CERTS Microgrid Test Bed
Phase III Activities

Role of Microgrids in Facilitating Integration of Distributed Renewable Electricity Sources

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Impacts and Benefits

Microgrids can enhance the values that DER offer:

Customer benefits include: bill savings, price certainty, reliability (including power quality), independence

Grid benefits include: a well-behaved electrical “citizen”

Societal benefits include: more resilient local energy infrastructure, possibly also environmental benefits

The CERTS Microgrid Project is recognized internationally as one of the leading microgrid R&D activities
“A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode.”

Microgrid Exchange Group. October 2010

Distinguishing features of the CERTS Microgrid Concept
- Seamless islanding and reconnection via single PCC
- Peer-to-peer, autonomous coordination among micro-sources (w/o high bandwidth communications)
- Plug-and-play - no custom engineering
- Energy manager on arbitrary platform

Distinguishing features of the CERTS Microgrid Test Bed Demonstration
- Small sources (<100 kW each)
- No stand-alone storage (yet)
- No power flow onto the grid
CERTS Microgrid R&D Timeline

DOE Transmission Reliability Program – 1999-2002
- Development of the original CERTS Microgrid concept
- Simulation and bench-scale testing
- Assessment of potential test bed sites
- Creation of enabling software tools (DER-CAM, mu-Grid)

- Construction of AEP CERTS Microgrid test bed
- Completion of proof-of-concept CERTS Microgrid tests

DOE Renewables and Distribution System Integration Program – 2006-2010
- Value and technology assessments to enhance the business case

DOE Smart Grid R&D Program – 2010-present
- Integration of storage and variable renewable generation
Technical Approach for Phase III

GENERALIZED TECHNICAL APPROACH


KEY ELEMENTS OF TECHNICAL APPROACH FOR PHASE III

Mechanical switch – Install mechanical switch; repeat tests conducted with static switch

Synchronous generator – Acquire a synchronous generator; implement CERTS control algorithms in governor controls; conduct component and system tests at AEP

Energy management – Build an interface between AEP test bed and DER-CAM; use information from DER-CAM to support intelligent load-shedding

Intelligent load shedding – Install under-frequency relays with adjustable settings for amount of load shed, frequency trip points, and delay times; conduct system tests at AEP

Storage – Install a conventional storage system (lead-acid batteries); implement CERTS control algorithms; conduct component and system tests at AEP

PV – Acquire a PV emulator; implement CERTS control algorithms; conduct component and system tests at AEP
Bench-Scale Test Bed at UW

Grid 220V/60Hz
Allen Bradley Drive and Controls
PMSM Wound Rotor Induction Machine

Smart Switch

Resistive Loadbank

700Vdc to 880Vdc
UW-Madison Microgrid Drive and Controls

100A Square D Disconnect Switch

ABB A110-30 Contactor?

480V/60Hz

100A Square D KAL361001021 Circuit Breaker

208/120V 60Hz

Smart Switch

CB2: 100A Square D KAL361001021

Bus B1

208/120V 60Hz

Prime Mover Simulator

Grid 220V/60Hz
Allen Bradley Drive and Controls

PMSM

Shorted Rotor

Wound Rotor Induction Machine
AEP/CERTS Microgrid Test Bed

60 kW Sources

New 100 kW InVerde

Static Switch

Loads
Interactions & Collaborations

The CERTS Microgrid Project Team consists of:
Lawrence Berkeley National Laboratory
University of Wisconsin
American Electric Power Company
Sandia National Laboratories

The research partners currently include:
Tecogen
The Switch (inverter manufacturer)
Woodward/PowerSecure

Project Team members are involved in a number complementary activities
SMUD microgrid field demonstration
Chevron microgrid field demonstration at Santa Rita Jail
Maxwell Air Force Base microgrid demonstration
International Microgrid Symposium

In addition the project team is in discussions with a wide variety of potential field demonstration partners and microgrid equipment manufacturers
Technology Transfer, Collaborations, and Partnerships

Visitors to AEP Dolan Test Laboratory since 2009

- Hawaiian Electric + Texas A&M
- Raytheon Microgrid
- Ohio House Committee on Alternate Energy
- KEMA + CPFL (Brazil)
- Tokyo Electric
- UCAlug OpenSG - 80 utility members
- International Microgrid Consortium tour group
- State Grid of China
- Ohio Green Energy Open House
- Tokyo Electric
- Eisenhower Fellows
- Arts Impact Middle School
- Consert EMS Tour
- HD Supply Tour
- Battelle RTP Team
- Energy Conversion Devices

- Kyushu Electric and Hitachi
- GE Energy
- Cooper Power Systems
- Energy Conversion Devices + Ovonics
- Rexorce Waste Heat Recovery
- Panasonic Home Energy Manager Team
- Chevron
- EPRI Intelligrid meeting - 50 members from various utilities
- Ohio State Student Group
- AEP Coop Students
- University of Michigan Group
- Columbus State University
- Chung Yuan Christian University
- Ohio Secretary of State
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