# Connecticut Municipal Electric Energy Cooperative

***Connecticut Municipal Electric Energy Cooperative Smart Grid Project***

## Scope of Work

The Connecticut Municipal Electric Energy Cooperative (CMEEC) smart grid project (ConnSMART Program) involved participation of four municipal utilities: Groton Utilities, Jewett City Department of Public Utilities, Norwich Public Utilities, and South Norwalk Electric and Water. The project deployed 38,598 advanced meters and made interval usage web presentment available to two thirds of advanced meter customers; the ultimate intention is to provide access to all customers with smart meters. All substations located within Groton Utilities' two service territories have been fully automated. The project also developed a new business intelligence platform to improve understanding and control of wholesale power costs. In addition, small pilot programs introduced and tested voluntary time-based rates and direct load control devices.

## Objectives

The project goals were to realize operational efficiencies, improve service reliability, enhance customer service, and lay the groundwork for competitiveness. The project introduced the municipal utilities' smart grid infrastructure, resulting in increased reliability, staff and asset productivity, and customer service. New wholesale and retail informational programs and customer systems enabled both the participants and their retail customers to understand and take action to control their own energy use. Together, these benefits help control and reduce utility and customer power costs while improving customer usage and understanding, service level, and communications quality.

## Deployed Smart Grid Technologies

- **Communications infrastructure:** The project deployed several advanced network systems, that were all RF based with backhaul communications via fiber, for smart meter communications and future integration with other smart grid technologies. This infrastructure provides participating utilities with two-way information feedback capabilities to collect data from, and send signals to, smart meters in the program. This two-way capability allows utilities to optimize energy delivery and system reliability and develop the capacity for expanded customer participation in existing and new energy management programs.
- **Advanced metering infrastructure**: This project rolled out 37,215 single-phase smart meters to residential and small commercial customers, as well as 1,383 poly-phase smart meters to larger commercial and small industrial

### At-A-Glance

**Recipient:** Connecticut Municipal Electric Energy Cooperative (CMEEC)

**State:** Connecticut

**NERC Region:** Northeast Power Coordinating Council

**Total Project Cost:** $18,376,100

**Total Federal Share:** $9,188,050

**Key Partners:** Groton Utilities, Jewett City Department of Public Utilities, Norwich Public Utilities, and South Norwalk Electric and Water

**Project Type:** Advanced Metering Infrastructure
Customer Systems
Electric Distribution Systems

**Equipment**

- 38,598 Smart Meters
- 3 AMI Communications Systems
  - Meter Communications Network
  - Backhaul Communications
- 4 Meter Data Management Systems
- Web Portal Access for 26,159 Customers
- Distribution Automation Systems
  - 11 Substation Remote Terminal Units
  - 11,000 Automated Status and Control Points

**Time-Based Rate Programs**

- Real-Time Pricing for Wholesale and Retail Customers

**Key Benefits**

- Improved Operational Efficiency
- Enhanced Customer Service Options

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customers. An additional 2,600 meters were installed in a pilot program prior to initiation of the federally funded project, and meter installation continues outside of the funded project, including meters to monitor customer-owned solar installations. The smart meters support a variety of current and future customer electricity price and service options. Operational cost savings result from the ability to read meters remotely and customer service efficiencies enabled by automation and two-way communications networks. The project integrated the advanced metering infrastructure (AMI) system with existing outage management systems, customer web presentment information and billing systems, and new meter data management and billing systems, allowing the utilities to respond to outages and customer requests more efficiently.

- **Direct load control devices:** The project piloted new voluntary load control programs and deployed direct load control devices to customers who volunteered for the new device trials. The load control programs enable participating utilities to better manage peak loads and wholesale power costs while offering greater cost control opportunities to their customers through smart thermostats.
- **Advanced electricity service options:** The project offered customers additional information services and energy management options through new time interval energy use website portals. This deployment facilitates two-way information feedback between participating customers and the utility, enabling customers to better understand and manage their electricity use and costs. The web portal data is helping customers can help identify the cause of usage spikes and correct inefficiencies, such as space heaters accidentally left running.
- **Time-based rate programs:** Once the supporting technologies were in place, real-time pricing options were offered to a small number of volunteer customers. These opt-in pricing options were designed to encourage participating customers to reduce consumption and/or shift usage from on- to off-peak periods. These programs were intended to provide the customer with greater cost control and help reduce overall peak demand for electricity.

### Benefits Realized

- **Reduced meter reading costs:** The participants have deployed AMI meters at almost all of their customer sites and will continue to deploy these meters going forward. Multi-service utilities have leveraged the technology to metering of other services, including both gas and water. Billing will be automated for all participating utilities. Significant meter reading labor and vehicle cost reductions have been realized, and far fewer estimated bills are rendered. In addition, working capital requirements are reduced because garnering billing data and executing the billing cycle can be done much more quickly.
- **Reduced operating and maintenance costs:** AMI enhances system operations through provision of new or additional visibility on distribution system operating conditions. AMI is used to monitor voltage across the distribution system, allowing utilities to address issues proactively rather than reactively. The ability to remotely “ping” a meter to learn its status, coupled with head-end system algorithms to process results, supports a reporting system that provides both new and enhanced operational monitoring capabilities. Smaller distribution systems without supervisory control and acquisition (SCADA) find that AMI has provided capacity to monitor distribution voltage sag and swells. Customers are being grouped to track feeder voltage levels through the AMI system, allowing utilities to identify voltage irregularities and providing system insights not previously available without a field inspection and measurement. If utility personnel identify, for example, a failing transformer with this technique, the utility can address the problem before it results in damage to customer equipment and/or loss of power. For a small utility, this capability represents an improvement that, if obtained through stand-alone systems rather than as part of AMI system development, would prove too costly to implement.

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AMI also helps municipal utilities work with customer-owned renewable energy generation, which is on the rise. By placing a dedicated AMI meter on customer generation system outputs, utilities can monitor impacts to help properly protect and operate the distribution system and better forecast loads to minimize the costs of wholesale purchased power.

- **Reduced costs from theft:** Standard AMI reports offer information used to identify irregularities in customer use when compared to customer account information. Utilizing standard meter data management reports and flags enables early detection of usage discrepancies. An AMI meter that has been shut off remains in communication with the base station. When a meter ceases to respond to communication pings, a flag is issued, prompting a site visit. The site visit reveals whether the meter has simply malfunctioned or whether there has been an unauthorized pulling of the meter and theft of electricity. This rapid indication allows a same-day response and greatly reduces losses from meter theft that can otherwise go undetected for long periods.
- **Increased electric service reliability:** AMI allows real-time monitoring of service status down to the individual customer level. Such data reduces the likelihood of an outage and help provide more timely service restoration in the event of an outage. Grouping meter information by feeder allows monitoring of sags and swells, providing information that supports preventative maintenance.
- **Reduced truck fleet fuel usage:** Participating utilities report more than a 50% reduction in truck rolls though elimination of manual meter reads, use of remote connect and disconnect meter capabilities, better ability to pinpoint outage locations, and the ability to verify individual customer service status remotely. Further reduction in truck rolls is expected as system implementation matures and remote read capability is expanded to other utility services, including water and gas.

## Lessons Learned

During the project, the utilities worked closely with vendors to refine product offerings to match intended use. Some scope items were ambitious relative to both the initial state of the technology and market conditions. Technology issues were largely resolved through vendor redesign and the next generation of product.

Software compatibility with existing systems, such as billing, can be problematic. Utilities with limited IT resources should consider simply introducing whole new integrated systems that are fully vendor-supported. Certain economies of scale were found to apply, such as using third-party meter installers for all but the most challenging installs.

Introducing pricing and demand side options can be technically and economically challenging; AMI allows utilities to provide such options in a way that is operationally practical. However, very strong cost-based incentives and consumer education may be needed to motivate customer participation. Overcoming barriers to providing adequate incentives and successfully marketing voluntary programs has been less successful than implementing the underlying technology.

However, other benefits have been material and greater than anticipated, e.g., operational savings, reliability improvements, distributed generation applications to support new rate structures, and significant operational adaptations.

## Future Plans

All participating utilities are committed to maintaining full implementation of AMI technology. They supply utility services other than electricity, and these metered services will be accessed for meter reads via the established communications links serving the electric service.

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Deployment of AMI meters and web presentment are the foundation of any alternative rate design, demand response program, and integration of customer-owned generation. As underlying wholesale markets transform to allow compensatory response to near- and long-term marginal costs, the utilities expect further implementation of these AMI-enabled demand-side programs. Critical peak pricing may be tested for application to commercial and industrial customers not otherwise subject to real-time contract pricing service.

Web presentment will be further refined as customer- and utility-initiated device installations command further customer attention to cost control. AMI meters will be used to measure gross and net output of customer-owned solar generation. Increasing customer on-site generation and energy storage options will cause changes in rate design, metering, web presentment, and frequency of interface with customers. Innovative solutions will be required to maintain fair and equitable rates for all customers, ensure utility revenue requirements are met, and return value to the customers hosting such systems, including an opportunity to share in long-term cost savings. The AMI investment is the informational foundation for these advancements.

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