



Center for Advanced Power Engineering Research

### CAPER MISSION

*To advance, develop, and promote research related to the reliable and efficient management of the power grid, including modeling and analysis techniques for generation, transmission, distribution, planning and operation with and without the presence of renewable energy resources.*

## RESEARCH FACILITIES

At UNC Charlotte, the Energy Production and Infrastructure Center (EPIC) hosts the Duke Energy Smart Grid Laboratory with its real-time data system simulator, phasor measurements units, various software packages, and hardware equipment used to analyze and test system grid conditions.

Clemson University operates a Wind Turbine Drivetrain Test Facility at its Clemson University Restoration Institute (CURI). This 15 MW Hardware in the Loop (HIL) Grid Simulator provides a platform for research, testing, and workforce development.

NC State University FREEDM Systems ERC is developing smart grid technology applications that will enable the U.S. to take full advantage of advances in renewable energy for a sustainable future.

**Providing a cooperative industry-university forum to tackle the challenges faced by the power industry in the United States.**

Dr. Michael Mazzola  
Center Director  
[mmazzola@uncc.edu](mailto:mmazzola@uncc.edu)

Steven Whisenant  
Chair CSC and Facilitator  
[steven.whisenant@duke-energy.com](mailto:steven.whisenant@duke-energy.com)

## Industry Members

Dominion Energy  
Duke Energy  
Savannah River National Laboratories

## Collaborating Universities



Clemson University



North Carolina State University



UNC Charlotte

## Energy Hub

The Southeast is the fastest growing energy consuming region in the US. Reliable and economical energy and a technically qualified workforce are necessary to sustain this growth. With an evolving grid that will be subjected to more intermittency, operators must be prepared to handle these challenges and increase situational awareness to maintain high levels of reliability.

## CURRENT RESEARCH

- Impacts of New Smart Grid Technologies and Renewable Energy Integration on Transmission System Operation
- Fault Detection in Underground Cables
- Energy Storage and Market Models
- Cyber-security, Wide-area monitoring, Control, and Real-time measurements
- Dynamic Performance of Active Distribution Networks with High Penetration Solar Photovoltaic Sources
- Integration of Stochastic Sources and Energy Storage in Microgrids
- Improving Resiliency in Power Systems with Self-healing Microgrids
- Load Profile Analysis and Short-term Load Forecast for Commercial and Residential Loads
- Stochastic Planning Considering Renewable Integration
- Implementation of Distributed Grid Intelligence

## ABOUT

CAPER, the Center for Advanced Power Engineering Research, is a membership-driven consortium between universities and industry partners created to develop and demonstrate a comprehensive and integrated methodology for grid modernization.

CAPER will develop, research, and demonstrate advanced technologies to meet the operational and expansion needs of distributed renewable generation.



## RESEARCH THEMES



### Power Delivery

Impacts an increasing penetration of distributed generation resources and a desired resiliency to extreme weather events have on the power delivery system.



### Power Utilization

Smart distribution systems and energy analytics to meet increasing customer demands and expectations of energy utilization



### Power Generation

Optimal strategies to manage diverse distributed resources and storage



### Policy & Markets

Impacts regulatory policies and requirements place on the planning, design and operations of the grid.