

Oklahoma Gas & Electric Company

Positive Energy® Smart Grid Integration Program

Scope of Work

The Oklahoma Gas and Electric Company (OG&E) project involved system-wide deployment of a fully integrated advanced metering infrastructure (AMI) solution and distribution of in-home devices to selected customers. OG&E also deployed a distribution management system (DMS), automated switching, and integrated volt/volt-ampere reactive (var) control (IVVC). The project included an AMI-enabled study of consumer behavior in response to different forms of dynamic pricing and home area network technologies on an opt-in basis. Additionally, OG&E collaborated with University of Oklahoma faculty and students to deploy energy saving technologies within 46 buildings on the Norman, Oklahoma, campus and took advantage of opportunities for smart grid education and training.

Objectives

The project is a partnership with customers aimed at reducing peak loads, overall electricity use, and operations and maintenance costs. Distribution system upgrades are expected to increase operational efficiency, reduce line losses, lower operational costs, and improve service reliability for customers.

Deployed Smart Grid Technologies

- **Communications infrastructure:** A secure wireless mesh AMI network enables two-way meter communications, provides the backbone for energy management programs, and allows for integration with smart appliances and home area networks. OG&E also installed a WiMAX point-to-multi-point Wide Area Network (WAN) that connects to a point-to-point microwave network for backhaul communications.
- **Advanced metering infrastructure:** The project has deployed 818,415 smart meters covering OG&E's entire service territory and supporting information technology infrastructure, including a Meter Data Management System (MDMS). The AMI system enables automated meter reading, fewer estimated bills, enhanced outage response and notification, and improved theft-of-energy detection. More detailed and timely data on peak electricity usage improve load forecasting and capital investment planning.

At-A-Glance

Recipient: Oklahoma Gas & Electric Company

State: Oklahoma and Arkansas

NERC Region: Southwest Power Pool

Total Project Cost: \$334,914,444

Total Federal Share: \$130,000,000

Key Partner: University of Oklahoma

Project Type: Advanced Metering Infrastructure
Customer Systems
Electric Distribution Systems

Equipment

- 818,415 Smart Meters
- Advanced Metering Infrastructure Communications Systems
 - Meter Communications Network (Wireless Mesh)
 - Backhaul Communications (WiMAX, Microwave)
- Meter Data Management System
- Customer Systems for 44,438 Customers
 - Home Area Network
 - In-Home Displays
 - Programmable Communicating Thermostats
- Distribution Automation Equipment
 - Distribution Management System
 - Automated Reclosers (50 circuits)
 - Automated Capacitor Banks (100 circuits)

Consumer Behavior Study

- Time of Use
- Variable Peak Pricing
- Critical Peak Pricing

Key Benefits

- Reduced Operating and Maintenance Costs
- Increased Electric Service Reliability
- Deferred Investment in Generation, Transmission, and Distribution Capacity Expansion
- Reduced Greenhouse Gas Emissions

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- **Advanced electricity service options:** The project deployed a variety of customer-focused tools to homes and businesses. These tools include a customer web portal, home area network capability, in-home displays (IHDs), and programmable communicating thermostats (PCTs), all supported by the AMI system. Customers can view their electricity consumption data at any time through a personalized website, while allowing OG&E to manage, measure, and verify targeted demand reductions during peak periods. Study participants tested IHD's, providing OG&E with information to develop programs that meet consumer needs and have the greatest impact on load reductions.
- **Time-based rate programs:** Customers are also participating in studies of variable peak pricing and standard time-of-use pricing, both with peak price elements (see Consumer Behavior Study below).
- **Distribution automation deployment:** OG&E deployed reclosers on 50 high-priority circuits integrated with a DMS. The DMS provides monitoring and control of the distribution system. It also supports advanced applications, such as IVVC, which optimizes the voltage on automated circuits. **Automated volt/var control:** OG&E deployed capacitor and load tap changer controllers to facilitate voltage optimization on 100 circuits.

Consumer Behavior Study

OG&E assessed the relative merits of several time-based pricing options and information treatments on a subset of residential and commercial sector volunteers in Norman, Oklahoma. This was a randomized, statistically based study involving 4,000 residences and 1,320 small businesses, including the control group. The pricing options included (1) variable peak pricing, a rate plan in which the peak period price changes daily to better reflect exigent system conditions and the real cost of providing power with a critical price element, and (2) a time-of-use rate plan with a critical price element. Smart technologies tested included a personalized website, IHDs, and PCTs. The study explored how consumers respond to the peak price options as well as the relative effects of the various information-providing technologies. The study also estimated impacts on total electricity use, customer bills, and hourly load profiles using information collected through the smart meters.

Benefits Realized

- **Lower electricity bills for customers:** New AMI-enabled energy management tools give customers the information they need to make more informed decisions about their peak and overall energy usage on a real-time basis. On average, the demand response participants saved \$200 over the course of the summer of 2012, and 99% of the demand response customers saved money through the program.
- **Demand response:** The time-based rate program (SmartHours) and IVVC have given the utility the ability to reduce load by 70 MW (megawatts) and 17 MW respectively.
- **Reduced operating and maintenance costs:** AMI has reduced OG&E's meter reading expenses by approximately \$9 million per year.
- **Increased electric service reliability:** The project's distribution automation component facilitates reduction of the frequency and duration of outages through recloser deployment and remote switching via the DMS. Additionally, automated capacitor controls, load tap changer controls, and IVVC application allow for improved power factor and voltage control, contributing to overall available demand reduction.
- **Reduced greenhouse gas emissions:** The remote meter reading, diagnostic, and troubleshooting functionalities of the AMI system greatly reduce vehicle fleet fuel requirements associated with manual meter reading and investigative field maintenance.

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- **Other:** Customer collaboration opportunities with the University of Oklahoma include a range of programs to engage students and faculty, as well as to complete the engineering design and implementation of smart grid technologies in 46 campus buildings that will reduce electricity consumption and operating costs.

Lessons Learned

- Implementation of IHDs did not meet the cost–benefit threshold established as part of the consumer behavior study. The kilowatt savings associated with the IHDs did not support the initial and ongoing supports costs necessary for acquisition and implementation. Consequently, full deployment included PCTs only.
- Vendors were challenged to meet OG&E’s cybersecurity requirements. Several fault circuit indicator devices and communications solutions were assessed, and many potential solutions were ruled out because of unmitigated cybersecurity risks. The piloted solution failed to meet OG&E security architecture standards as well.
- Proactive communication with customers is required to ensure a smooth transition to advanced metering. OG&E credits much of the project’s success to keeping customers informed.

Future Plans

- OG&E is continuing the IVVC deployment, with a targeted total demand reduction capability of 75 MW at the close of 2017. This reduction capability represents deployment of automated capacitor stations and load tap changer controls on an additional 300 circuits.
- OG&E is continuing time-based rates through the SmartHours Program. OG&E will maintain the current participant level (approximately 120,000) and level of demand response (150MW) through at least 2017.
- OG&E is currently integrating the AMI system into the outage management system to provide the latter system with AMI outage information. The integration will provide additional data for assessment of outages, ideally decreasing the time to restoration.

Contact Information

Harry Emerson
Director, Business Management
Oklahoma Gas & Electric Company
emersohw@oge.com

Recipient team project website:

www.oge.com/residential-customers/products-and-services/Pages/Smart%20Grid.aspx