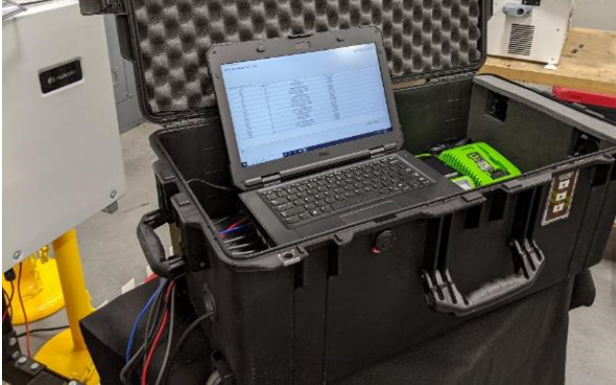


DER Commissioning Procedure and Toolkit



Prototype of the proposed DER commissioning toolkit

Background and New Learnings

The IEEE 1547-2018 distributed energy resource (DER) interconnection standard made grid support functions mandatory for all DERs. Smart inverter functions like volt-var, volt-watt, watt-var, and abnormal voltage and frequency ride through capabilities are now required for DERs. For larger scale DER plants (>500kW), these requirements need to be met at their point-of-common-coupling (PCC). In recent years, plant designers have preferred to deploy multiple three-phase string inverters instead of one large central inverter on MW-scale DER plants. This type of plant's performance at the PCC not only depends on the individual inverters within the plant, but also on other components like the interconnection transformer, AC-wiring within the plant, and the Power Plant Controller (PPC).

Certifications by nationally recognized testing laboratories (NRTLs) test individual inverters one-at-a-time. As such, use of certified inverters does not provide assurance that the plant will meet interconnection requirements at the PCC. Commissioning tests are a key step in the interconnection process to confirm that the plant meets the grid support function settings and power quality requirements specified by the utility. A DER plant's performance depends on many individual hardware and software components, which are not possible to evaluate together during NRTL certification testing. Hence it is important to perform commissioning tests before permitting to operate.

As utilities adopt the IEEE 1547-2018 standard, detailed commissioning tests will become critically important for the safety and proper operation of these systems. In addition to the complexity of the tests, the number of interconnection

- Understanding technical requirements and methods to witness or perform DER commissioning in the field as per IEEE 1547-2018/1547.1-2020 standards and interconnection agreements
- Software providing step-by-step test procedures and automating data transfer, analyses, result visualization, and report generation before leaving the site
- All-inclusive transportable and ruggedized hardware ready for varied and often rough field conditions

applications are growing nationwide. Utilities and other entities who are tasked to commission these DER systems need practical and efficient procedures, criteria, tools, and skilled manpower.

Objectives

This project aims to identify the best practice for DER commissioning and to design, develop, and demonstrate a DER Commissioning Toolkit to simplify and automate the process to the extent possible. The procedures will identify practical ways to verify DER performance requirements and the toolkit will include the hardware and software components necessary to record and automate measurement data transfer, analyses, and reporting in the field. Key features of the project include:

- Understanding performance elements that should be tested in the field for the complete system
- Practical approaches to in-field testing of DER behaviors
- A supporting, all-inclusive travel-ready toolkit
- Utility grade power quality (PQ) analyzer and ruggedized computer with all necessary accessories
- Step-by-step guidance for each individual test and requirement
- Automated data transfer, analysis, and result visualization (graphs/figures)
- Automated, standard format test report generation that incorporates on-site test results

Benefits

This project is expected to improve the quality and efficiency of DER commissioning. It aims to reduce the burden of data collection, analysis, and reporting from test engineers while

they perform or witness tests in the field. This project aims to decrease interconnection cost by reducing the time needed to perform commissioning tests and post process the data. This can help accelerate deployment of renewable systems and reduce emissions at lower societal cost.

Project Approach and Summary

EPRI has developed the prototype hardware components of the proposed commissioning toolkit and has demonstrated application of the concept software that automates extraction of data from the PQ analyzer and performs analysis and visualization.

In this project EPRI plans to work with participants to identify best-practice procedures and to complete development of the toolkit to support commissioning. This will include finalizing the list of commissioning/witness tests, developing step-by-step guidance for each test as per IEEE 1547-2018/1547.1-2020 standards and utility interconnection agreements, recording data, automating data transfer from PQ analyzer, analyzing data, and generating results (graphs/tables). The software component of the toolkit can be used independently to analyze data made available in standard file format. This software will also generate a report using the site-specific test results.

Additionally, this project plans to review the prototype hardware component of the toolkit and make design updates as identified by the participants. A user guide will be developed, and training will be provided as part of this project. EPRI will work with the project team to use the toolkit at DER sites to perform commissioning tests, analyze data, and generate reports. Certain tests in the field may require changing inverter and/or plant controller settings and operating feeder components (e.g., opening/closing switches for open phase and islanding tests). Because of the variety of hardware (type, size, communication protocol, etc.) in the field, these operations cannot be automated.

Deliverables

Option I: Commissioning Procedure and Software

- DER commissioning guidelines and recommendations
- Step-by-step guidance for each test and corresponding requirements as per applicable interconnection standards and agreements
- Automated recording, extracting, analyzing of test data, and generation of visual results
- Graphical User Interface and software manual

- Automated report generation
- Online user training and one year of remote technical support

Option II: DER Commissioning Toolkit

All of Option I deliverables plus:

- One commissioning toolkit including all the hardware components, software, and user guide
- Software ready to work plug-&-play with the PQ analyzer included in the toolkit
- In-person or remote staff training to perform DER commissioning tests using the toolkit
- Support one on-site commissioning test using the toolkit
- One year of remote technical support

Price of Project

Option I: \$45,000 per company

Option II: \$90,000 per company; payable over two years

Option I participants will be able to change participation level to Option II.

This project qualifies for Self-Directed Funding (SDF) or Tailored Collaboration (TC) funds.

Project Status and Schedule

Minimum of eight (8) participants will be required for full scope of the project. This project will begin when sufficient funding is achieved and run for approximately 18 months.

Who Should Join

Utilities experiencing increasing demand for PV, energy storage, PV plus energy storage, and vehicle-to-grid interconnection, installation, and commissioning.

Contact Information

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