Distributed Energy Resource Interoperability Testing

Smart Grid International Research Facility Network (SIRFN) is creating internationally harmonized interoperability test protocols to verify electrical behavior and communications functionality of distributed energy resources.

International Collaboration

Under the auspices of the multi-lateral International Smart Grid Action Network (ISGAN) International Energy Association (IEA) Implementing Agreement, the Smart Grid International Research Facility Network (SIRFN) is composed of 15 laboratories in 13 countries in North America, Europe, and Asia. SIRFN laboratories collaborate on smart grid research to accelerate the integration of higher penetrations of PV and other renewable energy resources.

Test Protocol Development

In February 2013, a set of standardized interoperability functions were defined for distributed energy resources (DERs) in IEC 61850-90-7. Sandia National Laboratories established a testing protocol for these functions in November 2013 with the goal of using this as a basis for national and international certification tests for interoperable DER devices. To improve the test protocol SIRFN labs completed PV inverter tests of many advanced grid-support in September 2014 and updated the test protocols.

Testing Automation

In collaboration with the SunSpec Alliance, a trade alliance of solar and storage distributed energy industry members, SIRFN laboratories have created automated testing software called the System Validation Platform (SVP). The SVP is architected to communicate with any DER device, laboratory test equipment, data acquisition system, and speaks a range of protocols. By communicating to these devices, the test protocols—which would normally take weeks to complete by hand—can be finished in a matter of hours.

Energy Storage Test Protocols

SIRFN has expanded the testing protocols to energy storage systems (ESS) by harmonizing multiple protocols in Europe and the Americas into a single test procedure. The team then completed a variety of tests with the draft test protocol to improve its precision and usability. To ensure the repeatability and robustness of these protocols, interoperability test beds were constructed at each SIRFN lab to evaluate the effectiveness and portability of the test protocols with different hardware and different grid parameters. Currently SIRFN is seeking wide-spread adoption of the test procedure through international standards-making bodies.

Impact

The Test Protocols for Advanced DER Interoperability Functions program has made many contributions to the field of DER integration. The SIRFN interoperability test protocols were used as a basis for the U.S.'s certification standard, UL 1741, and the draft South Korean interoperability test protocol. The SVP and associated test scripts are being used by seven laboratories and quickly gaining contributors.

Further Reading

- J. Johnson, R. Bründlinger, C. Urrego, R. Alonso, "Collaborative Development Of Automated Advanced Interoperability Certification Test Protocols for PV Smart Grid Integration," EU PVSEC, Amsterdam, Netherlands, 22-26 Sept, 2014.
- D. Rosewater, J. Johnson, M. Verga, R. Lazzari, C. Messner, R. Bründlinger, K. Johannes, J. Hashimoto, K. Otani, International development of energy storage interoperability test protocols for renewable energy integration, EU PVSEC, Hamburg, Germany, 14-18 Sept, 2015.
- M. Verga, R. Lazzari, J. Johnson, D. Rosewater, C. Messner, J. Hashimoto, SIRFN Draft Test Protocols for Advanced Battery Energy Storage System Interoperability Functions, ISGAN Annex #5 Discussion Paper, 2016.

SIRFN ISGAN Annex 5
Smart Grid International Research Facility Network

ISGAN international smart grid action network

CLEAN ENERGY MINISTERIAL
Accelerating the Transition to Clean Energy Technologies

iea Energy Technology Network

For more information please contact:
Jay Johnson
Photovoltaic and Distributed Systems
E-mail: jjohns2@sandia.gov
Phone: (505) 284-9586
www.sirfn.net

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND2016-4971 M.

U.S. DEPARTMENT OF ENERGY

Sandia National Laboratories