Examining Microgrid Operation And Protection At The CERTS Microgrid Testbed

John Stevens
Sandia National Laboratories

Montreal, Quebec
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jwsteve@sandia.gov
CERTS Microgrid Team

- Joe Eto, LBNL – Principle Investigator
- Bob Lasseter, Univ of Wisconsin – Technical lead
- John Stevens, Sandia National Labs – Project manager
- Northern Power Systems – Detailed design/test plans
- Tecogen/Youtility – Generators/Control Integration
- American Electric Power – Test bed host/constructor

Supported by
The California Energy Commission and
The US Department of Energy
Project Objectives

• Allow installation of DERs at optimum location for CHP
  – No need to electrically co-locate sources

• Have all millisecond-level control imbedded in DER
  – No need for communications for stability-related controls

• Protect sensitive loads from voltage sags and outages
  – ITIC/CBEMA or SEMI F47 criteria controls static switch

• Provide protection techniques for inverter-based DER
  – Inadequate fault current for conventional overcurrent protection
Conceptual CERTS Microgrid Design

Energy Manager

- 4-Wire 480 V
- 3-Wire 480 V
- 4-Wire 480 V

Sensitive Loads

Non-sensitive Loads

- Microsource
- Power Flow Controller
- Point of Common Coupling
- Breaker

13.8 kV

Circuit A
Circuit B
Circuit C
Details Regarding Design Objectives

- **Voltage sag/outage protection for sensitive loads**
- **Z between sources** \( V_{\text{Source A}} \neq V_{\text{Source B}} \)
- **Varying loads** \( \rightarrow \) **Varying frequency**

Diagram:
- **Source A**
- **Source B**
- **Static Switch**
- **Power Flow Controller**
- **Point of Common Coupling**
- **Breaker**
- **Loads**
- **Microsource**

Certified by CERTS, Consortium for Electric Reliability Technology Solutions.
CERTS Microgrid Operation

• Grid-tied operation
  – Power dispatch (energy manager)
  – Peak shaving (energy manager)
  – Rapid response to utility sags/outages

• Islanded operation
  – Voltage control with droop (no communication)
  – Frequency control with droop (no comm.)
  – Automatic resynchronization upon normal utility
Generation Trailer and Cabinets
Construction Near Completion
Input Side of Generator Trailer
Output Side of Generator Trailer
The Power Source
Site Overview
Progress

- Installation complete
- Commissioning underway
- Testing to begin mid-July
  - First phase expected completion Sept 1.
- Website with project information and test results to be established in August