

Abridged Synopsis of NRECA CRN's Smart Grid Regional Demonstration

The National Rural Electric Cooperative Association (NRECA) is pleased to submit this proposal to support the Department of Energy's (DOE's) Smart Grid Regional Demonstration Program (SGDP) and the Smart Grid Clearinghouse. NRECA, through its research arm, the Cooperative Research Network (CRN), supports 930 co-ops in the adoption of new technology and technology applications meant to control costs and improve reliability and service levels. The project submitted here for your review strongly supports the DOE as it faces the complexity of developing national use cases for speedy, cost-effective deployment of the Smart Grid.

NRECA's proposed project demonstrates diverse Smart Grid technologies, spanning multiple utilities, geographies, climates, and applications. It significantly advances interoperability and security.

OVERVIEW OF THE PROJECT

1. *NRECA's CRN has organized a project that will install and study a broad wide range of advanced Smart Grid technologies in a regional demonstration involving 27 cooperatives in 10 states.*
2. *We will install:*
 - a. *131,720 smart meter modules*
 - b. *18,480 demand response switches*
 - c. *3,958 in-home displays/smart thermostats*
 - d. *2,825 ZigBee gateways*
 - e. *169 voltage sensors*
 - f. *247 fault detectors*
3. *The scale of the project offers advantages both in terms of project efficiency and study value. It makes it possible for the co-ops to participate at a higher level than would be possible individually. Planning, procurement, project reporting, high-level engineering, NEPA issues, and the study components are executed by a central team working with the co-ops.*
4. *Installations are planned and executed at the individual co-op level by locally experienced teams.*
5. *Study data will be collected in a coordinated way. Specifications will be developed with the DOE at the outset of the project. The central team will establish a database at NRECA to receive the data, as well as software to validate the data. Working with IT at the co-ops, we will automate collection, validation, and transmission. This system will operate for the duration of the project.*
6. *The data will allow us to conduct the following studies:*

<i>NRECA's Enhanced Demand and Distribution Management Regional Demonstration</i>	
<i>END-TO-END DEMAND MANAGEMENT</i>	<i>ADVANCED DISTRIBUTION GRID MANAGEMENT</i>
<i>Advanced Volt/VAr for Total Demand</i>	<i>Tests of MultiSpeak Integration Extensions</i>
<i>G&T-wide Demand Response</i>	<i>Enhanced Use of Integrated Data</i>

<i>Program over AMI</i>	
<i>Critical Peak Pricing over AMI</i>	<i>Multiple AMI Integration at G&T Co-ops</i>
<i>Water Heater and AC Load Control over AMI</i>	<i>Distribution Co-op MDM System Applications</i>
<i>Advanced Water Heater Control and Thermal Storage</i>	<i>Advanced Volt/VAr for Reduced Losses</i>
<i>Consumer Internet Energy Usage Portal Pilots</i>	<i>Self-Healing Feeders for Improved Reliability</i>
<i>Consumer In-Home Energy Display Pilots</i>	<i>Meter Data Management Applications and Uses</i>
<i>Time-Sensitive Rates Pilots</i>	

7. *Installations will be implemented in four successive tranches, each of four months' duration. Each tranche will be treated as a separate project with a firm schedule and deliverables. Data have shown that projects of short duration are much more likely to succeed and that decomposition of large projects is the most effective way to improve performance.*
8. *At the end of each of the first three tranches we will conduct a project improvement exercise, update our Project Management Plan (PMP), and adjust the team and our processes.*
9. *At the conclusion of each tranche, we will conduct a preliminary study. This will help us: (a) improve our study plan and possibly alter the data we collect; (b) assess the type of equipment we are installing and its configuration.*
10. *Results of preliminary studies will be provided to the DOE and disseminated to the co-op community through NRECA's Tech Surveillance series. In addition, we will prepare a more qualitative "best practices" report. We believe that early dissemination of results is important—our member community and the broader utility industry are keenly interested in this work.*
11. *Interim and final technical reports provided by NRECA will quantify Smart Grid costs, benefits, and cost-effectiveness; verify Smart Grid technology viability; and validate new Smart Grid business models at a scale that can be readily adapted and replicated around the country. Cost-benefit studies are essential to rapid and cost-effective technology adoption at consumer-owned utilities such as electric cooperatives. They also serve the entire industry well.*
12. *NRECA's mission is to serve its member co-ops. The project includes a comprehensive outreach program using NRECA's full range of capabilities, including reports, seminars, site visits, and Webinars.*
13. *We are taking a comprehensive approach to interoperability. NRECA is the owner and developer of MultiSpeak, the most widely used cross-application interoperability specification in this space. As part of the project, we intend to extend MultiSpeak to address the critical data exchanges between software applications.*
14. *The final MultiSpeak standards will be made available—as consistent with other standards at the end of the project—to the DOE, utilities, and software developers. In addition, we will provide any additional source code we develop as a model for future development.*
15. *Our approach to cyber security is aggressive and comprehensive. We have engaged Science Applications International Corporation (SAIC) to develop the MultiSpeak security extensions and the integration and data collection software at the co-ops. SAIC has a respected security practice, and two security experts from SAIC are on our team. Its responsibility extends beyond the software to other areas of security such as authentication and perimeter protection. We have also engaged Cigital, which is recognized as the pre-eminent firm in software security. Cigital will provide audit, review and independent validation and verification.*

16. *The project will be completed in four years, during which time we will get the maximum amount of equipment into use and generate useful study results quickly. This project timeline also reduces project labor costs.*
17. *We will continue to collect data using the automated system through five years and make the data available to the DOE.*

Project Objectives

The Smart Grid will be comprised of numerous software, hardware, and communications applications operating in harmony. It will never be a packaged product ready for purchase and installation or a straightforward information technology deployment.

Smart deployment of infrastructure on its own, however, will not produce the efficient, responsive grid of tomorrow. The roles and actions of industry and consumer stakeholders must be expanded and understood. Good stewardship of our economic and natural resources demand that we understand the outcomes and costs of these efforts.

The proposed project offers the DOE excellent support as it faces the complexities of developing valuable, relevant national use-cases for speedy, cost-effective deployment of Smart Grid capabilities. Our project involves 27 cooperatives from 10 states, conducts multiple studies, demonstrates a wide range of technologies, expands interoperability, and addresses cyber security. The high-level study structure is outlined below.

NRECA Study 1: End-to-End Demand Management

Study 1.1: Demand Response Using Two-Way Communication

Study 1.2: Utility-Consumer Technology and Pricing Pilots

Core Objectives: End-to-End Demand Management

- a. Demonstrate advanced two-way metering infrastructure and conservation voltage reduction programs to study technology readiness and impact on peak demand.
- b. Advance systems integration and cyber security controls that will enable end-to-end control and sophisticated pricing signals and load control.
- c. Quantify the impact of in-home energy use display devices for household accounts in terms of energy use reduction and shifts in time of energy use; and describe the shifts in customer energy usage behavior in response to the presence of in-home displays and, if applicable, price signals.
- d. Support the DOE's SGDP studies, Clearinghouse, and industry/public outreach.

NRECA Study 2: Advanced Distribution Grid Management

Study 2.1: Integrated Systems Advances and Studies

Study 2.2: Meter Data Management (MDM) Applications and Uses

Study 2.3: Distribution Automation Applications and Studies

Core Objectives: Advanced Distribution Grid Management

- a. Develop and test MultiSpeak specification extensions and additional software development to enable and advance systems integration of multiple AMI, MDM systems, self-healing feeders, and advanced Volt/VAr programs.
- b. Demonstrate self-healing feeders for low-density utilities and advanced Volt/VAr programs for reducing losses. Learn what works, at what cost—and what doesn't work—and report on case studies and best practices.