, and environmental technology concepts, and supports the education of scientists and engineers from diverse backgrounds by sponsoring research in support of NETL's technology lines at schools designated as HBCU/OMI. The Advanced Research Technology Team strives to accomplish the following goals:

- Provide and promote opportunities for HBCU/OMI in science and engineering.
- Foster private sector participation and interaction with HBCU/OMI in fossil energy-related programs.
- Provide a forum to facilitate technology transfer, strengthen educational training, and develop/enhance the research infrastructure capabilities of HBCU/OMI.



Advanced Research Congressional Breath *FY2007 Projects by State*



Projects by Organization

• Industry	8
• University	89
• National Laboratories	36
• Non-Profit	3
Total	136

 States with AR Projects



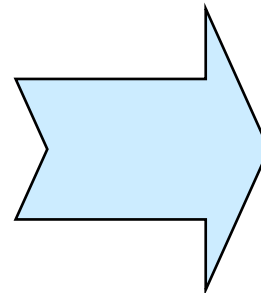
University Coal Research Statistics

- **During the Past Eight Years:**

- 172 institutional grants awarded
- 1130 technical papers published
 - Technical Awards >7
 - Patents Issued >9

Educational Benefits

- Numerous B.S., M.S., Ph.D. Graduates
- Post-doctoral Research
- Interns

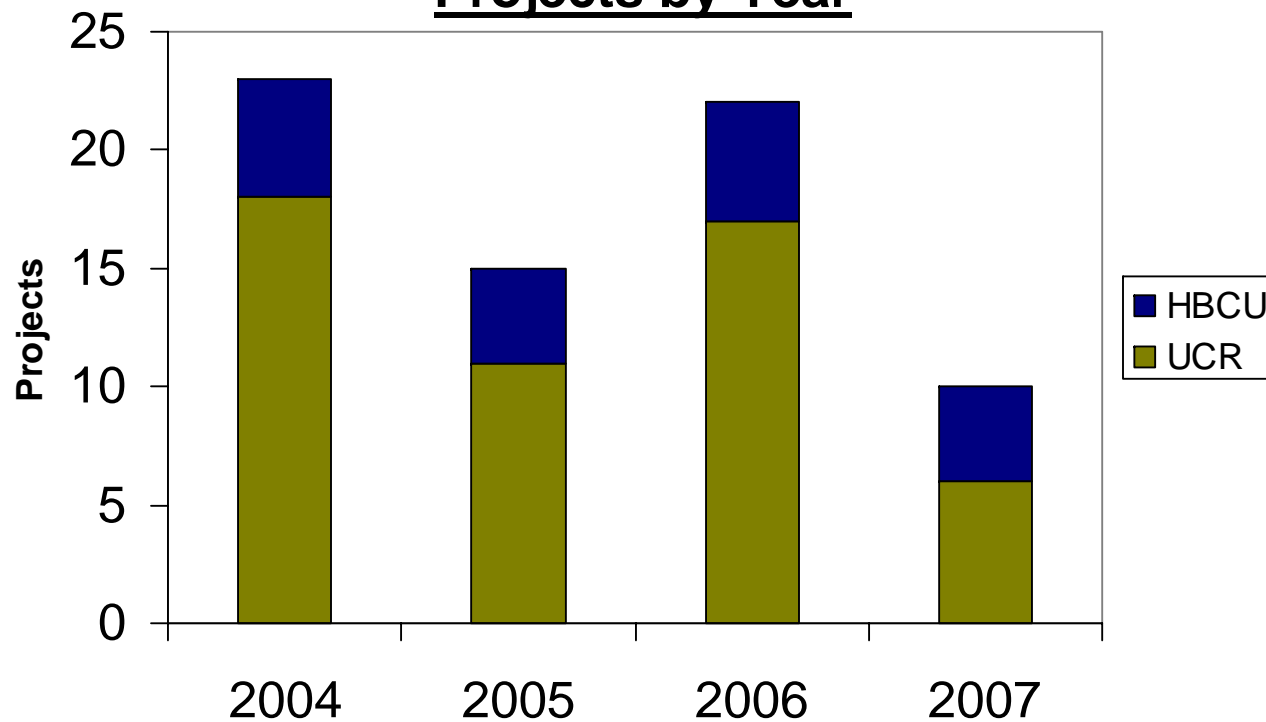


Economic Benefit
Over \$12 million in Annual Salary Return



UCR/HBCU Project Statistics

Projects by Year

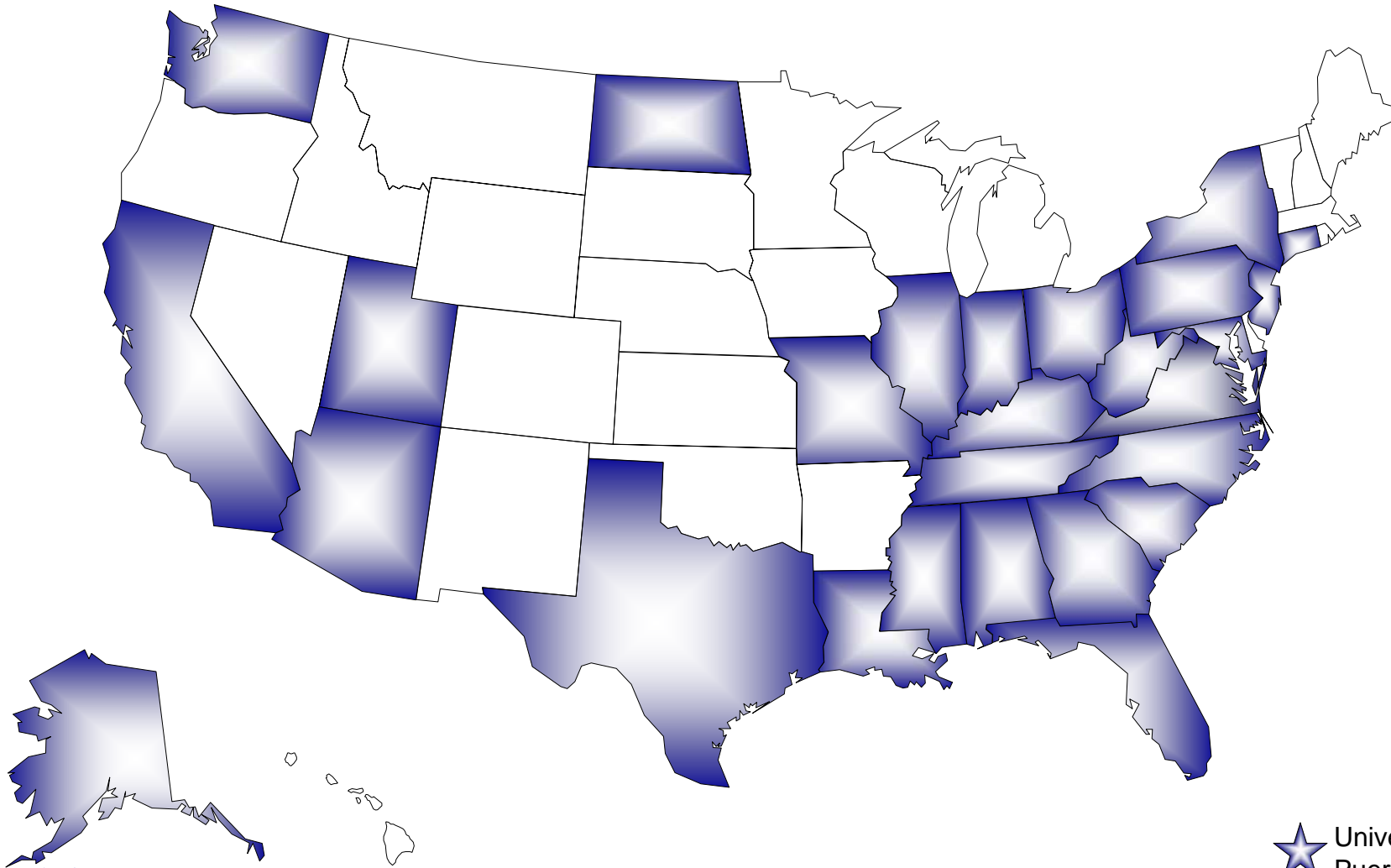


Projects Summary

<u>Year</u>	<u>UCR</u>	<u>HBCU</u>
2004	18	5
2005	11	4
2006	17	5
2007	6	4



UCR and HBCU/OMI Project Map



★ University of Puerto Rico



Future Directions In UCR/HBCU

- **Solicitation date changing from late fall to April-May timeframe**
- **Award date changing to end of calendar year or early January**
- **Programs can now have full funding at award**
- **The program will be re-structured with research emphasis on top priorities in fossil energy program needs**



University Coal Research FY07 Awards

Performer	Description	Funding
University of Central Florida (Orlando, Fla.)	An optical technique will be developed to measure temperature and pressure in hazardous environments.	\$300,000
Georgia Institute of Technology (Atlanta, Ga.)	Georgia Institute of Technology will join with The Pennsylvania State University, GE Energy, and Siemens Power Generation to develop a design tool that can predict flashback and combustion instability in gas turbines operating on coal-derived high-hydrogen fuels.	\$600,000
Princeton University (Princeton, N.J.)	Princeton University will team with Iowa State University and City College of City University of New York, on a joint computational, experimental, and theoretical effort to understand the frictional flow of granular materials.	\$600,000
Rensselaer Polytechnic Institute (Troy, N.Y.)	Simulation and modeling tools to optimize the operation and control of complex IGCC plants will be developed.	\$300,000
University of Notre Dame (Notre Dame, Ind.)	Computer-aided design to investigate materials will be employed for use in future high-temperature power-plant applications.	\$300,000
University of California at San Diego (La Jolla, Calif.)	Experimental studies will be conducted leading to improved joining of high-temperature alloy tubes.	\$265,000



HBCU/OMI FY07 Awards

Performer	Description	Funding
University of Puerto Rico at Mayaguez	Researchers will design and fabricate wireless battery-free sensors for high temperature environments to measure temperature, pressure and CO2 concentration.	\$192,797
Florida International University	The proposal submitted by Florida International University in Miami addresses an urgent need in computational fluid dynamics and will help better understand the gas-solids flow, especially cluster formation in gasifiers or combustors.	\$134,928
Grambling State University of Louisiana	Scientists at Grambling State University in Lincoln, La., will focus their research on membranes for hydrogen separation.	\$194,747
University of Texas at San Antonio	Researchers will fabricate low-temperature solid oxide fuel cells out of novel electrode and electrolyte materials and determine the structure-performance relationship of these materials.	\$192,528



FY08 UCR Solicitation

- **FY08 – UCR PROGRAM**
 - Approximately \$550,000 will available to fund two projects
 - Maximum of just over \$275,000 per project.
 - Each project will involve one or two colleges or universities and will extend over 36 months.
- **Research will be conducted under one broad topic:**
 - Enabling advanced modeling and simulation for fuel-flexible combustors.
 - Topic research interests include:
 - Quantifying current prediction capability for flashback and lean blowout and identifying the sensitivity to physical sub-models.
 - Conducting numeric investigations of boundary condition effects on computational fluid dynamic simulations of thermo-acoustic instabilities.
 - Evaluating the role of transport parameters in model prediction accuracy.



HBCU/OMI FY08 Solicitation

- **TECHNICAL TOPIC 1 – SENSORS & CONTROLS**

- Subtopic 1A. Robust Sensor Networks for Intelligent Control of Advanced Coal
 - Combustion/Gasification Processes
- Subtopic 1B. Novel Sensors for Deep Resources (DOE's Deep Trek Program)
- Subtopic 1C. Air Emission Sensors, Controls, and Modeling for Oil and Gas Resources

- **TECHNICAL TOPIC 2 – COMPUTATIONAL ENERGY SCIENCES**

- Subtopic 2A. Multiphase Flow Simulation
- Subtopic 2B. Advanced Diagnostics For Gas Solids Flow Systems
- Subtopic 2C. Dynamic Simulation and Advanced Process Control of Integrated Gasification
 - Combined Cycle (IGCC) Plants

- **TECHNICAL TOPIC 3 – ADVANCED MATERIALS**

- Subtopic 3A. Development of High Temperature Structural Materials
- Subtopic 3B. Advanced Materials for Gas Turbine Coatings
- Subtopic 3C. Development of Functional Materials for Hydrogen Separation and Storage



AR Scientific Awards

1985	Roe-Hoan Yoon	Camicia Award
1988	Irving Wender	First Lowry Award
1995	Adel Sarofim	Lowry Award
1995	Roe-Hoan Yoon	Alumni Award
1998	A. N. Murty	White House Award for Science & Technology
2002	Douglas Smoot	Lowry Award

