

DOE-NREL Minority University Research Associates Program

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DOE-NREL Minority University Research Associates Program

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ABSTRACT

The DOE-NREL Minority University Research Associates Program (MURA) encourages minority students to pursue careers in science and technology. In this program, undergraduate students work with principal investigators at their universities to perform research projects on solar technology. Then, students are awarded summer internships in industry or at national laboratories, such as NREL, during the summer.

Because of its success, the program has been expanded to include additional minority-serving colleges and universities and all solar energy technologies.

1. Objectives

The focus of the DOE-NREL Minority University Research Associates Program (MURA), formerly the Historically Black College and University (HBCU) PV Research Associates Program, is to encourage undergraduate minority students to pursue careers in science and technology while participating in DOE/NREL-sponsored research projects.

Once accepted into the program, students can work on a research project for between one and three years. The program provides year-round renewable energy research opportunities and continuous mentorship through faculty and professional researchers at such workplaces as the National Center for Photovoltaics at NREL.

Students involved in research excel in the classroom and are committed to contributing to sustainability through the development of renewable energy technologies. The program helps retain minority students in the science and technology areas and enables many students to reach their educational and career goals.

2. Technical Approach

2.1 History

The MURA program is an expansion of the former DOE-NREL HBCU PV Research Associates Program, which began in 1995. In the past nine years, the program has sponsored more than 100 undergraduate students to participate in research projects. In addition, more than 13,000 high school, middle school and elementary school students have benefited from renewable energy camps and summer academies that program undergraduates and graduate students facilitated.

These activities have produced many research accomplishments and success stories. Several of our students have gone on to graduate school to master their

skills in fields such as physics, chemistry, architecture, and engineering. Others are now working in industry and government labs, using the knowledge and expertise they have gained as DOE-NREL Research Associates.

The impacts of the HBCU PV Research Associates Program can be seen in local and international communities, through student-managed community education projects, solar energy workshops, and installations in South Africa, Senegal, and on the NREL campus. Perhaps the most valuable outcome of the program has been to inspire students to excel in their scientific quest for knowledge. Students leave the program with the desire to share their excitement about solar technologies with their local and international communities.

2.2 Expanded program

The expanded program includes tribal colleges and universities, as well as those serving native Hispanics, Alaskans, and Hawaiians. Each university will conduct research in one of three areas: Basic Research, Photovoltaic Panel Measurement and Testing, or Solar Radiation Profile Study

2.3 Selection and program outline

Outstanding science and technology majors are selected by faculty at their universities to participate in a solar technology research project during the school year. Then, students are awarded summer internships in industry or at national laboratories, such as NREL, during the summer.

At the close of the summer internship, program advisors, students, and host professionals participate in an annual Renewable Energy Academic Partnership (REAP) review meeting and conference to discuss their research papers and future opportunities, as well as the national and global role of renewable energy in ensuring a secure and sustainable environment.

2.4 FY 2004 universities and projects

As a result of the Request for Proposals in the fall of 2003, eight minority-serving universities were awarded subcontracts. Six are HBCUs and two are Hispanic-serving universities. The universities and projects are listed below.

2.4.1 Southern University

"Energy Conversion and Storage Devices: Solar Energy Research and Education." Three undergraduate students majoring in physics, chemistry, and engineering will gain research skills and training in (1) photo-electrochemical production of hydrogen and hydrogen energy, (2)

nanocrystalline thin-film semiconductors for PV devices, and (3) high-energy and high-power-density electrochemical cells.

2.4.2 University of Texas at El Paso

"Fabrication, Characterization and Modeling of Solar Cells." Student/faculty teams will investigate fabrication, characterization, and modeling of solar cells. Collaborators: NASA; Global Solar; Solar Cells, Inc.

2.4.3 Fisk University

"Development of Quantum-Dot-Sensitized ZnO and TiO₂ Nanorod-Array Solar Cells." Research will focus on the development of silicon quantum dots for advanced solar cells with maximum efficiency, while minimizing power losses and solar cell degradation caused by thermal effects. Collaborator: NASA Glenn Research Center.

2.4.4 Howard University

"PV and Renewable Energy Research/Training for Optimal Power Management and Distribution." At the university's Center for Energy Systems and Control, research will focus on ways to develop automation, as well as strategies to improve the power management and distribution of power driven by renewable resources. Collaborators: NASA; NSF.

2.4.5 North Carolina Central University

"Investigation of Photovoltaic and Thermoplastic Semiconductors." Experimental and numerical-modeling approaches will be used to train selected students in research in fabricating and characterizing various bulk and nanophase PV materials, and also to facilitate basic research and training of students in energy-related technologies. Collaborators: Duke University; North Carolina State University.

2.4.6 University of Texas at Brownsville

"Design, Development, and Implementation of Simulation Tools for Analysis of Solar Concentrating Systems." Student/faculty teams will design, develop, and validate a computer-simulation tool, which will provide a sophisticated and efficient software environment for the design and analysis of solar concentrating systems. Collaborator: Sandia National Laboratories.

2.4.7 North Carolina A&T University

"Performance Testing and Utilization of Photovoltaic Energy in Residential Environments" Students will investigate and evaluate a grid-connected PV system in a residential area of Greensboro. Collaborators: Florida Solar Energy Center; State Energy Office; North Carolina Department of Administration; United States Army; Construction Engineering Research Laboratory; Honeywell; Oak Ridge National Laboratory; North Carolina Solar Center; Johnson & Johnson; Piedmont Natural Gas; Duke Power; Duke Solar.

2.4.8 Central State University

"Renewable Energy Technology and Technology Transfer in Developing Countries." Students will participate in a

basic research program designed to introduce them to the practical application of renewable energy technology in the fields of economic development and various modes of transportation. Collaborators: CARET; NASA; Ohio Department of Transportation; Federal Highway Administration; United States Highway Administration.

3. Results and Accomplishments

Eight minority-serving universities have been awarded contracts in the MURA Program this year. Many of the projects started in the summer of 2004 with the DOE-NREL MURA 2004 Summer Internship Program. Ten MURA Research Associates worked on internship assignments with industry partners or at their universities, and nine students worked at the National Center for Photovoltaics with NREL researchers/mentors. NREL interns also attended a series of professional development courses and seminars to enhance their training experience.

The last REAP Conference was held August 11-14, 2004, at the Florida Solar Energy Center in Cocoa, Florida. MURA interns, principal investigators, industry professionals, and professional development trainers participated in the conference. Each university team, including principal investigators, presented current research accomplishments and future plans. Students who participated in summer internships presented their summer research results.

The keynote speaker was Dr. Marvin Gunn of the United States Department of Energy, Chicago. The conference culminated with an awards banquet honoring the most outstanding student presentations.

4. Conclusions

Over the past nine years, many minority-serving universities and their students have benefited from MURA. For many undergraduate students, acquiring a degree in science/engineering—and participating in MURA—has evolved into a passion for a career in solar energy technology research and development. By combining research experience at the university with consistent mentorship and summer internships, the program facilitates the creation of a diverse and competent workforce for existing and developing solar technologies.

Bolstering the institutions that graduate large percentages of African Americans, Native Americans, and Hispanic Americans will enhance the diversity, competitive strength, and prosperity of the American workforce in the years ahead.

Future work will include ensuring progress on the projects that are currently underway, as well as inviting additional universities to participate in the REAP Conference through partnerships with other similar programs.

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