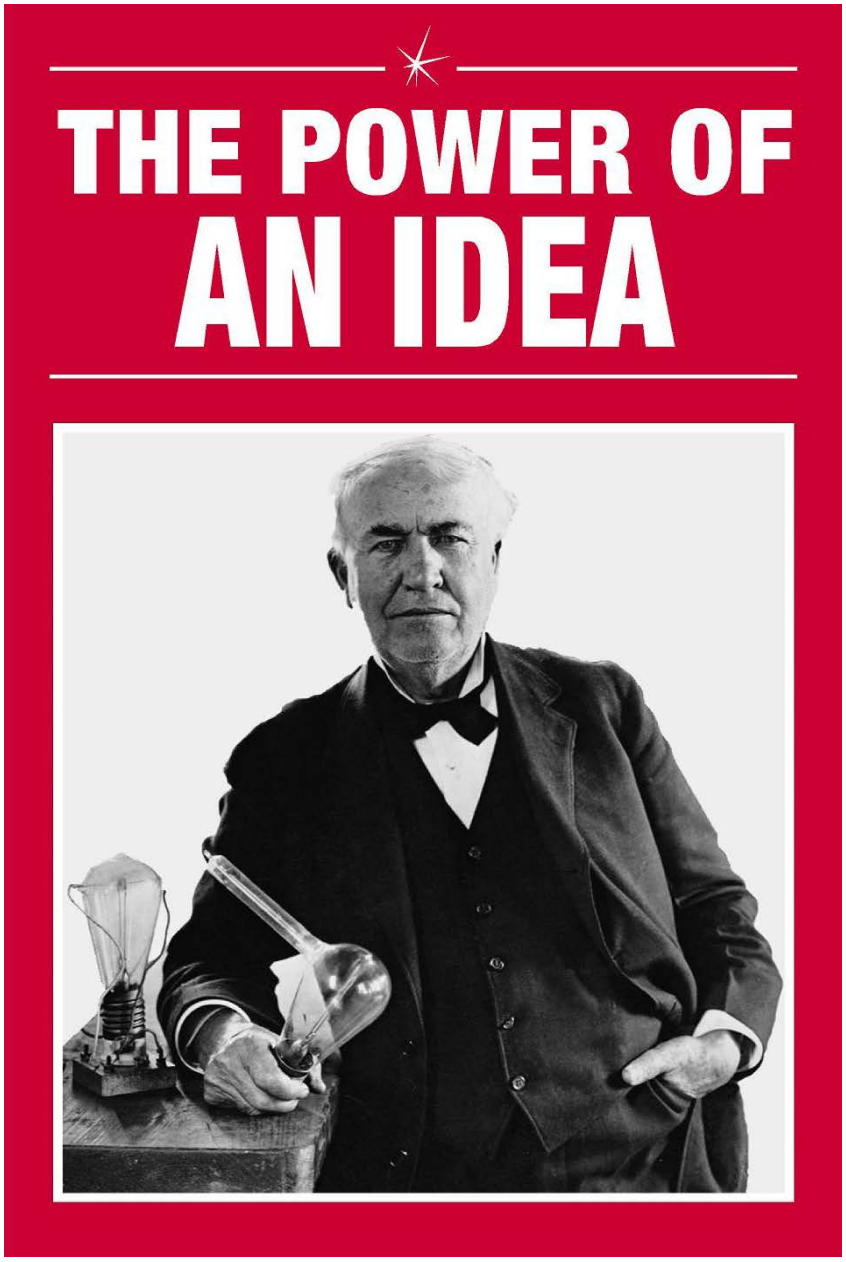
Smart Grid Advanced Metering Annual Implementation Progress Report

ATTACHMENT 3

Test Bed / Technology Demonstrations

ComEd
An Exelon Company

Commonwealth Edison Company's Quarterly Smart Grid Test Bed Report



February 13, 2015

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I. Introduction

Pursuant to subsection 16-108.8 of the Public Utilities Act ("Act"), ComEd created its Smart Grid test bed ("Test Bed"). The purpose of the Test Bed is to provide opportunities to test and demonstrate Smart Grid programs, technologies, business models, and other Smart Grid-related activities that may benefit ComEd's customers in a live-grid environment. Test Bed demonstration projects may come from a variety of sources including, but not limited to: parties that submit applications ("Applicants") to participate in ComEd's test bed pursuant to the application process outlined in ComEd's Smart Grid Test Bed Plan, the Illinois Science and Energy Innovation Trust ("Energy Foundry"), ComEd's own employees, professional organizations, universities, and technology partners.

ComEd's goal is not to provide a lab where investigational ideas are tested out; those facilities exist and such tests are not appropriate for a live environment. Rather, the Test Bed is aimed at providing a new and nearly unique to demonstrate, in an open and unbiased manner, how working technology actually operates in a live utility scale environment. The Test Bed allows approved technologies, subject to appropriate protections, to connect equipment to the utility grid for the purpose of demonstrating that the equipment or systems function as designed. The Test Bed is designed to help validate business models or services by permitting demonstration of the functional aspects of specific equipment and/or verification that services/business models provide the intended results.

Accordingly, this report summarizes the test bed activities, discoveries, and other information deemed mutually relevant from October 1, 2014, through December 31, 2014 as described in subsection (i) of Section 16-108.8 of the Public Utilities Act ("Act").

II. ComEd Innovation Hub

ComEd recently created the Innovation hub ("iHub") to improve visibility to new and innovative technology ideas; to encourage innovation within the organization; and to improve cross-departmental collaboration on developing innovations. The mission of the iHub is to introduce and maintain a platform that recognizes, celebrates, implements and institutionalizes innovation and new technology. ComEd will leverage this newly-established iHub process to provide consistent evaluation and management of Test Bed demonstration projects.

The iHub defines the following stages to track the progress of ideas through the innovation development cycle: New Idea, Analysis/Planning, Pilot, Implement, Institutionalize. These stages, described in greater detail below, are founded on, and align to our Four Pillars of Innovation, namely: Inspiration, Ideation, Investigation, Implementation.

New Idea: Ideas are received and entered into the iHub technology inventory database, which tracks and ensures proper progression of innovation through the development lifecycle. An initial review is conducted to seek clarification on the idea, and determine applicability of the technology for the ComEd system.

Analysis/Planning: Internal subject matter experts work closely with the idea owner (or Applicant), to develop a Demonstration Plan, which includes the demonstration objectives and key functions of the technology to be tested, as well as the scope of work ("SOW"), success metrics and associated costs. In the case of a Test Bed demonstration project proposed by an external Applicant, ComEd works with the Applicant to develop a Project Agreement, which includes the SOW and any fees to be charged to the Applicant for ComEd to administer the Applicants Test Bed demonstration.

Pilot: The technology is installed/constructed, and demonstrated on ComEd's grid in accordance with the Demonstration Plan and/or Project Agreement. At the end of the demonstration period, a report is generated, which documents the results versus the objectives and success metrics defined, as well as any learnings from the demonstration.

Implement: Following a successful pilot, it may be determined that the technology has further applicability to the ComEd system and the potential to provide additional benefits to ComEd and/or its customers. In such cases, an implementation plan may be developed which includes the scope of proposed deployment, project budget, and change management strategy. The implementation plan is then presented to the appropriate level of authority for approval.

Institutionalize: Much like the Implement stage, certain technologies may have broader ComEd-wide, or even Exelon enterprise-wide applicability. In such

cases, the proposed technology deployment will go through the Exelon project authorization process, which includes presentation to pre-defined levels of authority and includes a more detailed review of costs vs. benefits, risk assessment, and technological feasibility.

III. Test Bed Applications Received During the Reporting Period

Following are the applications that ComEd received in the current reporting period for Test Bed demonstrations, with a technology description and the current status of each.

Power Delivery Products (PDP)

PDP proposed a demonstration of a "Smart Load Tracker" fault detection device it is currently developing for underground pad-mount applications. The innovative feature of this device is its capability to provide remote notification via ComEd's two-way wireless mesh network. ComEd accepted the application and is in the process of working with PDP to develop a Project Agreement. The technology is described in greater detail in the following section.

Alstom Grid

Alstom Grid proposed a demonstration of its advanced distribution management system (ADMS) on the ComEd system, which integrates function such as outage management system (OMS) automation, and supervisor control and data acquisition (SCADA) to provide capabilities such as fault location and volt/VAR optimization. ComEd rejected Alstom Grid's application because the costs to integrate its software with the necessary ComEd systems would be prohibitive for a temporary demonstration project. Alstom

Grid's application was also rejected because its ADMS is an established commercial product, which does not meet the spirit or intent of the Test Bed.

NoteVault

NoteVault proposed a demonstration of its service that takes information spoken by field personnel into a tablet or smart phone, and uses human transcribers to enter the voice information into pre-defined forms to create digital records. The service also allows pictures taken with the tablet or smart phone to be attached to the digital record. ComEd rejected NoteVault's application because the costs to create the new forms and integrate its software with the necessary ComEd systems would be prohibitive for a temporary demonstration project. NoteVault's application was also rejected because its transcription service is an established commercial product, which does not meet the spirit or intent of the Test Bed.

IV. Current Demonstration Projects

Following are summaries of current technology demonstration projects at ComEd. The list represents projects from a variety of internal and external sources, spanning multiple technology areas. Each project summary includes a symbol designating the current stage of development, as described in Section II of this document.

GlidePath, LLC

During the first quarter of 2014, ComEd received and approved one new Test Bed Application from GlidePath Power, LLC. GlidePath is currently developing three 20MW battery storage facilities within the ComEd footprint of PJM. These facilities are intended to participate in the PJM frequency regulation market and will be located in

McHenry, West Chicago, and Joliet, respectively. Construction is projected to be complete in 2015. Along with participating in the PJM regulation market, GlidePath expressed an interest to demonstrate certain grid support capabilities in ComEd's Test Bed, namely:

- Distributed fast frequency control
- Smart inverter functionality and capability to limit impacts of the battery facilities on grid equipment (e.g., substations)
- Distributed dynamic volt/VAR support, and how this can co-exist with the frequency control noted above

Based on the specific grid support capabilities listed above, ComEd accepted GlidePath's Test Bed application. Development of a Test Bed Project Agreement with GlidePath is currently on-hold, pending resolution of open issues related to the interconnection of GlidePath's battery facilities.

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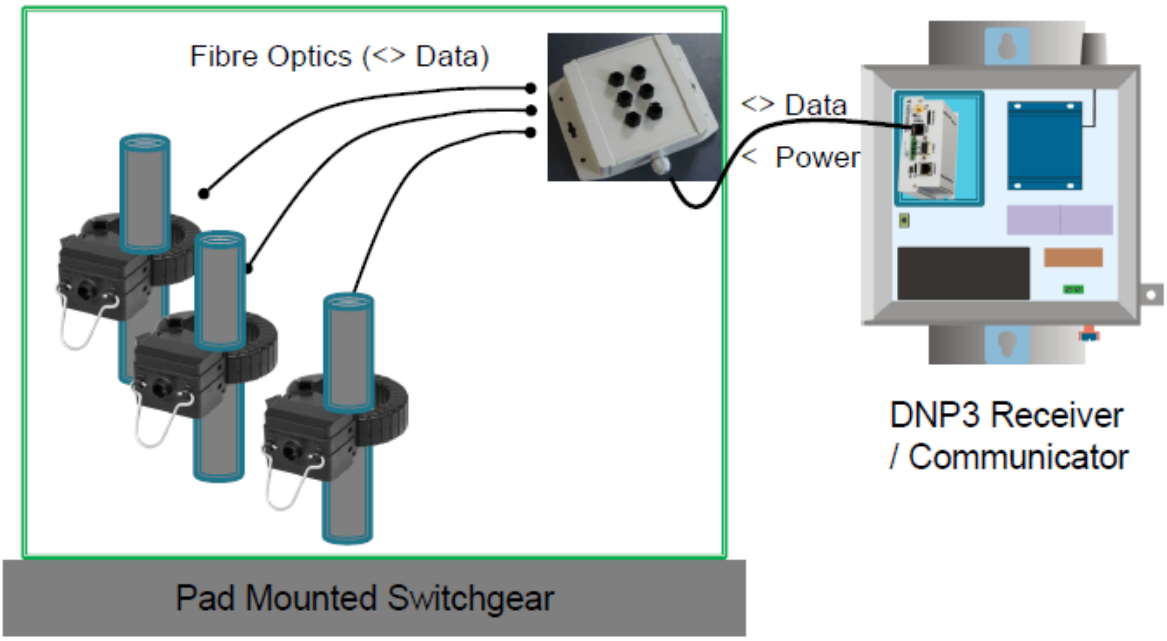
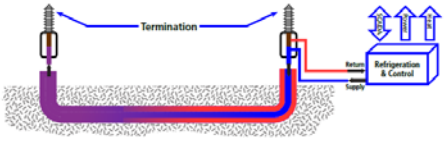


A key feature of this technology is its capability to provide remote notification via ComEd's two-way wireless mesh network. The solution is designed to cost-effectively reduce customer outage response times, and is particularly applicable for underground direct buried cable "loop schemes", which can include up to 20 pad-mount transformers and cable sections. The Smart Load Tracker solution provides intelligent identification and real-time reporting of underground cable faults, as well as information to improve ongoing monitoring of distribution lines. A key capability that will be demonstrated in the Test Bed is real-time notification of cable faults and communications via the Silver Spring communications network. ComEd and PDP are currently developing the scope and schedule for the demonstration, which is expected to begin during the second quarter of this year.

Superconductor Development

ComEd and American Superconductor (AMSC) recently agreed to participate with the Department of Homeland Security (DHS) in its Resilient Electric Grid Program Developing plans to deploy high temperature superconductor cable in Chicago's central business district (CBD). This DHS program is designed to provide protection against the catastrophic effects resulting from the loss of critical substation facilities by allowing the sharing of capacity of nearby substations that cannot typically be accomplished through conventional means.



The superconductor cable would interconnect five key electrical substations in the city and provide enhanced security and redundancy to critical infrastructure. Given the significant level of external funding and the size and scale of the project, one of the project goals is to significantly reduce the cost of manufacturing the superconductor cables.

In addition to providing reliable power and increased security, this installation of more than three miles of superconductor cable would create the most extensive superconductor technology infrastructure in the world. ComEd's transformation of our business relies heavily on technology and innovation. In this era of increasingly intense weather events and other potential catastrophic occurrences, this project will not only

support the City of Chicago but can serve as a model to enable widespread implementation of the superconductor technology nationally and globally. ComEd and AMSC are currently in the midst of a feasibility study that will be conducted over the next 6-9 months to develop a deployment plan.

Fuel Cell Demonstration

ComEd is working with Toshiba to showcase the first implementation of a Toshiba fuel cell in the United States. The initial Toshiba Ene-Farm unit, originally designed for residential applications in Japan, is being planned for installation at Brookfield Zoo, to provide power and heated water to the Zoo's Stingray Bay exhibit. The demonstration will help ComEd and Toshiba to better understand the operation and applicability of the technology in the U.S., and the exhibit will serve to educate the public on fuel cell technology. The Toshiba Ene-Farm unit is in the final stages of testing by Underwriters Laboratories (UL), and the exhibit is being finalized in preparation for a grand opening at the Zoo in May, 2015.

Community Energy Storage for Frequency Regulation

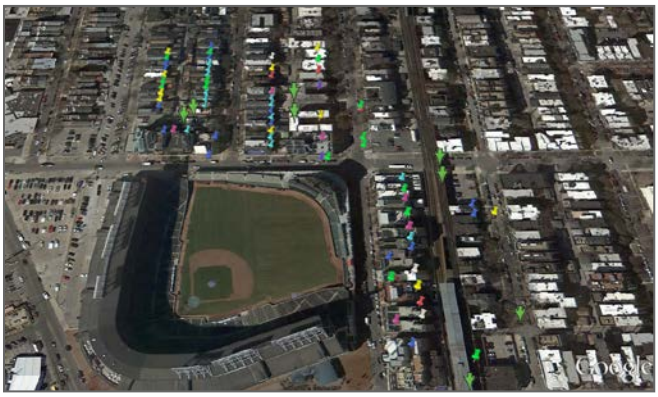
S&C Electric, located on Chicago's north side, has developed a demonstration that utilizes distribution-connected community energy storage (CES) for frequency regulation.

The objective of the demonstration is to show the many uses for distribution-connected energy storage, as well as how stored energy can participate in the PJM frequency regulation market.

The demonstration includes six of S&C's "Purewave" 25kVA CES units, each with its own 25kWh battery for a total combined output of 150 kVA/150 kWh. When given a command from PJM (the Reg D signal) the CES units automatically discharge into the grid - providing the level of power requested by PJM - or absorb excess power from the grid while charging the batteries.

ComEd and S&C are currently developing a demonstration of this CES technology for battery storage to support improved reliability – particularly for customers experiencing multiple interruptions. The objective will be to demonstrate use of the Purewave CES solution to mitigate short-duration outages to a single customer or multiple customers. The ability of the CES device to be monitored and controlled via SCADA, along with providing real-time outage notification, will also be a key component of the demonstration. Site evaluation and selection are currently underway, and installation is expected to take place mid-year.

In 2010 and 2011, ComEd experienced cases of low-voltage and transformer overloading in the neighborhood surrounding Wrigley Field. These events were particularly impactful to the Wrigley RoofTops – multi-story residential buildings across the street from the ball park that have been renovated to add rooftop seating to watch Chicago Cubs games, while offering food and beverage services.



With the night games at Wrigley field and the RoofTop venues, load factor and system loading profiles are not typical of a residential area.

ComEd's Regional Engineering was able to address the issues and none have been reported since that time, however with the deployment of Smart Meters, the opportunity arose to utilize voltage data from these meters to both validate effectiveness of the solutions employed, and monitor this high-profile area on a real-time basis to predict potential future issues.

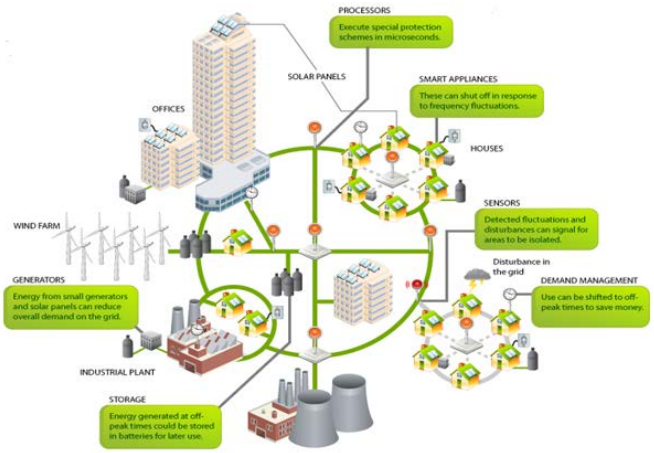
To conduct the study, ComEd accelerated deployment of the Silver Springs network in the area - 269 Smart Meters on accounts associated with impacted transformers - and began gathering time-sequenced load and voltage data.

ComEd has also been demonstrating the Grid Sense TransformerIQ monitoring device with Silver Springs Network communications capability on local transformers in the Wrigleyville neighborhood.

The data from the TransfomerIQ is fully integrated into ComEd's PI Historian system, which is used to collect and display SCADA data. As ComEd deploys more smart meters, we will have an enhanced ability to see very granular load and voltage information and aggregate that information to the transformer level. Thus, it is projected that use of devices such as TransformerIQ would be limited to niche situations such as monitoring 3:1 transformers and network transformers, or to investigate very complex theft of service situations. Through the use of the voltage and usage data collected, ComEd has also been able to identify and address meter-to-transformer issues, and improve its data analytics in this area.

Microgrid Development

In support of President Obama's Climate Action Plan and the Administration's commitment to improve national power grid resiliency, the U.S. Department of Energy (DOE) awarded more than $8 million for microgrid controller related R&D projects to help cities and towns better prepare for extreme weather events and other potential electricity disruptions.



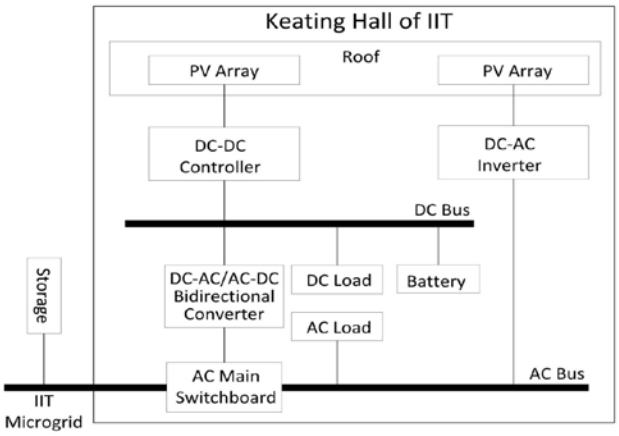
In September 2014, ComEd was selected by the DOE to receive a $1.2 million grant to build a master controller that

could drive the operations of clusters of microgrids. As part of this funding opportunity, ComEd's project was the only utility led effort to receive DOE funding. ComEd has assembled a group of leading science and technology partners for the DOE proposal including Argonne National Laboratory, Illinois Institute of Technology (IIT), OSIsoft, Quanta Technologies, S&C Electric, and University of Denver. With its partners, ComEd kicked-off the controller development effort in November 2014, and is currently in the middle of the R&D effort scheduled to be completed in August 2016.

As part of the controller R&D effort, ComEd is in the midst of evaluating Chicago's Bronzeville neighborhood, adjacent to IIT, potentially for its first microgrid installation. The potential microgrid would also demonstrate all the capabilities of the clustered microgrid controller – under development. ComEd's microgrid concept includes a diverse mix of facilities and critical loads, including police and fire department headquarters, major transportation infrastructure, healthcare facilities, and private residences.

Nanogrids: AC/DC Hybrid Systems

ComEd, IIT, Argonne National lab, DOE, Emerge Alliance, and Starline DC Solutions are partnering to develop a hybrid nanogrid for IIT's Keating Hall. This effort is funded through a U.S. DOE grant. Nanogrids are a sub-category of microgrids, generally supplying power to a single building or load. Hybrid nanogrids include both alternating current (AC) and direct current (DC) circuitry. As their name suggest, nanogrids are generally much smaller than conventional microgrids. DC loads, such as data centers and LED lighting, together with proliferation of DC-based distributed generation and energy storage are likely to reshape power distribution.



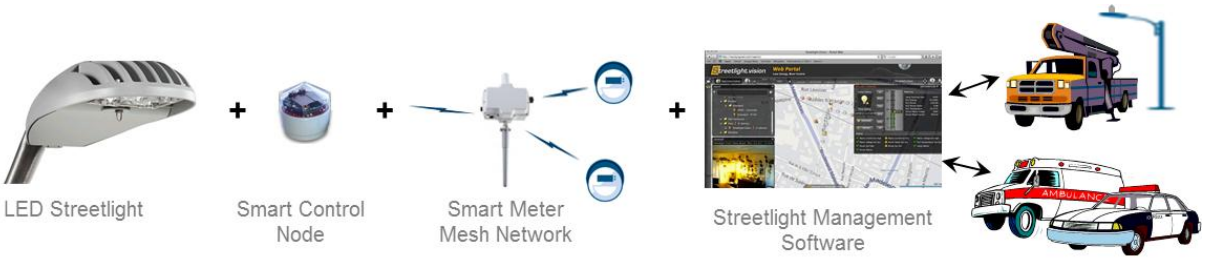
The Keating Hall nanogrid will incorporate PV generation, LED lighting, and power electronic based conversion equipment. The main drivers for hybrid nanogrid development are (1) DC based PV assets installed on the rooftop, (2) reduced conversion losses, through centralized energy conversion and (3) LED lighting solutions for more efficient and controllable lighting for the building.

The overall goal of the project is to learn about integrating the AC and DC systems for a building-scale nanogrid solution. The learnings from this small demonstration could enable ComEd to apply these technologies in future microgrid and nanogrid developments. The project does not only include installation of new technology, but applying that technology to robust integration of renewables and improved energy

efficiency. The project is progressing on schedule; rooftop solar panels and the energy storage system for the nanogrid system will be installed in February 2015.

Smart LED Streetlights

ComEd is evaluating opportunities to offer smart LED streetlight service to the communities we serve. The solution would leverage the wireless mesh communications network that is currently being built as part of our smart meter deployment The ubiquitous nature of the network allows us to reach all areas of the ComEd territory, extracting additional value from the smart grid investments ComEd is already making.



A smart streetlight control node would be installed on each light fixture. The control node include the same wireless radios in ComEd's smart meters, allowing it to communicate on the same mesh radio network as our smart meters. Each control node also includes revenue grade metrology, enabling improved accounting for energy usage, and potential further energy reductions through functions such as streetlight dimming.

The web-based streetlight management software enables the creation of portals for various users with specific functionality sets (e.g., emergency responders, maintenance personnel, event management). Streetlights can be controlled via pre-set schedules or an ad-hoc basis, either individually or as groups.

A smart LED streetlight solution leveraging ComEd's smart meter communications network offer a variety of benefits. The highly-efficient, longer-lasting LED fixtures with remote control & monitoring, significantly increase energy savings and reduce maintenance costs, while improving security and safety through fewer light failures and greater resiliency to damage. Also, the web portals for police and emergency responders enable lights to be controlled on demand in the event of an emergency. The network itself creates a platform for a wide array of potential future sensors (e.g., weather, traffic, air quality); and measurement devices such as water meters.

ComEd recently initiated a pilot demonstration of smart LED streetlights in two communities it serves – Bensenville and Lombard. Approximately 800 LED fixtures are currently being installed, collectively, between the two municipalities. Each fixture is equipped with a newly developed CIMCON brand control node. The demonstration will also include the provision of streetlight management software to the two municipalities, enabling them with direct control and monitoring capability over the streetlights. The pilot is expected to run for 6 months, and will be used to determine costs and benefits of deploying the technology on a broader scale.

Smart FAA Warning Lights

Three new poles installed in downtown Dixon are being equipped with new LED FAA warning lights due to the proximity of the poles to a nearby hospital heliport. The new lights are equipped with a communication panel that leverages ComEd's wireless mesh communications network to provide real-time status of the lights. When a failure is indicated, the communications panel communicates this to ComEd's SCADA system, and sends texts and emails to appropriate personnel so issues can be addressed promptly. Additionally, loss of power to the system, or a communications failure will trigger an alarm. ComEd is currently exploring opportunities to streamline the design of the smart FAA warning lights by integrating the same control node being used in its smart streetlight pilot to reduce equipment and installation costs.

Pedestal Communications Relay

ComEd engineers recently developed an innovative solution to a significant operational challenge. When designing and building the distribution automation ("DA") radio communications networks, it is not unusual to encounter a situation where traditional standards and methods are insufficient.

DA radio communications relay equipment is traditionally installed only on overhead facilities. These relay radios may take the form

of pole top antennas, lighting brackets or even decorat
streetlights. However, each installation requires an ove
structure for mounting both the radio and antenna hard
In the past, ComEd has identified multiple situations w
existing overhead standards cannot be utilized. This is
often caused by:

- No existing overhead infrastructure in the general a
  (underground subdivision)
- Distribution poles not owned by ComEd
- Installation of a new pole is not feasible
- Utility easement is only provisioned for underground facilities

The above conditions present significant challenges to designing efficient, cost-effective radio installations. In certain cases, no feasible solution existed.

Two of ComEd's own engineers developed an innovative solution to solve the problem by creating ground-based radio repeater using a conventional three-phase pedestal. This chassis, commonly used within the company, is very rigid and can be installed within underground easements.

The pedestal is used to house all of

the conventional overhead radio equipment. This equipment is simply mounted and installed inside the box using all of the standard mounting hardware used to attach a relay and bracket to a wood pole. The benefits include:

- Enclosure, radio, and hardware are all existing items within ComEd stores
- Time to assemble and install is less than pole-based solutions
- Cost is less than setting poles or adding relays
- Any maintenance can be performed from ground level
- Secondary enclosure is less intrusive than 40' pole
- Resembles a standard three phase pedestal
- Unit does not need concrete pad and can be relocated if needed
- Very safe to install, operate and maintain

The pedestal communications relay has proven to be effective and cost-beneficial. ComEd has applied for a U.S. patent for this innovative new technological solution.

Smart Meter Connected Devices

ComEd's recently developed Smart Meter Connected Devices ("SMCD") service enables residential customers to receive electricity usage and cost information, and in some instances messages and alerts, through a smart device that is wirelessly connected to and can communicate with the ComEd smart meter installed at their home. With access to more information about their electricity use, customers can make changes that can help them manage electric bills.

A SMCD participant can purchase any smart device in retail that meets program requirements, register the devices with ComEd, and ComEd will wirelessly connect the devices to the ComEd smart meter at their residence. The types of devices that qualify for the program include:

- **In-Home Displays (IHDs)**: IHDs have the ability to display electricity-usage and cost information available from smart meters. IHD features may also provide access to time of day, price and cost of electricity, as well as text messages. This information appears on the digital display of the device shortly after electricity is used. Some IHDs display energy costs (Price * Usage) based on the fixed-price electricity supply rate from ComEd or other electric suppliers as well as ComEd delivery rates.
- **Energy Management Devices**: These devices can take multiple forms, but are most commonly a Programmable Controllable Thermostat. Some Energy Management Devices have features similar to IHDs, with additional capabilities that allow you to actively manage electricity usage such as providing notification of unusual periods of high electricity use.
- **Other Devices**: Smart appliances, range extenders (which boost or extend your Wi-Fi signal) and internet gateways are examples of other smart devices that may be capable of receiving information from smart meters.

Bidgely HomeBeat™ Pilot

ComEd recently announced a pilot with Bidgely, a leading energy analytics Software as a Service ("SaaS") provider serving utility customers to test Bidgely's new HomeBeat™ Energy Monitor and Web & Mobile engagement solution with ComEd customers. ComEd is the first utility to offer this technology to customers, which will provide them with personalized energy reports detailing how and when they use energy in their home. During the pilot, 250 participants will be selected to receive the HomeBeat Energy Monitor, which will allow participants to connect directly to their ComEd smart meter and provide real-time data to the Bidgely cloud. An additional 2,500 participants will receive access to Bidgely's HomeBeat Web & Mobile platform, which utilizes information collected and sent over the ComEd smart meter network to Bidgely's cloud. The pilot is expected to launch in late spring 2015 and run for approximately six months. Bidgely's HomeBeat platform will provide personalized appliance-level insights through the company's disaggregation-based solution. This technology will empower customers to take specific actions that will help them save energy. The inclusion of Bidgely's HomeBeat Energy Monitor enables ComEd to offer real-time energy insights, such as high-usage alerts via mobile push notifications within minutes of use.

ComEd is the first utility to offer Bidgely's new suite of HomeBeat products that include:

- **HomeBeat Web & Mobile app**: Enhanced mobile app that provides real-time notifications and insights around energy use and puts the

ability to make smarter decisions about energy in the palm of the customer's hand.

- **HomeBeat Energy Monitor**: Simple and affordable in-home gateway that syncs smart meter data with Bidgely's cloud to enable real-time energy insights.

Nest Learning Thermostat™ Pilot

During the summer of 2014 ComEd partnered with Nest Labs, Inc to offer up to $140 in rebates for customers who purchased a Nest Learning Thermostat™ and participated in ComEd's Smart Ideas Central Air Conditioning (AC) Cycling Pilot program. Customers received a $100 rebate from ComEd for signing up to participate in the pilot that features Nest's Rush Hour Rewards™(RHR), and an additional $40 rebate for participating in the pilot all summer. RHR events only occurred from June 1st thru September 30th, 2014 at ComEd.

The Nest Thermostat facilitates automated changes to customer's individual schedules to drive energy savings called the "Seasonal Savings Program". ComEd will measure the amount of energy efficiency benefits to customers from the Seasonal Savings program for a full year from 6/1/2014 to 5/31/2015. Demand Response Programs such as AC Cycling can use Nest's RHR service to help reduce

electricity demand on the hottest days of the summer. With ComEd's AC Cycling pilot, Nest sends a wireless signal over the customer's Wi-Fi in their home to the Nest thermostat to adjust the customer's air conditioner, automatically helping them reduce electric demand during peak periods.

With Nest's RHRs program a customer's thermostat temperature is automatically adjusted around rush hours events. During a rush hour event the customer's air conditioner can be controlled by the thermostat to pre-cool the home before the event and can let the temperature raise a few degrees during the event. This helps reduce the electric demand of the home during rush hour events while still keeping customers comfortable. Customers can override the temperature during an event if they become uncomfortable by simply changing the setting on the thermostat.

As part of ComEd's AMI rollout, customers with smart meters will be able to participate in ComEd's Peak Time Savings (PTS) Program during the 2015 summer months. Some of the customers that sign up for the PTS Program can participate in a Direct Load Control (DLC) Pilot that will leverage a PCT device similar to the Nest device used in 2014. The experience of the Nest Thermostat Pilot in 2014 will directly benefit ComEd's efforts to operate their DLC Pilot in 2015

Root3

ComEd has contracted with Root3 for a one-year pilot of its Balance energy management system (EMS) at four industrial/large commercial locations. The Balance tool uses big data and predictive analytics to optimize energy operations and enable

strategic energy planning at chilled water, steam, cogeneration, and compressed air plants (also referred to as Central Plants).

Balance has a step-by-step guidance system that updates based on ambient conditions and helps operators eliminate waste and improve their productivity and dispatch consistency across shifts. Algorithms in Balance continuously track operational efficiency and effectiveness. This makes it easier to identify bottlenecks and continuously improve energy operations. Balance also brings together data from a site's existing energy management system and plant process control systems, and combines it with information on weather, energy prices, operational constraints, business constraints and goals. It uses algorithms to continuously predict the safest, most reliable, and most cost-effective way to run a plant. In this aspect, Balance is very much like a navigational system, guiding users to Lean Energy Operations.

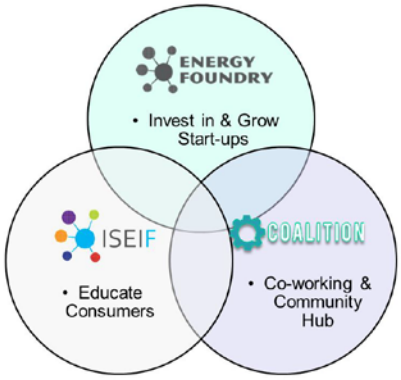
Another advantage of Balance is that it requires no capital investment to deploy – it uses data from a plant's existing sensors and meters.

To date, ComEd has two of four locations secured for the pilot. The other two open locations are being pursued by ComEd and Root3.

V. Smart Grid Collaboration

At ComEd, we recognize that great innovations come from engaging forward-thinking individuals with a broad diversity of perspectives, experiences, and expertise. That's why we're forging key relationships with industry leaders, technology accelerators, universities and others, to further encourage the development of new and innovative grid-related products and services by entrepreneurs. Following are a few examples of key collaborative relationships ComEd has established.

Energy Foundry



ComEd continues to support the Energy Foundry in its mission to foster innovative new grid-related and energy-related products and services. ComEd's vice president of smart grid and engineering holds weekly office hours at the Foundry's Coalition Space in downtown Chicago to talk face-to-face with entrepreneurs and provide the utility perspective as they develop new ideas. The pipeline continues to be robust, with applications received that span across a diverse range of business sectors and development stages such as gas, water, energy storage, transportation, generation, power electronics, building technology and infrastructure. To date, the Energy Foundry has made investments in the following companies:

Investments during Q4:

- EDCS Power: They are a DC-based Uninterruptible Power System (UPS) technology that provides the missing link to convert data centers to DC power, and

creates a path to commercializing DC microgrids and direct integration of renewables.

Prior active investments:

- ***Root 3:*** An integrated software decision tool to help Central Utility Plants with $1M - $10M in energy spend optimize their decision-making, enabling them to meet energy demands with the lowest fuel and capital spend. They have a development path that includes smart controls and integrated demand response.
- ***Intellihot***: A tankless water heater that targets the commercial market (i.e., hotels, restaurants, etc.). Achieves savings in energy and installation costs, while enhancing reliability. They have a development path that includes combined heat and power.
- ***SiNode***: An early stage advanced materials company developing the next generation of lithium-ion batteries, with a core focus on silicon-graphene anode technology.
- ***GlidePath***: Developing next-generation power resources, including grid-scale energy storage, using cutting-edge technologies and strategies.

CSMART Laboratory at IIT

Built with the support of IIT, ComEd, Silver Spring Networks and West Monroe Partners, CSMART is one of the first of its kind to bring together academic, industry and utility

experts to provide a fully-functional test environment for smart grid and smart city technology.

CSMART provides the platform to conduct a wide range of smart grid and smart city R&D analysis projects. Some of the initial state-of-the-art demos include:

- Smart street lights operational testing – Intelligent and adaptive networked street lights can reduce operating and maintenance and energy costs by 75 percent through LED lights that are controlled and connected by a network. The software helps provide scheduling, remote on/off and dimming features as well as outage detection notification for faster repairs to ensure the safety of citizens and the community. Smart street lighting networks can also establish a platform upon which additional smart city applications can be deployed.
- Street Light Smart Applications - Exploring and developing an application integrating the campus 911 emergency call buttons with the smart streetlights that enables control of streetlights based on activation of 911 call button. The key research component is how to intelligently and precisely correlate the streetlights with an external information source.
- Cyber-security Evaluation of the IIT Smart Streetlight Project - Conducting a complete cyber-security evaluation of the prototype system currently installed in the CSMART lab to discover potential vulnerabilities in the smart streetlight system, and investigating means to eliminate or mitigate them.

- Distributed Energy Resource Management – ConnecttheGrid™ – cloud-based application that provides work-flow management and an online dashboard for utilities to manage distributed generation application approvals, including roof top solar, as well as providing asset tracking, reporting and forecasting.
- Data analytics and real time interactive dashboard - smart-grid communications networks are used to monitor operations and collect data from throughout IIT's electric microgrid in order to optimize electrical efficiency of the system and predict faults prior to their occurrence.
- (GRIDCO) "Advanced Distribution Automation: In-Line Power Regulator (IPR)" – Initially testing and demonstrating two use cases that are relevant to the utility business: Conservation Voltage Reduction (CVR) and detection of technical and non-technical losses. If tests are successful, this will demonstrate not only the Gridco Systems product but also the concept of distributed local control for the distribution grid using Smart Meters and Bridges on the Silver Spring communications network. Other applications include distributed power factor control and distributed harmonic mitigation, which will be tested in later phases of the project.

SmartGridExchange™

The mission of the SmartGridExchange™ is to seek out, foster, and execute pilots and innovative products and relationships. Through the SmartGridExchange™, ComEd is starting the process of co-designing the future of electricity with companies interested in developing smart grid-enabled products and services. These include enabling third parties to develop new products and services that leverage the smart grid investments ComEd is already making; working with select developers who bring demonstrated value to customers; and giving our customers a convenient portal from which they can learn about new and developing energy products and services.

Programs and technology demonstrations already underway through the SmartGridExchange™ include the following:

- Through ongoing ideation sessions, the SmartGridExchange™ has already become the birthplace of multiple new technology demonstrations, such as Smart Meter Connected Devices, Bidgely, Nest Learning Thermostat™, and Root3 described in the Current Demonstration Projects section above.
- ComEd, in partnership with Silver Spring Networks (NYSE: SSNI) and Accenture, hosted its SmartGridExchange™ Forum, bringing together leading technology and innovation companies, including Oracle, Nest Labs, Home Depot, GE Energy, and the Energy Foundry, with other customer and stakeholder organizations, including

the City of Chicago, Citizens Utility Board and Smart Grid Consumer Collaborative, to discuss how to leverage the smart grid to deliver increased value to consumers.

- Student Innovation Contest – In May (2014), ComEd launched its new "Student Innovation Contest", which tasks college students with creating innovative smart meter related products, services or software apps that will help empower low-income customers to use their home's smart meter to manage their electric bill and save energy. Forty four (44) student and teams entered, and the top five formally presented their ideas to a panel of industry experts in October for a share of $10,000.

EPRI Smart Thermostats Collaboration

Advances in technology have led to the development of a new generation of programmable communicating thermostats that hold the potential for energy and demand savings at a relatively low cost to electric and gas utility customers.

Known as "smart thermostats", these control devices for space conditioning systems have capabilities beyond just allowing the customer to program temperatures for different times of the day and days of the week. They allow customers to remotely

program their thermostat, often via internet-enabled devices (such as a PC or mobile device) with a consumer-friendly user interface. They enable two-way communication of data outside the building premises (either built-in or expandable), including indoor temperature data, operational sequence of space conditioning equipment and so on. They can also be adapted to receive demand response event signals from utilities.

Industry experience has shown that customer acceptance and usability can be key drivers to a thermostat's energy or demand reduction potential. Given that smart thermostats may offer better customer usability due to their remote programming capability, the objective of this project is to evaluate their energy and demand savings impacts, as well as how customers perceive and use them.

In 2014, Exelon Utilities joined the Electric Power Research Institute's (EPRI) Evaluating Smart Thermostats' Impact on Energy Efficiency and Demand Response project which is being executed under EPRI's program 182, Understanding Electric Utility Customer. Presently, ComEd has a two thermostat pilot underway and joining the EPRI effort will provide the opportunity to not only share the learnings from our own pilots, but to learn from the pilots that are being conducted by nine other utilities participating in this project. Additionally, EPRI will serve as a third party for evaluation, measurement and verification (EM&V) of each member pilot's ability to achieve established objectives. New learnings for the industry and the public will come about through collaboration and conducting pilot projects to evaluate the capabilities of various vendors and technology.