Overview of Microgrid R&D in the US

presentation at the
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by

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Outline

1. CERTS Update
2. GE Microgrid Project
3. DUIT & Benefits Study
1. Consortium for Electric Reliability Technology Solutions (CERTS) Microgrid
The CERTS Microgrid Features

• peer-to-peer electronic microgrid devices avoids dependence on any central fast control or protection scheme
• devices are plug-and-play, so configuration is flexible, maximum advantage of CHP possible (possibly highly dispersed)
• a cluster of small (e.g. < 500 kW) sources, storage systems, and loads which presents itself to the grid as a legitimate entity, i.e. as a good citizen, and manages power quality and reliability locally
• interconnected with the familiar wider power system, or macrogrid, at a point of common coupling, but islands at a fast static switch
DER Customer Adoption Model (DER-CAM)
Optimal Solution, Low Cost Batteries

- 1 x 200 kW reciprocating engines with heat recovery
- 320 kW absorption chiller
- 3680 kWh electrical storage

January

July
μGRD: Unique Characteristics

Components are modeled in **direct phase quantities** without any approximating assumptions, for example symmetrical components.

- Provides the capability of handling three wire, four-wire and five-wire systems
- Provides high fidelity models
- Provides voltages and currents in Neutral wires and ground wires
2. GE Microgrid Project
General Electric Project: MicroGrids

**Supervisory Controls**
- optimize electrical and thermal performance and cost
- manage feeder connection to bulk grid
- manage renewable intermittency

**Local Controls**
- control response based on local measurements
- respond to system disturbances and supervisory level commands
- provide stability and load sharing
Demonstration at a Campus

demonstrate energy efficiency, CHP and renewable integration achieving long-term cost savings, enhanced reliability, and improved environmental quality

- peak load of 1.3 MW & peak critical load for island operation of 670 KW
- combined cooling, heating, and power (CCHP)
- islanded operating mode
- Islanded black start capability
- control of active and reactive power at PCC
- optimal dispatch

- 7 buildings and 2 additional facilities
- Grid electricity, NG boilers for heat
- 2 X 335 kW Jenbacher
- 305 KW of PV
- 1 point of interconnection to the grid

Central Plant

Tomorrow

Today

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3. Other Activities
Distributed Utility Integrated Test: Objectives

- measure interactions among diverse DER on the distribution system
- examine issues related to the high penetration of DER
  - including islanding, voltage regulation, & stability
- test solutions that mitigate adverse interactions, using distribution design techniques as well as optimizing DER
The DUIT Facility: A Complete Medium Voltage Distribution System

- tied to medium voltage distribution system via one or more pole-mount transformers
- 21 kV motor-operated load break switch allows for isolation of total DUIT facility from grid
- (34) single phase PV inverters from 2.5-5 kW, 115 kW
- 2 three phase inverters, 140 kW
- 2 Capstone microturbines, 90 kW
- 500 kVA Genset
- ability to insert impedances equaling ~50 km of distribution line
DOE Benefits Study

• major study of DER benefits
• required by EPAct 2005
• limited to requirements of Act
  i.e. not comprehensive
• some parts are informative
  e.g. background material
  & sec. 7: DER and security
• open for public comment

available at:
http://www.oe.energy.gov/epa_sec1817.htm
If You Have More Questions

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arigato gozaimas!

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