

San Diego Gas & Electric Company

SDG&E Grid Communication System

Scope of Work

San Diego Gas & Electric's (SDG&E's) Grid Communication System (SGCS) project involved the installation of various wireless communication systems. These systems cover targeted intelligent electronic devices on transmission and distribution poles and other electric assets. SDG&E implemented advanced high-speed wireless communications systems, updated and expanded supervisory control and data acquisition (SCADA) capabilities, and increased the communications fiber footprint, allowing the utility to remotely monitor, communicate with, and control transmission and distribution equipment. The project made critical communications upgrades at substations and supporting telecom sites. SDG&E also expanded and optimized communications infrastructure to support smart grid initiatives while increasing system resilience.

Objectives

SDG&E aimed to enhance electric service reliability, minimize outage durations, reduce operations/maintenance costs, and improve grid security. The project (1) allows for integration of new distribution automation equipment, (2) provides increased system visibility, allowing SDG&E to identify the scope and location of outages, and (3) laid the foundation for more intelligent end-point devices that support new forms of electric generation (i.e., wind and solar).

Deployed Smart Grid Technologies

- **Communications Infrastructure:** SDG&E evaluated technologies and equipment in pilot studies, allowing the utility to select best-of-breed systems for full-scale deployment. Wireless backhaul solutions provide the backbone for energy management programs and allow for the future integration of synchrophasor technologies, distribution automation equipment, hard-to-reach smart meters, smart appliances, and home area networks. This scalable infrastructure provides opportunities to add future service offerings and further optimize electricity delivery, system reliability, and customer participation.
- **Low-power communications network (LPCN):** The project deployed a proprietary unlicensed 2.4-gigahertz (GHz) wireless radio system that provides low-speed, low-power, wide-area communications to enable remote monitoring of overhead and underground fault circuit indicators (FCIs), smart transformers, Federal Aviation Administration (FAA) tower obstruction lights, and other similar low-bandwidth assets.

At-A-Glance

Recipient: San Diego Gas & Electric Company

State: California

NERC Region: Western Electricity Coordinating Council

Total Project Cost: \$59,820,000

Total Federal Share: \$28,115,052

Project Type: Electric Distribution Systems

Equipment Installed

- Low-Power Wireless Communications Network
- SCADA Narrowband IP-Based Network
- Expanded Substation Wide Area / Local Area Networks (WAN/LAN)
 - Microwave Technologies
 - FIBER JMUX Equipment
 - Substation Hardened Network Routers and Switches
- Field Broadband Device Connections
 - Unlicensed and "Lightly" Licensed Broadband Point-to-Point (PTP), Point-to-Multipoint (PTMP), and Mesh Wireless Radio Equipment

Key Benefits

- Improved Electric Service Reliability and Power Quality
 - Reduced Costs from Equipment Failures and Distribution Line Losses
 - Reduced Troubleman Dispatch
 - Reduced Operating and Maintenance Costs
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- **Field broadband device connections (FBDCs):** The project installed FBDCs at targeted locations, supporting up to 80 advanced SCADA devices (high-speed SCADA devices with phasor measurement units [PMUs] enabled) and other high-speed intelligent electronic devices installed on 10 distribution circuits. This deployment created a high-speed wireless radio infrastructure for future smart grid expansion.
- **SCADA optimization and enhancements:** SDG&E implemented a narrowband internet protocol (IP-based) SCADA system to increase system capacity and enhance electric grid operations.
- **Substation communications:** The project expanded SDG&E's wide-area network (WAN) to connect additional substations via microwave and last-mile fiber.

Benefits Realized

- **Improved electric service reliability and power quality.** By expanding the SCADA communications infrastructure, SDG&E will be able to install a greater number of SCADA-enabled devices. These devices will allow SDG&E to implement volt/volt-ampere reactive (var) control and expand implementation of fault location isolation and service restoration (FLISR), improving system reliability and performance.
- **Reduced costs from equipment failures and distribution line losses.** Circuits with wireless fault indicators may be restored up to 30 minutes faster, with the potential for \$3,000 savings per event. Once PMU-enabled switch device installations are completed, savings from nomid-point distribution SCADA may reach hundreds of thousands of dollars per event.
- **Reduced troubleman dispatch.** Greater visibility of system conditions helps prevent problems in the field, reducing the number of service dispatches. If dispatch is required, the improved visibility helps pinpoint trouble, resulting in quicker restoration.
- **Reduced operating and maintenance costs.** Monitoring transformer conditions allow SDG&E to anticipate failures before they happen. Condition-based maintenance can extend equipment lifespan, resulting in deferred capital upgrades of millions of dollars.

Lessons Learned

- One overall technology solution may not address all communications needs for an organization. Unique service territory characteristics may require a combination of technologies for optimal network performance.
- Pilot testing with end-user devices may uncover the need for more targeted solutions.
- Utilities implementing similar projects should allow significant lead time to accommodate any zoning and permitting requirements for multiple site implementations. In addition, utilities should allow for exceptionally long lead times for any required military site approvals.
- Information security final testing should be started as early as possible after implementation to allow enough time to address any potential findings.

Future Plans

SDG&E plans to use its newly implemented advanced wireless communication system to monitor, communicate with, and control transmission and distribution equipment. In addition, the utility will utilize and expand the new high-speed wireless communication system to support additional smart grid functionality such as microgrids, advanced battery storage, dynamic voltage controllers, falling conductor applications, high-risk fire mitigation, and photovoltaic penetration volatility.

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