

PowerAmerica: Accelerating The Next Generation Of Wide-Bandgap Power Electronics

by Julia Casadonte, Communications Manager, PowerAmerica, Raleigh, N.C.

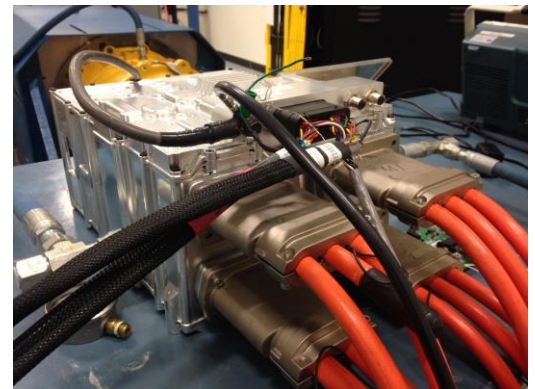
Power electronics systems based on silicon carbide (SiC) and gallium nitride (GaN) semiconductors are becoming mainstream. Supporting the transition to these long-anticipated technologies is PowerAmerica, a consortium of nearly 50 industry and university members focused on accelerating the adoption of SiC and GaN technology in a wide range of power electronics systems. Based at North Carolina State University, members range from startups to multinational corporations, as well as top research universities across the U.S.

Since its inception in January 2015, PowerAmerica has awarded funding of approximately \$44 million (excluding 1:1 cost matching) for 59 SiC and GaN projects in the areas of large volume power device fabrication, module development, device reliability, and power electronic applications—all boosting manufacturing in the United States. Funding for these projects is provided by the U.S. Department of Energy, the state of North Carolina, industry, and academia. Notable project achievements include:

- The nation's first open high-volume silicon carbide foundry, X-FAB Texas, which has allowed fabless semiconductor companies access to low-cost product manufacturing in the U.S.
- A collaboration between John Deere and the Department of Energy's National Renewable Energy Laboratory to develop a high-power SiC traction inverter to electrify heavy-duty construction vehicles.
- Researchers at Virginia Tech are using SiC parts to create more-efficient data centers.
- A team of researchers at Texas Tech University is helping boost confidence in SiC by establishing a third-party testing center to evaluate and benchmark SiC power devices' lifetime transient performance and long-term switching reliability.
- United Silicon Carbide, announced the release of 650-V and 1200-V SiC diode products from its 6-inch platform. The diodes are qualified according to AEC-Q101 standards and manufactured in a TS 16949 supply chain making them ideal for automotive applications. The wafers are produced at X-FAB Texas.
- Wolfspeed-Fayetteville has developed a commercialization pathway for their SiC power module including gate drive, module testing and design optimizations, and is also creating the manufacturing capability leading to full production.



Inside the X-Fab lab.



An inverter developed at John Deere.

These are just a few examples of the many successful projects PowerAmerica has funded, and we encourage you to explore more of them in our annual report, available on our website at poweramericainstitute.org.

Training Wide-Bandgap Professionals

In addition to funding projects that accelerate commercialization of SiC and GaN in power electronics, PowerAmerica has a robust education and workforce program that trains the next generation of wide-bandgap professionals. In the realm of continuing education, the institute hosts a monthly webinar during which experts in the field present their work. The webinar is free and open to the public.

PowerAmerica also offers an annual short course in the form of a multi-day training session that enables working power electronics engineers to incorporate and fully utilize the benefits of silicon carbide and gallium nitride technology in their products and systems. In addition, PowerAmerica university education programs

prepare undergraduate and graduate students for careers in wide-bandgap power technologies, helping to link them with potential employers.

Members derive substantial value from participation in the PowerAmerica ecosystem. Over the years, PowerAmerica has been a hub for those working to drive the SiC and GaN industries in the United States. In addition to project funding, membership in PowerAmerica provides exclusive access to networking opportunities, technology roadmapping, the institute's engineering sample device bank, and trained students that strengthen the workforce of the wide-bandgap industry.

The PowerAmerica Team



Major General Nick Justice joined PowerAmerica as the executive director in January of 2015. General Justice retired from the United States Army after more than 42 years of service as an American soldier. He earned a BA in History from the University of Maryland, a Master's degree in Management from Pepperdine University, and a Master's degree in International Relations from Salve Regina College. General Justice's military education includes a Master of Science degree from the Industrial College of the Armed Forces, the Senior Acquisition Course of the Armed Forces, and a Master's degree from the United States Naval War College.

Dr. Victor Veliadis serves as PowerAmerica's deputy executive director and chief technology officer, and is also a professor in the N.C. State University Department of Electrical and Computer Engineering. Prior to this, he worked for Northrop Grumman where he designed, fabricated, and tested SiC SITs, JFETs, MOSFETs, thyristors, and JBS, Schottky, and PiN diodes in the 1- to 12-kV range. Veliadis has given over 60 invited presentations/keynotes/tutorials, authored/co-authored 108 peer-reviewed technical articles, authored three book chapters, and has 24 issued patents to his credit. Veliadis earned his Ph.D. in Electrical Engineering from Johns Hopkins University.



Jim LeMunyon is PowerAmerica institute's membership and industry relations manager. He is a technology company entrepreneur who co-founded Sterling Semiconductor, now a unit of Dow Corning, which was established as the second silicon carbide substrate company in the United States. Jim served as a deputy assistant secretary at the U.S. Department of Commerce from 1989 to 1993. His public service also includes serving eight years in the Virginia legislature as well as chief of staff to former congressman Ed Zschau from California's Silicon Valley. Jim graduated from Valparaiso University with a B.S. in physics and mathematics, and earned an M.S. in meteorology at the University of Wisconsin.

Dr. Pam Page Carpenter is the director of Education and Workforce programs for PowerAmerica and the Future Renewable Electric Energy and Delivery Management (FREEDM) Center at N.C. State University. Carpenter has developed and administered programs in renewable energy, the electric grid, and electric vehicles with a focus on and science, technology, engineering, and mathematics (STEM) from K-12, community colleges, undergraduate, and graduate education. She received her doctorate in Technology, Engineering, and Design Education in the College of Education at N.C. State University where she is also an affiliated associate professor.



Our Unique Setting

PowerAmerica's location on the Centennial Campus of N.C. State University uniquely positions it for continued success. The university has a 130+ year history of technological innovations in fields such as energy, biomanufacturing and materials science, and Centennial Campus has spawned numerous successful business partnerships and public-private research.

The PowerAmerica Institute will build on its past record of success, playing a pivotal role in driving wide-bandgap power electronics manufacturing in the United States, thereby increasing domestic jobs and increasing the nation's energy productivity through the use of wide-bandgap semiconductor components.

About The Author



Julia Casadonte, PowerAmerica's communications manager, has a specialized background in government strategic communications and marketing. In her former role at the N.C. Department of Transportation, she led the marketing and rebranding of the state's fast-growing Amtrak train system, and prior to that, served as NCDOT's communications lead for the North Carolina mountain region as well as the state's bicycle and pedestrian division. Casadonte also previously worked as a print and digital reporter for media outlets in the North Carolina mountains and Raleigh. She graduated from Appalachian State University with a B.S. in Communication, Journalism.