City of Glendale

Smart Grid Initiative

Scope of Work

The City of Glendale's (Glendale's) Advanced Metering Infrastructure (AMI) Smart Grid Initiative project involved system-wide deployment of advanced meters; meter data management system (MDMS); use of customer systems and in-home displays; installation of distribution automation equipment systems; enterprise computers systems, including outage management/distribution management system, enterprise service bus, conservation voltage reduction system, meter data analytics system; and management of distributed energy storage. The project implemented secure wireless communications (1) to allow customers to view their electricity consumption through web portals on mobile devices and in-home displays 24 hours a day, and (2) to provide Glendale with the ability to manage, measure, and verify targeted demand and voltage reductions during peak periods. In addition to the AMI deployment, Glendale upgraded selected feeders with distribution automation equipment to improve operational efficiency as well as system reliability.

Objectives

Through this project, Glendale aimed to reduce peak loads, overall electricity use, and operations and maintenance costs while increasing distribution system efficiency and reliability.

Deployed Smart Grid Technologies

- **Communications infrastructure:** An Ethernet/Internet protocol backhaul and a local wireless radio frequency (RF) network enable two-way communication between meters and utility data systems and allow for the monitoring and control of select distribution automation equipment. Data management systems enable Glendale to develop actionable information from equipment notifications and customer electricity usage data. All capacitor banks include advanced controllers with communications devices, facilitating remote control via the supervisory control and data acquisition (SCADA) distribution management system (DMS).
- **Advanced metering infrastructure:** Glendale deployed 85,582 smart meters, and the supporting MDMS. The AMI systems provide the capability for a variety of current and future customer electricity price and service options and reduce Glendale's costs of electricity delivery. New AMI features such as outage and restoration notification and a remote connect/ disconnect switch enable Glendale to respond to outages and customer requests more efficiently.

At-A-Glance

Recipient: City of Glendale

State: California

NERC Region: Western Electricity Coordinating Council

Total Project Cost: $51,302,105

Total Federal Share: $20,000,000

Project Type: Advanced Metering Infrastructure

Equipment

- 85,582 Smart Meters
- AMI/DA Communications Systems
  - Wireless RF Meter Communications Network
  - Ethernet/Internet Backhaul Communications
- Meter Data Management System Enterprise Service Bus
- Data Warehouse In-Home Displays/Home Area Networks
- Customer Mobile App and Web Portal Access
- 1.3 MW of Distributed Energy Storage Devices
- Distribution Automation Equipment for 4 out of 110 Feeders
  - Outage Management/Distribution Management System
  - Automated Feeder/Reclosers/Fault Interrupters
  - Automated Capacitors
  - Disturbance Monitoring Relays
  - Smart Protective Relays

Time-Based Rate Programs (Time of Use) Targeting All Customer Classes

Key Benefits

- Reduced Meter Reading, Operations and Maintenance Costs
- Improved Electric Service Reliability and Power Quality
- Reduced Costs from Equipment Failures and Distribution Line Losses
- Reduced Truck Fleet Fuel Usage
- Reduced Greenhouse Gas and Criteria Pollutant Emissions

City of Glendale *(continued)*

- **Advanced electricity service options:** Glendale offered customers in-home displays, a mobile device application, and a web portal facilitating two-way information exchange, allowing customers to view their consumption and manage their bills.
- **Enterprise computer system improvements:** Glendale incorporated a number of computer system improvements designed to increase operational efficiencies, including an enterprise service bus, DMS, outage management system (OMS), data warehouse, and a meter data analytics program, as well as an integrated voice recognition upgrade.
- **Distribution automation pilot project:** The project allowed Glendale to demonstrate automated feeder switches, feeder monitors, remote fault indicators, and automated capacitor controls on select feeders. The distribution automation devices are integrated with the AMI communications infrastructure, allowing Glendale workers to detect and isolate outages to minimize their duration and the number of customers affected. These devices were implemented in conjunction with the above-noted DMS and OMS. The distribution automation devices and the enterprise applications combine to allow Glendale to improve distribution loading conditions and system reliability. In addition, the project implemented a distribution system efficiency pilot using conservation voltage reduction (CVR) utilizing AMI data on two feeders.
- **Time-based rate programs:** Glendale implemented time-of-use pricing programs for all customer classes to encourage participating customers to shift consumption from peak- to off-peak periods.
- **Behavioral demand response pilot project**: Glendale conducted a pilot of 40,000 people in the summer of 2014 using AMI data.
- **Electric vehicle charging program:** Glendale implemented a rebate program to incentivize the installation of 60 residential charging stations to understand, and thus ultimately manage, the effects of vehicle-related increased loading on the distribution system. The stations provide information that Glendale needs to develop service options and pricing programs for customers with electric vehicles.
- **Distributed energy resources interface and control systems:** Glendale implemented information systems for managing peak load and energy costs for 214 thermal energy storage units, which represent approximately 1.3 megawatts (MW).

Benefits Realized

- **Reduced meter reading and customer service costs:** Glendale realized a $3.6 million in annual cost savings—a 51% reduction in annual costs—from lower meter reading and customer service operations since 2010:
  - Meter reading errors decreased from an average of 2.82% a month in fiscal year FY2011 to 0.04% a month in FY 2015.
  - Annual total truck rolls decreased from 33,814 in FY 2010 to 5,424 in FY 2015.
  - Customer service staff was reduced by 15 staff members, from 61 in 2011 to 46 in 2015.
- **Reduced operating and maintenance costs:** Although full benefits are still to be determined, Glendale expects significant operational savings from enterprise computer system improvements, customer programs, and distribution automation programs. Total annual system benefits could exceed $10 million by the tenth year of operation.
- **CVR pilot project:** The pilot helped Glendale realize 2.95% in energy savings over the baseline on two feeders, suggesting that a full-scale program could save a minimum of 14,500 megawatt-hours (MWh) each year.

City of Glendale *(continued)*

- **Behavioral demand response pilot project**: Three project-related events resulted in the following benefits:
  - Glendale realized statistically significant savings (on-peak and off-peak) for the period from August 27–October 9, 2014, yielding 10 kilowatt-hours (kWh) saved per household for a total of 392,000 kWh.
  - The behavioral demand response (BDR) indicated a benefit–cost ratio of 6.7 using a total resource cost (TRC) test for the summer 2014 program.
  - The BDR remains cost-effective at a list price of $4.50 per household.
  - Participants receiving BDR communications show an 85% satisfaction rate.
- **Reduced costs from technical and non-technical distribution line losses:** Once fully deployed, Glendale expects its distribution automation improvements, along with its Meter Data Analytics and Conservation Voltage Reduction Programs, will result in line loss savings equal to 1%–2% of annual sales.
- **Reduced greenhouse gas emissions and criteria pollutants:** A Glendale contracted study suggests carbon dioxide reductions will approach 60,000 tons a year once programs reach full implementation. Reductions result from customer care and metering (i.e. reduced truck rolls), customer demand management programs, and power delivery improvements (i.e., load balancing, voltage monitoring, and fault detection).

Lessons Learned

- **Project teams must have a shared vision.** For a major project to succeed, the executive team should have a vision of the direction the enterprise is taking—and share that vision with all project and utility staff. Glendale used a video about the project and frequently asked questions (FAQs) to get the project and executive team on the same page regarding the Smart Grid Investment Grant project and its targeted outcomes and objectives. Glendale is now using the Smart Grid Maturity Model to clarify aspirations for smart grid implementation as a whole.
- **People and processes are as important as technology.** With a project of this size and scope, a team could easily overlook the importance of business process and staffing redesigns while focusing on technological changes. Glendale learned that technology is merely an enabler of processes that people execute and maintain. Attention to the process changes and the impact of those changes on human resources at Glendale ensured that the program succeeded on all fronts.
- **Resource management is key.** Hiring numerous permanent staff members for this project was not practical. Instead, Glendale leveraged an alliance of leading industry experts combined with in-house management under the governance of Glendale's project sponsor and its Smart Grid Executive Policy Committee.
- **Details are important.** Detail-oriented individuals were an invaluable asset to the success of the Glendale Smart Grid Initiative project. Seemingly small details have the potential to turn into large problems if not addressed carefully.
- **A project management office (PMO) should be set up and properly staffed.** The Smart Grid Initiative was the largest project Glendale has ever undertaken. A project of this magnitude comes with considerable risks and rewards. It was imperative that a strong PMO be established and have sufficient resources for maximum effectiveness.
- **A project of this magnitude necessitates risk management.** Potential risks should be identified and tracked upfront. At the beginning of the project, Glendale identified a number of potential risks that could adversely affect the project and developed a mitigation plan to address these risks. Only one risk was realized and had an impact on schedule but project was still completed successfully due to risk planning.
- **The "smart" in smart grid implies a significant information technology (IT) component to the project.** Those considering smart grid projects should not underestimate the significance of associated IT work. The interfaces

City of Glendale *(continued)*

between Glendale's customer information system, meter data management system, and head end systems proved to be one of the largest technical challenges of the AMI project. Glendale commissioned a systems architect to document the entire system and prepare a roadmap to migrate the utility's systems to a service-oriented architecture with an enterprise service bus before adding all of the software needed for distribution automation. This fundamental IT task was a major endeavor.

- **Establishing and fully staffing a new AMI operation team is key.** AMI is a disruptive technology; its introduction will not allow utilities to conduct "business as usual." AMI implementation demands that the utility adjust some or all of its operations. Attempting to staff an AMI operation though a matrix system creates an unacceptable risk. AMI operations and maintenance is primarily an IT effort—but needs to be infused with business knowledge to be effective. Co-location of the core team is an essential ingredient for the team's success. AMI projects should establish a stable core AMI team with permanent full-time employees who report to the AMI operations project manager.
- **The Hype Cycle is real.** Glendale's customer surveys support the Hype Cycle,[1] a description of a technology's life cycle stages from conception to maturity and widespread adoption. Project teams should have programs ready for customers in a timely manner or be prepared to weather the "trough of disillusionment."

Future Plans

Glendale intends to conduct the following smart grid-related tasks:

- Implement Phase II of the BDR pilot July to October 2015.
- Implement a full-scale CVR program.
- Implement a customer information system automation platform by December 2015.
- Automate a minimum of six additional feeders each year through 2020.
- Implement mobile access to data for all customers by December 2015; enroll 10,000 customers by June 2017.
- Enroll 3,000 customers in the in-home-display/ home area network program for residential customers by June 2017.
- Continue piloting systems to ensure that analytics, automation, and control operate across multiple systems and organizational functions by June 2016.
- Have a fully functioning business intelligence program by June 2017.
- Implement new residential time-of-use and electric vehicle rates by June 2017.
- Fully integrate all Glendale business IT systems through the enterprise service bus by June 2019.
- Complete a functional-level business case for work and asset management by June 2017; implement effective mobile workforce and asset management by June 2019.

Contact Information

Craig R. Kuennen
Business Transformation and Marketing Administrator
Glendale Water and Power
CKuennen@glendaleca.gov

Recipient team project website: www.glendalewaterandpower.com/smart_meters.aspx

[1] See http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp.