

Background

Commercial buildings spend over 120 billion dollars annually on electricity. Sub-metering data provides visibility to building energy use. Better understanding of energy-use profiles can help building owners reduce costs by taking actions to resolve problems identified through data. Where the savings potential justifies measurement, actual consumption data can be used to identify energy reduction opportunities, improve operations, verify improvements, and assess system performance. Although metering systems do not directly improve energy efficiency, they enable focused actions that can allow organizations to achieve energy management goals.

Historically, installing a metering system in an existing building has required expensive hardwiring, retrofitting and new software. For many energy management applications the investment in metering is too significant to be cost effective, thus leaving energy conservation opportunities unaddressed. To remedy this cost barrier, the Better Buildings Alliance issued the Low-Cost Wireless Metering Challenge in June 2013.

Objective of the Challenge

The Challenge objective was to encourage market introduction of a cost-effective, wireless system that could measure electricity use at various locations in a building and wirelessly communicate the data to a local collection point.

Attributes of the desired system included:

- Low cost meter with a target cost under \$100
- Electrical energy measurement
- Reliable wireless data transmission to an onsite collection point
- Operation independent from existing building internet and intranet networks as well as the cloud.

Ease of use was another desired characteristic of wireless metering systems resulting from the Challenge, and included:

- Ease of installation
- Ease of start up
- Ease of learning system operation
- Ease of data collection.

The Challenge specification contained features that met fundamental government and private industry needs including security.



Prototypes were tested at the General Services Administration (GSA) Headquarters in Washington D.C. (Photo from GSA)

Industry Response to the Wireless Metering Challenge

Initially, 30 companies indicated interest in the Wireless Metering Challenge. A phased review approach was used to evaluate the candidate technologies. For Phase 1, firms were asked to affirm their products' qualifications. Several firms met the basic criteria and approached the cost target to qualify for Phase 2. One system developed by Meazon was installed and tested in Phase 3.

Key Takeaways

- Better understanding of energy-use profiles can help building owners reduce costs by taking actions to resolve problems identified through metered data.
- Scalable, low cost wireless metering systems allow small initial installations that can easily and inexpensively be expanded in the future to measure additional loads.
- Low cost, wireless metering products that measure energy consumption, operate independently from the building's communications systems, and are easy to install and operate are available from at least one supplier.
- One product produced by Meazon passed all requirements of the Wireless Metering Challenge.
- The Technology Challenge process can spur companies to introduce new products to the market.

Key System Specifications

- Measurement of electrical watt-hour energy consumption for a three-phase circuit.
- Full compliance with NFPA 70 (National Electrical Code) and UL 61010.
- 1% of reading accuracy (metering device as a complete assembly: measurement device and current sensors). (ANSI C12.1-2008).
- Communication success rate greater than or equal to 95% (in-building test).
- All data encrypted using 128-bit (or greater) Advanced Encryption Standard (AES-128).
- Stand-alone wireless communications network (i.e., it could not leverage the other communication systems in the building).
- Data measurement, transmission, and collection must be open protocol.
- Power source from within the power panel it connects to or the system being monitored.
- No additional software required by the user.

In order to maintain competitive pricing, features such as revenue grade and two-way communication were not required.

System Installation and Testing

In January 2017, the Meazon system was ready for final in-building testing. The system included two meters (each with three current transformers), signal repeaters and a gateway. Equipment installation time was fast. The building electrician installed the entire system in under 2 hours. The system was started, commissioned, and began transmitting energy data in less than 30 minutes. Over two weeks, 15-minute interval data were collected from two electrical panels.

Results

In February 2017, testing of the Meazon system data transmission at the GSA Headquarters Building in Washington, D.C. was completed. The system exceeded the required communication success rate of 95%. The cost of the meter is under \$100, and data are provided in an easy to use CSV format. This system successfully met the Challenge specifications.

Proper preparation including full review of system installation information by the installer resulted in quick and easy installation and startup.

The Wireless Metering Challenge stimulated the market to meet an unmet need for a low-cost system that measures internal loads, eliminates the need for hardwiring in an existing building, and provides communications independently from a building's other networks.



Meter installed in protective box
Photo from Pacific Northwest National Laboratory



Components of wireless metering system during installation including wireless meter (left photo), meter wireless signal repeater (upper right photo), network gateway (lower right photo) *Photo from Pacific Northwest National Laboratory*

Learn More

Through the High Impact Technology (HIT) Catalyst program, initiated in 2014, the U.S. Department of Energy (DOE) identifies and guides HITs through their early market introduction phases, ultimately leading them to the broader market through partnerships with the commercial buildings industry via the Better Buildings Alliance, federal leaders, regional nonprofits, utilities and efficiency organizations.

Learn more about the HIT Catalyst program by visiting energy.gov/eere/buildings/high-impact-technology-catalyst, or learn more about the *Better Buildings Alliance* at energy.gov/betterbuildings.