

Denton County Electric Cooperative *CoServ Advanced Metering Project*

Scope of Work

The Denton Country Electric Cooperative (CoServ) Advanced Metering project installed advanced metering infrastructure (AMI) throughout CoServ’s service territory and explored the application of distribution automation (DA) and customer systems.

Objectives

The project was aimed at improving customers’ understanding of their electricity usage, reducing utility operations and maintenance costs, and improving CoServ’s awareness of and response to distribution system outages. The project implemented two-way communications 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 DA, load management, and customer systems equipment.

Deployed Smart Grid Technologies

- **Communications infrastructure:** The project deployed an unlicensed wireless radio frequency (RF) network that enables two-way communication between meters and utility data systems and allows for the monitoring and control of select DA equipment. Meters and routers send data to collectors, which connect to CoServ’s wide-area network utilizing public cellular technology.
- **Advanced metering infrastructure:** The project entailed a system-wide replacement of all 165,784 residential meters and all 14,034 commercial and industrial meters with advanced meters. These advanced meters provide 15-minute interval load data for improving distribution operations, forecasting, and planning. This information also enables CoServ and its wholesale power provider to better plan requirements for wholesale power supply and ancillary services. AMI features include outage and restoration notification and remote service switches so that CoServ can respond to outages and customer requests faster and more efficiently. Operational cost savings are derived from the automation of meter reading and customer service activities, as well as enhanced theft detection. CoServ deployed a meter data management system (MDMS) to house meter data, provide analytics, and allow for verification and gap filling in meter

At-A-Glance

Recipient: Denton County Electric Cooperative

State: Texas

NERC Region: Texas Reliability Entity

Total Project Cost: \$41,068,154

Total Federal Share: \$17,205,844

Project Type: Advanced Metering Infrastructure
Customer Systems
Electric Distribution Systems

Equipment

- 179,818 Smart Meters
 - AMI Communications Systems
 - Meter Communications Network (RF Mesh)
 - Backhaul Communications (Cellular)
 - Meter Data Management System
 - Customer Web Portal
 - 5 In-Home Displays
 - 8 Programmable Communicating Thermostats
 - 9 Direct Load Control Devices (water heaters and HVAC)
 - Distribution Automation Equipment (Pilot-Scale Demonstration)
 - 2 Automated Feeder Switches
 - 2 Automated Capacitors
 - 2 Automated Regulators
 - 2 Feeder Monitors
 - 6 Remote Fault Indicators
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Key Benefits

- Reduced Electricity Costs for Consumers
 - Reduced Meter Reading Costs
 - Reduced Operating and Maintenance Costs
 - Improved Electric Service Reliability and Power Quality
 - Reduced Costs from Equipment Failures and Theft
 - Optimized Generator Operation
 - Reduced Ancillary Service Cost
 - Reduced Truck Fleet Fuel Usage
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interval data.

- **Advanced electricity service options:** The project included a pilot-scale demonstration of a small number of customer systems, including in-home energy displays, programmable communicating thermostats (PCT), and direct load control devices for water heaters and A/C units. These devices were installed in both a laboratory and field environment. The in-home energy displays and the PCTs interfaced to the AMI RF mesh network through the AMI meter ZigBee communications module. The load control devices were interfaced directly to the AMI RF mesh network. The devices were successfully commissioned and tested and operated as expected over the AMI communications network. The testing demonstrated that the AMI communications network supports this functionality, but additional testing will be required to determine the effect on the network of a larger scale deployment of these type devices. CoServ also conducted a consumer survey and held a consumer focus group discussion to evaluate consumer opinions and acceptance of these types of devices and possible retail programs that could be offered utilizing this AMI system functionality.
- **Distribution automation systems equipment:** The project implemented a demonstration to test the performance of a small number of DA devices in conjunction with the AMI communications network to demonstrate the capability of the AMI communications network to support DA functions. The devices installed included automated feeder switches, automated capacitors, automated regulators, feeder monitors, and remote fault indicators. Testing successfully demonstrated the functionality of these devices when connected to the AMI communications network. Further testing will be required to determine network latency for DA network traffic to determine the impact on the AMI communications network for real-time communications traffic for DA devices.

Benefits Realized

- **Improved distribution operations, forecasting, and planning:** Using the MDMS to analyze 15-minute interval data, CoServ was able to integrate other data sources, such as central appraisal district property records and weather data, with the interval data and integrate the data with CoServ's geographic information system (GIS). CoServ engineering personnel can overlay planning grids and aggregate interval data to each grid to determine peak kilowatts, kilowatts coincident with the wholesale provider system peak, and kilowatts coincident with the transmission system peak by planning grid and customer type. These capabilities greatly improve engineering planning models and load forecasting. Other planning and engineering capabilities include evaluating peak demand and energy consumption by substation, feeder, transformer, city, county, home size, age of home, homes with electric heat, homes with swimming pools, etc. CoServ can also aggregate interval data by rate class to develop accurate allocations of capacity-related costs to rate classes for rate-making purposes. Operations personnel use voltage interval data, outage data, and blink count data to assist customers with service questions and concerns and to quickly identify system issues that need correction.
- **Functionality regarding distribution system outages:** CoServ system operations personnel use an on-demand AMI meter query to determine the extent and possible source of an outage and provide this intelligence to linemen en route to restore service. This greatly reduces the time for linemen to determine the source of the trouble and restore service to the affected area.
- **Reduced operating and maintenance costs:** Since meters can now be read remotely, CoServ has been able to significantly reduce meter reading costs associated with this activity. Expenses were also reduced through the smart meters' remote service switching feature and other efficiency improvements in operations and maintenance activities.
- **Detailed electric consumption data:** Customer service personnel have access to detailed 15-minute, hourly, daily, weekly, and monthly electric usage data to better assist customers with billing questions and high bill concerns.

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CoServ implemented a customer web portal to provide direct access for customers to view these same electric usage data, along with heating and cooling degree days and temperature. The web portal also allows members to set usage threshold notifications.

- **Reduced truck fleet fuel usage and reduced service fees:** CoServ has automated the service order process and eliminated the need to roll a truck to read a meter or start or stop service.
- **Reduced costs from theft detection:** Advanced meters send CoServ meter tampering alerts, and internal analysis of meter consumption data allows the utility to identify unusual trends associated with electricity theft.
- **Identification of unreported distributed generation:** Meter consumption data indicate locations where reverse power flow is present. Thus CoServ can identify unreported interconnected distributed generation installations, allowing the utility to inspect, register, and properly monitor those installations.

Lessons Learned

- **Implement a high level of quality assurance, recognizing that vendors and utilities are on a learning curve with maturing technologies.** CoServ's testing of DA equipment indicated that even though DA technology has improved dramatically, vendors are still working to provide equipment with complete functionality and compatibility with targeted communications systems.
- **Utilize standard designs and installation processes.** This is particularly important when using contractor resources, new standards, or new types of equipment.
- **Plan customer system programs realistically.** Results from CoServ's small-scale in-home device rollout indicated that large-scale load control or demand response programs would not succeed without financial incentives and extensive customer/employee education. In-home displays did not provide the flexibility for on-the-fly rate changes or remote rate updates.
- **Design and build cyber security into the system architecture and deployment process from the beginning rather than retrofitting later.** The protection of customer data and the integrity of the electric grid are paramount considerations and should be viewed as one of the integral components of any smart grid project.
- **Develop the capability to monitor performance of the equipment installed in the field and deploy the infrastructure necessary to operate that equipment successfully.**
- **Deploy a meter data management system.** This technology is a necessary component of the AMI system and should be implemented before or during AMI deployment.

Future Plans

CoServe intends to move forward with the following activities:

- Continue DA implementation and finalize evaluation of the AMI system RF mesh's suitability as the communications means for the full spectrum of DA functionality.
- Evolving security standards necessitate future security enhancements, including security appliances and related applications that provide advanced security functions and scalability.
- Continue to leverage the AMI system technology and expand integration to other IT systems such as customer information system.
- Implement "pay as you go" service using the AMI system capabilities.
- Fully integrate AMI meter outage reporting capabilities to the outage management system.

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- Implement a pilot demand response program using AMI system capabilities and/or the AMI system RF mesh communications system and consider viability for full deployment.
- Continue to develop ways to use the meter data analytics system to analyze interval data for operating purposes and improvements.

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