PROJECT BRIEF

360 KW DC FAST CHARGER USES COMMERCIALLY AVAILABLE COMPONENTS

By 2020, experts estimate there will be millions of electric vehicles and hundreds of thousands of fast chargers around the world. Many charging station manufacturers are pursuing higher power levels using yesterday's technology. These systems will be large, heavy and inefficient.

Researchers at NC State have developed the architecture for a modular DC fast charger that utilizes the advanced capabilities of wide bandgap semiconductors to substantially increase power density compared to the current state of the art. Existing DC charging stations require a dedicated service transformer to convert from medium voltage (i.e., generally between 4kV and 35kV) to 480 volts and then use banks of silicon-based power electronics to convert the AC to DC. Most existing DC chargers are rated at 50 kW, but many manufacturers plan to increase this power to over 300 kW. Higher power levels with their technology will mean larger transformers, bigger boxes of power electronics and reduced efficiency.

The NC State Modular Fast Charger does not require a service transformer and is more than 97 percent efficient. It uses discreet power modules that contain silicon carbide (SiC) and gallium nitride (GaN) devices. This class of power electronics operates at higher voltages, higher switching frequencies and higher currents than existing state-of-the-art silicon devices.

In addition, researchers built the system using commercially available components. The university owns intellectual property in the controls and some design aspects, but all the parts are easily purchased. The result is a low-cost, high-power, efficient, pole-mounted DC fast charger.

With funding from PowerAmerica and FREEDM, researchers developed and demonstrated a 50 kW proof of concept. The next phase of the project is to scale to a 360 kW unit.

NC State is seeking commercialization partners to provide cost share for this research.

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