GO solar CALIFORNIA

CSI RD&D PROGRAM

Grid Integration

Grantee:
Electrical Power Research Institute

Partners:
SunSpec Alliance, SMA, Fronius, Sandia National Laboratories, TUV Rheinland, and Xanthus Consulting

CSI RD&D Funding:
$882,193

Match Funding:
$1,228,919

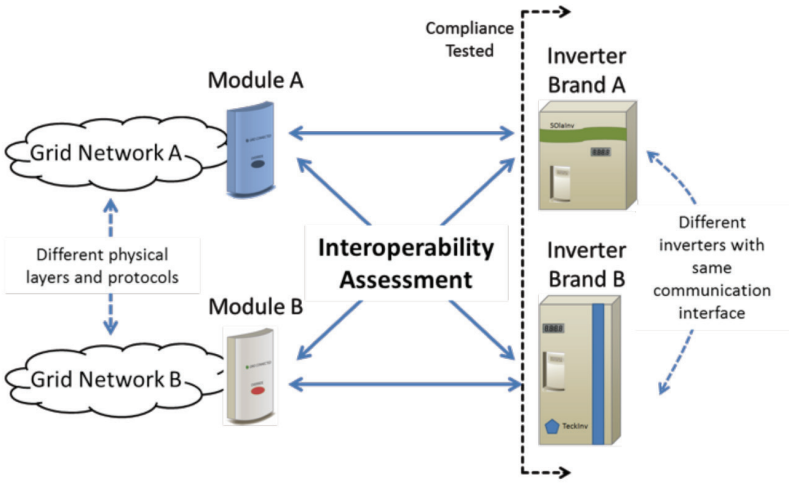
Project Timeframe:
2014-2016

RD&D Project Portal:
calsolarresearch.ca.gov/csi/107

Standard Communication Interface and Certification Test Program for Smart Inverters

OVERVIEW AND OBJECTIVES

As photovoltaic (PV) penetration in the California grid increases, utility and grid operators are looking for technical mitigation solutions. One possibility is to use advanced inverters on the distributed energy resources. Inverters are responsible for converting DC power generated by PV systems into AC power, and advanced inverters possess the capability to use data about the system to increase feeder hosting capacity. Communication from these inverters, however, requires standardization through a modular communication interface. This Electrical Power Research Institute (EPRI) research project focused on assessing the relationship and reliability between two commercial inverters and two commercial communication modules by testing the modules on a variety of inverter functions to certify that both are secure and interoperable in a real-life grid setting.



Tested combinations of communication modules and inverters

This document provides a brief project description. For more detail on the project and the California Solar Initiative's (CSI) Research Development, Demonstration & Deployment (RD&D) Program, please visit calsolarresearch.ca.gov

The CSI RD&D Program is managed by Itron on behalf of the California Public Utilities Commission (CPUC).

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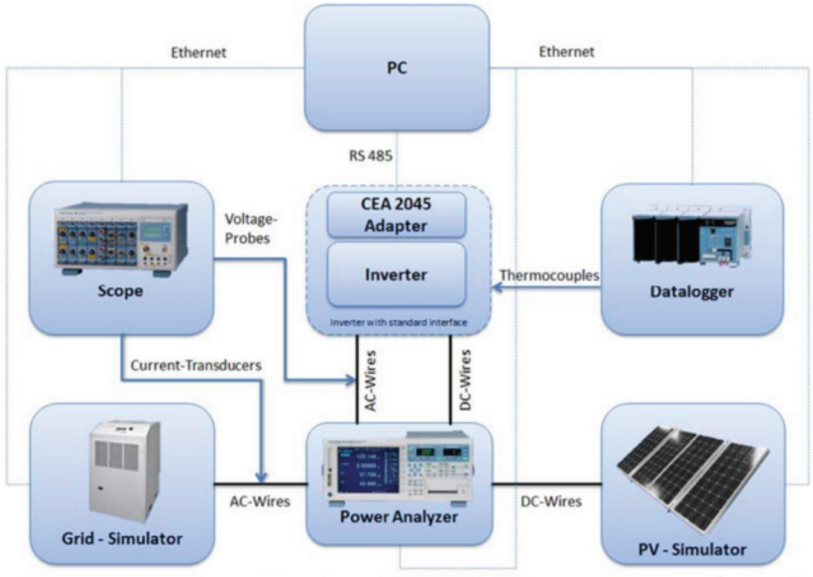
METHODOLOGY

The two inverters, developed by Fronius and SMA, were paired with two communication systems, Kitu's IEEE2 2030.5 protocol and EPRI's OpenADR 2.0b protocol, for a total of four tested combinations. In both cases, the local connection to the inverter was based on the SunSpec protocol, with the communication modules translating to and from their native system. Modules were integrated in compliance with current standards and regulations for both cybersecurity and resilience to both physical and cyber disruptions. The inverter/module combinations were tested in the lab, with both a PV and grid simulator, and on a real distribution grid with a PV system. More than seven common smart inverter functions were tested in each combination. The success of each combination in supporting these functions, along with any complications was analyzed for each environment.

RESULTS AND OUTCOMES

The project found that many of the tested functionalities were successful and supportable. The SunSpec Modbus protocol were able to achieve interoperability with smart inverters, the tested communication systems proved they were functional with any generic inverter, and the inverters proved they could operate with multiple communication modules. The Fronius inverter passed far more tests than the SMA inverter, both in the lab and in the field, failing only in frequency-watt functionality not supported by its design. With further development, commercial smart inverters, in combination with commercial communication modules, will be able to reliably and securely operate a variety of functions in nearly-limitless hardware/software combinations.



Tested combinations of communication modules and inverters

PUBLIC BENEFITS

Providing Consumer Choice:
The project proved the viability of a variety of inverters being integrated with any communication system. As more technologies enter the market, the inverter communication system will grow stronger.

Enabling New Value Streams for Solar PV Owners:
The tested smart inverters support a wide range of functionality that allows numerous services for which markets may exist, and ratepayers will be able to more easily participate in PV systems due to the flexibility of communication systems.

Enabling Marketplace Competition and Innovation:
The demonstration of interoperability between the multiple inverters and communication systems will encourage technological innovations by manufacturers eager to provide more functional products, and barriers to market entry will be reduced.

Avoiding Product Obsolescence:
This interoperable approach provides ratepayers a path for modular hardware upgrades throughout their lifetime using the PV grid.