

Introduction to Advanced Electric Infrastructure

The GCEP efforts in advanced electric infrastructure stem from the recognition that a future power system will need to operate differently in a carbon-constrained world. There are many technical challenges to integrating carbon-free energy carriers from renewable resources and other distributed sources into the electricity network. The current communication, command and control paradigm for the power system cannot accommodate a high penetration of deeply distributed renewable energy or an influx of electric vehicles. The requirements for bi-directional information and power flows are not in place nor optimized. GCEP anticipates that the future generation mix will range in load response times and capacities, posing complex research issues for power quality, asset management, network control and reliability.

The current project in advanced electric infrastructure is in its second year of funding and is a multi-institutional effort that examines a system-wide effort in the control of the electric network to allow over 50% penetration of renewable energy. This team is led by Professor Kevin Tomsovic at the University of Tennessee, Knoxville and includes three other institutions, University of Illinois, Northeastern University/Tufts University and Rensselaer Polytechnic Institute. The researchers are addressing the five issues surrounding command and control of the electric grid: flat control and communication framework, intelligent device interfaces, optimization with multi-scale energy sources and demands, transmission grid management and operation and test and verification. Within the past year, notable achievements have been the establishment of an \$18.5M NSF/DOE funded center and a patent application to improve the control system and enhance voltage stability for a popular power control device.