

Electric Distribution R&D Peer Review 2006 Project Summary

YOUR ORGANIZATION:	University of Wisconsin-Madison
PROJECT TITLE:	Value and Technology Assessments to Enhance the Business Case for the CERTS Microgrid
PRESENTERS:	Professor R. H. Lasseter
FY 2005 FUNDING:	N/A
FY 2006 FUNDING:	\$ 600,000
START/COMPLETION DATES:	~1 July 2006 to 30 June 2008

Overall Project Purpose and Objectives: The CERTS Microgrid concept is an advanced approach for enabling integration of, in principle, an unlimited quantity of distributed energy resources into the electricity grid. The CERTS Microgrid concept is driven by two fundamental principles: 1) A *systems* perspective is necessary for customers, utilities, and society to capture the full benefits of integrating distributed energy resources into an energy system; and 2) The *business case* for accelerating adoption of these advanced concepts will be driven, primarily, by lowering the first cost and enhancing the value of microgrids.

This project will build from the base established by the CERTS Microgrid test bed – the world’s first, full-scale, inverter-based microgrid - to prioritize, develop, and, as appropriate, demonstrate at bench-scale needed additional technology enhancements required to further optimize the microgrid from the explicit perspective of enhancing the business case for microgrids. The initial list of microgrid technology enhancements proposed for study includes: 1.) Reduction of protection costs; 2.) Reduction of DC storage costs; 3.) Inclusion of AC storage; and 4.) Inclusion of non-inverter-based microsources.

FY 2005 and FY 2006 Results and Accomplishments: The project has not started. The plans for 2006 are:

Task-1 “Baselines for Microgrid Business Case Assessments” is expected to start July 2006 and be completed in January 2007. This work is to identification and prioritization of prospective microgrid applications and establishes traditional solution (no microgrid) baseline cases. This will provide technical and cost targets for Task 2-5.

Task-2 “Reduction of protection costs” is expected to start September 2006 and be completed early 2008. At each microsource in the CERTS Microgrid, a shunt trip molded case breaker is used to isolate faults within the microgrid. Current implementation at the CERTS microgrid test bed of this designed scheme relies on Schweitzer digital relays with independent current and voltage sensors. In order to lower the overall cost of the CERTS Microgrid, the protection logic needs to become an integral part of the control logic within each inverter. This will allow for elimination of the external relays and enhance the plug-and-play functionality of the microsources. This work has three subtasks. 1.) Detailed tests, using the existing CERTS/AEP test bed, to better understand the protection requirements fulfilled by the Schweitzer digital relays. (AEP, Northern Power, UW) 6-Month. 1.) Evaluate the functionality and technical feasibility of including these protection functions as part of the inverter controller (AEP, Tecogen, Northern Power, UW) 12-Months. 3.) Assessment of cost targets and market adoption potential (LBNL, Tecogen) – 12-Month.

Task-5 “Inclusion of non-inverter-based microsources” is expected to start July 2006 and be completed in June 2008. The objective of this task is to develop techniques for successfully integrating synchronous generators that do not include inverter interfaces into the CERTS Microgrid system. The first 18 months of this work will evaluate possible modifications to the exciter and governor controls of non-inverter-based micro-sources to function as an autonomous component of the CERTS microgrid (UW).

FY 2007 Plans and Expectations: In addition to Tasks 1, 2 & 5 described in above paragraph we plan to start Tasks 3 & 4.

Task-3 “Examination of Technical Requirements to Reduce DC Storage Costs” is expected to start January 2007. We expect to explore the technical feasibility of reducing the storage sizing or removing to reduce cost while retaining the autonomous operation of the microsources in the CERTS Microgrid. This work includes extensive modeling and simulation compared against field data.

Task-4 “Enhancing Microgrid Functionality by Optimizing the Role of AC Storage” is also expected to start in January 2007. We expect to evaluate the technical issues involved in including AC storage as an autonomous component of the CERTS Microgrid and start designing a storage unit for bench testing.

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Public/Private Partnerships

The CERTS Microgrid team for the project is composed of the same partners and individuals that are involved in prior work that are demonstrating the functionalities of a microgrid in a full-scale demonstration funded by the California Energy Commission Public Interest Energy Research program. The CERTS team consists of the R&D department of the nation's largest electric utility (American Electric Power), an established manufacturer that has been installing microsources commercially for over 20 years (Tecogen), the university professor responsible for the intellectual development of the CERTS Microgrid concept (Dr. Robert Lasseter, University of Wisconsin), and the national laboratories that have managed the CERTS Microgrid project since its inception in 2000 (Lawrence Berkeley National Laboratory and Sandia National Laboratories). The Technical Advisory Committee (TAC) for the CERTS CEC project includes representatives from the following organizations: National Renewable Energy Laboratory staff managing the IEEE Std. 1547 process; Southern California Edison staff leads for DER interconnection and DER demonstrations; Pacific Gas and Electric staff lead for DER interconnection; and EPRI PEAC staff lead for power quality and DER R&D (DOE Microgrid program manager is also a member of this TAC).