Campus Research Review

Solar energy program finds home in Center of Excellence

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Most of the students that are in the Van Leer building every day-electrical engineering majors studying for their next circuits test, or architecture majors shortcutting through on their way to studio-have probably never noticed the basement entrance to the University Center of Excellence for Photovoltaics Research and Education, home to Tech's nationally-recognized solar energy program.

Photo courtesy Institute Communications and Public Affairs

ECE Professor Ajeet Rohatgi created the solar energy program at Tech in 1985, and today, with production and research capabilities, the program has become nationally recognized in silicon solar technology.

The program, which began in 1985, has grown from just one professor to a full-fledged research and fabrication center, mostly through the work of Electrical and Computer Engineering Professor Ajeet Rohatgi, who recently received the 2003 Paul Rappaport Renewable Energy and Energy Efficiency Award, a national award given by the U.S. Department of Energy (DOE).

"When I came, there was no activity in solar cells," Rohatgi said, "So I started a little bit here and there to see how it would take off."

The program began with Rohatgi working with just a few graduate students to research what kind of materials could be used for solar cells.

Since there was not much interest in solar energy at the time, "I just hired a couple of students, and we started doing some work on silicon solar cells and started characterizing the material," he said.

At first, Rohatgi purchased much of the equipment himself, but soon, he said, "We got some funding from the Department of Energy and Sandia National Laboratories to do that." This funding allowed Rohatgi to improve upon the existing research being done by developing computerized modeling capabilities.

"It's not so exciting just to characterize materials," he said. "So I started developing...capabilities [for] solar cell modeling, device modeling."

Not long after, Rohatgi began adding capabilities to fabricate solar cells, though the task of setting up a fabrication line was not easy. It took Rohatgi and his colleagues almost three years to complete the facilities.

However, when the project was complete, "It became lots of fun," Rohatgi said. "Things started getting interesting, and we started making some very good solar cells in the next year or two after that."

In 1992, the DOE noticed Rohatgi's work, and, impressed by the program's growth as well as the research and development going on, the Department decided to make Tech the first University Center of Excellence for Photovoltaics (UCEP).

This was in part due to the completeness of the program. "We are probably one of the few universities in this country that can do research from materials to modeling to fabrication," said Rohatgi.

The initial three-year funding was followed with two more five-year grants. "We've done well so far as far as research is

concerned and the DOE is concerned," Rohatgi said, adding, "Our funding level is something on the level of a couple million dollars a year."

Currently, the program has been flourishing, developing solar energy initiatives around the Atlanta area both for academic and industrial purposes. One of the highlights of the Center's accomplishments occurred during the 1996 Olympics in Atlanta, where they successfully installed a solar energy system on the rooftop of the aquatic center.

For this undertaking, Rohatgi was approached by DOE and Georgia Power. "[They] said we should showcase something that is green and related to renewable energy," he said, "So that is how we ended up building the world's largest rooftop grid-connected photovoltaic system on top of the aquatic center."

The system is still fully functional today, and still produces enough energy to energize an entire subdivision of 70 homes.

In addition, there is also a solar thermal system which, though less often employed, can be used to heat the pool water when needed. "So it's a double system, one is the active electricity generation [through photovoltaics], and the other is the passive heating of the pool water," Rohatgi said.

Though the panels are still functioning well today, they only produce about 30 to 40 percent of the energy the aquatic center needs to run; therefore, there are no plans to use the energy for anything else besides the aquatic center.

However, Rohatgi pointed out that "[the system] produces something like 400 megawatt-hours of electrical energy each year, which prevents the release of 400 tons of carbon dioxide into the air."

As director of the Center, one of Rohatgi's roles also is industry communications. "They contract us to look at their materials and products and provide them with the guidelines of how to improve their products, materials and devices," he said. The center has

programs with many of the major companies involved in solar energy research, such as Shell and BP Solar.

Rohatgi also teaches a graduate level ECE course on solar cells, as well as some other courses on fabrication of semiconductor devices and integrated circuits. Many of the Ph.D. students that he is currently advising have become involved through his classes.

Lastly, the center also serves as a base for education. Students often come to UCEP to learn about the process of making a solar cell.

"I try to promote photovoltaics, because I feel that is one thing that is very important for [us] to advance," Rohatgi said. "People don't fully understand how solar cells work...and the more we educate people at the younger level, the better it will be for photovoltaics to move faster."

Currently, the cost of solar energy is about two to four times higher than fossil fuels. Much of the center's research focuses around improving this statistic.

In addition to trying to produce low-cost, high efficiency cells, another way is to integrate photovoltaics into buildings.

"The idea here is not to put the panels on top of an existing roof, but to make the roof out of panels, so you replace the building materials by solar panels," he said, thus replacing the cost of materials and installation.

Rohatgi remains optimistic that solar energy will eventually be comparable to fossil fuels.

"Photovoltaics have been growing at a rate of 30 to 35 percent a year since 1996, and it is projected that it will continue to grow at least at 25 percent for the next two decades," he said. "[So] by 2020 it is expected that the cost will become competitive with fossil fuels."

"That's what we are all working towards," Rohatgi said.