

GRIDED

The Center for Grid Engineering Education

Training on PV and Energy Storage Technology Testing & Evaluation

Course Description

This course is one in a series of several courses developed and offered through GridEd to enhance workforce readiness through training and education of personnel with needed skill sets at the intersection of power systems and power electronics.

This 3-day course focuses on Photovoltaic (PV), Energy Storage (ES) and hybrid inverter system technology performance evaluation testing. Hands-on training will be given on configuration, operation, commissioning, and performance evaluation testing of smart inverters. Participants will also be exposed to installation practices, DER plant design with inverter choices, National Electric Code (NEC) code requirements, interconnection standards, and safety.

The topics covered in the short course includes:

Inverter Technologies • Circuit Topologies • Maximum Power Point Tracking • Islanding Detection • Real and Reactive Power Control • Grid Support Functions • Voltage and frequency ride through • Harmonics

Laboratory Systems • Grid, PV, and ES Simulators • Active and Passive Load Banks • Data Recording • Power Quality Meters • Current Transformers and Shunts • Test Setup Design • Laboratory Safety • National Electric Code Application

Steady State and Dynamic Performance Evaluations

• Abnormal Voltage and Frequency • Fault Ride-Through • Dynamic Voltage Support • Smart Inverter Function Testing • Energy Storage Inverter Testing • Inverter Commissioning • Post-processing and Data Analysis

Learning Objectives

1. Comprehend PV, ES, and PV plus ES hybrid system topologies, design fundamentals, interconnection standards, and smart inverter grid support functions/settings.
2. Learn how to create lab test setup to evaluate steady state and dynamic performance of PV and ES smart inverters.
3. Gain hands on experience of operating test equipment, including grid/PV/ES simulators, smart inverters, load banks, PQ meters, and data recorders to execute tests and analyzing data.

Who Should Attend?

The course is intended for anyone wanting to gain hands on experience operating a smart inverter and/or required to test or field commission inverters. This course is also ideal for utilities and other stakeholders who are planning to develop a testing lab or would like detailed insight into how smart inverter tests are performed.

Registration Information

Dates and Times: TBD

Course Length: Three days with 50–50 split between classroom and lab time.

Location: In-person at the EPRI Knoxville, TN office and laboratory.

Course Outline

Day One

- Course Overview
- Electrical Fundamentals
- DER System Topologies and Inverter Choices
- Lab – Safety, Setups and Equipment
- PV and ES Inverter Fundamentals
- Lab Test Equipment
- Lab Test Setups
- Smart Inverter Grid Support Functions
- Energy Storage and Support Functions
- DER Interconnection Standards, Certifications and Challenges
- Inverter Interoperability
- Abnormal Voltage Testing
- Abnormal Frequency Testing
- Lab – Testing of Abnormal Voltage and Frequency

Day Two

- Fault and Frequency Ride-Through Testing
- Lab – Testing of Fault and Frequency Ride-Through
- Smart Inverter Grid Support Function Testing (part 1)
- Lab – Testing of Smart Inverter Grid Support Functions (part 1)
- Smart Inverter Grid Support Function Testing (part 2)
- Lab – Testing of Smart Inverter Grid Support Functions (part 2)
- Energy Storage Inverter Testing
- Lab – Testing of Energy Storage Inverter Function

Day Three

- Unintentional and Intentional Islanding Testing
- Lab – Testing of Unintentional and Intentional Islanding
- Three-Phase Verses Single Phase Inverter Testing
- Field Commissioning
- PV and ES Trends and Future Testing Considerations
- Course Wrap-up with Questionnaire

Bio



Charles Brewster

Technical Leader, DER Integration

Charles Brewster is a Technical Leader at EPRI. In his current role, Charles leads laboratory evaluation and testing of distributed energy resources (DER) which focuses on research and development related to DER interconnection on the electric grid. Charles has worked on several projects utilizing a variety of laboratory equipment in evaluating product design, standards requirements and overall functionality. Charles earned his Bachelor of Science in Biosystems Engineering from the University of Tennessee in Knoxville. He also earned his Bachelor of Science in Forest Management from the University of Maine at Orono.



Aminul Huque, PhD

Program Manager, DER Integration

Dr. Aminul Huque is currently working as a Program Manager at EPRI. He manages smart inverter and grid support technology research at EPRI which supports safe and reliable integration of renewables on the power grid. Dr. Huque leads research projects to develop and demonstrate solution to challenges associated with higher penetration of distributed energy resources (DER), including solar Photovoltaic (PV), energy storage, vehicle-to-grid, and controllable loads. He is a key contributor of DER interconnection standards like IEEE 1547. Dr. Huque received a PhD from the University of Tennessee at Knoxville (Tennessee, USA) and an MSc from the Imperial College London (London, UK) in 2010 and 2003 respectively.

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EPRI

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