



Test of a 250 kVA Battery-Inverter System Micro-Grid

Cooperative Research and Development Final Report

CRADA Number: CRD-11-460

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Cooperative Research and Development Final Report

In accordance with Requirements set forth in Article XI.A(3) of the CRADA document, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

CRADA Number: CRD-11-460

CRADA Title: Test of a 250 kVA Battery-Inverter System Micro-grid

Parties to the Agreement: Portland General Electric

Joint Work Statement Funding Table showing DOE Commitment:

Estimated Costs	NREL Shared Resources
Year 1	\$ 00.00
Year 2	\$ 00.00
Year 3	\$ 00.00
TOTALS	\$ 00.00

Abstract of CRADA Work:

Portland General Electric (PGE) is installing a 5-megawatt (MW) lithium-ion-based battery-inverter system (BIS) in Salem, Oregon, as part of the Pacific Northwest Smart Grid Demonstration Project. NREL will assist PGE in testing a 250-kilovolt-ampere (kVA) portion of the BIS in order to verify correct operation and minimize risk to subsequent demonstrations. In this project NREL will provide technical support for the 250-kVA test and will work with PGE to write a test plan and evaluate the system in the lab before deployment in the field.

Summary of Research Results:

The purpose of this research was to integrate and evaluate a 250-kVA lithium-ion BIS prior to deployment in the field at a larger scale (5 megavolt ampere [MVA]). The BIS was an integrated system of devices, each of which was built by a different PGE partner. Thus, much of this project was performing the integration of these key devices and ensuring that the system would perform as intended. NREL researchers utilized key infrastructure—a 480- volts alternating current electrical bus system, grid simulators, load banks, a diesel generator with an onboard control system, an NREL-designed fault simulation box, and oscilloscopes and meters—of NREL’s Distributed Energy Resources Test Facility to simulate the grid-connected and local microgrid (islanded) conditions that the BIS would experience when connected to a substation in PGE’s electrical system. This effort involved three phases of testing:

- Performance testing – Verify that the battery, inverter, and PGE control system function as intended and work together as an integrated system

- Transition testing – Verify correct operation of the BIS and controls in changing between operating states (e.g., on-grid vs. off-grid)
- Fault simulation testing – Evaluate the response of the BIS and controls in the event of a fault while operating on-grid and islanded.

This project was successful in that many improvements were identified and corrected at NREL prior to trying to deploy the BIS at a much larger scale in the field. Also, the performance of the integrated BIS was evaluated and used to help inform the design and operation of the larger 5 MVA system. NREL has the capability of evaluating integrated energy systems up to the megawatt scale at its DERTF and Energy Systems Integration Facility.

Subject Inventions Listing:

None

Report Date:

Nov. 4, 2013

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