Electric energy security, savings goals of power electronics research

December 9 2004

The National Science Foundation (NSF) has announced a four-year, $12.5 million funding renewal for the Virginia Tech-based Center for Power Electronics (CPES), a university/industry coalition working to help resolve the nation's power problems.
One of only 19 active NSF Engineering Research Centers in the United States, CPES was the first such center based in Virginia. The NSF established CPES in 1998, with Virginia Tech as the lead university in partnership with the University of Wisconsin-Madison, Rensselaer Polytechnic Institute, University of Puerto Rico-Mayagьez and North Carolina A&T State University.

The funding renewal marks a successful sixth-year review of CPES efforts by the NSF, which already has awarded about $18 million in funding to the center since 1998. The academic coalition is additionally supported by funding of more than $1 million annually from an industrial consortium that includes 78 industry affiliates.

Power electronics technology uses electronic circuits to convert and control electric energy with optimum efficiency. Today, this technology is part of most electrically powered machines and devices, from railroad trains and industrial robots to telephones and stereos.

The major goal of CPES research during the past six years has been development of power electronics technology that could lead to significant savings in energy consumption and also help increase U.S. competitiveness in the market. The coalition efforts are led by CPES

director Fred Lee, a University Distinguished Professor of electrical and computer engineering at Virginia Tech. CPES researchers and students can count among their successes 24 patents, 56 Ph.D. dissertations and hundreds of journal and conference publications.

In addition, said Dushan Boroyevich, a professor of electrical engineering at Virginia Tech and co-director of CPES, center researchers have made significant contributions in three areas critical to power electronics evolution: powering of a new generation of microprocessors; developing technologies for integration of power electronics components, such as circuits and sensors; and using the integrated components for standardized methods of assembling power converters, which are still custom-designed.

During the next four years, Boroyevich said, CPES will continue to work toward the goals of increasing energy savings and U.S. competitiveness by developing more efficient and integrated power electronics devices. Widespread use of power electronics in the future will improve electric energy security and availability -- resulting, for example, in the prevention of large-scale blackouts.

"Electricity is taken for granted, but we are reaching the limits of our electric power infrastructure," said Albert J. Tucker, a member of the CPES Scientific Advisory Board. "The electric power grid is rapidly approaching overload."

Power electronics technology is the key to increasing both the amount of electric power transmitted over the grid and the efficiency of power use, said Tucker, who began working in the area of power electronics about 14 years ago when, as director of ship research for the Office of Naval Research, he oversaw non-weapons research for ships, aircraft carriers and submarines.

"About 15 years ago, power electronics devices were so large and expensive that they were used primarily by the military," Tucker said. "But microelectronics circuitry has decreased the size and lowered the cost of power electronics. We're in a period now in which this technology is becoming widely used. CPES is helping to train a new generation of power electronics researchers and engineers."

As was planned from the inception of CPES, primary funding from the NSF will cease in 2008. "A recent survey of our 78 industry affiliates found strong support for continuation of life beyond NSF, and all five CPES universities are working with the affiliates to ensure that our research and education programs continue after 2008." Boroyevich said. "With encouragement from NSF and industry, we're also exploring ways to expand our research collaborations overseas to provide global leadership in advanced power electronics research."

Source: Virginia Tech