

# PROGRAM facts

Power Systems  
Advanced Research

05/2008

U.S. DEPARTMENT OF ENERGY  
OFFICE OF FOSSIL ENERGY  
NATIONAL ENERGY TECHNOLOGY LABORATORY



## 2008 HISTORICALLY BLACK COLLEGES AND UNIVERSITIES AND OTHER MINORITY INSTITUTIONS (HBCU/OMI) PROGRAM

### Description

The Historically Black Colleges and Universities and Other Minority Institutions (HBCU/OMI) Program provides grants and other mechanisms to encourage cooperative research among participating institutions, the private sector, and Federal agencies. The program was established in 1984–1985 by the U.S. Department of Energy (DOE) and is carried out by the National Energy Technology Laboratory (NETL) under DOE's Office of Fossil Energy (FE).

The purpose of the HBCU/OMI Program is to generate fresh ideas and tap underutilized talent, define applicable fundamental scientific principles, and develop advanced concepts for generating new and improved technologies across the full spectrum of fossil energy research and development (R&D) programs. The program also provides a forum to facilitate technology transfer, strengthen educational training, and develop and enhance the research infrastructure and capabilities of HBCU/OMI participants for producing the next generation of scientists and engineers of diverse backgrounds. It provides and promotes science and engineering opportunities that foster private sector participation in fossil energy-related programs.

By increasing cooperative opportunities to perform fundamental and applied scientific research, the HBCU/OMI Program also supports DOE's Strategic Plan to:

- Promote America's energy security through reliable, clean, and affordable energy;
- Strengthen U.S. scientific discovery and economic competitiveness; and
- Improve the quality of life through innovations in science and technology.

### CONTACTS

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**Advanced Research** — To support coal and power systems development, NETL's Advanced Research Program conducts a range of pre-competitive research focused on breakthroughs in materials and processes, coal utilization science, sensors and controls, computational energy science, and bioprocessing — opening new avenues to gains in power plant efficiency, reliability, and environmental quality. NETL also sponsors cooperative educational initiatives in University Coal Research, Historically Black Colleges and Universities, and Other Minority Institutions.



## RECENT GRANT RECIPIENTS FY2008 GRANTS

### North Carolina A&T University,

Greensboro, NC —  
Investigation of a new approach for coating thin film membranes using pulsed laser deposition to yield a uniform coating of palladium, laying a foundation for effective high-temperature hydrogen separation technology.

### Southern University A&M College,

Baton Rouge, LA —  
Study of air plasma spray for making new thermal barrier coatings for advanced gas turbines operating on synthesis gas (syngas) at very high temperatures and harsh chemical environments.

### University of Puerto Rico at Mayaguez,

Mayaguez, PR —  
Derivation of governing and constitutive equations based on the kinetic theory of poly-dispersed systems using a generalized Boltzmann equation that considers both particle size and velocity distribution.

### University of Texas at El Paso, El Paso, TX —

Study of gas turbine combustor flashback, possibly caused by combustion-induced vortex breakdown due to the effects of variable high-hydrogen syngas fuel composition.

## Program Areas

The HBCU/OMI program is organized into two elements:

**Core Program** — The HBCU/OMI program encourages grant applicants to focus on innovative research and development involving advanced concepts that are pertinent to fossil fuel conversion and utilization in areas that support NETL's technology lines. The core program stimulates collaborative efforts for improving prospective U.S. commercial capabilities, and enhances the scientific and technical understanding of chemical and physical processes involved in conversion and utilization of fossil fuels. These efforts will broaden potential utilization of fossil energy resources and provide technological benefits for the U.S. commercial sector and the American consumer.

**Symposium** — Held jointly with NETL's University Coal Research (UCR) program as part of an annual program review, the symposium promotes the exchange of scientific and engineering information to enhance the educational training and research capabilities of participants, as well as to stimulate interest in these programs by others in the fields of science, engineering, and technical management.



Photo courtesy of  
Lawrence Berkeley  
National Laboratory.

*"I'm pleased to see the strong interest of faculty in conducting this research and training a promising group of college students. The bright minds and enthusiasm that the students bring to the program will help promote our nation's energy security and will assure the growth of future energy researchers."*

— James Slutz,  
Acting Principal Deputy  
Assistant Secretary for Fossil Energy

## Core Research Areas

Program core research is organized under three technical areas:

**Sensors and Controls** — Control system development is viewed as an important enabling technology for the commercial deployment of advanced power generation systems. Topics of current interest include:

- Robust Sensor Networks for Intelligent Control of Advanced Coal Combustion/ Gasification Processes
- Novel Sensor Systems for Meeting the Objectives of DOE's Deep Trek Program for Well Penetration Below 15,000 Feet
- Air Emission Sensors, Controls, and Modeling for Oil and Gas Resources

**Computational Energy Sciences** — Work may be proposed in areas such as the development of theory and advanced computational models, gathering of experimental data from physical systems or molecular dynamics simulations, and the validation of the models. Topics of current interest include:

- Multiphase Flow Simulation of Gas-Solids Flows
- Advanced Diagnostics for Gas-Solids Flow Systems
- Dynamic Simulation and Advanced Process Control of Integrated Gasification Combined Cycle (IGCC) Plants

**Advanced Materials** — New materials are required to significantly improve performance and reduce costs of existing and/or advanced coal-based power systems. Topics of current interest include:

- Experimental Studies for Development of High-Temperature Structural Materials
- Experimental Studies for Development of Functional Materials
- Advanced Materials for Gas Turbine Coatings for Use in High-Hydrogen Fuel Applications

## Recent Awards

The eight grant projects listed on this and the previous page are those most recently awarded under the HBCU/OMI program for fiscal years (FY) 2007 and 2008. Project durations vary from 12 months to 36 months. The projects shown represent a total of \$1,514,802 in NETL awards, in addition to matching funds from a number of the participating institutions (typically, less than one-fourth of the total grant).

### RECENT GRANT RECIPIENTS FY2007 GRANTS

#### University of Puerto Rico at Mayaguez, Mayaguez, PR —

Design and fabrication of wireless, battery-free sensors for high-temperature environments to measure temperature, pressure, and carbon dioxide concentration.

#### Florida International University, Miami, FL —

Development of an experimental technique for measurement of the gas-solids flow, especially cluster formation, in gasifiers or combustors.

#### Grambling State University, Lincoln, LA —

Production of a prototype membrane reactor for hydrogen production and separation at extreme conditions, and integration of a carbon dioxide separation unit.

#### University of Texas at San Antonio, San Antonio, TX —

Fabrication of low-temperature solid oxide fuel cells out of novel electrode and electrolyte materials, and determination of the structure-performance relationship of these materials.

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## WEBSITE

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## Earlier Awards

Projects awarded by the HBCU/OMI Program in earlier years are described in the following fact sheets:

HBCU/OMI Program Grants [2005-2006] (Program089.indd)

2004 HBCU/OMI Program Grants (Prog007.pmd)

All of these fact sheets may be accessed electronically through the following link to the NETL Advanced Research Reference Shelf:

<http://www.netl.doe.gov/technologies/coalpower/advresearch/ref-shelf.html>



Additional details on each of the projects included in this program can be found on the Department of Energy's Fossil Energy Website at:  
<http://www.fe.doe.gov/techline/techlines/Index.html>