

Minnesota Power

Smart Grid Advanced Metering Infrastructure Project

Abstract

Minnesota Power's Smart Grid Advanced Metering Infrastructure project (AMI) involves the installation of AMI and explores the application of distribution automation. The project is aimed at improving customer understanding of their electricity usage, reducing operations, and maintenance costs, and improving awareness of and response to distribution system outages. The project implements two-way communication to: (1) provide customers with more timely electricity usage information, (2) identify when and where outages are occurring, and (3) demonstrate the performance of select distribution automation equipment.

Smart Grid Features

Communications infrastructure includes a radio frequency wireless and cellular backhaul network that enables two-way communications between meters and utility data systems and allows for the monitoring and control of select distribution automation equipment.

Advanced metering infrastructure includes deployment of 8,030 meters providing the capability for a variety of current and future customer electricity price and service options and reducing Minnesota Power's costs of electricity delivery. Operational cost savings come from lower meter reading and customer services costs. New AMI features such as outage and restoration notification potentially enable Minnesota Power to respond to outages and customer requests more efficiently than existing technology. This AMI system deployment provides outage management messaging, provides the ability to differentiate between momentary and sustained outages, and provides the time the outage occurred and duration of the outage. This information is integrated with Minnesota Power's existing outage management system via a near-real-time interface. The meters provide more timely and frequent load data for improving distribution operations, forecasting, and planning. This project also includes a meter data warehouse that provides a central repository for multiple uses of the AMI data, including distribution operational data.

Direct load control devices currently deployed by Minnesota Power are being upgraded from an existing one-way communication network to the two-way communication network that is also being used for AMI and distribution automation. This project includes 1,750 direct load devices, and the new communications infrastructure allows

At-A-Glance

Recipient: Minnesota Power, a Division of Allete

State: Minnesota

NERC Region: Midwest Reliability Organization

Total Budget: \$3,088,008

Federal Share: \$1,544,004

Project Type: AMI and Customer Systems
Electric Distribution Systems

Equipment

- 8,030 Smart Meters
- AMI Communication Systems
 - Meter Communications Network
 - Backhaul Communications
- Customer Web Portal
- 1,750 Direct Load Control Devices
- Distribution Automation Equipment for 1 out of 336 Circuits
 - Automated Distribution Circuit Switches
 - Equipment Condition Monitors

Time-based Rate Programs Targeting up to 2,300 Customers

- Time of Use
- Critical Peak Pricing

Key Targeted Benefits

- Reduced Electricity Costs for Customers
- Reduced Meter Reading Costs
- Improved Electric Service Reliability
- Reduced Costs from Theft

Minnesota Power (continued)

Minnesota Power to verify targeted demand reductions and verify the operation of these meters with integrated service switches.

Time-based rate programs include time-of-use rates with a critical peak price overlay (subject to regulatory approval) and related information services in conjunction with advanced metering to encourage consumers to reduce peak demands or shift consumption from on- to off-peak periods and then to measure and validate the demand response.

Distribution automation systems include five automated switches, two recloser monitors, and associated micro remote terminal units to test the performance of those devices in conjunction with the AMI communications network on one circuit. Load and voltage data, provided by 3,600 smart meters, will be used along with the distribution automation equipment to refine distribution operations. The purpose is to assess smart grid functions, applications, and interoperability issues while improving reliability and reducing operational costs.

Consumer Behavior Study

A consumer behavior study includes an assessment of how customers respond to varying types of information and the mechanisms for delivering it. During the pilot, customers have access to usage information through different levels in frequency and resolution. Specific research questions include estimates of the incremental effects of customers with only Web access to their consumption information versus those with in-home displays. Minnesota Power is assessing whether or not customers make more frequent use of AMI-enhanced usage information compared to standard (monthly) on-line usage information and how the frequency with which customers view enhance on-line information changes over time.

Timeline

Key Milestones	Target Dates
AMI asset deployment begins	Q3 2010
Distribution asset deployment begins	Q3 2010
AMI asset deployment ends	Q4 2011
Distribution asset deployment ends	Q1 2012

Contact Information

Dan Gunderson
SGIG Project Manager
Minnesota Power
dwgunderson@mnpower.com