University of Tennessee, Knoxville

Project Title: Multi-functional High-efficiency Highdensity Medium Voltage SiC Based Asynchronous Microgrid Power Conditioning System (PCS) Module **Objectives**: Develop a multi-functional highefficiency high-density PCS module at medium voltage level (13.8 kVac) using 10 kV SiC power semiconductors Task No. BP5-4.28 PI: Fred Wang Email: fred.wang@utk.edu Phone: 865-974-2146

WBG Technology Impact

- 1. Fast switching high frequency for improved efficiency, density, control bandwidth, and resultant multiple grid facing functions compared to Si devices
- 2. Promote proliferation of power electronic converters in medium-voltage distribution and microgrids
- 3. Timeframe for commercialization: 2 to 3 years
- 4.

State-of-the-art Si NPC based PCS module w/ low frequency transformer Efficiency 98.52% Volumetric density Specific power **Control BW 100 Hz** 8.33 m³/MW 0.12 kW/kg (a) full power Limited grid facing functions = 13X ↑ = $10X \uparrow \blacksquare$ **Control BW 1 kHz** Efficiency 98.6% Volumetric density Specific power Multiple grid facing functions, (a) full power $1.2 \text{ m}^3/\text{MW}$ 1.6 kW/kg WBG baseline design SiC MMC based PCS module w/o low frequency transformer

TENNESSEE Academic Member



Accomplishments/Outcomes

1. Specification and grid requirement determined for the asynchronous microgrid PCS module.

- 2. Grid requirement impact on the PCS design.
- 3. 10 kV SiC MOSFET characterization.
- 4. PCS control algorithm development and validation in Hardware Testbed.
- 5. Medium voltage test platform building.
- 6. Three-phase DC/AC PCS converter developed and tested at rated power and voltage.

PowerAmerica

For Public Release

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