



CASE STUDY: ComEd



ComEd Improves Reliability and Efficiency with a Single Network for Multiple Smart Grid Services

BACKGROUND

Commonwealth Edison (ComEd), a unit of Chicago-based Exelon Corporation, provides electrical service to more than 3.8 million customers in Chicago and northern Illinois, operating as the state's largest electrical utility. Set in motion by an Energy Infrastructure Modernization Act (EIMA) by the State Legislature of Illinois, ComEd is undergoing a 10-year, \$2.6 billion Infrastructure Investment Plan, investing \$1.3 billion to strengthen its electric system and another \$1.3 billion to add new smart grid technology.

THE CHALLENGE

With the passage of EIMA, ComEd was required to improve its overall system reliability. In order to reach the goals outlined in the law, ComEd decided to leverage a common network for multiple applications, including advanced metering infrastructure (AMI), distribution automation (DA) and smart city programs. With a modernized communications infrastructure, the utility would be able to increase grid reliability by identifying problems faster, optimizing business processes, automating problem resolution and reducing truck rolls.

"Silver Spring Networks continues to be a great partner for ComEd as we continue our deployment and operations of both their smart meter and distribution automation solutions. Their multi-application technology not only demonstrates its flexibility in support of these two core use cases, it also is being evaluated for additional smart city applications."

— Rich O'Toole

Director of Customer Strategy, AMI for ComEd

Adopting a smart grid strategy based on a single, unified network, ComEd identified the following benefits for its customers and the State of Illinois:

- Minimize impact of power outages by reducing outage frequency by 20% and duration by 15%
- Improve customer satisfaction by empowering customers with more information about their energy usage and providing better service
- A positive impact on the state economy by creating more jobs as a result of smart grid investments

In addition, ComEd anticipated streamlining internal processes and increasing overall efficiencies with an integrated, standards-based platform. ComEd projected lower long-term operational costs through a gradual reduction in meter reading and field services operations. By creating a highly secure smart grid foundation, ComEd’s AMI system would also support future applications, such as advanced rate designs and distribution operations asset optimization. In all, ComEd expects \$2 billion in savings over 20 years from an upgraded, stronger electric system, fewer power interruptions and greater operational efficiencies.

THE PILOT

Over a three-year period, ComEd conducted due diligence to research and select a smart grid technology provider. Following an extensive evaluation process, ComEd selected two-way communications from Silver Spring Networks, integrated into GE and Landis+Gyr meters. The AMI pilot, including 131,000 meters, leveraged Silver Spring Networks’ SilverLink™, an integrated set of solutions for networking, control and application enablement, as well as solution-specific AMI hardware, software and services widely implemented and commercially proven at scale.

As a result of the pilot’s success, ComEd chose Silver Spring Networks’ end-to-end IPv6 SilverLink Network Platform for deployment to all 3.8 million Illinois customers. Relying on Silver Spring’s secure and standards-based foundation for delivering smart grid services, ComEd could unlock customer benefits more rapidly, as well as easily integrate future technologies and applications. Increased business efficiencies expected from the project included a targeted reduction of \$30 million in uncollectable expense, a 90% reduction in consumption of inactive meters and a 50% reduction in unaccounted energy use.

**MOST
IMPROVED
UTILITY**

ComEd’s ranking in customer satisfaction between 2012 - 2015

\$2 BILLION SAVINGS

over 20 years from an upgraded, stronger electric system, fewer power interruptions and greater operational efficiencies



\$1.1 BILLION

In societal savings from avoided outages since 2012

ADVANCED METERING (AMI) SOLUTION

ComEd's integrated AMI solution provides two-way communications between customers and ComEd, enabling applications such as automated billing, remote disconnect and connect service operations, a customer web portal with near-real time consumption information, AMI-based outage management, meter hazard discovery, revenue assurance and dynamic pricing.

Silver Spring's mesh radio frequency network ensures reliable communications for ComEd's full-scale deployment. As illustrated in Figure 1, the network consists of smart meters at customer homes and businesses and network infrastructure including access points and relays. The intelligent devices collect information and communicate with ComEd's IT systems for billing, customer information and outage management.

As of April 2016, ComEd installed more than 2 million smart meters. Due to meter acceleration, all 3.8 million ComEd customers are expected to have smart meters by the end of 2018—three years ahead of the original commitment, resulting in increased customer savings of approximately \$170 million.

ComEd's investment in AMI hardware is already enabling a variety of advanced applications that deliver value to the utility and consumers. ComEd implemented Silver Spring's analytics solutions—including the Operations Optimizer application—to enhance grid resiliency and increase operational efficiency. The application allows operators to leverage vast amounts of data from multiple internal and third party sources for a unified enterprise analytics solution covering numerous use cases.

Silver Spring's analytics solution enables operators to improve hazard detection and revenue assurance through actionable insights and workflow automation capabilities. This has significant implications for operators, who can now leverage data and proven pattern recognition techniques for proactive rather than reactive problem resolution. They can use analytics as virtual "eyes-in-the-field" to identify and track cases of meter tamper, meter malfunction and theft. The results have been immediate. With an average accuracy of over 95%, the software has dramatically improved ComEd's ability to remotely detect incidents of theft and meter malfunction.

ComEd's investment in AMI infrastructure has already delivered significant and measurable value. With the flexible and adaptive capabilities of the Silver Springs' Operations Optimizer application, operators are equipped with powerful tools and insights they need to continue to unlock future gains for ratepayers.

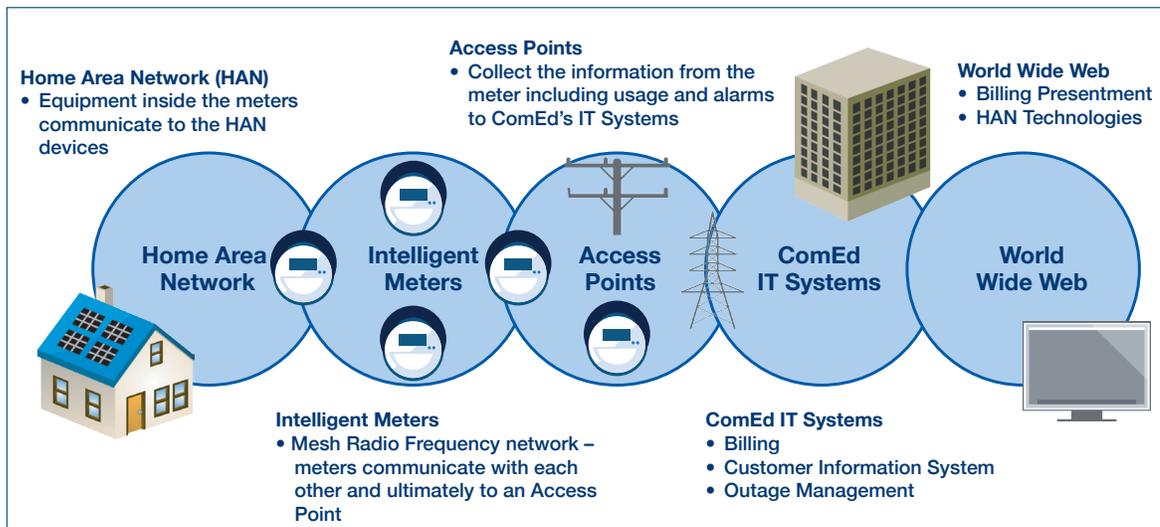


Figure 1: ComEd Advanced Metering Infrastructure (AMI) Solution

DISTRIBUTION AUTOMATION (DA) SOLUTION

ComEd is implementing a five-year DA plan to improve outage management through better targeting of restoration crews to fault locations, enhanced asset tracking and faster power restoration through the automatic detection of faults and rerouting of power around the faults.

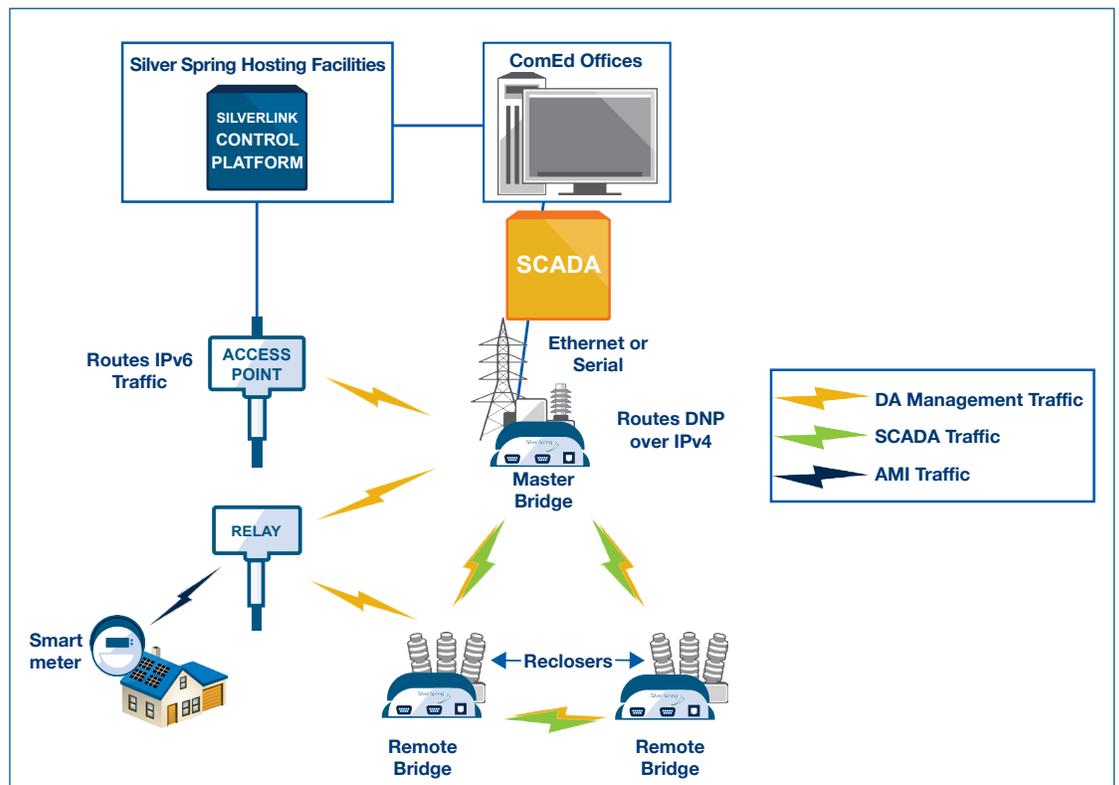
ComEd leveraged its Silver Spring network infrastructure to deliver two-way communications for 6,100 DA devices, including the migration of more than 3,000 DA devices from a legacy Utilinet 900 MHz system onto a Silver Spring mesh network. The Silver Spring network transports SCADA communications to control and monitor reclosers and other grid hardware in the field and delivers the DA network management traffic to the SilverLink Control Platform, hosted by Silver Spring Networks. As of December 2015, ComEd’s smart grid network supports more than 4,965 DA devices.

ComEd has enabled additional gains by combining its investment in DA hardware with the Silver Spring Operations Optimizer application. ComEd leveraged the software’s advanced analytics capabilities to unlock additional gains in outage management capabilities while reducing costs related to on-site investigation.

Operations Optimizer uses analytics to improve asset tracking of critical hardware across the DA network. Whereas legacy systems required trained field technicians to identify cases of meter-to-transformer mismatch, Operations Optimizer empowers ComEd to remotely discover and proactively solve problems, also improving ComEd’s asset tracking capabilities. Operators have discovered that approximately 5% of meters have incorrect transformer listings. The analytics have also improved workflows, achieving a success rate of up to 90% in remote identification of meter-to-transformer mismatch without costly truck-rolls.

The implications for distribution automation are significant. Operators are gaining improvements in outage management, distribution transformer load management and transformer/feeder-level analysis. The Silver Spring solution also supports the high bandwidth and low latency requirements of the most demanding DA applications, giving ComEd the ability to add other use cases in the future.

Figure 2:
ComEd Distribution Automation (DA) Solution



SMART CITY SOLUTION

In 2015, ComEd began extending the use of its mesh network to support a smart street light pilot for 750 of the 176,000 ComEd-owned fixtures in the Chicagoland area. The program equips energy-efficient LED lighting fixtures with Silver Spring's wireless monitoring and controls, leveraging the same smart grid network infrastructure used to support AMI and DA. The pilot is testing advanced functionality including remote control and scheduling the lights, outage and maintenance alerts, and public safety support. ComEd is providing the two pilot villages, Lombard and Bensenville, with access to central management software that allows them to monitor the status of street lights for outages or proactive maintenance and allows them to adjust dimming levels in near-real time from a mobile device. ComEd expects this project to reduce costs for operations, maintenance and energy by up to 65%, improve mesh resilience, provide an 'anchor' for other smart city applications as well as improve customer satisfaction.

BENEFITS FROM SMART GRID DEPLOYMENT

Since the SilverLink Network Platform supports multiple smart grid applications, it enables ComEd to run integrated DA, customer programs, smart city, AMI communications and asset management on a single, unified network while supporting the unique network performance requirements of each application. The addition of new nodes, such as street lights communications, serves to strengthen the overall network to benefit existing and future applications.

By building upon a common network, ComEd is also maximizing the impact of its investments in analytics solutions. ComEd's modernized IT infrastructure integrates multiple data streams from internal and third party sources, enabling seamless data transactions for enhanced visibility and control across multiple business units. Operators can now leverage proven algorithms and robust role-based workflow management tools to generate actionable, predictive insights for enhanced operations and program management.

ComEd's smart grid investments are improving the strength and reliability of the electric system and providing benefits across multiple areas:

Fewer and shorter outages delivered societal savings of \$1.1 billion

From 2012 to 2015, ComEd avoided more than 4.8 million customer interruptions with smart switches that automatically route power around potential problem areas, including 1.5 million avoided interruptions in 2015 alone. Outage avoidance enabled an estimated \$1.1 billion in societal savings from 2012 to 2015.

Improved reliability, now in the top 10%

ComEd's reliability performance is now in the top 10% of comparable U.S. utilities. 2013 and 2014 were the company's best performances on record.

Accelerated storm recovery performance reduces outages by 44%

Despite more intense weather events, storm storm hardening work and accelerated restoration performance has resulted in a 44% reduction in the number of customer interruptions in 2015 as compared with a similar storm in 2005.

1.5 MILLION

Avoided customer interruptions due to distribution automation in 2015



Reduces electricity delivery rates by \$66.7 million

Strong cost management throughout the company and operational efficiencies from improved outage management have enabled ComEd to reduce delivery rates by \$66.7 million—an average of \$1 per month on the average residential bill—in 2016, achieving ComEd’s goal of passing-on savings to directly to ratepayers.

Enhances discovery of meter tamper and theft

With Silver Spring analytics, ComEd has significantly improved the efficiency of its revenue assurance operations. Using AMI data and proven algorithms, investigators have been able to increase the accuracy of remote theft detection to more than 95%.

Improves asset tracking for critical DA hardware

Operators have also improved their ability to proactively discover meter-to-transformer mismatches remotely. The algorithm is highly accurate, achieving a success rate of up to 90% in identifying and correcting mismatched assets. In total, the software estimates that 5% of meters are associated with mismatched transformers.

Reduces the cost of street lighting by 65%

ComEd expects the ability to monitor and control fixtures will reduce costs to manage its street lights by up to 65% due to increased efficiencies in operations, maintenance and energy use.

Supports economic growth

In addition to benefits to ComEd customers, ComEd’s smart grid program is also delivering benefits to the state of Illinois through job creation. ComEd work related to the smart grid program has resulted in more than 4,569 full-time equivalent jobs and over \$4 billion in supply chain spend in Illinois as of April 2016.

Enables customers to control usage and costs with innovative demand side management programs

Smart meters are providing customers with better tools to track and manage their energy costs and usage. Participants in ComEd’s Hourly Pricing program are saving an average of 8% as compared with fixed-price rates.

A FLEXIBLE FOUNDATION FOR THE FUTURE

Silver Spring Networks’ SilverLink solutions serve as a foundation to add future smart grid applications. In addition to its new street light pilot, ComEd is exploring analytics, grid efficiency and restoration acceleration applications. With a standards-based smart energy infrastructure, ComEd can easily integrate new smart services and solutions, driving additional benefits for its customers in the future.

About Silver Spring Networks

Silver Spring Networks is a leading networking platform and solutions provider for smart energy networks. Silver Spring’s pioneering IPv6 networking platform, with more than 23 million Silver Spring enabled devices delivered, is connecting utilities to homes and businesses throughout the world with the goal of achieving greater energy efficiency for the planet. Silver Spring’s innovative solutions enable utilities to gain operational efficiencies, improve grid reliability, and empower consumers to monitor and manage energy consumption. Silver Spring Networks’ customers include major utilities around the globe such as Baltimore Gas & Electric, CitiPower & Powercor, Commonwealth Edison, Consolidated Edison, CPS Energy, Florida Power & Light, Jemena Electricity Networks Limited, Pacific Gas & Electric, Pepco Holdings, Progress Energy, and Singapore Power, among others. For more information please visit www.silverspringnet.com. Rev.5/23/16