Electric Distribution R&D Peer Review 2006
Project Summary

YOUR ORGANIZATION:	**Montana Tech of the University of Montana**
PROJECT TITLE:	**Load Control System Reliability**
PRESENTERS:	Dan Trudnowski
FY 2005 FUNDING:	$0
FY 2006 FUNDING:	$1,800,000 (DOE), $450,000 (Matching), $2,250,000 (Total)
START/COMPLETION DATES:	4-18-2006 through 4-17-2008

Overall Project Purpose and Objectives: Provide a brief project description. Identify specific project goals and objectives. Outline the major milestones that have been set for the entire timeframe of your project. Explain how this project contributes to the achievement of the U.S. Department of Energy's Electric Distribution R&D program goals. Describe the expected benefits of your project for the U.S. DOE and the Nation.

The goal of this project is to research and develop intelligent measurement and control technologies to improve the reliability and efficiency of electricity transmission and distribution on the nation's grid. Research will focus on two areas: 1) real-time load control methodologies; and 2) measurement-based stability-assessment operation and control tools.

Several US government studies have concluded that advanced control and new operating paradigms offer considerable benefits in terms of cost savings, reliability, and national security for the grid of the future (e.g., see 2001 *National Energy Policy Report* and the 2002 *National Transmission Grid Study* report). This project is focused on researching and developing new control technologies to improve grid reliability and efficiency. The research to be conducted under this project support the goals of both the DOE-OE *Transmission Reliability* program and the *Electric Distribution* program. Enabling technologies for the research under this project include the *Transmission Reliability's* development of Phasor Measurement Technologies and *Electric Distribution's* GridWise initiative.

Although advanced controls offer considerable benefits in terms of cost savings, reliability, and national security, significant investment in research and development is required. Intelligent control requires reliable real-time measurement systems and decision-making technologies as well as control actuators. Measurement and decision-making research will focus on developing advanced algorithms for detecting and measuring unstable operation induced by grid overload in real time, and developing advanced algorithms for controlling unstable operation. New grid operation and control tools will be developed. Control actuator research will focus on using load control (i.e., electricity demanded by consumers). Control of consumer loads for grid benefits meshes with the recent developments forged within DOE-OE under the GridWise initiative. For example, load control concepts could include the use of grid-friendly intelligent consumer appliances, buildings, and clusters of buildings that regulate usage in real time. The technology research, development, and demonstration project proposed here is aimed at applying advancements in intelligent control and information technologies to the challenges of improved reliability of existing grid resources, load leveling of limited energy resources, and improved efficiency among systems of loads on a common distribution system.

To accomplish the project objectives, three complementary technical tasks are proposed under the project. The goal of each task is to address a fundamental barrier to the implementation of intelligent control technologies. The first task is aimed at developing load-control methodologies and demonstrating the potential of intelligent loads (i.e., user consumption) for improved grid reliability and efficiency using computer modeling and simulation. The second task focuses on developing next-generation stability-assessment operation and control tools. Specifically, real-time electromechanical stability assessment will be addressed. The last task is aimed at scoping and designing a Montana-based state-of-the-art electric power research facility. Montana Tech will be the lead institution in the research with work being conducted at Montana Tech, Montana State University, MSE Technology Appications, the University of Wyoming, and Pacific Northwest National Laboratory. All tasks will be closely coordinated with similar

DOE National Laboratory projects being conducted at Pacific Northwest National Laboratory in Richland, WA and the National Energy Technology Laboratory in Morgantown, WV, as well as projects being conducted by the utility industry. All four tasks will be executed over a 24-month timeframe starting upon award of the agreement. A project advisory board consisting of industry and government experts will be formed to help oversee the tasks.

FY 2005 and FY 2006 Results and Accomplishments: Describe specific technical results achieved, milestones reached, publications released, and any other accomplishments since the previous Peer Review in April 2005. (Can be in paragraph or bullet form.)

NA (new project).

FY 2007 Plans and Expectations: Identify and describe your FY 2007 plans and expected FY 2007 milestones. Explain any key technical barriers that you foresee and your strategy to overcome these barriers. If applicable, please provide 2008, 2009, and 2010 milestones.

TASK 1: During year one, Task 1 will be broken into four subtasks: 1) scoping and developing modeling and simulation tools; 2) development of load control strategies; 3) conducting computer simulation case studies; and 4) conducting a frequency measurement study. Year 1 milestones include: 1) complete scoping and development of simulation and analysis tools; scope required commercial tools; 2) complete scoping of control methodologies; 3) identify case studies; and 4) complete purchasing, installation, and construction of data acquisition equipment. At the end of year 2, this task will be complete. Year 2 milestones are: 1) develop load control strategies; 2) demonstrate strategies on computer-simulation case studies; and 3) determine feasibility of distribution level frequency measurement.

TASK 2: During year one, the following milestones will be competed: 1) refining and testing of current mode frequency and damping estimation algorithms; 2) identify and develop industry partnerships for developing and testing mode-meter concepts in the operation and control centers. During year two, the following milestones will be completed: 1) development and demonstration of algorithms for accurate mode estimation; 2) testing mode-meter monitoring systems in operation and control centers.

TASK 3: By the end of year one, Task 3 will be completed.

Public/Private Partnerships: Identify cooperative efforts and technology transfer/outreach activities related to this and related projects. When answering, consider work with private industry, state and local government, federal government, national laboratories, academia, and trade associations. List the major partners, including subcontractors, with whom you are participating in this project, and the role they play in its completion.

Collaborators on the project include the Bonneville Power Administration (BPA), the Western Area Power Administration (WAPA), NorthWestern Energy, PNNL, and the Electric Power Group. Co-funding for the project includes Montana Tech, Montana State University, the University of Wyoming, and BPA. A project advisory board consisting of industry and government experts will be formed to help oversee the tasks.