Smart Grid Advanced Metering Annual Implementation Progress Report

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ComEd
An Exelon Company

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I. Introduction and Overview

Commonwealth Edison Company ("ComEd") presents this Annual Implementation Progress Report ("Report" or "AIPR") of its Smart Grid Advanced Metering Infrastructure ("AMI") Deployment Plan ("AMI Plan" or "Plan") to the Illinois Commerce Commission ("Commission" or "ICC"). ComEd's original proposed AMI Plan was filed on April 23, 2012 in ICC Docket No. 12-0298. The Commission entered an Order approving ComEd's AMI Plan with certain modifications on June 22, 2012 in ICC Docket No. 12-0298 ("June 2012 Order"). ComEd filed a modified AMI Plan in compliance with the June 2012 Order in ICC Docket No. 12-0298 on July 13, 2012 ("Modified AMI Plan"). On October 3, 2012, ComEd submitted a revised Modified AMI Plan on rehearing in ICC Docket No. 12-0298 ("Revised AMI Plan"). The Revised AMI Plan was approved by the Commission in its Order on Rehearing in ICC Docket No. 12-0298 dated December 5, 2012 ("December 2012 Order"). On April 1, 2013, ComEd submitted the 2013 AIPR, which included certain updates to the Revised AMI Plan ("2013 Revised AMI Plan"). On April 9, 2013, the ICC opened ICC Docket No. 13-0285 to investigate the 2013 AIPR. After the passage of PA 98-0015, the ICC entered an Interim Order on June 5, 2013 approving an accelerated deployment schedule in conformance with the new law. The 2013 AIPR was approved in the final Order entered on June 26, 2013 in ICC Docket No. 13-0285 ("2013 AIPR Order").

On March 13, 2014, ComEd filed a petition with the Commission seeking approval to accelerate the deployment of AMI meters (throughout this document, the terms "AMI meters" and "smart meters" will be used interchangeably) that was assigned ICC Docket No. 14-0212. The Commission, on its own motion, reopened Docket Nos. 12-0298 and 13-0285 and consolidated those dockets with the acceleration petition as ICC Docket Nos. 14-0212, 13-0285, 12-0298 (Cons.) ("Deployment Acceleration Proceeding"). On April 1, 2014, ComEd submitted the 2014 AIPR, including updates to the 2013 Revised AMI Plan to reflect the incremental updates to be made if the Commission approved the proposed accelerated meter deployment schedule in the Deployment Acceleration Proceeding. The Commission approved the proposed accelerated deployment schedule in its final Order dated June 11, 2014, in Docket Nos. 14-0212, 13-0285, 12-0298 (cons.), and required certain modifications to the updated 2013 Revised AMI Plan to reflect that ComEd's consumer education budget will be maintained and that ComEd will devote the same level of resources for education and outreach that it had planned under the acceleration schedule approved in Docket No. 13-0285. On July 2, 2014, in compliance with the Commission's June 11, 2014 final Order, ComEd filed a Revised AMI Plan ("2014 Revised AMI Plan") reflecting the changes approved and required by the Commission in the Deployment Acceleration Proceeding.

On April 1, 2015, ComEd submitted the 2015 AIPR, with updates to the 2014 Revised AMI Plan ("2015 Revised AMI Plan"). These updates presented a change to the operational tracking measure for customers with net metering and updated the AMI Deployment Schedule to reflect actual deployments to date (above planned deployment levels). The 2015 Revised AMI Plan was deemed accepted by the Commission by operation of law when an investigation of the 2015 AIPR was not commenced within 21 days of its filing.[1] On April 1, 2016, ComEd submitted the 2016 AIPR, with updates to the 2015 Revised AMI Plan ("2016 Revised AMI Plan"). These updates presented changes to the AMI Deployment Schedule to reflect actual deployments in 2015 (above planned deployment levels) and to update the estimated program costs. On April 20, 2016, ComEd

submitted a supplemental filing, as indicated in the 2016 Revised AMI Plan, reflecting the results for updated Metric #9 regarding Green House Gas ("GHG") emissions. The 2015 Revised AMI Plan was deemed accepted by the Commission by operation of law when an investigation of the 2016 AIPR was not commenced within 21 days of its filing. On April 3, 2017, ComEd submitted the 2017 AIPR, with updates to the 2016 Revised AMI Plan ("2016 Revised AMI Plan"). These updates presented changes to the AMI Deployment Schedule to reflect actual deployments in 2016 (above planned deployment levels) and to update the estimated program costs. On April 20, 2017, ComEd submitted a supplemental filing, as indicated in the 2016 Revised AMI Plan, reflecting the results for updated Metric #9 regarding Green House Gas ("GHG") emissions. The 2016 Revised AMI Plan was deemed accepted by the Commission by operation of law when an investigation of the 2017 AIPR was not commenced within 21 days of its filing.

This Report summarizes the activities and achievements accomplished in 2017 and the activities and goals planned for 2018 in the areas of AMI Operational Deployment, Customer Applications, Customer Outreach and Education, and Metrics and Milestones.[2] There are six numerical attachments to this Report that are referenced in the Metrics and Milestones section. Additionally, there are four appendices to this Report. Appendix A addresses issues and topics beyond those specified for inclusion in this Report by Section 16-108.6(e) of the Public Utilities Act ("PUA"),[3] that the Commission originally directed ComEd to submit with its 2013 AIPR, and that ComEd has voluntarily chosen to update in this AIPR for informational purposes only. Appendix B is the sixth Biannual Report required by ComEd's Rider NAM – Non-AMI Metering ("Rider NAM"). Appendices C and D contain updates to the 2017 Revised AMI Plan in legislative "redline" and "clean" forms, respectively, to reflect the upward adjustment to the AMI meter deployment volume for 2017, and corresponding downward adjustments to the deployment volumes planned for 2018 and 2019. Appendices C and D also contains small adjustments to the overall number of AMI Meters to be deployed and adjustments to Capital and O&M spend.

Operational Deployment

In 2017, the AMI team completed a number of operational objectives, including: (1) the successful installations of AMI meters in rural areas ; (2) successfully installing meters based on the updated meter deployment schedule presented in the 2017 AMI plan; (3) building on the progress made in previous years with an increase the realization of business case benefits due to new functionality delivery, enhanced systems, and an increase in AMI meters deployed throughout the service territory; (4) improvements in the areas of reliability, outage management, field and back office operations, customer programs and the overall customer experience; (5) enabling significant customer and operational benefits, which are driven by the automation and enhanced functionality of remote connect and disconnect, data analytics solutions, and a system-wide improvement of read rates.; and (6) delivering a premiere customer experience as shown by the J.D. Power customer satisfaction index score improving throughout 2017. In 2018, the AMI team plans to complete mass meter deployment of AMI meters (approximately 330,000) and will continue ramping down resources and deployment volumes. This work will be done while focusing on safety, quality and driving for a premier customer experience. ComEd will continue to focus on identifying new opportunities for employees including additional Career Fairs, active communication of opportunities, and the availability of management to advise these employees during their career transition.

Customer Applications

In 2017, the AMI team accomplished a number of Customer Applications goals, including: (1) successfully completing the third year of the Peak Time Savings program; (2) continuing to launch or enable programs and services under the "SmartGridExchange℠", such as integrating If This Then That ("IFTTT"), a free Internet of Things service that controls connected home devices through customizable applets, into the Peak Time Savings and Hourly Pricing Programs; (3) the continuation of using the Emerging Technology program that evaluates energy efficient concepts such as the energy disaggregation pilot; and (4) the continued collaboration with the Illinois Energy Foundry, a nonprofit venture fund fostering the development of innovative smart grid-related businesses in Illinois.

In 2018, ComEd plans to further build on its SmartGridExchange℠ progress by pursuing ways to expand successful 2017 initiatives to bring the benefits of AMI to even more customers, such as implementing an online widget for customers to view graphs of their net metering information. ComEd will also pursue ways to expand on the successes of the Peak Time Savings program. Finally, in 2018, ComEd will expand Data Services by promoting the availability of the Green Button Connect functionality to customers with Smart Meters and work with Third Parties to expand the portfolio of offerings that provide better insights and value to our customers.

Customer Outreach and Education

In 2017, the AMI team accomplished a number of goals related to the development of Customer Outreach and Education programs, including: (1) attending and scheduling local events to distribute information and educate customers about the benefits of smart meters; (2) on-going staged-messaging communications to educate customers throughout the deployment process; and (3) offering education programs customized to fit specific customer segments as identified by demographic data. The outreach and education efforts planned for 2018 include: (1) continuing focus on general education to provide customers with information on the use and benefits of smart meters; (2) continuing the use of messaging to educate customers about energy-saving tips and energy efficiency programs; (3) continuing research to enhance customer outreach efforts and messaging; (4) on-going staged-messaging communications to customers throughout the AMI deployment process; and (5) on-going customization of education programs that are tailored to specific customer segments.

Consultation with Smart Grid Advisory Council ("SGAC")

As required by Section 16-108.6(e) of the PUA, 220 ILCS 5/16-108.6(e), ComEd consulted with the SGAC regarding this AIPR. ComEd provided a complete draft of the AIPR to the SGAC in advance of its March 20, 2017 meeting. ComEd also made a presentation on its AIPR at that meeting, and personnel were present that were knowledgeable on each relevant subject.

AMI Plan Revisions

The revisions to implement the updates to the 2017 Revised AMI Plan as discussed above are contained in Appendices C and D. The updates to the deployment volumes for 2017, 2018, and 2019, along with the updates to the program costs, are discussed above and explained in greater detail in Chapter 2 of this AIPR.

II. AMI Operational Deployment

A. 2017 Activities and Accomplishments

2017 was another very successful year for the AMI Program that included the expansion of deployment to new areas across the service territory and the enhancement and optimization of field and back tools and technologies to drive greater customer engagement and benefit realization. Throughout the year ComEd installed 789,307 AMI meters in a safe and quality fashion across an expanded territory that included city, suburban, and rural geographies. The team also completed the core AMI network design and deployment activities for AMI network devices throughout the territory, which was a significant milestone.

A focus area for the AMI team was planning and executing the steady ramp-down of deployment volume and overall activity across the program. This included pro-active resource management to ensure that AMI personnel are aware of opportunities for assignments that may become available. ComEd leadership's strong commitment to this element of the program drives positive employee engagement and a culture of collaboration and transparency, allowing the AMI Program to balance the needs of our employees with the desire to finish well.

As the program nears completion, AMI is solidified as a value-adding technology platform for ComEd's operations and customers. It has enabled the delivery of enhanced communication and operating capabilities, innovative customer programs, and an enhanced energy marketplace that benefit customers across the service territory, while streamlining internal operations.

The AMI Program provides economic benefits to the Illinois economy in several ways. A diverse range of jobs have been created and maintained in the field and back office, including positions for meter and network device installers, Cross Dock personnel, electricians, supervisors, project managers, IT analysts, engineers, and customer service professionals. The program also provides ComEd employees with skills, training, and technology knowledge and understanding that will benefit them in their ongoing professional development. Additionally, the supporting ecosystem of service professionals and materials manufacturers have experienced growth and development from their ongoing partnership with ComEd during the AMI Program.

The Program continues to drive the realization of benefits to ComEd and customers and enabling broad customer adoption of AMI-enabled programs such as Peak Time Savings. There are also improvements in the areas of reliability, outage management, field and back office operations, customer programs and the overall customer experience – all enabled by the AMI technologies. Details of these improvements are outlined later in this report.

ComEd continued to deliver a premiere customer experience in 2017 as reflected in J.D. Power customer satisfaction index score, which has continued to improve. The improvement of satisfaction scores across all categories demonstrates the impact of the AMI program in enhancing the overall relationship and level of engagement between customers and ComEd, including enabling safer power and more efficient responses to outage events.

The sections below contain the highlights and details of the AMI program activities in 2017. Included in these sections are Program costs (Capital and O&M) and accomplishments. This includes accomplishments that were made by all of the groups that comprise the AMI program including; AMI Network and Meter Deployment, Customer Experience, AMI Operations, AMI Information Technology ("IT"), and Change Management. The results for specific metrics and milestones can be found in Chapter 5 of this report.

Figure 1 Meter Installation

1. Project Management Office (PMO)

The PMO function focuses on scope, schedule, and budget management along with providing overall guidance, planning, oversight, and identification and mitigation of risks and issues. Ongoing deployment tracking and reporting also remain a focus of the PMO, and has become increasingly important during the later stages of the AMI deployment to ensure successful ramp-down of the Program. This element of planning and management included the creation and execution of resource management plans that have integrated valuable and experienced field and back office resources from the AMI Program into other ComEd departments and functional areas.

The Program remained under budget through a dedicated focus on financial scrutiny of spend across all AMI work streams. This diligent operating culture extended to the centralized management of field and back office contractors, both in terms of the safety and quality of the work performed, and the overall performance compared to contractual commitments and expectations. Frequent reviews and field visits were conducted throughout the year, and results were shared collaboratively with the contracting partners to drive continuous improvement.

In 2017, ComEd continued relationships with a diverse group of vendors for various functions within the AMI Program. These vendors include rewarding and mutually beneficial partnerships with certified Minority-Business Enterprises ("MBEs") and Women-Business

Enterprises ("WBEs"). As noted in the table below, consistent with the planned ramp-down of field resources, there was a decrease in the total number of contractor resources in these areas.

Contractor Name	Services Provided to ComEd in 2016	2017 Headcount[1]
HBK Engineering	Network design	1
KDM Engineering	Network design	1
PMI Energy Solutions	Network installation and AMI Pole Cuts	10
Corix Utilities	Meter installation	52
MZI	A-Base style meter housing upgrades and meter installation	18
Quantum Crossings	Electrician repairs to customer meter-related equipment	6
Durkin Electric/ B-3 Integrated	Electrician repairs to customer meter-related equipment	7
Loescher	Electrician repairs to customer meter-related equipment	4
LiveWire	Electrician repairs to customer meter-related equipment	7
Intren	Frost Loop repairs (detailed below) and AMI Pole Cuts	2
Total		108

The AMI Network Governance Committee continues to manage the established process to evaluate potential programs and services that would potentially leverage the AMI network for wireless communications and transactions in addition to the core functions identified in the initial scope of the AMI Program. Cross-functional working sessions with a group of subject matter experts are facilitated by the PMO and continue to provide important insights for ComEd relating to the future-state vision of the foundational AMI platform. As the program ramps down and the AMI footprint continues to grow, the responsibility for Network Governance has shifted from the

[1] Values rounded to nearest whole number based on average headcount over the 12-month period.

PMO to the AMI Operations team. This is aligned with the post-program, steady-state of operations for ComEd.

2. AMI Network and Meter Deployment

The AMI deployment team safely and efficiently installed 789,307 meters, exceeding the planned total of 722,900 meters. This marks the fifth consecutive year that the program has exceeded the planned target, while also remaining under budget and demonstrating continued high-performance in safety and quality. The team also effectively planned and executed the design, planning, and device installation of the AMI network, which is required to enable two-way communication between the installed AMI meters and the back office.

Network Deployment

The completion of the core AMI network design and deployment activities was a significant 2017 program milestone. This included completion of field surveys and engineering designs for several new geographical deployment areas in advance of the launch of meter deployment. The surveys and designs set the foundation for the installation of SSN Access Points and Relays to support the expanding AMI footprint, optimize communications levels, and remediate any issues or gaps that were noted in previously deployed areas. In 2017, ComEd and contracted partners installed 36 AMI Access Points and 54 Relays. While core deployment activities were completed and network optimization did take place in some areas, more wide-ranging optimization of the network will take place once full meter deployment is completed in each operating area.

The team continues to monitor the real-time performance of the high-rise communication solution that was successfully planned and deployed in prior years, specifically in the Chicago Loop area. The combination of near-real-time network monitoring and advanced analytics solutions were leveraged to pro-actively address communication performance gaps. The result is a robust and reliable communications network within what was initially assessed to be an operationally challenging area, which is a significant success story.

The table below outlines the network design and installation activities that were completed in 2017.

Table 1: Operating Area Network Design and Installation Progress

Operating Area	Network Design	Network Installation	# of Access Points Installed[2]	# of Relays Installed
Maywood	Complete	Complete	23 of 23	80 of 80
Chicago South	Complete	Complete	135 of 135	75 of 75
Glenbard	Complete	Complete	51 of 51	123 of 123
Mt. Prospect	Complete	Complete	21 of 21	54 of 54
Chicago North	Complete	Complete	175 of 175	20 of 20
Crestwood	Complete	Complete	57 of 57	56 of 56
Skokie	Complete	Complete	38 of 38	68 of 68
Rockford	Complete	Complete	41 of 41	151 of 151
Libertyville	Complete	Complete	58 of 58	163 of 163
University Park	Complete	Complete	60 of 60	396 of 396
Bolingbrook	Complete	Complete	29 of 29	34 of 34
Elgin	Complete	Complete	30 of 30	24 of 24
Aurora	Complete	Complete	31 of 31	64 of 64
Joliet	Complete	Complete	45 of 45	183 of 183
Freeport	Complete	Complete	46 of 46	151 of 151
Crystal Lake	Complete	Complete	29 of 29	113 of 113
Dixon	Complete	Complete	61 of 61	332 of 332
DeKalb	Complete	Complete	15 of 15	116 of 116
Streator	Complete	Complete	25 of 25	133 of 133
Chicago Loop	Complete	Complete	36 of 36	0 of 0
Total			1,006 of 1,006	2,336 of 2,336 [3]

[2] Additional Access Points and Relays may be installed or removed after Network Installation in an Operating Area is "complete" to optimize communications and remediate issues. The Access Point and Relay installation numbers in this table are accurate as of the end of 2017, representing the impacts of Optimization activities that take place after all devices and meters are installed to ensure proper connectivity levels, and remediation activities to ensure communication to difficult-to-reach-meters from an RF perspective. These adjustments will continue through the project and can result in increases and decreases in the devices volumes as the AMI team refines and adapts the network to be both robust while also cost effective.

[3] Values in this table reflect the number of devices in the field as of the end of 2017 and include adjustments to planned and actual installations noted in prior reports.

Meter Deployment

The AMI Program successfully deployed meters across an expanded territory in 2017 by leveraging two deployment models that were designed specifically for the areas in which deployment was taking place. The Rural Blitz model was designed and executed to improve efficiency in areas where there was a relatively low concentration of meters and customer premises by avoiding long daily drive times and an extended period of deployment presence in those areas. This approach was leveraged in the Dixon, Freeport, and Streator Operating Areas in 2017.

The team leveraged this model to concentrate a high number of meter installers and supervisors for a relatively short period of time until all the meters in that area were deployed. Customers in these rural areas expressed appreciation for the timely manner in which these meters were installed and the presence of meter installers resulted in a boost to local economies in those areas through incremental ComEd spend on transportation, lodging, and meals for the workforce. The installations in these areas were completed safely and efficiently, further highlighting the effectiveness of ComEd's flexible workforce and innovative management team.

The majority of AMI installations in 2017 were completed using the traditional Cross Dock model that has proven successful since the beginning of the program. This modular approach again provided the structure and consistency required to safely and efficiently complete work at a very high volume. The total number of meters installed in 2017 was 789,307, which exceeded a target of 722,900 by 66,407 exchanges (9% favorable to plan).

ComEd installed AMI meters in all 19 of ComEd's operating areas in 2017, leveraging best practices and process improvements noted in previous years and through a focus on continuous improvement. The majority of exchanges were completed by the core AMI Deployment team, consisting of dedicated meter installers, supervisors, and contractors distributed across 12 of the 19 operating areas (Chicago North, Bolingbrook, Aurora, Libertyville, University Park, Elgin, Joliet, Crystal Lake, Dixon, Rockford, Freeport, and Streator).

The partnership between ComEd and Union Local 15 ("Union") remained strong and has become a model for a mutually beneficial working relationship between ComEd and the Union that can be used for future partnerships that drive value to customers and the local economy.

In 2017, ComEd F&MS (Field and Metering Services) completed over 36,000 AMI meter installations as part of the periodic exchange program and other field visits to customer locations where an AMI meter had not yet been installed. This approach continued to prove effective in driving efficiency and removing the need to visit a customer premise again in the future to install an AMI meter.

As the service territory now approaches a fully-deployed state, Corix Utilities has completed its meter installation scope of work. The Corix team installed over 167,000 meters in 2017 and over 1 million during the course of the program. While Corix is done installing meters for ComEd, it is expected that they will continue to provide project support services, such as route planning in 2018.

Another strong partner in the program, the MZI Group, continued to complete meter exchanges in 2017 for A-Base locations and other complex exchanges following the completion of electrician repairs. These organizations have effectively supplemented ComEd labor by providing a stable workforce for the program and providing services that ComEd is not staffed to perform. To ensure consistency across the combined Meter Deployment team, the organizations followed ComEd-approved processes, procedures, staffing structure, and material tracking protocols.

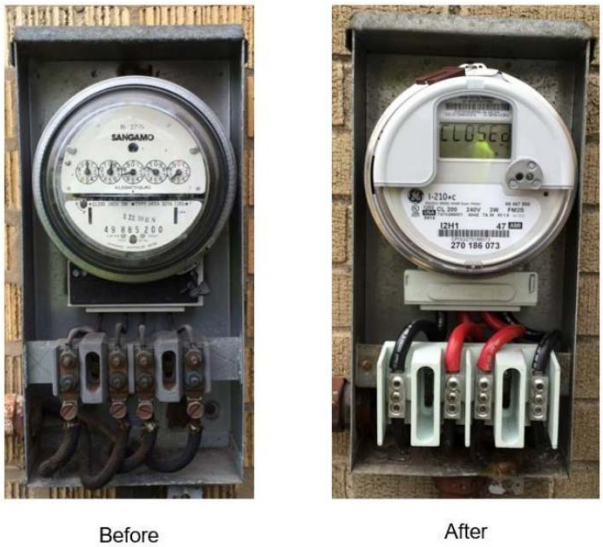


Figure 3 – A-Base Exchange: Before and After

As in prior years, exceeding productivity targets was the primary driver for achieving higher-than-planned completions in 2017. These results are continued validation of pro-active management and supervision, and an operating culture focused on safety, efficiency, accountability, and continuous improvement. The team was once again active in sharing lessons learned from the field that are applicable to the installation work force through a variety of channels, such as morning 'tailgate' sessions, program status updates, safety briefings, re-fresh training, and 'all-hands' meetings with exposure to Senior Management. Additionally, due to limited turnover and strong commitment from Local 15, many of the meter installers now have several years of experience to apply to their work each day, resulting in improved performance.

The Deployment Planning Team also worked pro-actively to improve the process of planning and dispatching work to field resources. This included re-examining assumptions related to the selection and prioritization of installation routes, identifying ways to minimize inefficient 'drive time' by installers, and engaging directly with field supervisors to incorporate opportunities

to improve from a back-office perspective. The improvements in the field and back office were particularly valuable in 2017 due to the expanding footprint of deployment into areas where completion volume and overall productivity was expected to drop significantly due to logistical and geographic challenges. Through effective partnerships, the team was able to overcome these challenges and again exceed expectations.

The total number of AMI meters deployed via the AMI Program, including the AMI Pilot, in the ComEd service territory is 3.8 million as of December 31, 2017. This remains significantly ahead of previously established targets. The table below provides additional detail.

Year	Meters Deployed	Operating Center(s)
Pilot	127,857	Maywood
2013	70,882	Maywood
2014	540,744	Maywood, Chicago South, Glenbard, Mount Prospect, Chicago North
2015	1,077,758	Maywood, Chicago South, Glenbard, Mount Prospect, Chicago North, Crestwood, Skokie, Rockford
2016	1,165,742	Mount Prospect, Chicago North, Crestwood, Skokie, Libertyville, University Park, Elgin, Rockford, Aurora, Bolingbrook
2017	789,307	Chicago North, Bolingbrook, Aurora, Libertyville, University Park, Elgin, Joliet, Crystal Lake, Dixon, Rockford, Freeport, Streator
2018	330,850	University Park, Joliet, Crystal Lake, DeKalb, Rockford
2019	17,000	Planned clean-up and Rider NAM exchanges
TOTAL	4,120,140	Projected AMI Program Total
Projected New Business Installs	85,810	ALL
Current Meter Population	4,205,950	Updated Total System Meter Population

Operating Area Close-out and Unable to Complete (UTC) Orders

The Operating Area Close-out Team was mobilized in 2017 to drive the completion of meter exchanges in areas where full-deployment activities have been completed, including an initial focus on Chicago, Maywood, Glenbard, and Crestwood. This team consists of field and back office resources that focus on completing UTC work resulting from access issues or other operational challenges that have led to a scattered population of non-AMI meters. Based on lessons learned from similar deployments across the country, this team was launched in parallel to full-deployment to avoid having a large and challenging back-log of work remaining in 2018-2019 with reduced staff on-hand for resolution.

The team leveraged several focused tactics, including detailed account reviews to ascertain property ownership and customer of record contact information, increased flexibility in setting appointments, and leveraging the manual meter reading activities and other unrelated ComEd field visits to these remaining non-AMI locations to obtain access and complete the meter exchange. In more challenging instances, the writ of replevin process was followed as an effective last resort. (Nearly 2,800 writs of replevin have been completed during the course of the Program, with nearly 80% of those being completed in 2017).

Once access is granted, specialized resources are often required to complete the exchange. If not managed properly, these factors and additional resource requirements can lead to reduced productivity and increased cost. Through experience and process improvement, the Operating Area Close-out Team has become proficient in dealing with these unique situations and their dedicated focus will continue.

Additionally, the broader deployment team leveraged a number of refined processes and methods to gain access to locations for a safe and efficient exchange of meters during the initial visit in areas where full deployment is active. This includes pro-active customer outreach and allowing flexible options for appointments. Customers that do not allow access to the ComEd-owned meter were entered into the Rider NAM process and had the associated fees applied to their account (~4,000 accounts are in this category as of the end of 2017). In 2017, there was a significant reduction in the inflow of UTC orders, particularly in November and December of 2017 when ComEd increased the dedication of field and back office resources to these order types, in alignment with the established plan.

The AMI Program has just over 8,000 unique UTC locations as of the end of 2017, which equates to a UTC rate of 0.24%. Over the course of 2017, the number of UTCs reduced by over 13,000, as a result of focusing on reducing UTC inflow and efficiently resolving UTC back-log via the tactics mentioned above and the formation of the Operating Area Close-out Team. The updated projection for remaining orders of this type that require resolution in 2019 has dropped significantly as a result of these efforts.

While the overall AMI Program team was very successful in completing deployment work ahead of schedule, sustained emphasis on “clean-up” work across the service territory will continue. This more challenging work generally occurs in areas which have a large number of meters that have been historically difficult to access and read manually by meter readers. It often

requires the use of additional back office resources to contact building owners and customers to gain access to the meter, in many cases via a scheduled appointment.

Program Ramp-down

In alignment with the planned ramp-down in deployment volume, the ComEd Deployment team remained focused on creating and managing a dynamic work plan and set of completion targets that matched the decreasing number of available meter installation resources. As discussed in previous versions of this report, keeping the planned completions at the peak levels reached in 2015 and 2016 would have resulted in a resource challenge with a large number of meter installers seeking new positions all at once. To more prudently plan for the effective transition of resources, ComEd developed a plan to align the AMI program ramp-down with the availability of alternative employment opportunities within the company, many of which are a direct result of the Grid Modernization investments made as part of the Energy Infrastructure Modernization Act (EIMA).

Throughout 2017, the managers frequently engaged with meter installers to encourage them to pursue opportunities for job training and to seek permanent placement in other growing organizations at ComEd. Mike McMahan, VP AMI Implementation, was quoted as repeatedly telling installers to, "Make it my problem" by finding another position prior to the program end. Frequent Job Fairs, one-on-one discussions with managers and supervisors, and other information exchanges were conducted throughout the year in support of this transition process. These activities have resulted in improved employee engagement and a transparent culture that has allowed meter installers to continue to enhance their professional development and expand their internal prospects, while also allowing the AMI program to successfully ramp-down.

City of Chicago Progress and Chicago Loop

Completion of meter deployment in the City of Chicago, including the Chicago Loop was another significant program accomplishment in 2017. While a very small volume of "clean-up" work is still being completed, ComEd has effectively planned and executed the installation of over 1.3 million meters within the City of Chicago (~31,000 in 2017), which is traditionally an operationally challenging area for the completion of field work. The benefits associated with completing the City of Chicago have been significant.

This includes the deployment of over 80,000 meters in the Chicago Loop (~500 in 2017), which as discussed in the 2017 AIPR, required a unique and innovative approach. The unique and award-winning solution provided premier customer service through timely, customized communication with customers and building managers, efficient and flexible design of the AMI mesh network solution, and unique logistical solutions to accommodate difficult-to-reach locations, and building infrastructure that is unique and often quite dated.

Automatic Meter Reading ("AMR") to AMI Meter Exchanges

As noted in the 2017 AIPR, the team began the conversion of over 5,300 AMR meters to AMI in 2016. These meters are read through phone line, Ethernet, or cellular connections, and leverage communications technology that is going to be retiring. Specific planning, training, and field deployment activities were completed in 2017 for all remaining AMR locations except for

those located at Supervisory Control and Data Acquisition (SCADA) at ComEd and customer-owned substations. The completion of these exchanges through an effort focused on minimizing customer impact represents a significant program milestone.

Supervisory Control and Data Acquisition (SCADA) Meter Exchanges

In 2017, the AMI team began the targeted, two-year deployment of AMI meters to certain interconnection sites and substations that serve generators or other PJM market participants. With this deployment, ComEd will effectively satisfy all of the various regulatory requirements for metering data at these unique connections. There are over 300 of these connections in 80 locations across the service territory.

The AMI meters are being installed in parallel along with the original [non-AMI] meters at these connections. The original meters are being retained to provide wholesale market settlement operations and supervisory control and data acquisition (SCADA) and to protect critical infrastructure in accordance with NERC CIP V5 and Exelon's security requirements.

Due to the fact that AMI meters are now required at all billable connections for ComEd retail billing and because the communication technology of the AMI meters is not allowed for SCADA or critical infrastructure protection, ComEd developed a solution of using a dual meter fitting panel to accommodate an AMI meter for retail operations and a SCADA meter for wholesale operations. This innovative approach is planned for completion at all connections by the end of 2018, with over 100 connections completed in 2017. Below is an example design illustration and an actual photograph of one of the locations completed in 2017.

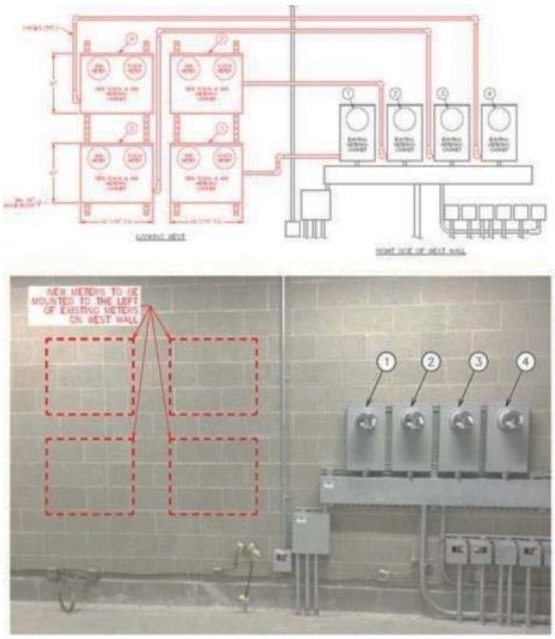
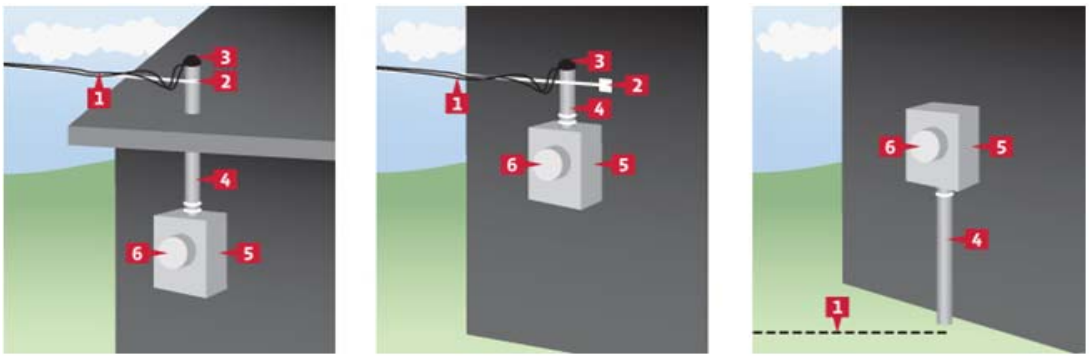


Figure 4 – SCADA Meter Installation Design

Repairs and Upgrades

The AMI deployment effort continues to make the ComEd service territory safer and more reliable through the completion of electrician repairs and upgrades. AMI meter installers are trained to identify degraded meter-related equipment during the course of the exchange process. If such a location is identified, the installer identifies the need for the services of an electrician to avoid a potential safety risk or future operational problems prior to completing the exchange of a new meter. The appropriate repairs are then completed, followed by the meter installation at no additional cost to that specific retail customer.



Item	Responsibility	Description
1	ComEd	Electrical Service Wire coming from ComEd's system (overhead or underground)
2	Customer	Attachment (the point where ComEd equipment attaches to customer property)
3	Customer	Weather Head and wire drip loop (the weather resistant entry point for customer wires going to the meter box)
4	Customer	Riser/Raceway (the conduit that physically protects wires going to the meter box)
5	Customer	Meter Enclosure/Box (contains and safely secures the electric meter)
6	ComEd	Meter (measures the amount of electricity used by the customer)

Figure 5 – Socket-style meter Ownership and Responsibility

Socket repairs and frost loop repairs were again the two most common types of repairs completed by the contracted electricians. Additional details on the types and quantities of repairs completed in 2017 are contained in the table below.

Table 3: Electrician Repair Details

Type of Repair	Description	# of Repairs Completed
Repair / Refurbish	Modification of meter housing, cleaning of meter base jaws, rebuilding of meter block, modification of fitting cover	3,883
Replacement	Changing of jaws, block, fitting cover, fitting, riser	7,818

Damage from Tampering	Bypassing, diversion of power with insertion of jumper wires or objects in fitting, wire connected directly into house, line side tap	144
Other	Other repairs to jaws, riser pipe, loose wires, loose jumpers, etc.	578
Total Socket Repairs		12,423
Frost Loop	A frost loop refers to the operating condition of insufficient slack in the entrance wires to the electric service that connects to a meter [4]	6,529

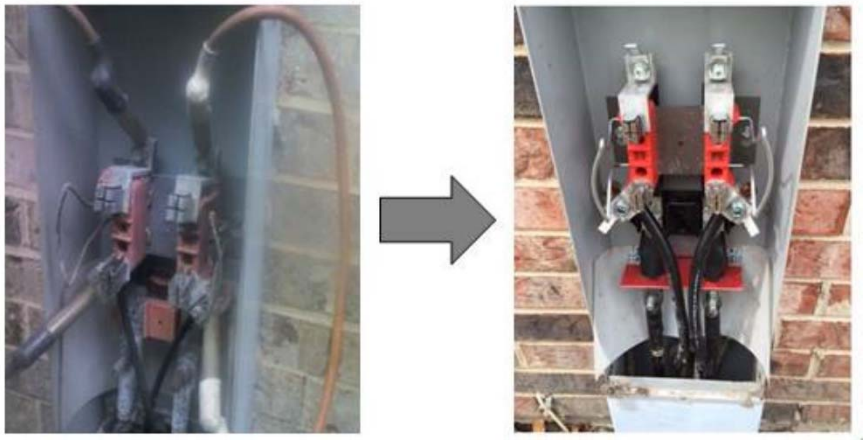


Figure 6 -- Electrician Repair 'Before and After'

The AMI Program has provided ComEd with a unique opportunity to visit every customer premise in a relatively short period of time. The team has taken pride in the fact that the opportunity was leveraged to prudently enhance the safety and operating conditions of customer equipment as the AMI technology is deployed in parallel.

In the case of Frost Loop Repairs, ComEd has developed an innovative solution. Previously these repairs and adjustments to the cable and splice material were timely, costly, and required digging in the customer's yard that typically required landscape restoration. Additionally,

[4] The approaches to addressing this situation are to either splice new wire to the existing entrance wire or extend the buss connection on the entrance meter block

using this 'splicing' approach can introduce a new point of failure if it is not completed properly. Through a process of re-engineering, ComEd developed a solution leveraging a "Buss Extender' product that is now a UL-listed product. This innovation reduces the overall cost of these repairs by ~80% and can be completed in 30 minutes or less, as opposed to the 6+ hours required for the previous method. The customer disruption is also minimal, as there is no longer a need to dig a hole in the yard or break-down patios or other embedded structures. Lastly, the added risk of a new failure point is eliminated.

Figure 7 – Frost Loop Repair Prior Practice: Dig and Cable Splice

Safety

Safety remained a core component of the AMI Program operating culture in 2017, in alignment with ComEd's strong reputation in this area. The Program had another successful year via a focus on safety training, communications and lessons learned, and a reinforcement of the core safety principles for field and back office employees. Daily operational calls with AMI team employees and contractors were used to create a transparent safety environment to communicate openly, drive accountability, and address and resolve any issues or potential trends immediately. As in prior years, field "Safety Blitz" reviews were performed by management throughout the year to assess the performance of the team based on the established safety protocols.

The AMI team (labor and management) continues to participate in Safety Council meetings on a monthly basis at each ComEd Cross Dock. These sessions serve as an open forum for the discussion of safety topics and to share ideas for improvement going forward. This ongoing commitment to transparency has led to employees being invested in the safety culture and continually striving to improve the work environment.

The AMI team continued to execute the Behavior and Prevention Process ("BAPP") Driving initiative due the significant amount of drive-time required of meter installers. The BAPP initiative is used to educate drivers by addressing at-risk behaviors through peer-to-peer

observations. Observations are performed by trained BAPP personnel on a bi-monthly basis and the findings are shared with meter installers, along with opportunities for improvements.

In 2017 the project team experienced seven Occupational Safety and Health Administration ("OSHA") recordable incidents. Six of these involved ComEd resources, none of which led to lost days of work. One involved a contracted electrician, which did lead to lost days of work. ComEd continues to be recognized as an industry leader in safety thanks in part to the contributions of the AMI Team.

ComEd's quality control reviews for the meter installation process continued to prove valuable in 2017 as the team completed over 69,000 individual audits of meters, which represented over ~9% of all installations during that period. These installations were assessed to check for alignment with quality and safety guidelines. The results of the audits showed that meters were exchanged in a high-quality and safe fashion, with less than 1.8% of meters deviating from the process. These audits demonstrate ComEd's continued commitment to quality assurance as the Program ramps down.

Meter Deployment Work Planning

The majority of the remaining non-AMI meters in the service territory were located in new geographic areas, specifically suburban and rural communities, which added a new layer of complexity to the work planning. The operating conditions in these areas required the planning function to adjust productivity and work planning assumptions to avoid a significant dip in installation efficiency due primarily to longer drive times. The planning team also had to account for the movement of installation resources across the service territory in alignment with new Cross Dock locations required to reach these areas.

As noted previously in this report, the team also had to account for the planned ramp-down of resources and overall deployment capacity for the first time in 2017. The initial plan called for the installation of 722,900 during the year which represented a reduction of nearly 443,000 from the prior year. Working closely with the field supervisors, the team had to account for the resource ramp-down and position the installers for safe and efficient work plans in these more logistically challenging locations. The 2017 plan was executed very effectively, as the planned target for completions was exceeded by over 9%.

AMI Operations

As more meters are deployed, the scope of the AMI Operations function continues to grow. In parallel to the increase in volume of meters, the team continued to enhance the supporting tools, technologies, and processes that they leverage to effectively manage this increasing component of the ComEd operating system.

The most significant accomplishment from the AMI Operations team in 2017 was reaching a new high-point for the read rate of AMI meters. As of December 31, 2017, the YTD system read rate (including AMI and non-AMI, manually read meters) was 99.41%, which is the best

performance on record for this key performance indicator with many positive downstream impacts. This result was achieved by establishing and empowering a dedicated team to the remediation of RF communication challenges across the territory, shifting from reactive to proactive meter analysis, leveraging enhanced analytics tools to automatically, create and process service orders to resolve issues that require a field visit, and collaborating closely and effectively with departments across ComEd that can contribute to the improvement of this metric.

This performance level has significantly reduced the number of estimated bills (reduced from 12.1 million in 2010 to 124K in 2017) and delayed bills (over 80% reduction since 2010 -- from pre-AMI level of 0.99% to 0.18%) to customers, while also serving as a clear indication of the overall health, stability, and reliability of the AMI network. Support of outage management activities (meter "pinging" and "last gasps") along with the ability to perform remote commands and capture key data from the meter for operational awareness and pro-active analytics-driven improvements are also greatly enhanced. These continuous improvements also enable customers to reliably view interval level usage (load profiles) online, while allowing ComEd to investigate more rigorous "Interval Success Rate" (ISR) metrics for measuring AMI system/meter performance, raising the bar for internal and external service levels.

The AMI Operations team continues to focus on leveraging data analytics tools and AMI functionality to monitor meter temperatures to ensure safety. High temperatures are caused by defective customer-owned meter equipment, including loose jaws, broken blocks and high resistant lug connections. As a result of detailed root cause analysis and testing, high temperature findings have never been deemed to have been caused by ComEd's UL certified and safety-tested smart meters. ComEd is proud to offer high temperature detection as an additional service for its customers.

This pro-active monitoring includes a two-pronged approach, the first of which is completing monitoring scans that leverage an algorithm on a data set of meter temperature, ambient temperature, and load to identify potential safety concerns. Emergency investigations are created for Field and Meter Services technicians to investigate instances that are identified through this monitoring. The second element of the approach is the creation of 'AMI High Temperature Events' using the Outage Management System (OMS) when temperatures are outside of a certain range. These tickets are then handled as 'high priority' by the on-call 24x7 overhead electrician specialists in the field. Additional findings on the High Temperature Meter Investigations are included in the chart below.

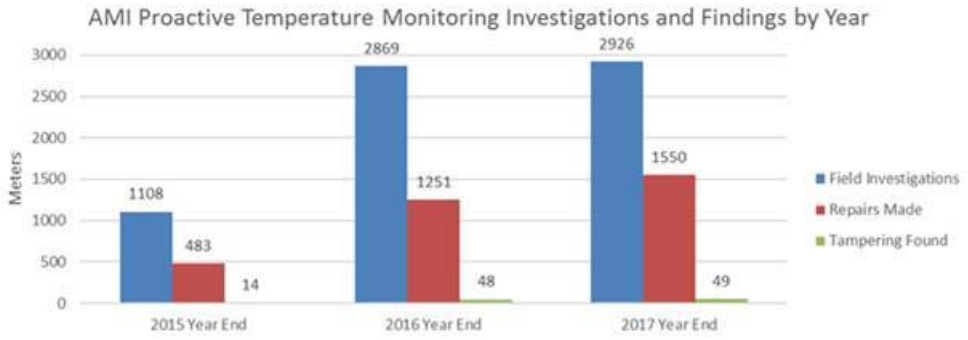


Figure 8 Proactive Temperature Monitoring Data

Smart City Lab

During 2017, the AMI team took a leading role in the development of the 'Smart City Lab', as further demonstration of its commitment to innovation. This lab occupies a floor of an existing ComEd facility in Maywood, and provides the ability to conduct comprehensive meter and communications testing as well as providing an environment to develop Smart City technologies that

Figure 9 Smart City Lab Exterior (artist rendering)

leverage the AMI network. The lab is also an accurate representation of the production AMI network as more devices and technologies are incorporated, which will allow for real world application design, testing, configuration, and 'proof of concept' analysis.

Figure 10 – Smart City Lab Interior (artist rendering)

This effort was the result of strong partnership across many ComEd departments, including AMI Operations, Metering Standards, Smart Grid, Energy Efficiency, and Demand Response and Dynamic Pricing. The lab is over 35,000 square feet, including indoor and outdoor components. Construction began in October of 2017 and is planned to be completed in Q2 of 2018.

Grid-related Applications and Processes Utilizing AMI Data

As noted in the 2017 AIPR, AMI infrastructure continues to bolster operations across the service territory that enables grid-related improvements to ComEd and customers. This includes enabling ongoing monitoring of power factor to drive overall system efficiencies for commercial and industrial customers, allowing for efficient integration of distributed generation resources through hosting capacity analysis, leveraging data captured via the network for advanced data analytics and pro-active asset management, optimizing voltage levels through the use of AMI data, and verifying outage events and activities through the meter 'pinging' capability. These improvement areas and others will continue to derive value from the investment in AMI infrastructure as additional tools and functionality 'use cases' are identified and deployed.

3. Customer Experience

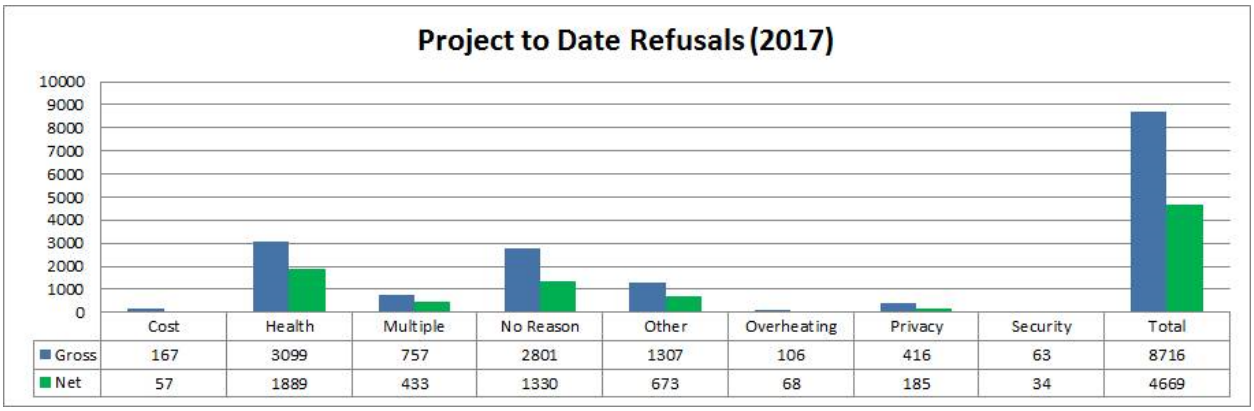
Call Center Operations

Efforts to improve Call Center quality and the overall customer experience have continued through the education and training of Call Service Representatives (CSRs). This training includes the scheduling CSR field-visits for a better understanding of the meter replacement process in-person. Various training courses were also held with a focus on managing challenging

conversations with customers, empathy-based dialogue, and understanding Silver Spring Networks' tools and applications. Frequent reviews and audits of CSR calls were performed to provide valuable feedback in lieu of ComEd's culture of continuous improvement. These audits were done in addition to the Call Center evaluations performed by ComEd's call center vendor, HyperQuality.

Customer Experience

The Customer Experience function remains an integral component of the AMI Program, helping to improve ComEd's overall customer satisfaction along with contributions to the Call Center Operations. The Customer Experience team continued to refine and execute the proactive outreach strategy to educate customers and communities on the benefits of AMI, resulting in a net refusal rate of 0.12% for the Program to-date. The conversion of customers who initially refused the installation of a smart meter only to change their minds after speaking with a Customer Experience team member remained above 40%. Additional details regarding customer refusals are shown below.



	Cost	Health	Multiple	No Reason	Other	Overheating	Privacy	Security	Total
Gross	167	3099	757	2801	1307	106	416	63	8716
Net	57	1889	433	1330	673	68	185	34	4669

Figure 11 – Project to Date Refusals

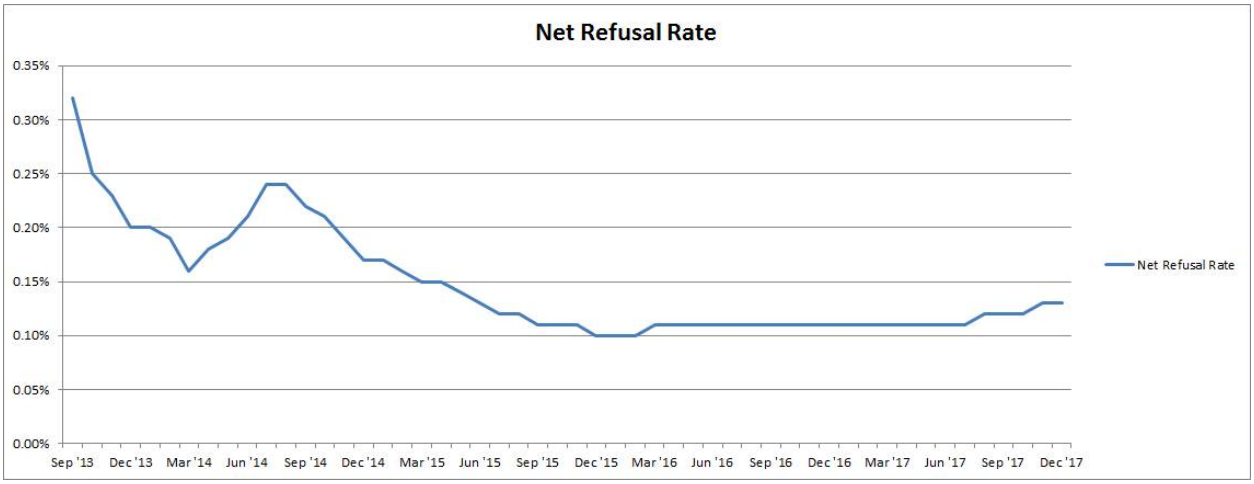


Figure 12 – Net Refusal Rate

As was done in 2016, the team sent letters to customers who had refused the meter in the past. This year, the letter was personalized with the cumulative amount that each customer had already incurred in refusal fees. The purpose of these letters was to educate the customer and raise awareness to the ongoing cost to have their meter read manually each month. This letter was sent to over 3,000 customers who had been paying the charges for at least one year.

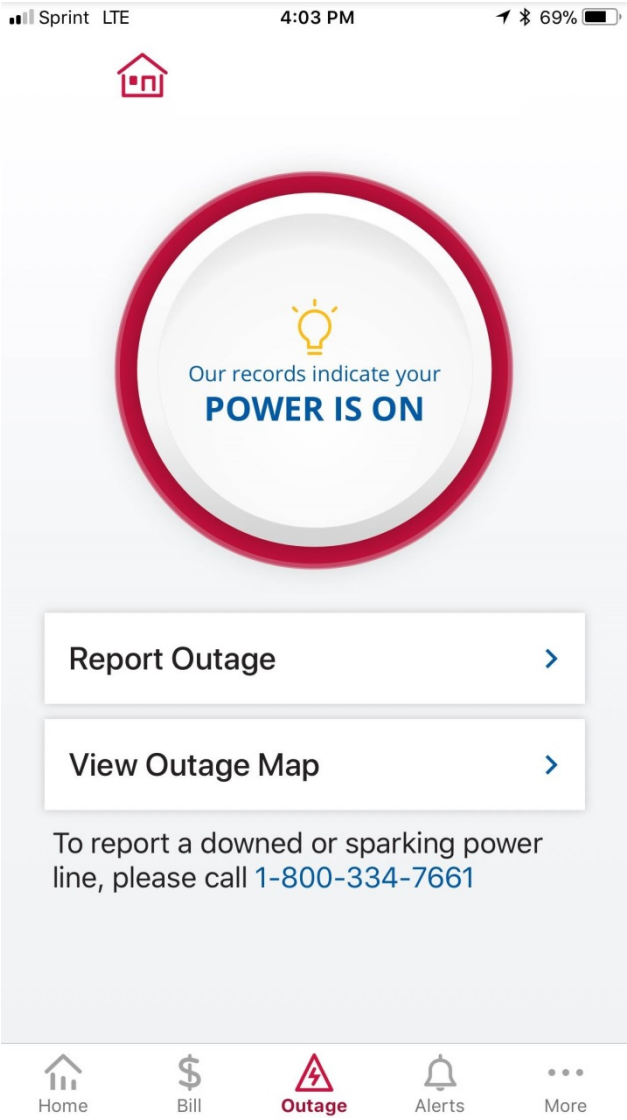


Figure 13 Outage Alert Mobile Functionality

The team, often supported by ComEd Executives, hosted events and engagement activities across the service territory throughout 2017. This dedicated commitment to outreach and education across the service territory is further detailed in Chapter 4 and via the specific metrics for this area within Chapter 5.

As part of the proposal developed for the ICC in 2015, ComEd has extended the smart meter deferral period from December 31, 2019 to June 30, 2022. The Customer Experience team has worked with the network technology provider to identify customer options with alternative AMI meter offerings and conducted internal workshops to identify process changes to support making these offerings real. ComEd will share more details regarding these offerings in 2018.

Since the outset of the AMI program and other grid modernization activities, ComEd's overall customer satisfaction performance has shown significant improvement. This is as a result

of an over-arching focus on the importance of driving a positive customer experience in every interaction with ComEd, including before, during, and after the AMI meter exchange process. The AMI team's consistent focus in this area has been a key driver of the improvements made, as recognized through several industry awards announced in 2017, including being named 'Most Improved Electric Utility of 2016' as well as '2016 Brand of the Year' by Market Strategies International (MSI) Cogent Reports. By focusing on the customer experience, of which AMI investments were a part, ComEd also was the most improved large utility over the last five years in J.D. Power's customer satisfaction index.

4. AMI Information Technology ("IT") and Business Transformation ("BT")

The sections below contain details on specific areas of improvement that were delivered by the AMI IT and BT teams in 2017, in addition to diligent maintenance.

Outage Management

In 2017, AMI meters automatically created 82,627 trouble reports representing 15,697 individual outage events. These reports came through the Outage Management System and the information was immediately communicated with the proper ComEd personnel to respond. AMI technology made the rapid communication of these events possible as previously it would have taken significantly longer for these events to have been discovered. The quick identification and response to these events improves customer satisfaction, safety, and reduces the impact of the event.

Since January 2015, ComEd has avoided over 95,000 truck rolls by using the "Meter Status Check" ("pinging") functionality of the COMPASS (OMS) application, integrated with AMI systems. This enhanced functionality avoids the need to send employees to check outages in the field as that information can be communicated in real-time to the back office and allows for more efficient use of field resources during storm and non-storm restoration operations.

Incorporating the "Meter Status Check" capability into customer channels was recognized in the industry and is further evidence of ComEd's commitment to innovation and driving a premiere customer experience. This enhancement has avoided trouble reports allowing improved customer experience and first contact resolution for customer-side power interruptions. The AMI Program has been a key enabler of the significant reliability improvements, along with overall ComEd grid modernization investments that reduce the impact of storms on customers. Overall, since the beginning of the program there has been a 37% reduction in customers impacted by storms and an 80% reduction in customers who experience lengthy outages.

Security and Redundancy of Data and Systems

Throughout 2017, the IT team continued to focus on redundancy and security for AMI systems and networks. Security efforts included ongoing testing and improvements to operations of the SSN networks in alignment with industry standards. The team enhanced network protection from external intrusion by continuously refining firewall confirmations and the overall security

architecture. These security enhancements were done along with vulnerability assessments and reviews of network flow patterns to proactively monitor network and system security.

Customer and Financial Benefits

AMI technology has proven to be valuable for ComEd and its customers. Much of the value is recognized through new functionality, automation, and the enhancement of operations that was delivered and/or supported by the IT and BT teams. Below is a sub-set of notable benefit highlights that have been enabled by the AMI program and ongoing ComEd grid modernization efforts. Details on the actual performance metrics can be found in the multi-year performance metric report.

12-month rolling reduction in Consumption on Inactive Meters (CIM) to 86K MWh; 69% favorable to target	228,700 Peak Time Savings (PTS) program enrollments resulting in $2.5M in customer savings	177,292 high–usage alert enrollments by customers
99.41 YTD Read Rate in 2017	84 Million manual meter reads avoided	824,000+ truck rolls avoided since the beginning of the program; 319,000+ in 2017
73,000+ avoided trouble tickets since the beginning of the program; 44,000+ in 2017	80% reduction in delayed bills since 2010	95% reduction in estimated bills since 2010

Figure 14 ComEd Performance Highlights

Additionally, as AMI meters have been installed, more and more customers have access to the digital tools needed to track energy use and leverage programs that save them energy and money. Customers on ComEd's Hourly Pricing program have saved more than $16.5 million in electricity supply charges—an average savings of 15% compared to ComEd's fixed-price rate.

The AMI Program has also been a technology enabler that has led to improvements to overall system reliability, in conjunction with other large-scale grid modernization investments by ComEd as part of the Energy Infrastructure Modernization Act (EIMA). These combined investments have resulted in record reliability for customers across many dimensions.

5. Change Management and Business Readiness

ComEd recognizes the importance of employee engagement and communication as the AMI Program reaches full deployment. The Change Management and Business Readiness team has remained focused on communicating, preparing, and training employees on how to effectively utilize the new tools and processes of AMI in the context of their day-to-day jobs.

Communications

In 2017, the Change Management team remained pro-active in driving awareness of the AMI Program through internal communication and outreach efforts. They did so by creating and distributing job aids, newsletters, progress reports and regular communications throughout the organization. The Change Management team continued to build on and refine tools that were previously used to communicate program updates, including the Knowledge Center website.

Employee Engagement

Kick-off events were hosted in Dixon, Freeport, and Streator by the Change Management throughout the year in new geographic for AMI deployment. The team also facilitated other internal ComEd outreach and engagement events that informed employees about the progress and status of the AMI Program ongoing enhancements to daily operations.

Figure 15 – Rural Blitz Cross Dock Openings (left to right: Dixon, Freeport, Streator)

B. 2018 Activities and Goals

The main focus of the AMI Deployment will be on effectively executing the planned ramp-down of activities in a safe and productive manner. This includes the completion of mass

deployment activities via the planned installation of over 330,000 meters and the deployment of additional network devices in support of AMI communication optimization for completed operating areas. The team will also continue to follow-through on its earnest commitment to actively identifying new opportunities within ComEd for field and back office resources as the volume of work declines and is eventually completed.

1. Project Management Office

Going forward, the PMO team will focus on responsibly and effectively managing the Program ramp-down in the field and back office while continuing to perform core management functions. The role of the PMO will be focused on the ongoing tracking and measurement of benefit realization that stems from AMI deployment, along with the effective management of risks and issues, budget oversight, contract management, communications, and reporting activities.

2. AMI Network and Meter Deployment

ComEd plans to complete over 330,000 installations in 2018, representing the completion of mass deployment. The table below outlines the targeted deployment volume for the remainder of the AMI Program.

Table 2: Remaining Meter Exchanges

Year	Remaining Meter Exchanges	
	2017 AIPR	Updated
2018	400,675	330,850
2019	24,000	17,000
Total	424,675	347,850

ComEd will continue to manage the gradual ramp-down of resources that began in mid-2017. The ramp-down efforts have been successful in allowing impacted individuals to identify and pursue long-term opportunities at ComEd while providing ComEd with the time to efficiently absorb these resources. Several activities are planned for 2018 to identify new opportunities in ComEd, including additional Career Fairs, active communication of opportunities, and the availability of management to advise these resources during their career transition.

The transition of responsibility to ComEd operating groups and the close-out of meter exchanges will require a collaborative approach going forward. The remaining exchanges may be logistically challenging and is important to have a smooth transition to train the operating groups on the lessons learned during the exchange process.

The Operating Area Close-out Team will remain in place and active in 2018. Their focus will be on completing meter exchanges in areas where full-deployment activities have been completed.

A key activity in 2018 will be the optimization of the AMI network, once meter deployment is completed in a given operating area. The optimization process includes a detailed review and assessment of the SSN mesh network performance in the fully-deployed state and the targeted deployment of additional network devices, as needed, to ensure sustained performance to the agreed upon service levels. This process will be executed by SSN and ComEd field and back office resources.

ComEd will remain focused on safety, quality, and maintaining a premiere customer experience in 2018 and for the remainder for the AMI Program. The team will continue to repair damaged meter equipment that is identified during a meter exchange through working closely with contracted electricians. These repairs will ensure the safety, quality, and reliability of the energy provided to customers throughout the service territory. The team remains dedicated to continuous improvements to day-to-day operations through frequent training and audits.

ComEd will leverage the Smart City Lab for continued progress and innovation following its opening in 2018. This unique resource will prove valuable as ComEd continues to explore the many ways in which AMI and Grid Modernization technology can benefit customers and drive economic growth and job creation.

3. Customer Experience

The team will continue to focus on delivering a premiere customer service 2018. The Customer Experience function will manage customer inquiries, including escalated issues and requests for meter installation appointments. The team will also manage the Rider NAM (meter refusal) process along with customer outreach and education efforts as the AMI Program nears completion.

4. AMI Information Technology and Business Transformation

As was the case in 2017, the focus of the IT and BT teams will be the proactive maintenance of the tools and technologies that have been delivered via the program. System enhancements and improvements will be completed as they are identified and prioritized based on the established processes focused on continuous improvement. Key areas of focus are again expected to be around continued refinement of analytics tools, improved outage management capabilities, the ongoing expansion of the Peak Time Savings (PTS) program, and continuing to proactively monitor and protect networks and systems from intrusion.

5. Change Management and Business Readiness

The Change Management and Business Readiness team will focus on managing the impact of the program ramp-down in 2018 and beyond. The team will be actively communicating business impacts to field and back office employees through engagement activities, internal communications, and other forms of outreach. An important part of the program ramp-down will

be capturing lessons learned that can be useful for future programs of this scale. This team will support the transition of employees that will be taking place in alignment with the ramp-down of resources for the program.

C. Budget

Below are the budget tables updated with 2017 actual results and refined projections for future years, along with the associated variance explanations for Capital and Operations and Maintenance ("O&M").

Table 3: Capital and O&M Spend Profile AMI Deployment

Capital[5] ($M)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
2017 AIPR Budget	0.3	42.6	151.6	243.6	234	155.0	91.2	16.5	4.2	4.2	943.2
Updated Budget	0.3	42.6	151.6	243.6	234	148.5	75.2	15.6	4.2	4.2	919.8
Variance (Increase) Decrease	-	-	-	-	-	6.5	16.0	0.9	(0.0)	(0.0)	23.4
O&M ($M)	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
2017 AIPR Budget	18.4	29.3	45.1	59.9	71.5	70.5	62.2	43.5	40.4	40.9	481.7
Updated Budget	18.4	29.3	45.1	59.9	71.5	66.7	59.7	41.8	38.6	38.2	469.2
Variance (Increase) Decrease	-	-	-	-	-	3.8	2.5	1.7	1.8	2.7	12.5

As noted in the table, there is a decrease in total projected Capital of $23.4M from 2018 through 2021 when compared to the previous projection within the 2017 AIPR. This reduction is a result of several factors, including a decrease in the required volume of materials required to complete the meter exchange (locks, seals, etc.) due to operating conditions being better than

[5] The total spend amount captured in the table does not include costs associated with the Peak Time Savings (PTS) program, which is consistent with prior AIPRs.

expected in some areas. Additionally, there are reduced labor costs for ComEd resources (salary, pension, benefits) and contractors resulting from improved efficiencies and productivity and refined cost projections based on past results.

The projected O&M costs through the end of the program have also decreased when compared to the 2017 AIPR. This overall net reduction is the result of some cost areas that increased, and others that were lower than projected. The increases in spend were associated with a change in accounting treatment for a sub-set of the program costs associated with SCADA meter exchange previously included in Capital spend[6]. The areas that were lower than projected included a decrease in projected spend for labor and contracting, as well as a reduced need for a component of ongoing IT costs related to the support for AMI Access Points in the field.

A culture of tight and transparent financial management continues to drive cost savings and reduced spending practices across the program. These practices will continue to be important as the program ramps down throughout 2018.

D. List of AMI Investments

The AMI investments undertaken in 2017 and scheduled for 2018 are in the table below:

Table 4: List of AMI Investments

($ in 000's)	2017 (Actual)			2018 (Projected)		
Category	Capital	O&M	Total	Capital	O&M	Total
Meters and Deployment	131,325	27,745	159,070	67,637	21,076	88,713
Communication System	9,470	8,698	18,168	5,052	9,664	14,716
IT Applications and Operations	3,265	14,630	17,895	-	14,167	14,167
Project Management and Other Costs	4,458	15,583	20,041	2,536	14,838	17,374

[6] While impacting budget presentation as discussed herein, the change in accounting treatment does not directly involve AMI Plan implementation. To the extent the change in accounting treatment raises or involves cost recovery issues, those issues will be addressed through the discussion of O&M cost recovery pursuant to the provisions of EIMA in ComEd's Formula Rate Update proceeding.

Total	148,518	66,656	215,174	75,225	59,745	134,970

2017 – Actual Spend

Meters and Deployment

The meter costs for 2017 were primarily related to the purchase and installation of meters. Other costs include tools and other materials associated with meter installation, meter inventory management, and electrician repairs to customer-owned meter-related equipment.

Communication System

The Communication System costs for 2017 were primarily associated with the purchase and installation of field network equipment for the deployment of the AMI communication system. This category also contains charges for the AMI technology provider SSN, including materials, maintenance of the required SSN IT hosting environment, professional services support, software fees, and server costs.

IT Applications and Operations

IT Applications and Operations costs for 2017 included the delivery of key functionality and system enhancements described earlier in this report (Outage Management, Billing, Peak Time Savings, etc.). Additional costs were incurred for ongoing IT maintenance of the hardware and software used to support the operation of the AMI meters installed and the associated data analytics.

Project Management and Other Costs

The Project Management and Other Costs for 2017 were related to project management activities, contractor management efforts, operations of the meters installed, meter deployment planning, ongoing planning and execution of customer experience activities, and business transformation and change management activities. Additional cost components included ongoing planning and rollout of customer outreach and education activities and labor costs for revenue assurance work.

E. 2018 – Projected Spend

Meters and Deployment

The meter costs for 2018 primarily relate to the purchase and installation of meters. Other costs include tools and other materials associated with meter installation and meter inventory management, along with electrician repairs to customer-owned meter-related equipment.

Communication System

The Communication System costs projected for 2018 relate primarily to the network optimization activities that will take place as overall deployment ramps down. This will also include charges for SSN, including materials, maintenance of required SSN IT hosting environment, professional services support, software fees, and server costs.

IT Applications and Operations

Projected IT Applications and Operations costs for 2018 will be related to ongoing enhancements to Outage Management, continued expansion and enhancement of the Peak Time Savings Program, and ongoing enrichment of the existing AMI systems and functionality. Additionally, costs will be incurred related to the ongoing IT maintenance of the hardware and software used to support the operation of the AMI meters installed and the associated data analytics.

Project Management and Other Costs

The Project Management and Other Costs for 2018 will continue to be incurred for project management activities, contractor management efforts, operation of the meters installed, meter deployment planning, ongoing planning and execution of customer experience, including the call center and customer relations, and business process redesign and change management activities. Additional cost components are related to ongoing rollout of customer outreach and education activities.

III. Customer Applications

A. Introduction

ComEd is continuously moving towards a future-oriented utility model and customer ecosystem. As the rollout of more than four million smart meters throughout ComEd's service territory concludes, more and more ComEd customers are benefiting from the innovative technologies, programs, and cost savings that are enabled by the smart grid. ComEd has committed to bring forth additional products and services that will help customers realize and increase the tangible value they can get from a smart meter.

ComEd continues to operate its "SmartGridExchange℠" initiative ("SGE") to further support its effort to identify, evaluate, and implement new and promising solutions that leverage AMI and AMI-related technology. Key stakeholders continue to participate in this highly collaborative initiative. The SGE continues to focus on developing collaborations with manufacturers, developers, entrepreneurs, technology start-ups, universities, and students in order to search for ways to deliver smart grid and smart meter-enabled benefits to our customers.

In 2017 — the fourth year of the SGE — ComEd continued to evaluate, implement, and expand a number of programs. The collaborations and initiatives under the SGE helped explore, design, and shape the development of products and services that take AMI and AMI-related technology into the home that give customers more control and additional saving opportunities.

Specifically, ComEd worked to:

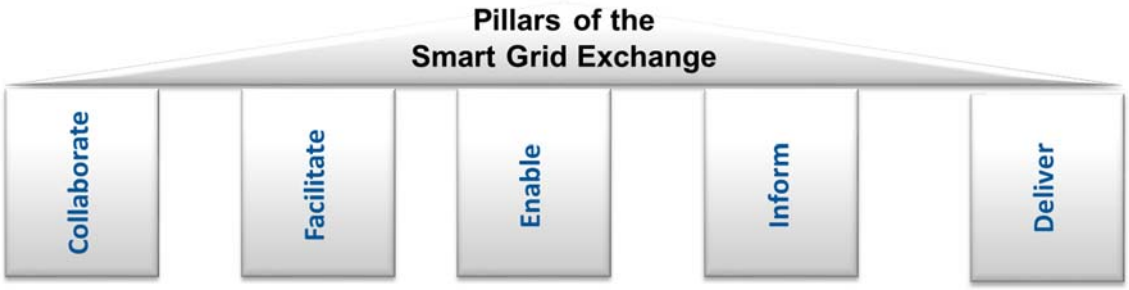
- **Collaborate** – Collaborate with developers who have technologies or concepts that could bring value to customers. For example, the Smart Meter Connected Devices service connects customers to a platform of meter-connected devices offered by different vendors.

- **Facilitate** – Facilitate customers' ability to access new cutting-edge products, tools, and services in the Marketplace that could yield energy savings and/or more control over their energy use or convenience. ComEd is running a Bidgely pilot, which provides participating households a breakdown of energy cost associated with their appliances. As of December 1, 2017, over 1,250 customers signed up to participate in the program.

- **Enable –** Support third party development of new applications, products, and services that could run on ComEd's platform, as well as on vendor and contracted third party platforms. One such initiative ComEd has is the Green Button Connect My Data solution for residential and commercial customers, which allows customers to automate the transfer of their usage data to authorized third parties, based on affirmative (opt-in) customer consent and control.

- **Inform –** Increasingly serve as a hub for information that offers ComEd's customers and the marketplace a convenient portal where they can learn about and share information regarding new and developing energy products and services; ComEd seeks to serve as an online clearinghouse for information, as well as to provide information to stakeholders, industry, and customers through initiatives such as the SGE Forum.

- **Deliver** – Where possible, provide products and services directly to interested customers, including Peak Time Savings and Hourly Pricing (formerly Residential Real Time Pricing).



The SGE initiative has continued to introduce, evaluate, and advance new ideas and potential pilots while deploying existing in-market initiatives and programs. ComEd has continued exploring industry developments to identify products and solutions with potential for piloting or collaboration under SGE. Promising technologies and initiative ideas that have been vetted are continuously added to the SGE initiative pipeline to monitor, evaluate, and charter new projects and pilots.

In 2018, ComEd will continue its efforts in deploying in-progress and planned new products and services. ComEd will further demonstrate the value of the smart grid, thus unlocking

more choice and control for customers by exploring promising potential offerings. As ComEd delivers on the benefits of the smart grid through SGE initiatives, ComEd will continue technology research to survey new opportunities, address emerging customer trends, and review new concepts and initiatives.

B. 2017 Activities and Accomplishments

ComEd undertook a series of efforts in 2017 targeted towards delivering value to our customers through the SGE initiative and other important AMI, energy efficiency, and demand response products and services. In 2017, ComEd continued to build on existing offerings and launched additional smart grid-related pilots and projects:

2017 Activities & Accomplishments			
Enabling Customer Choice and Control	Peak Time Savings ("PTS")	Opt-in demand response program offered to residential customers with smart meters. Enrolled customers are eligible to receive bill credits for using less electricity on select summer Peak Time Savings Hours when electricity demand is typically high.	
	Hourly Pricing	Dynamic pricing option that lets residential customers pay a charge based on the hourly market prices for electricity.	
	Capacity Guard	Enhancement to the Hourly Pricing program that provides day-ahead notification of possible "coincident peak" (CP) hours to Hourly Pricing program participants	
	Residential Energy Management Tools	Expanded on ComEd smart meter-enabled tools and offerings that give customers details about their energy usage.	
	Data Services	Allow customers to automate the transfer of their usage data to authorized third parties, based on affirmative (opt-in) customer consent and control with Green Button Connect, and began enabling external entities to purchase anonymized interval data.	
	Smart Streetlights	Continued to improve a smart LED streetlight solution leveraging ComEd's smart meter communications network.	

	ComEd Marketplace	Continued web-based "Beyond the Meter" Energy Marketplace connecting customers with energy saving products.	
Driving Energy Efficiency Through Innovation	Bring Your Own Thermostat ("BYOT")	Continued operation of a Nest Smart Thermostat option in the AC Cycling Program.	
	If This Then That ("IFTTT")	Integrated If This Then That ("IFTTT"), a free Internet of Things service that controls connected home devices through customizable applets, into the Peak Time Savings and Hourly Pricing Programs.	
	Smart Meter Connected Devices	Provides customers with electric usage information and associated costs from their smart meters through a wireless, connected home device.	
	Emerging Technology Pilots	Developing Internet of Things ("IoT") integration with smart meter capabilities and designing emerging technology pilot programs including an energy disaggregation service to provide customers with more personalized energy insights.	
Collaboration	Local Developer Collaboration	Continued to collaborate with the Illinois Energy Foundry, a nonprofit venture fund fostering the development of innovative smart grid-related businesses in Illinois	
	Student Innovation	Sponsored a competition for college students to generate ideas on web tools that can provide information on solar electricity to ComEd solar customers.	

	SmartGridExchange[SM] Forum	Hosted annual forum with thought leaders and stakeholder groups in the Illinois community aimed at sharing, debating, features and principles that can strengthen the SmartGridExchange[TM]	

1. Enabling Customer Choice and Control

In 2017 ComEd continued to grow a suite of programs, tools and products that leverage AMI technology to deliver greater choice and control.

a. Peak Time Savings ("PTS")

In October 2014, ComEd launched enrollment for Peak Time Savings (PTS)[7] – an opt-in demand response program offered to all residential customers who have smart meters. PTS pays customers for reducing energy use during select summer Peak Time Savings Hours. There is no cost to enroll and no penalty or payment if customers enroll and choose not to reduce usage during a Peak Time Savings Hours event. Customers who do reduce energy use receive a credit on their next bill amounting to $1.00/kWh. The program is the first-of-its-kind to be offered to customers in the Midwest.

Smart meters are a key part of ComEd's effort to show customers the value of a smart grid-enabled future, and PTS offers a tangible benefit to the consumer from ComEd's AMI investment. PTS encourages customers to use less electricity during high-demand times, when most air conditioners are on, stores are open, and factories are running. Managing high-demand periods can help reduce the need for additional generation capacity as well as potentially lower emissions due to reduced loads, help reduce the overall cost of electricity supply, and lessen the burden on the electricity delivery system, all while saving customers money.

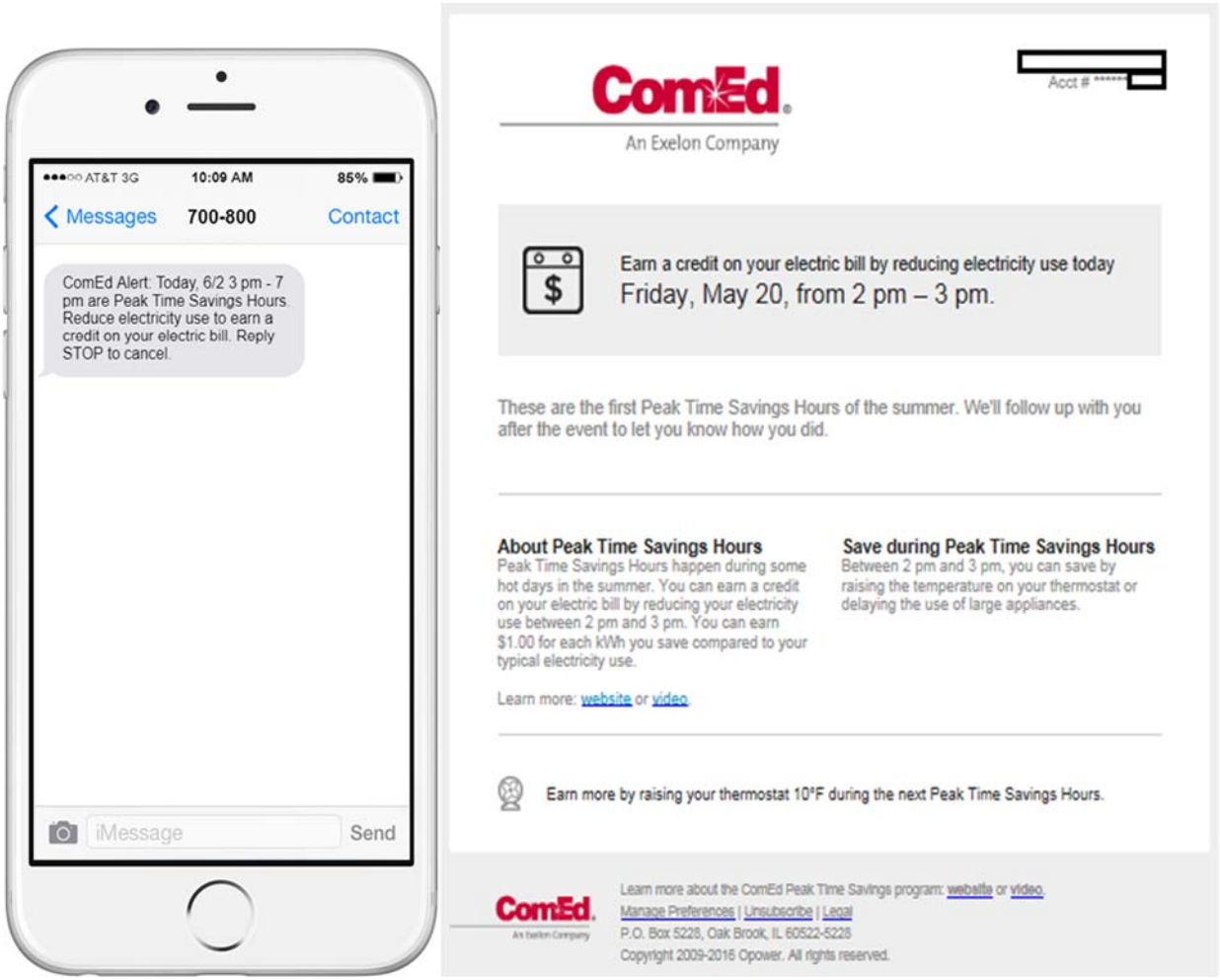
How Customers with a Smart Meter participate in Peak Time Savings:

[7] The Commission approved ComEd's proposed Rider PTR – Peak Time Rebate ("Rider PTR"), marketed to customers as the "Peak Time Savings" or "PTS" program, in ICC Docket No. 12-0484.

ComEd successfully completed the third year of Peak Time Savings in 2017. Highlights from the year include an effective marketing campaign that grew the program by more than 50% by adding more than 87,000 enrollments. The marketing campaign continues to build on proven research and tactics while maintaining the core objectives of enhancing ComEd's customer experience and helping customers realize the value of ComEd's investment in smart grid and smart-meter enabled technology. Similar to 2015 and 2016, the campaign was heavily focused on targeted direct mail to newly eligible AMI customers, driving both enrollment and awareness of the program. ComEd continues to enhance these enrollment materials based on in-market testing and customer research to maximize the customer response and optimize marketing costs. As part of the effort to optimize customer response to the enrollment materials, ComEd conducted an additional targeted mailer to AMI customers who will most likely benefit from PTS.

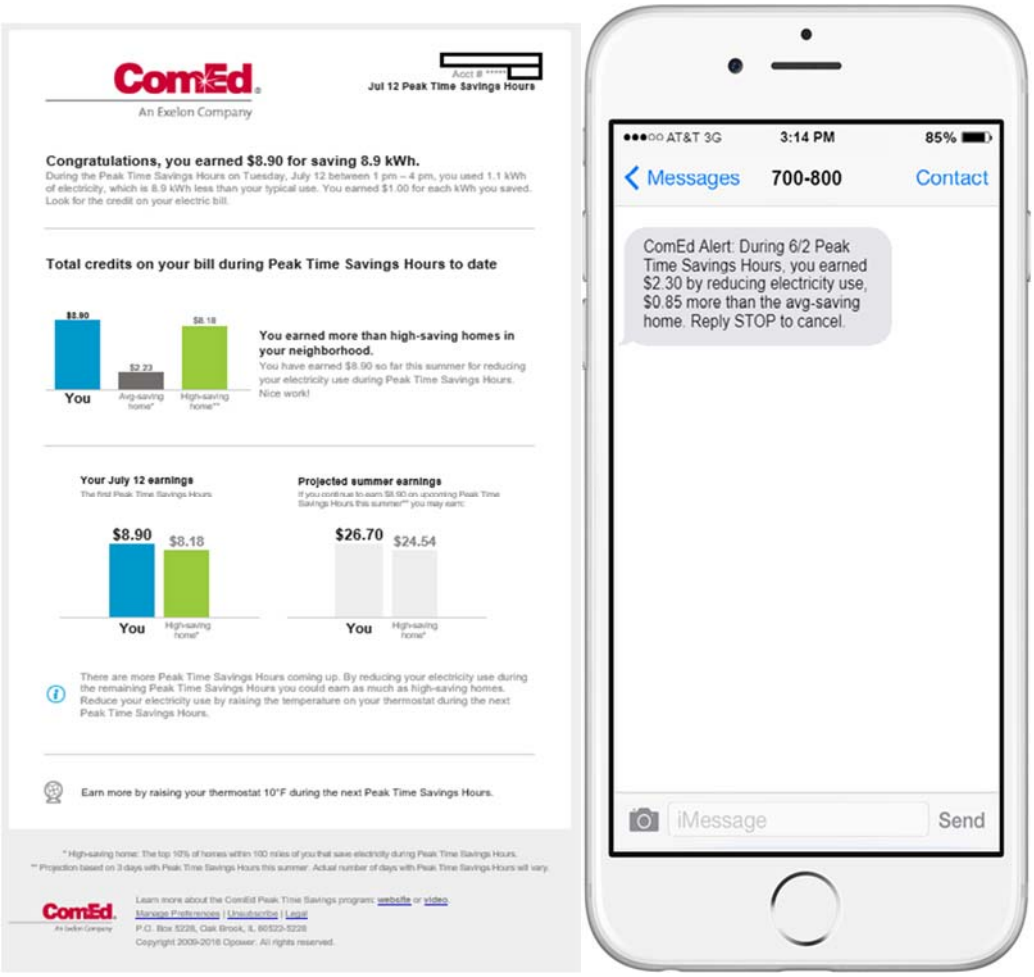
After a successful enrollment campaign, a total of 226,695 customers participated in Peak Time Savings during the 2017 summer season. These participating customers were given opportunities to earn credits during Peak Time Savings Hours. ComEd announced a total of three days with Peak Time Savings Hours in 2017, resulting in a total of 9 event hours and $1,211,572 in customer credits.

Pre-Event Notifications:



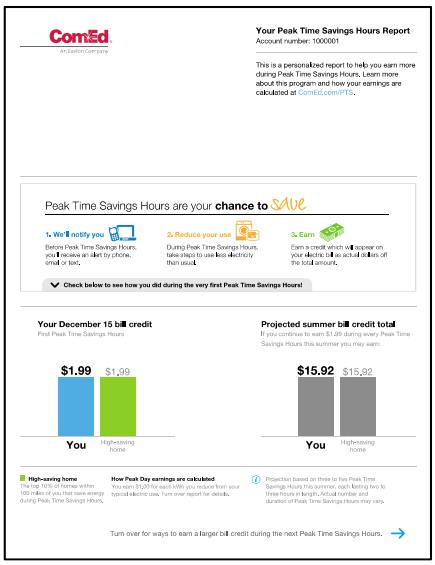
Customers are notified the morning of PTS Hours through their preferred notification channel(s) of phone, email, or SMS alerts. Pre-Event notifications provide customers with personalized tips to reduce electricity usage during PTS Hours.

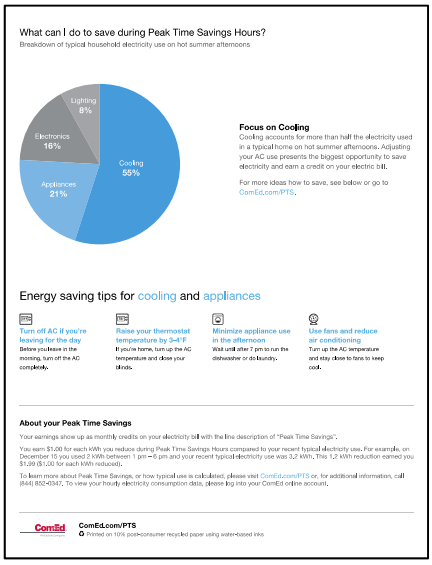
Post-Event Communications:



The day following PTS Hours, customers receive communication through their preferred notification channels(s) with feedback of how much they earned compared to other participants. Post-Event communication provides customers with next-day feedback of program earnings so they don't have to wait until their bill arrives. This short feedback loop helps validate the energy-saving actions participants may have taken, and can help lead to more effective participation during the next PTS Hours event.

Peak Time Savings Hours Report:





Peak Time Savings Reports are mailed to customers providing mid-season progress on savings earned, projections on what they could save during the summer, as well as personalized tips to maximize their savings.

Peak Time Savings Social Media team promoting the program during the summer season:

ComEd's social media team posted communications during event hours in Facebook and Twitter to increase customer awareness of the Peak Time Savings program.

Participating customers earned an average bill credit of $2.39 per event. In 2017, the average cumulative savings were $5.40 per participant, resulting in $1,211,572 of customer

savings in 2017. A core smart meter enabled offering under the SmartGridExchange™ initiative, PTS has delivered participating customers more than $2.4 million in total bill credits for reducing electricity usage since its debut in 2015.

To fund the customer incentives of the expanding program, ComEd continues to participate in the PJM Capacity Market to raise revenue. For the 2020/2021 delivery year, ComEd cleared approximately 49.8 megawatts ("MW") of demand response capacity for the ComEd demand response portfolio in the Capacity Market auction, which at the auction price of $188.12 MW/Day will enable ComEd to call one to three events during the summer of 2020, depending on customer participation levels, weather conditions, wholesale capacity revenue, and incremental auctions.

ComEd also conducted the second annual program evaluation for Peak Time Savings. The evaluation assessed the program design, customer segments, load impacts, customer credits and PJM revenues. The overall results of the evaluation were positive. The analysis estimated an 8.0% reduction of electric load during 2016 PTS event hours with a 90% or greater confidence level. The total PTS program participants of approximately 152,500 customers in 2016 saved an estimated average of 22.5 MW per event hour. Considering the load impacts, customer credits from 2016 and projected PJM revenues, the program is expected to be cost effective over a 15-year Net Present Value analysis. (See "Commonwealth Edison Company's Peak Time Savings Program Annual Report for the Year Ending May 31, 2017" in ICC Docket No. 12-0484).

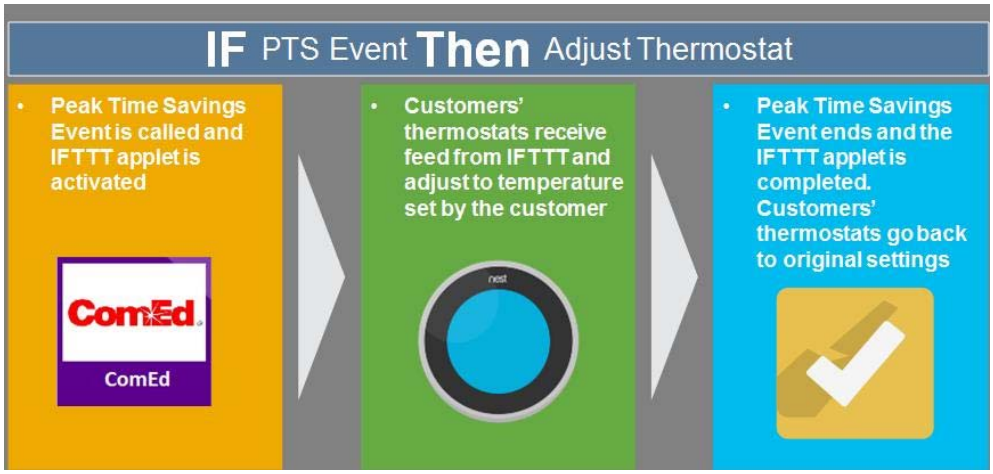
Aside from direct customer benefits, ComEd's PTS program also contributes to the reduction of Green House Gas ("GHG") emissions. In conjunction with the Citizens Utility Board ("CUB") and the Environmental Defense Fund ("EDF"), ComEd has developed a metric to measure the GHG emission reductions associated with smart meters. This study compared the reduced energy loads of a sample of PTS customers with those of similar customers who did not participate in the program, demonstrating that in 2016 the PTS program reduced an estimated 165 MT of CO_2 emissions (see Attachment 1, Metric #9).

2017 PTS Program Enhancements:

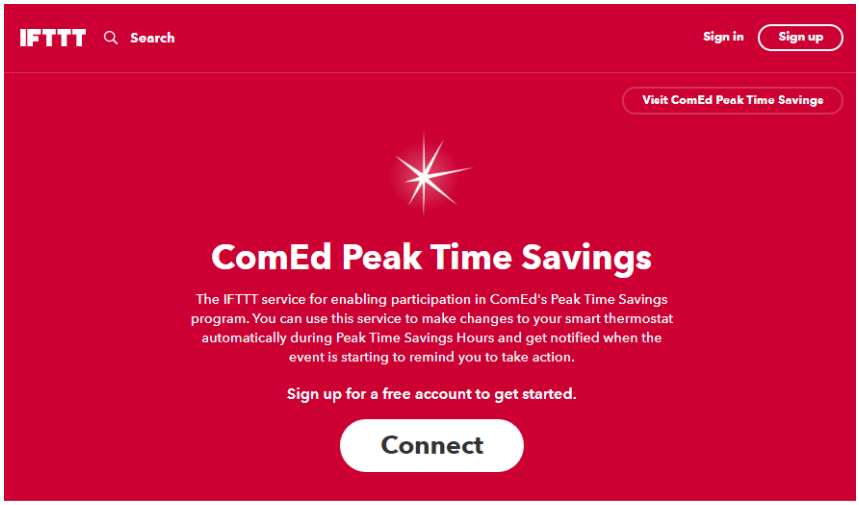
For the first time since the program's inception, eligible customers could enroll year-round for the current summer season. Prior to the summer 2017 PTS season, customers enrolled after April were not eligible to participate in PTS events until the following summer. The incorporation of in-season enrollments allows customers to register for the current summer season at any time and begin to immediately participate in PTS Events. ComEd believes this enhancement greatly improves the customer enrollment experience while reducing program operational complexities. As a result of the enhancement, the PTS enrollment attrition rate from May through September shifted from approximately 8% in 2016 to an attrition rate of 1.3% in 2017. ComEd anticipates the majority of annual enrollments will continue to occur as a result of the spring marketing campaign in February through April.

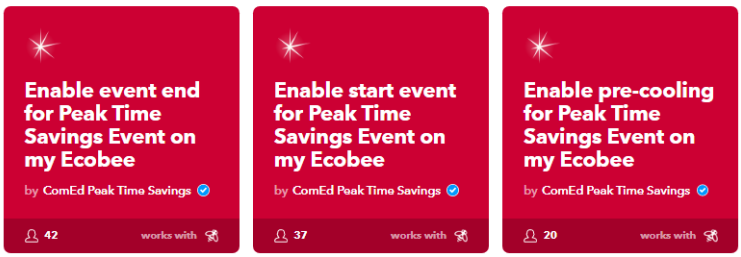
During the 2017 PTS season, ComEd leveraged connected home technologies to improve customer convenience and savings during PTS events by integrating the "IFTTT" (If This Then That) tool with PTS. IFTTT is a free web-based platform that allows users to setup "applets" that trigger actions on the customer's in-home devices based on events that occur. With IFTTT, PTS

customers can set their connected home devices to automatically adjust and reduce electric usage during PTS Hours. ComEd published 15 PTS applets for use by customers. 895 customers used these PTS IFTT applets in the 2017 PTS season, and 1,784 applet transactions ran over the course of the season's three PTS events.



The integration of IFTTT with PTS enables customers to conveniently automate various connected devices triggered by Peak Time Savings Hours. Customers connect to the ComEd PTS IFTTT Channel page below and can activate several pre-generated applets or create their own applets personalized for their household. Examples include automatically pre-cooling a smart thermostat prior to the start of PTS hours, shutting off connected lights during PTS hours, and adjusting a smart thermostat temperature once PTS hours are complete.





In additional to the enrollment enhancement and IFTTT integration, in 2017 ComEd launched the PTS web widget on the authenticated ComEd.com site. The new PTS web widget provides participants with a personalized view of their program participation, savings, and Peak Time Savings Hours information. Participants are also able to view how they compared to neighbors participating in PTS.

b. Hourly Pricing

ComEd's residential customers with smart meters obtaining electricity supply from ComEd have a choice between two electricity rates: the standard fixed-price rate and Hourly Pricing. Customers are defaulted onto the standard fixed-price rate where the price of electricity is the same irrespective of when they use it. In contrast, customers option to join Hourly Pricing purchase electricity at prices that vary each hour based on the wholesale market price of electricity. As a result, customers choosing Hourly Pricing can save money by shifting electricity usage away from high-priced periods, like summer afternoons, to low-priced periods, such as mornings, nights and weekends. Customers on Hourly Pricing typically save an average of 15 percent on the electricity supply portion of their bills compared to what they would have paid under ComEd's standard fixed-price rate.

ComEd's Hourly Pricing program concluded 2017 with a record number of participants – more than 21,500 – an increase of approximately 50 percent over the previous year. Additionally, since its debut, Hourly Pricing has saved customers approximately $18 million.

The program's growth may be attributed to two main factors: savvy target marketing and increasing awareness of the Hourly Pricing program. Elevate Energy's targeting of Peak Time Savings participants proved to be a particularly successful marketing tactic. Using email and direct mail channels, Elevate Energy saw PTS participants enroll in Hourly Pricing at three-to-six times these channels' historic response rates. Hourly Pricing also benefitted from the continuing roll-out

of AMI meters across ComEd's service territory and mentions of Hourly Pricing within the associated smart meter materials and customer communications.

c. Capacity Guard Alert

Capacity charges are levied upon all ComEd residential supply customers and reflect the costs to have adequate generation resources to ensure that the demand for electricity can be met at all times. Most customers are not aware of these charges, do not understand how they affect them, and/or don't realize that their energy usage behaviors can increase or decrease them.

ComEd's fixed-price electricity rate has a capacity charge within its energy supply cost that is invisible to customers. Customers on Hourly Pricing, however, have their capacity charge cost itemized as a separate line in the supply portion of their bill.

Hourly Pricing's capacity charges are based on the customer's household's average electricity use during the five highest ComEd system demand hours and the five highest PJM (ComEd's regional transmission organization) system demand hours from the previous summer. These peak system hours are referred to as "CP hours." An Hourly Pricing customer's capacity charge is based on these CP hours and the result can significantly impact their overall bill amount.

Realizing an opportunity to leverage data analytics to help customers manage – and potentially reduce – their capacity charges, ComEd data scientists developed a sophisticated algorithm designed to predict CP hours up to a week in advance. Internally, this algorithm was given the moniker, "Capacity Guard." The ComEd program manager worked with Elevate to create and implement a new, day-ahead alert for Hourly Pricing customers based on this algorithm's output. This new alert began notifying customers of a possible coincident peak hour at the start of the summer (June 1) and it remained active through the end of September. Because the alert gave participants day-ahead notification, customers could plan to lower their energy usage during the few hours the alert specified and thereby manage – or even lower – their resultant capacity charge.

ComEd and Elevate also produced two new videos about the alert and posted them to the FAQ section of the ComEd.com/HourlyPricing web site. One video essentially encouraged Hourly Pricing participants to enroll in Hourly Pricing Alerts. The other presented a more granular explanation of what capacity charge is and how it is calculated.

Capacity charges for Hourly Pricing customers are calculated after each summer and updated to customer accounts the following May. In 2018, ComEd will complete an analysis of this new alert and quantify the amount of savings it generated for customers who opted in to receive them.

Also in time for the summer of 2017, ComEd innovation specialists authored several new IFTTT applets to help Hourly Pricing customers automate energy-saving actions based on the price of electricity. These applets allowed owners of Ecobee, Honeywell and Nest smart thermostats to automatically increase their temperature settings when the hourly price of electricity exceeded a user-assigned threshold; and then resume normal cooling when the price dropped again.

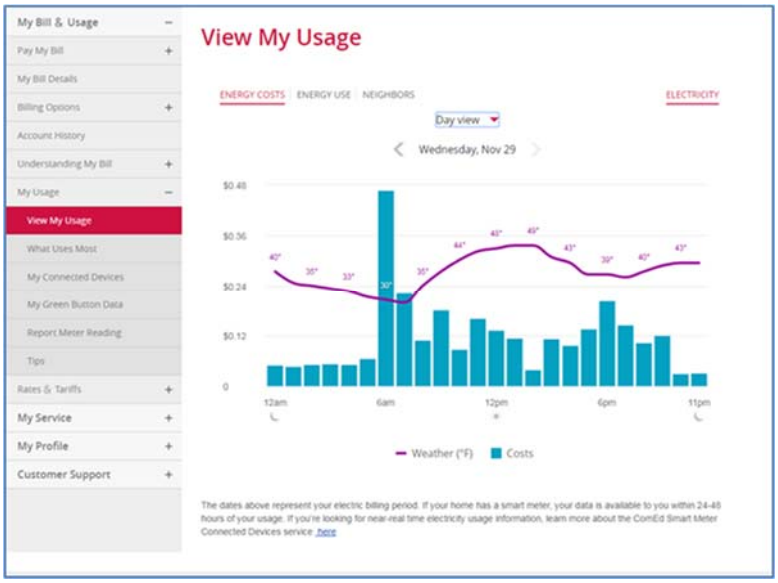
Additional applets were published that also helped customers automate smart devices such as WeMo Smart Plugs. These applets may be found at IFTTT.com/ComEd_HourlyPricing.

d. Residential Energy Management Tools

Currently, ComEd offers the following smart meter-enabled tools that give customers details about their energy usage. Customers can access these tools and set notifications and alerts by signing in to their online ComEd account (available at: ComEd.com/MyAccount):

Online AMI Data Insights:

Hourly and daily electricity usage information is available to help customers understand their usage, including weather, estimated costs, and neighbor comparison insights.



Weekly Usage Reports:

Weekly Usage Reports summarize daily electricity usage, provide a bill projection, and include personalized energy-saving tips.

ComEd
An Exelon Company

ComEd
Energy Efficiency Program

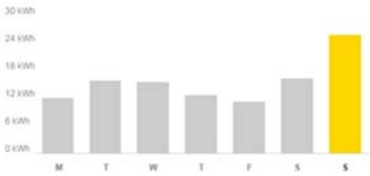
Feb 6-12

This report powered by your home's smart meter.

You used 48% more electricity this week than last week.

Your projected electricity bill: **$56.10***
With about 25 days left. This is not a bill.

A day by day breakdown
You used the most on Sunday, Feb 12. See more



A closer look at your highest day
Sunday, Feb 12 See more details

Ways to Save

Avoid over-drying clothes
Hang-drying is the most energy efficient and low-cost way to dry clothes. If you do need to use a clothes dryer, make sure to run only full loads and remove lint from the filter after each cycle.
Save up to $20 per year

Use computer power-saving modes

Running a computer constantly wastes a lot of electricity. Set your computer to go into "sleep" mode after 15 minutes of inactivity. This uses less power and keeps programs open for when you return.

Save up to $30 per year

Choose an efficient water heater
If your water heater is more than 10 years old, you may need to replace it soon. Consider an energy-efficient system such as a heat pump water heater, tankless water heater, or solar water heater.
Save up to $30 per year

Make my tips more personalized

See more tips

* Cost and energy projections are estimates only, not an assurance of what your actual bill will be. Your actual bill may vary due to factors like your actual usage, taxes, and fees.

Manage Preferences | Unsubscribe from these emails
ComEd, P.O. Box 5228, Oak Brook, IL 60522-5228
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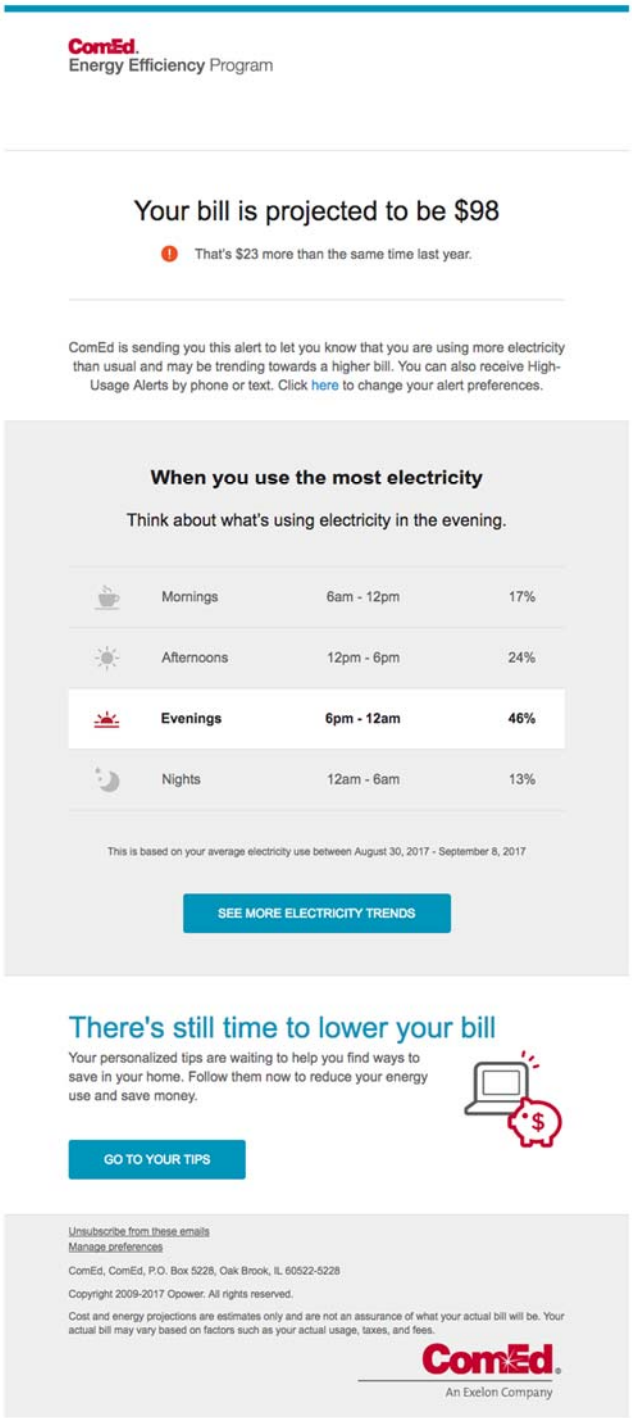
High-Usage Alerts:

High-Usage Alerts notify customers that their electricity usage is trending higher than usual, so they can make changes before their next bill arrives. High-Usage Alerts notifications are available by text, phone call, or email.



ComEd.
Energy Efficiency Program

Your bill is projected to be $98

That's $23 more than the same time last year.

ComEd is sending you this alert to let you know that you are using more electricity than usual and may be trending towards a higher bill. You can also receive High-Usage Alerts by phone or text. Click here to change your alert preferences.

When you use the most electricity

Think about what's using electricity in the evening.

Mornings	6am - 12pm	17%
Afternoons	12pm - 6pm	24%
Evenings	**6pm - 12am**	**46%**
Nights	12am - 6am	13%

This is based on your average electricity use between August 30, 2017 - September 8, 2017

SEE MORE ELECTRICITY TRENDS

There's still time to lower your bill

Your personalized tips are waiting to help you find ways to save in your home. Follow them now to reduce your energy use and save money.

GO TO YOUR TIPS

Unsubscribe from these emails
Manage preferences

ComEd, ComEd, P.O. Box 5228, Oak Brook, IL 60522-5228

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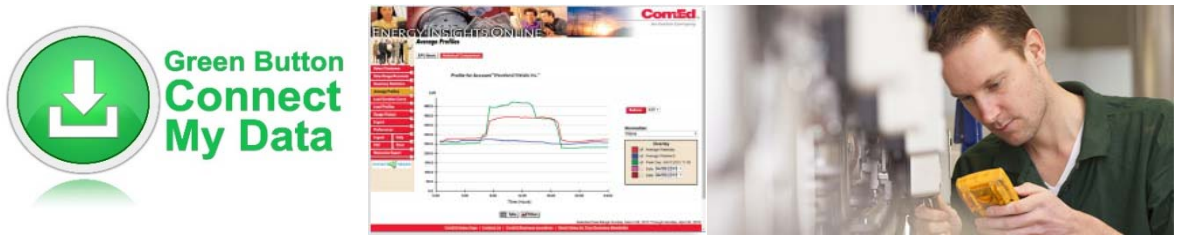
Cost and energy projections are estimates only and are not an assurance of what your actual bill will be. Your actual bill may vary based on factors such as your actual usage, taxes, and fees.

ComEd.
An Exelon Company

e. Data Services

Green Button Connect:

ComEd has enabled residential and commercial and industrial ("C&I")[8] customers to consent to the disclosure of personal energy information to third parties through electronic, web-based interface. Green Button is an industry initiative stemming from a White House call to action for utility companies to voluntarily provide customers with easy access to their energy usage in a secure and user-friendly electronic format. Green Button Connect My Data allows customers to authorize third-party service providers to receive direct access to their energy usage analytics via the Green Button functionality. The ability to transfer data more seamlessly to third party developers will help accelerate technology applications and analytics that leverage smart meter data.



Pursuant to the ICC's Final Order in Docket 15-0073 issued on March 23, 2015, ComEd deployed the Green Button Connect My Data solution in May 2016 to residential and small commercial customers through ComEd.com. Through the implementation of Green Button Connect, ComEd is providing C&I and residential customers with their usage data to enable them to better manage their energy consumption.

ComEd has partnered with Schneider Electric to deploy Green Button Connect My Data to large commercial customers in northern Illinois. To help customers maximize energy savings via the Green Button Connect My Data functionality, ComEd offers Energy Insights Online, a free web-based energy analysis service that interfaces with Green Button. Energy Insights Online provides ComEd's commercial and industrial customers with a more detailed analysis of their energy usage and enables third-party vendors like Schneider Electric, with customer consent to provide automated monitoring based commissioning (aMBCx) technology with embedded fault detection and diagnostics (FDD) analytics to more accurately prioritize energy savings opportunities.

During 2017, a second Third Party completed the Green Button Connect testing process and is displayed on the ComEd website. ComEd is currently working with three additional Third Parties on staging and production testing prior to being added to the website. 17 Third Parties have also expressed interest in this offering and are in various stages of the enrollment process.

[8] C&I customers up to 300kW of load can access GBC through ComEd.com.

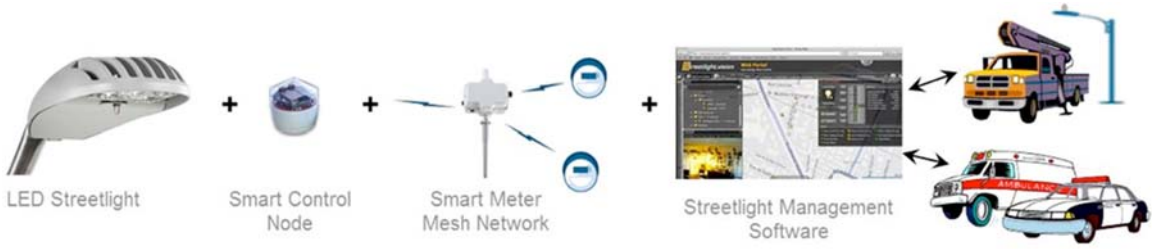
Anonymous Data:

In February 2017, ComEd implemented Anonymous Data Service. This enables external entities to access interval data anonymized per delivery service class per zip code using the 15/15 rule for the entire ComEd service territory for a fee. External entities are given access and permission to download files from a Sharefile site folder for 35 days with an option to refresh after six (6) months. In 2017, 12 external entities have requested this data service.

f. Smart Streetlights

ComEd has been working to establish opportunities to offer smart LED streetlight service to communities within its service territory. Smart LED streetlights bring together highly efficient LED lighting technology with powerful smart-grid enabled lighting controls. These smart controls allow for remote monitoring and control of streetlights through central management software systems. Individually, the LED lights and the smart controls are great technological innovations, but their impacts are greatest when brought together as a system. They can efficiently notify ComEd of maintenance needs, and the LED lights contribute to energy efficiency while having the ability to brighten in emergencies.

In order to remotely monitor and control each streetlight individually, ComEd evaluated ways to leverage the wireless mesh communications network built as part of ComEd's smart meter deployment. The ubiquitous nature of the network allows ComEd to reach all areas within its territory, extracting additional value from the smart grid investments ComEd is already making.



Through the Proof of Concept ("POC") deployment, monitoring of operations, identifying and triaging of issues, and developing system enhancements with vendors, ComEd developed a thorough understanding of the technical capabilities of this technology. ComEd also evaluated customer preferences with respect to this potential new service offering. The results of the POC are being used to make informed decisions about the potential to deploy the technology on a broader scale.

In 2017, the ICC approved the provisioning of smart streetlights. To move forward with full deployment, working groups were established to fully integrate Smart LED streetlights into our baseline operations. The groups will focus on business transformation, system integrations, device rollout and advanced metering infrastructure operations.

g. ComEd Marketplace

In late 2016, ComEd worked with a partner (Simple Energy) to launch an online marketplace where customers could find, learn about and purchase the latest energy-efficiency related products and smart technologies.

Providing instant, online access to rebates – and free shipping on qualified orders – the Marketplace was able to greatly reduce shoppers' out-of-pocket expenses and facilitate the adoption of the latest energy-saving technologies among ComEd's customer base. In fact, in its first year of operation, the ComEd Marketplace attracted more than 700,000 visitors and issued more than $2 million in rebates on energy-efficiency products and smart technologies.

In addition to promoting featured products and rebates on the ComEdMarketplace.com home page banner, ComEd increased customer awareness of its online Marketplace via the ComEd.com homepage, bill inserts, postcard mailings, social media alerts such as Facebook messaging and Twitter posts, and promotional email messages.

Each month ComEd and its partner review new products and technologies for inclusion into the Marketplace, ensuring that the collection remains fresh and current. In 2017 the Marketplace debuted several new and innovative products including:

- Keen Smart Vent Starter Kit, which allows remote operation – or smart thermostat control – of vent louvers in order to better "zone" a household and heat or cool only the zones that the homeowner desires

- The Nest Thermostat e, which brings the functionality and smart learning logic of the famous Nest Learning Thermostat to customers at a discounted price

- Ecobee4 Wi-Fi Thermostat with Built-in Alexa Voice Service, which brings smart thermostat savings to customers along with the convenience of Alexa's voice assistant capabilities

2. Driving Energy Efficiency through Innovation

The smart grid unlocks significant potential in the exploration of innovative technologies enabled by a resilient communications network and an abundance of data. In 2017, ComEd continued to utilize the Emerging Technology program to evaluate energy efficient concepts enabled by the smart grid.

a. Bring Your Own Thermostat ("BYOT")

For the summer of 2014, ComEd partnered with Nest Labs, Inc. in offering up to $140 in rebates for each customer who purchased a Nest Learning Thermostat™ and participated in ComEd's Smart Ideas Central Air Conditioning (AC) Cycling Pilot program.[9] In 2015, ComEd extended the 2014 Nest Pilot program to allow customers with Nest or Xfinity thermostats to receive a $40 incentive for participation from June 1st through September 30th, 2015. During the 2015 summer season, the expanded Thermostat Pilot offered customers participating in AC Cycling $40 in rebates with the Nest thermostat or Comcast Xfinity Home platform. In 2015, 2,988 customers signed up for this summer's AC Cycling Promotion and demand response pilot, and 316 customers signed up for Xfinity Home.

Smart thermostats moved from a pilot to a permanent option under AC Cycling on May 9, 2016 when the ICC approved a tariff change to Rider AC. Customers participating under the smart thermostat option using the Nest Smart Thermostat can receive an incentive of up to $40 per summer from ComEd. Nest's brand name for its AC Cycling Smart Thermostat Option is Rush Hour Rewards.

One AC Cycling event under the Smart Thermostat Option (i.e. Nest Thermostat) was called during the summer of 2016, on 8/19/2016 from 1 to 4 PM. Another AC Cycling event under the Smart Thermostat Option (i.e. Nest Thermostat) was called during the summer of 2017, on 9/15/2017 from 1 to 4 PM. As of 11/1/2017, there are 14,786 customers signed up for the AC Cycling Smart Thermostat Option.

b. If This Then That ("IFTTT") Enablement

ComEd is one of the first utilities to enable the If This Then That ("IFTTT") platform for demand response and dynamic pricing programs. Effective during the summer of 2017, more than 240,000 residential participants of ComEd's Demand Response and Dynamic Pricing programs had the ability to customize how and when their connected home devices respond during peak pricing hours and demand response events. IFTTT is a free Internet of Things ("IoT") service which provides customers the ability to subscribe, share and create custom applets capable of controlling just about any residential connected home device currently available.

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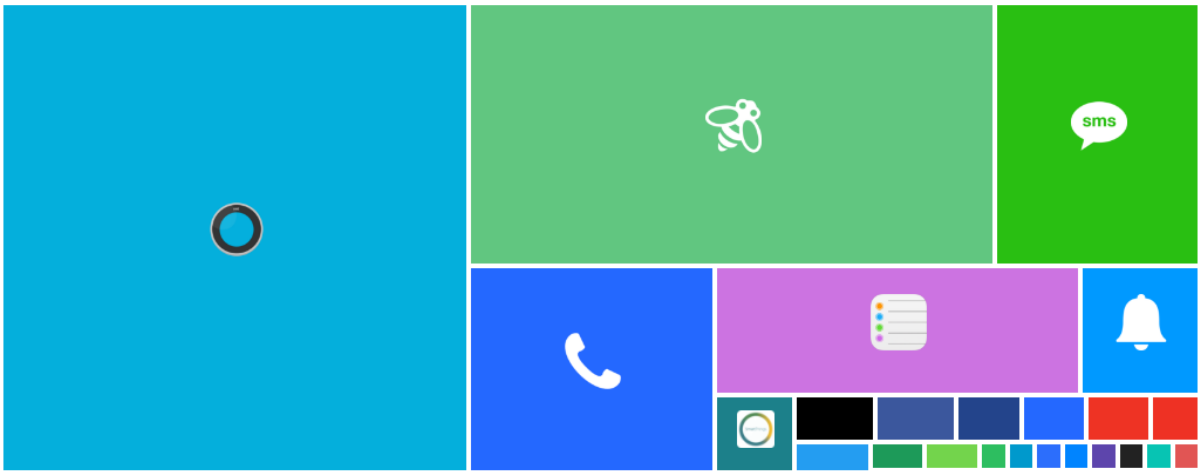
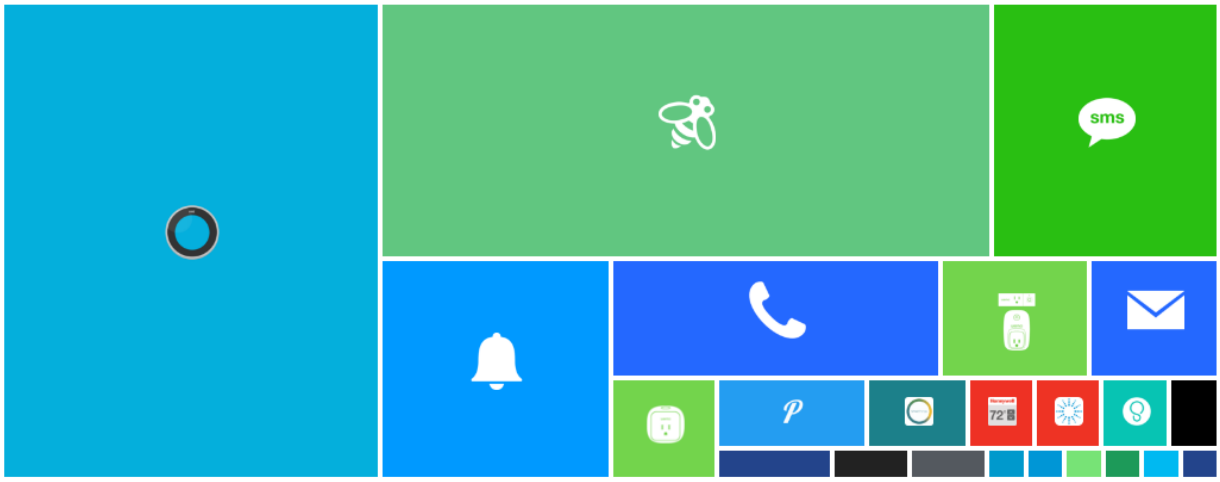
[9] The Commission allowed this program to become effective when it granted ComEd's Petition for Special Permission to allow revisions to Rider AC – Residential Air Conditioner Load Cycling Program, ILL. C. C. No. 10, 1st Revised Sheet No. 335, et seq. ("Rider AC") to become effective on less than 45 days' notice by order dated March 6, 2014, in ICC Docket No. 14-0120.

The integration with IFTTT enables ComEd customers to create their own IFTTT applets or subscribe to pre-configured applets of their choosing with endless possibilities -- including automatically pre-cooling their home before a demand response curtailment event, or automatically shutting-off lighting and appliances when electricity prices reach a pre-configured price threshold. ComEd created applets through IFTTT that customers can use, minimizing both costs and efforts needed on the customer side to leverage its capabilities. Integrating the IFTTT service with ComEd pricing programs not only offers customers a significantly more convenient experience, but it contributes to greater savings and participation during demand response events and peak pricing hours.

IFTTT was integrated into ComEd's Peak Time Savings (PTS) and Hourly Pricing programs in 2017. The service creates a "set it and forget it" experience for ComEd customers with connected home devices such as smart appliances and smart thermostats. Once PTS or Hourly Pricing customers enable the IFTTT service, they can automate devices based on energy pricing or demand response activation to optimize their program participation for ultimate convenience and control. Over 950 customers signed up to use the ComEd PTS IFTTT applets in 2017, and over 1800 transactions were completed between the IFTTT service and ComEd PTS customers. There are currently 15 ComEd PTS applets available to customers. A majority of PTS IFTTT users connect to the service using Nest thermostats, followed by Ecobee thermostats and then SMS.



Similarly, based on energy pricing for Hourly Pricing customers, IFTTT manipulates devices to adjust energy during peak pricing periods. More than 450 Hourly Pricing customers use ComEd IFTTT applets for the program, which has led to over 68,000 Hourly Pricing applet transactions in 2017. The ComEd Hourly Pricing IFTTT Channel has published 8 applets for customers, most of which are accessed through Nest thermostats, followed by Ecobee and SMS. IFTTT enablement is one of the many ways ComEd is constantly providing customers with more choices, and more convenient tools to increase program participation and savings.



ComEd's online Marketplace offers connected home devices that are compatible with IFTTT applets. These devices range from thermostats to lighting to power strips, with brands such as Philips Hue and Nest cooperating with the IFTTT technology. By supplementing the Marketplace with the IFTTT trigger platform, ComEd is providing customers with both the tools and knowledge they need to turn their home into a more connected space.

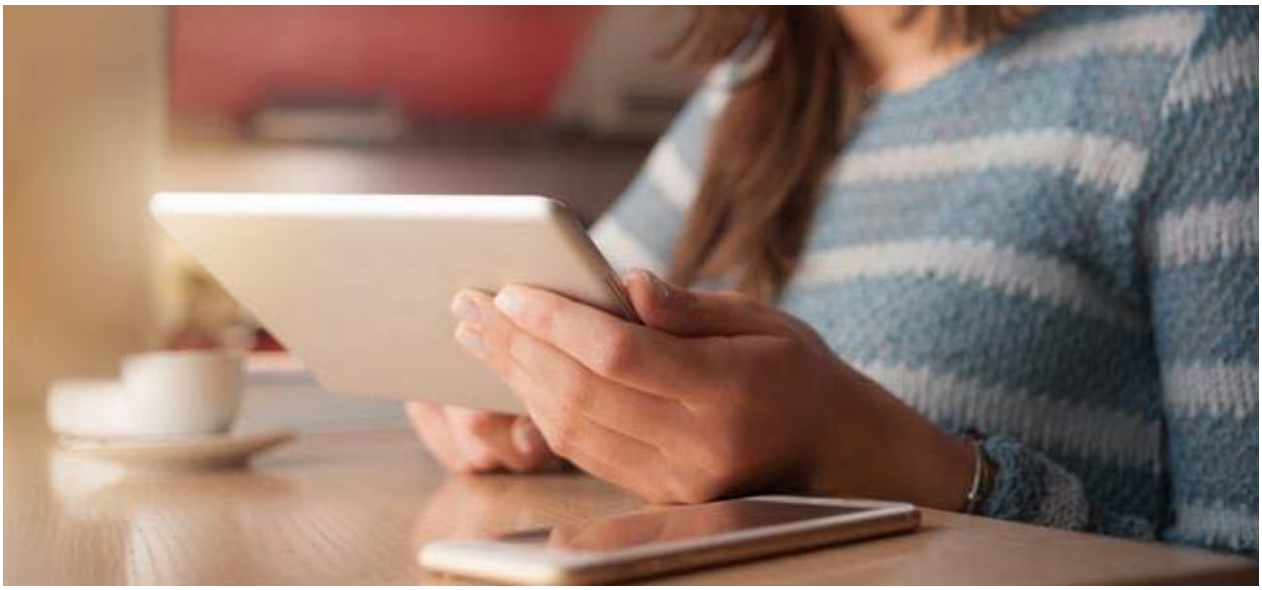
ComEd plans to expand marketing efforts to educate customers about this new offering. ComEd also plans to expand the offering based on customer feedback and engagement data with the aim of increasing customer satisfaction and accessibility.

c. Smart Meter Connected Devices ("SMCD")

ComEd continues to facilitate customer access to near-real-time electricity usage information directly from the smart meter along with estimated electricity cost information by identifying compatible retail in-home wireless smart devices. ComEd launched the pilot in December 2014 as the Smart Meter Connected Devices ("SMCD") Service.[10] It enables residential customers to receive electricity usage and cost information through a smart device that is wirelessly joined to the ComEd smart meter installed at their home. This initiative helps translate smart grid and smart meter-enabled benefits to customers via a platform of meter-joined smart devices. With access to more information about their electricity use, customers can make changes that can help them manage electric bills.

ComEd has also begun working towards the expansion of the SMCD service to select business accounts. These efforts are in the early stages and include various types of commercial customers.

[10] *See Commonwealth Edison Co.*, ICC Docket No. 13-0495, Order (January 28, 2014) at 81.



An SMCD participant can purchase a retail smart device that meets SMCD requirements, register their smart device with ComEd, and ComEd will wirelessly join the device 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. This information appears on the digital display of the device shortly after electricity is used.

- **Energy Gateway:** The Energy Gateway is a smart device that connects the ComEd smart meter to the Internet (Ethernet LAN), communicating wirelessly using an Ethernet cable or Wi-Fi. Depending on the device, you can view your real-time and historical energy usage from wherever you are through a website associated with the smart device, or stream your usage to any supported third-party cloud service.
- **Energy Management Devices**: These smart devices can take multiple forms, but are most commonly a smart thermostat. Some energy management smart devices have features similar to IHDs, with additional capabilities that allow customers to actively manage electricity usage such as providing notification of unusual periods of high electricity use.

The following SMCDs have been tested by ComEd to be compatible with and receive electricity usage and estimated electricity cost information from ComEd smart meters: Rainforest Automation's EMU-2 and Eagle Gateway device, Ambient's Energy Joule, AzTech IHD, and Energate HolHom Smart Thermostat.

d. Emerging Technology Pilots

Bidgely Pilot:

ComEd is conducting a pilot with Bidgely, an energy disaggregator and 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. Bidgely has created a technology which breaks a household's energy usage down to the appliance level. ComEd was one of the first utilities to offer customers this technology, which will provide them with personalized energy reports detailing how and when they use energy in their homes:

- 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

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, which is a customer-requested device, enables ComEd to offer real-time energy insights, such as high-usage alerts via mobile push notifications within minutes of use.

In September of 2016 the Bidgely pilot launched and currently has over 1,250 customers signed up and participating in the program. The pilot was extended until the end of 2017, after which a ComEd third party evaluator will provide evaluated savings for the pilot from September 2016 through December 2017. An extension of the pilot into 2018 is currently being discussed to allow customers to continue to access the Bidgely platform while evaluation is completed and to allow ComEd to test out new features, such as providing participants with smart meter data that is updated several times an hour compared to the current system that updates every 24 hours.

Bronzeville Community Energy Management Program:

ComEd is developing a pilot concept that would be offered to the 20,000 residents in Bronzeville that allows participants to receive direct incentives for taking control and reducing their energy use. This pay for performance model will utilize EnergySavvy, an M&V 2.0 provider, to create a week-ahead forecast of expected energy use for each residence and participants will be able to track their performance through a customized web and app portal provided by MeterGenius. EnergySavvy will also be utilizing their M&V 2.0 process to complete the evaluation of the project.

SensorIQ:

ComEd has been testing a system that would allow smart meters to send more granular data to improve grid performance as well as improve customer programs. The SensorIQ system is currently monitoring voltage on meters from select feeders to provide an alarm to ComEd if the grid voltage is above or below a target threshold, ultimately this information could be used to control a voltage optimization system. Additionally, the SensorIQ system can send 1-minute data every 15 minutes from the AMI meters for customer programs that include demand response and energy usage tracking.

M&V 2.0:

ComEd is currently in discussions with EnergySavvy to expand the use of M&V 2.0 technology beyond the Community Energy Management Program. M&V 2.0 offers ComEd the ability to receive evaluated savings for Energy Efficiency pilots and programs throughout the duration of the program, as opposed to waiting for the end of the pilot of program year to determine the results. This type of analysis allows ComEd insight into the performance of programs and Trade Allies to ensure the programs are operating as expected and to allow changes to be made mid-program, if necessary, to improve performance.

e. Innovation Lab

In 2017 the concept of a Customer Programs Innovation Lab was implemented. This concept included build out of a physical space for testing of new technologies in the Connected

Home and IoT Connectivity areas that allows better development of new programs and enhancements in these areas. In addition, the Innovation Lab concept provides a mechanism for developing and testing new program ideas with customers faster and more efficiently. The innovation lab played a large part in prototyping and launching the initial IFTTT service for PTS and Hourly pricing customers. The Innovation Lab serves as an incubator and important test bench for the following exploratory customer services.

Voice Assistant Devices:

With the number of Voice Assistant devices such as Amazon Alexa and Google Home becoming more prevalent in the market, the innovation team launched a summer BETA program to test these capabilities with customers. The limited customer trial allowed customers to ask many of the frequently asked questions such as "How can I sign up for outage alerts?" or "How do I start service at my new house?", but it also allowed customers on Hourly Pricing to ask more dynamic questions such as "What is the current Price?" or "What is the price forecasted to be at 3pm today?". The information gained from this BETA will provide insights and ideas to help release these types of features to more customers and additional programs.

3. Collaboration

ComEd has worked to collaborate with stakeholders, universities, local retailers and a venture capital fund to foster innovation through a collaborative approach.

a. Local Developer Collaboration

The smart grid serves as a launch pad for entrepreneurs to create innovative solutions to assist residents and businesses in conserving energy. ComEd helped found—and continues to contribute to—the Illinois Energy Foundry, a private nonprofit venture fund fostering the start-up or development of innovative smart grid-related businesses in Illinois. The Foundry has funded several new businesses in Chicago that continue to foster innovation on the smart grid.

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 new ideas are developed. 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.

b. Student Innovation

ComEd has an established "Co-Creation" process to engage customers and third parties in enablement of new products, tools and services. To this end, in October 2017 ComEd sponsored a competition for college students that sought to generate design ideas for a web dashboard or app that will bring engaging information and tools directly to solar customers on ComEd's website.

Current solar adopters use multiple third-party services to view relevant account information, track credits, and see accurate performance data for their rooftop solar systems. They are left to consolidate this information on their own to try to learn the value of their investment. Through the Solar Student Innovation Contest and Co-Creation process, ComEd is working to bring the cost, energy-saving benefits and education of solar electricity utilization to customers in one comprehensive, user-friendly tool.

The contest was announced to various colleges, universities, and energy organizations in October 2017 and students submitted ideas up until December 29, 2017. The contest was promoted externally through ComEd's Social Media channels, campus websites and newsletters, and was also highlighted in several media articles. The contest consisted of two rounds of judging. During the first round, the top 50% of submissions shared a prize pool of $1600. At the conclusion of the first round, the top five submissions presented their ideas for a share of $10,000 in prize money. Winning submissions were highlighted throughout post-contest communications.

c. SmartGridExchange^{SM} Forum

On September 26, 2017, ComEd sponsored the ComEd SmartGridExchange^{SM} (SGE) Forum which hosted select thought leaders, experts, and stakeholder groups in the Illinois community for a 1-day conference aimed at sharing, debating, and co-designing features and principles that can strengthen the SmartGridExchange^{SM}'s success. Industry leaders and innovators, as well as regulators and stakeholders, participated in a series of panels surrounding several core themes of the smart-grid, including discussing ways to incorporate new technologies like blockchain into smart energy solutions. The SGE Forum is a core activity aligned with the "Inform" pillar outlined in the introduction.

C. 2018 Initiatives and Plans

ComEd's smart grid investment is establishing a flexible infrastructure that will both encourage and take advantage of future innovations. As ComEd delivers on the value of the smart grid today, many of the benefits will continue to unfold over time as the role of the energy sector evolves. ComEd has the opportunity to bring the functionality and value of the smart grid to our customers by bringing forth more innovative programs, technology and cost savings. In 2018, ComEd plans to further build on the progress of the SmartGridExchange^{SM} by pursuing ways to expand successful 2017 initiatives to bring the benefits of AMI to even more customers.

Along with efforts to continue the deployment and expansion of new and existing products and services, ComEd plans to continue technology research on a regular basis. Promising ideas that are tested as new pilots help provide a preliminary picture and valuable insights, allowing ComEd to measure the results of the pilot/study and draw lessons in order to evaluate whether individual pilot or demonstration initiatives should develop into full-scale programs that offer greater value to customers with AMI. ComEd envisions this as a fluid process as the 2018 initiatives pipeline evolves—constantly evaluating potential offerings, introducing new ideas, and identifying and revising those with potential. This ongoing research and development process

ensures that the SmartGridExchange^{SM} can continue to serve as a seedbed of new ideas as the industry and vendor landscape evolves.

2018 Targeted Activities			
Expanded Initiatives in 2018	Bring Your Own Thermostat "BYOT"	Expand the Nest Thermostat option of the AC Cycling program offering as part of the Future Energy Jobs Act ("FEJA").	
	Smart Meter Connected Devices	Expand the Smart Meter Connected Devices service by improving the customer experience.	
	Data Services	Continue working with third parties to allow the transfer of customer's usage data to authorized third parties and launch a new data services platform for non-residential customers.	
	Smart Streetlights	Deploy smart streetlight technology to all ComEd-owned streetlights.	
Continued In-Market Programs	Peak Time Savings ("PTS") Enhancements	Continue to deliver a Premier Customer Experience by providing further enhancements to the Peak Time Savings program.	
	SmartGridExchange^{SM} Forum	Host annual forum with thought leaders and stakeholder groups in the Illinois community aimed at sharing, debating, and co-developing features and principles that can strengthen the SmartGridExchange^{SM}	

Areas of Further Exploration in 2018	Hourly Pricing	Improve the program through implementation of tariff changes and by running an Hourly Pricing Bill Protection Pilot.	
	Capacity Guard	Improve the coincident peak hour predictive algorithm and educate customers on Hourly Pricing alerts.	
	Solar Customer Experience	Implement an online widget for customers to view graphs of their net metering information.	
	Innovation Lab	Expanding the Innovation Lab to include more testing and integration with connected home devices and IoT systems.	
	ComEd Marketplace	Add sections to the Marketplace that connect customers with ComEd energy-saving programs and identify smart devices that are compatible with these ComEd programs.	ComEd MARKETPLACE

1. Expanded Initiatives In 2018

a. Bring Your Own Thermostat ("BYOT")

As part of the Future Energy Jobs Act ("FEJA"), ComEd is planning to expand the Smart Thermostat Option under AC Cycling in 2018 through the end of 2021. During that four-year period (i.e. from 1/1/2018 through 12/31/2021) 46,125 new Smart Thermostat Option customers are projected to sign up for the AC Cycling Program.

b. Smart Meter Connected Devices

As of November 2017, the Smart Meter Connected Devices ("SMCD") Service has 660 customers participating. Additionally, ComEd has been collaborating with Illinois Science and Energy Innovation Foundation ("ISEIF") to utilize SMCDs in various customer behavior research studies. ComEd is also exploring further expansion of the SMCD service in the future. To prepare

for that expansion, ComEd has conducted customer satisfaction surveys with existing customers, as well as investigating the possibility of automating the customer enrollment process.

c. Data Services

In 2018, ComEd plans to promote the availability of the Green Button Connect functionality to customers with smart meters and work with third parties to expand the portfolio of offerings that provide better insights and value to our customers. ComEd will also promote the availability of Anonymous Data to customers. A ComEd Data Services Handbook is being developed for use as a reference guide for Green Button Connect third parties and customers interested in Anonymous Data. Further, ComEd plans on launching a new data services platform for non-residential customers which will replace existing tools and provide additional functionality.

d. Smart Streetlights

ComEd is moving forward with its smart streetlight deployment. Over the next five years the target is to have, up to 140,000, lights that are owned by ComEd to be smart. This deployment will fortify ComEd's communications network. Upon the installation, the municipalities and townships will have lights with established dimming profiles to serve their communities. Additionally, the LED lights support a reduction to power consumption, and subsequently, customers will see savings on their utility bill.

2. Continued In-Market Programs

a. Peak Time Savings ("PTS") Enhancements

ComEd plans to continue the success of Peak Time Savings in 2018 and beyond. As the installation of residential smart meters progresses, more and more customers would become eligible for this program. In 2018, approximately 2.9 million customers will be eligible to participate in the summer 2018 PTS season. ComEd will continue to use proven and successful methods to recruit these eligible customers while also conducting testing of enhanced program materials to maintain or increase acceptance rates. Marketing will continue to use direct mail, email, and social media techniques. In addition, ComEd is exploring broader mass media marketing such as radio and television advertising campaigns.

Along with enrollment campaigns, ComEd will continue to promote connected devices to customers and their capabilities. ComEd is looking to grow use of the PTS IFTTT channel, which help customers save more during PTS events and increases the convenience of participating in events. IFTTT works with connected home devices such as smart thermostats, so ComEd will also continue to promote the Marketplace, a web-based tool that connects customers with energy-saving products and tips. Cross-promotion of IFTTT, the Marketplace, and smart thermostats will allow customers to take advantage of the synergies between multiple ComEd offerings.

PTS will also undergo IT enhancements in 2018 that will both increase operational efficiencies and ensure a premier customer experience. The deployment of a new data hub will

enable better targeting of customer segments in future marketing campaigns. New internal reporting platforms will also ameliorate report performance for analysis of customer programs.

b. SmartGridExchangeSM Forum

ComEd plans to continue the success of the past four Forums with a series of annual Policy Forums that gather stakeholders to discuss the future of the smart grid and how best to deliver its benefits to customers. The 2018 Forum will again gather industry leaders and innovators as well as regulators and stakeholders to participate in a series of panels surrounding core themes of the smart-grid space.

3. Areas of Further Exploration In 2018

a. Hourly Pricing

ComEd and Elevate Energy worked with stakeholders in 2017 to affect improvements in the way the Hourly Pricing program was funded in order to better align collections with program expenses and budgeting. They proposed that the monthly $0.39 participant fee be eliminated, and that the $0.04/month program fee that is applied to every residential customer be increased to $0.06. Stakeholders agreed that these changes would be beneficial to ComEd's aspirations to grow the program in the coming years. These changes also align with market research which had previously confirmed that potential participants were "turned off" by having to pay a monthly "participant fee" for a program that was supposed to save them money. ComEd's Regulatory Dept. filed the tariff to affect this change sometime in the first half of 2018.

ComEd also plans to file a tariff to conduct an Hourly Pricing Bill Protection Pilot in 2018. This pilot, which would be deployed among 25,000 "good fit" prospects, would provide a portion of them (a test cell) with a first-year guarantee of savings. If this test cell ended up paying more after their first 12 months on Hourly Pricing than they would have on the ComEd fixed-price rate, they would be credited the difference on their ComEd bill and placed back onto the fixed-price rate automatically. If this pilot is deemed successful in increasing enrollments (while staying within acceptable financial costs), it may be installed as a permanent feature of the program.

b. Capacity Guard

ComEd data analysts authored the coincident peak hour predictive algorithm upon which the Hourly Pricing Alert was based, and ComEd expects the accuracy of the algorithm to improve in 2018 resulting in even greater savings.

Two explanatory videos were created to explain both the advantage of enrolling in Hourly Pricing alerts, and how capacity charges are calculated. These videos will be posted to the FAQ section of the ComEd.com/HourlyPricing web site sometime during the first quarter of 2018.

c. Solar Customer Experience

ComEd is improving the experience of solar net metering customers by implementing a Net Energy Metering Widget online that customers can access in to view more detailed

information about their accounts. In the first phase of this implementation, customers have access to an online summary as of the end of 2017. The second phase, which is taking place in 2018, will also provide graphs for viewing in the widget.

d. Innovation Lab

In 2018, ComEd will expand the space and technology available in the Innovation Lab to include more capabilities to test and integrate with connected home and IoT systems that are available in the market. This can help expand existing programs and create new ones for customers. This will also include expansion into other tools such as Advanced Presence Detection for Energy Efficiency, Solar, Battery and other types of Storage. Additionally, there will be growth in the areas of IoT, Smart Thermostats, and Voice Assistant technologies such as Google Home and Amazon Alexa.

e. ComEd Marketplace

The current version of ComEd Marketplace provides an easy-to-use e-commerce experience with information about and discounts on energy-efficient electronics, smart appliances and lighting.

ComEd is adding a section to Marketplace devoted to its demand response and dynamic pricing programs. This new section will have program information and links to online enrollment forms or phone numbers to speak with program specialists.

Additionally, Marketplace will present customers who are purchasing technologies or products that are compatible with, or enhanced by, these ComEd programs a message at checkout that allows them an opportunity to opt in and be sent more information about the program(s) after purchase completion.

For ComEd, Marketplace serves as an important step forward in providing customers with actionable information about — and multiple options to fulfill — their energy service needs and to help them better understand and control their energy use.

IV. Customer Outreach and Education

In 2017, ComEd continued smart meter outreach and education efforts in support of its planned AMI deployment schedule as discussed in Chapter 2, by:

(1) attending and scheduling local events to distribute information to educate customers about the benefits of smart meters;

(2) delivering staged-messaging communications, prior to, during and after smart meter installation to provide customers with awareness, information and education about the installations and how to take advantage of online energy-management tools and programs;

(3) conducting education programs customized to fit specific customer segments as identified by demographic data; and

(4) promoting ComEd's CARE financial-assistance program that is designed to help eligible customers pay their energy bills.

Outreach and education efforts planned for 2018 include:

(1) continued focus on general education to provide customers with information on the use and benefits of smart meters;

(2) continued use of messages that educate customers about energy-savings tips and the ComEd Energy Efficiency Program;

(3) on-going staged-messaging communications to customers throughout the deployment process;

(4) on-going customization of education programs to fit specific customer segments as identified by demographic data; and

(5) continued education about ComEd's CARE financial-assistance program, which continues as a result of the Future Energy Jobs Act.

The accomplishments achieved in 2017 and the plans for 2018 are described in further detail in this chapter.

A. 2017 Activities and Accomplishments

1. Customer Outreach and Education

As previously noted, customer outreach and education efforts were delivered in a staged-messaging approach in 2017 that took customers through a journey to build awareness, strengthen understanding, promote engagement through participation, and encourage customers to advocate tools and programs enabled and available through smart meter technology.

2. Customer Education and Awareness

Throughout 2017, ComEd continued to provide customers with information to build awareness and education around energy management, smart meters and associated smart meter benefits. In addition, ComEd communicated specific actions that all customers can take to better manage their energy use, regardless of whether customers have smart meters. Channels for such information and education included the following:

Community Events & Outreach: ComEd sought out local community festivals and shopping malls in areas where meters were scheduled to be deployed to educate customers about smart meters and their associated benefits. To do so, ComEd relied upon direct interactions, brochures, and educational kiosks. In pre-deployment areas, this information focused on smart meter awareness and general energy-management tips. In post-deployment areas, customers received information about smart meters and tools and programs to help them save money on their energy bills. Specifically, they received information about online energy-management tools, such as High-Usage Alerts and Weekly Usage Reports. They also received information about programs such as

Peak Time Savings and Hourly Pricing, which are designed to help customers better manage their energy use. In the response section to ComEd's Smart Meter Installation Satisfaction Survey, one customer wrote: "Once I monitor weekly usage, it will be interesting to compare week to week usage (and) make smarter choices."

In 2017, ComEd continued to mix local, community outreach with large-scale events that would attract customers from numerous municipalities, including:

Event	Location
Rockford Home Show	Rockford
Black Women's Expo	Chicago
Fiesta Del Sol	Chicago's Pilsen neighborhood
Northern Illinois University football	Dekalb
Boo at The Zoo	Brookfield Zoo

To continue grassroots outreach during the colder months, ComEd extended education efforts to malls in pre- and post-deployment areas, doubling the number of activations in 2017 to 12 locations. This included Aurora, Gurnee, Joliet, Lombard, Orland Park, Rockford and Schaumburg.

ComEd also continued the deployment of Street Teams throughout areas of deployment in 2017. Street Teams utilized trained ambassadors to greet and interact with customers in high foot-traffic areas and to distribute educational brochures. Street Teams were mobilized to interact with commuters at train platforms, including CTA and Metra stations in Bartlett, Downers Grove, Elgin and Waukegan, to name a few. These "quick touch" interactions allowed for the distribution of brochures and a pen that included a unique website address where customers could learn more about smart meters while commuting to work or home.

Tent Setup at Community Event

Outreach at Local Mall

Peak Time Savings Campaign:

In 2017, ComEd initiated multiple marketing campaigns in the winter and early spring, and again in the fall, to promote enrollment in its Peak Time Savings ("PTS") program. Each campaign

was designed to help ComEd better understand what drives residential customer enrollment in PTS beyond the utility's AMI deployment period. While the initial enrollment campaign focused on customers who recently received a smart meter, the fall campaign allowed ComEd to gain a better understanding of the messaging and offers that will help increase enrollment and participation in PTS.

In total, the campaigns resulted in more than 87,000 new enrollees for the 2017 summer season, and a total of 226,695 new and existing enrollees participating in Peak Time Savings Hours during the 2017 summer season.

PTS Marketing Campaigns: In February, ComEd launched a marketing blitz to more than 930,000 residential customers who were divided into three separate groups:

- Customers who received smart meters from November 2015 to November 2016
- Customers whose demographic profile matched customers who previously enrolled in PTS
- Former PTS customers who de-enrolled primarily because they moved from one household to another

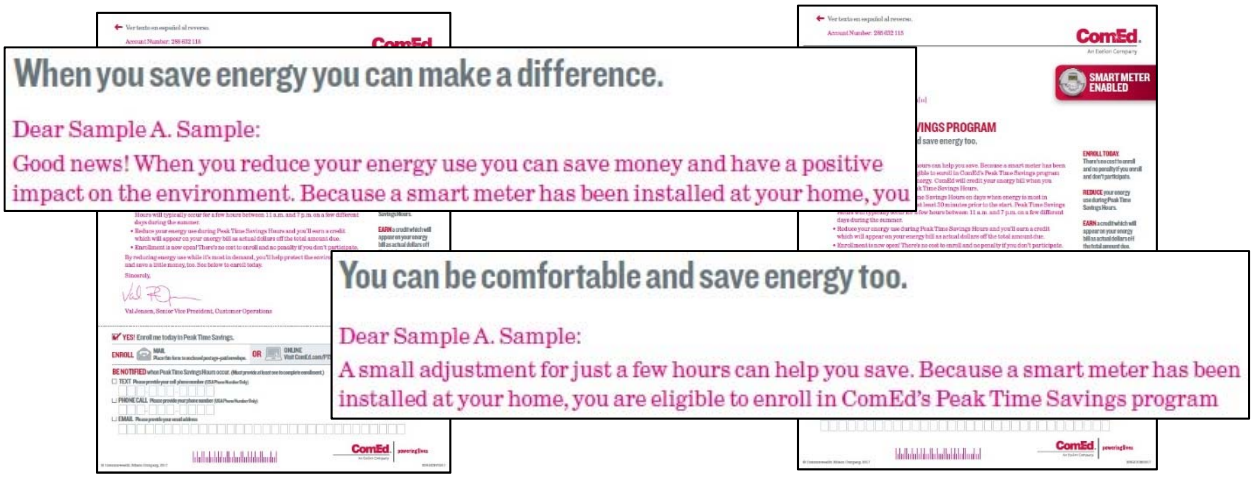
The purpose of the February campaign was to determine which group or groups were most likely to respond to marketing materials by enrolling in PTS.

In March, a second mailing was delivered to nearly 140,000 customers who received smart meters from November 2016 to February 2017. And in April, a reminder email was sent to approximately 153,000 customers who were part of earlier marketing campaigns, and who had email addresses on file with ComEd. Below is a list of each of the previously mentioned customer groups, the number of marketing communications sent, and the enrollment response rate:

Distribution Date	Customer group	Total Sent	Response Rate	Total Response
Feb. 2017	Letter to customers who received smart meters from 11/30/15 - 11/30/16	939,372	7.3%	68,989
Feb. 2017	Letter to customers with smart meters whose demographic backgrounds make them likely candidates to sign up for PTS	50,000	5.8%	2,895
Feb. 2017	Letter to customers who formerly enrolled in PTS but de-enrolled because they moved	6,509	21.3%	1,384
Mar. 2017	Letter to customers who received smart meters from 11/30/16 - 2/15/17	139,653	8.2%	11,402
Apr. 2017	Email to customers who received February or March mailing	153,029	0.9%	1,399

In the fall, at the conclusion of the 2017 PTS summer season, ComEd revised its existing enrollment letter – which focused on savings as the customer benefit – to add two new themes. One theme promoted the environmental benefits of participating in PTS. The other highlighted the comfort and control that PTS provided participants. The goal was to determine which new messaging would resonate with customers and entice them to enroll.

"Environmental" Letter (left) and "Comfort" Letter



Messages and their response rates are summarized below:

Message	Total Sent	Response Rate	Total Response
Savings message	84,594	5.9%	4,994
Environmental message	84,595	5.0%	4,192
Comfort and Control message	84,595	5.2%	4,424

At about the same time, ComEd sent communications to existing PTS customers to cross-promote other ComEd programs and initiatives that could help residential customers manage their energy use. The purpose was to gain further insights into whether PTS-enrolled customers would be interested in additional energy-management products and programs, and into which products these customers would likely participate.

Emails were sent to four groups of PTS-enrolled customers:

- Emails to newly enrolled PTS customers promoting ComEd's Smart Meter Connected Devices (SMCD) service and the "If This Than That" (IFTTT) applet, the latter of which triggers actions on the customer's in-home devices based on events that occur. With IFTTT, PTS customers can set their connected home devices to automatically adjust and reduce energy use during Peak Time Savings Hours or when energy prices are expected to be high.
- Emails to newly enrolled PTS customers promoting ComEd's IFTTT program and ComEd Marketplace, which is a website where customers could find, learn about and purchase the latest energy-efficiency related products and smart technologies.

- Emails to long-time PTS customers promoting ComEd's Hourly Pricing program, which lets customers pay the hourly market price for electricity and save money by shifting energy use to when its less expensive – such as during nights and weekends.
- Emails to newly enrolled PTS customers promoting Hourly Pricing.

PTS Emails Cross-Promoting SMCD, IFTTT and ComEd Marketplace

Below is a list of each customer group and click through rates:

Campaign	Total Delivered	Unique Open Rate	Clickthrough Rate
Email promoting SMCD and IFTTT	**16,751**	**44.10%**	**2.52%**

Email promoting IFTTT and Marketplace	**16,660**	**44.55%**	**2.30%**
Email promoting Hourly Pricing to long-time PTS customers	**29,971**	**28.96**	**3.40%**
Email promoting Hourly Pricing to newly enrolled PTS customers	**21,295**	**37.22**	**9.50%**

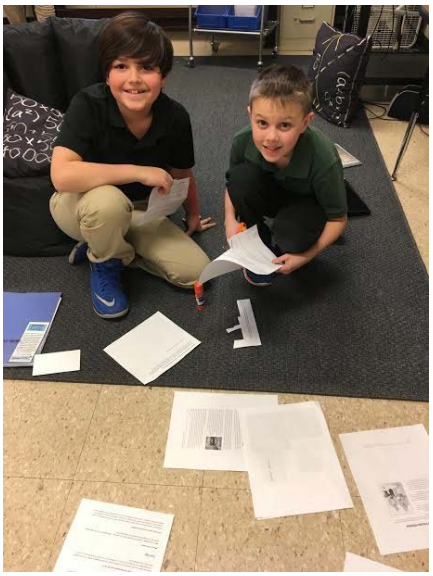
The fall campaign was also supported by social media posts on Twitter and Facebook that promoted participation in PTS.

Advertising: In September 2017, ComEd updated the approach of its "Smarter Power Made Simple" advertising campaign, incorporating lifestyle imagery for a stronger human connection with customers. The straightforward messaging supporting smart meter- associated benefits promoted tools and programs that can help customers manage energy use. A portion of the campaign focused specifically on the PTS program as enabled by the smart meter to help save money. Advertising efforts included television, radio, outdoor billboards, transit signs, digital and interior mall ads.

Smart Meter Digital Advertising

Targeted Education Initiatives: ComEd's education efforts consisted of its successful Student Power, Smart Grid Ambassador, Youth Ambassador and ComEd's Smart Energy Hub programs.

Student Power: During the 2016-2017 school year, ComEd continued Student Power – a signature program originally created for the 2014-15 school year in conjunction with Chicago Public Schools. Student Power provides students in grades 3 through 12 with curriculums tailored for elementary and high school students that teach them about energy generation and delivery, smart grid technologies, and energy-management programs enabled by smart meter technology. For the 2016-17 school year, ComEd promoted the program to suburban and private schools, as well as Chicago Public Schools. This effort resulted in participation from 79 schools that represented nearly 140 teachers who, in turn provided energy education to nearly 4,300 students. These totals include 42 schools and 79 teachers that participated as a result of Illinois Science and Energy Innovation Foundation ("ISEIF") grant funding.



Rockford Christian School Students Work on Energy Projects (left)
Before Giving Presentations (right)

Smart Grid Ambassadors: ComEd continued to recruit recent company retirees to voluntarily serve as Smart Grid Ambassadors. These retirees attend Lunch and Learn sessions throughout the year to receive smart meter program updates and share experiences from the field. Since the program launched, 38 retirees have been trained to become ambassadors and have participated in a total of 64 community events, presentations and Smart Energy Hub field trips.

Smart Grid Ambassadors Help Customers At 5th Annual Back-To-School Health Fair

Youth Ambassadors: ComEd again joined with After School Matters in the annual Youth Ambassador program, which resulted in 107 14-to-18-year-old students completing the program in 2017. Students completed their program training at Columbia College, Urban Prep Academy-Bronzeville Campus, Michael and Karyn Lutz Center and Eric Solorio High School. Through the program, the teens trained to become ambassadors of new smart grid technology and learned how to communicate the benefits of smart meters to their communities. The ambassadors utilized a variety of techniques and mediums to demonstrate their learning and outreach, such as digital media, video production, art, creative writing and design. In addition, ambassadors had opportunities to meet engineers, executive leaders and other professionals in the energy industry. Ambassadors also attended a culminating event at Eric Solorio High School Aug. 1, 2017, where they had the opportunity to reflect on their program experience in front of an audience and presented their final projects to ComEd professionals and community members. Now in its fifth year, ComEd's Youth Ambassadors program provided a dynamic summer experience that incorporates career and college readiness, critical 21st century skills, real-world science, civic engagement and community outreach.

2017 ComEd Youth Ambassadors at Culminating Event at Eric Solorio High School

ComEd's Smart Energy Hub: Smart Energy Hubs are located with ComEd's training centers in Rockford and Chicago's Bridgeport neighborhood. Throughout the years, the Hubs offered students of all ages opportunities to learn about smart meters and smart meter-enabled tools and programs that can help customers manage energy bills and save money – as they learn about electricity, the smart grid and energy management. With a curriculum based on Science, Technology, Engineering and Math (STEM), participants take field trips and learn about smart meters and energy-management through interactive exhibits and state-of-the-art technology that could not be duplicated in the classroom. According to Cheryl M., instructor with Karr Farms Homeschool Organizations, "This field trip captured the attention of our group of K-8th grade students. It was very informative and the kids enjoyed being a part of the discussion/demonstration. This was one of our favorite field trips!"

In 2017, ComEd conducted more than 200 field trips of the Smart Energy Hubs in Chicago and Rockford for more than 6,100 participants.

Local Students Take Field Trips to the Smart Energy Hubs in Chicago and Rockford

Community Presentations: Throughout the year, ComEd conducted presentations – in both English and Spanish – in smart meter deployment areas after meters had been installed to educate customers about smart meter benefits and energy-management programs available to customers. ComEd also provided presentations and literature specially designed for seniors and low-income customers. All presentations featured a trained speaker and a presentation that explains each of the energy-management programs available to customers, including how to enroll in Peak Time Savings. The presentations also provided customers with opportunities to ask questions and engage in dialogue with a knowledgeable ComEd representative.

Senior Presentation in Mendota

Online/Web presence: ComEd continued to utilize online channels such as ComEd.com/SmartMeter to inform and educate customers about online energy-management tools and programs available to customers with smart meters, as well as ComEd.com/HomeSavings to educate customers about its Energy Efficiency Program.

ComEd also took advantage of social media – e.g., Facebook, Twitter – to promote ComEd festival appearances, locations, and dates to encourage customers to attend events to pose questions directly to ComEd representatives and learn more about smart meters and energy-management programs. Throughout the year, ComEd continued to update its websites and staged-messaging communication materials to reflect progress in its deployment schedule.

Municipal Outreach: ComEd conducted outreach to municipal leaders and aldermen to inform them about the smart meter educational events and activities ComEd planned for their communities. In turn, they worked with municipal leaders and alderman to help share this information with their constituents. This municipal outreach included one-on-one meetings, attendance at city council meetings, and posting videos of Smart Meter Presentations to YouTube so that municipalities could access and use them as informational resources for local residents. ComEd used one-on-one meetings to update municipal leaders and aldermen on how residents can take advantage of the benefits smart meters provide, so that they could become third-party advocates for taking advantage of online energy-management tools and programs. ComEd conducted municipal meetings in a majority of towns where smart meters were deployed and provided municipality officials with a toolkit that included: smart grid-smart meter fact sheets, brochures, and samples of communications that customers would receive throughout the smart meter deployment process. ComEd External Affairs managers also met with municipal leaders, prior to the deployment of smart meters in their towns, to discuss the installation process and answer questions.

ComEd Presents at Park Ridge Municipal Meeting

Community Partners: In 2017, ComEd augmented smart meter outreach efforts by collaborating with community organizations to hold meetings, share materials, and support third-party community activities.

For example, ComEd collaborated with the Illinois Science and Energy Innovation Foundation ("ISEIF") and several of its grantees to support their smart grid outreach and education activities. With ISEIF in the lead, ComEd and Ameren shared program and initiative updates. ComEd also participated in ISEIF grantee gatherings to help align utility and grantee educational activities, educate ISEIF and grantees about smart grid technologies and smart meter benefits, and allow grantees to leverage information utilities could provide them for their educational efforts.

In January and July 2017, ISEIF provided grants to more than 23 organizations in the ComEd and Ameren territories to support smart grid and smart meter outreach and education, including a new small grants program. The small grants program provides funding to community groups who partner with larger grantees to execute projects within a specific community.

Throughout 2017, ComEd also collaborated with community organizations and educational institutions to help educate audiences, constituents and citizens about energy-management and smart meter benefits. Organizations included: Chicago Public Schools, Elevate Energy, Faith in Place, City of Chicago, Cook County Department of Environmental Control, Shedd Aquarium, Northern Illinois University, University of Illinois Extension and SciTech Museum.

Some of the highlights from planning and collaboration with community organizations included:

- Chicago Public Schools – expanded the Student Power education program during the 2017-18 school year for students in grades 3 through 12, resulting in participation by 75 teachers from 42 Chicago public, private and charter schools. This expansion enabled the program to achieve total participation of 140 teachers from 79 schools overall. Teacher professional development was provided by Educational Dividends.
- City of Chicago – assisted City with updating the smart grid content on their website; support of the Retrofit Chicago Residential Partnership group to incorporate smart meter messaging into the city's energy efficiency and retrofit outreach.
- Cook County – collaborated on outreach efforts to provide smart grid, smart meter and energy efficiency information to southwest suburban Cook County.
- Elevate Energy – collaborated to provide smart meter and energy efficiency education and outreach in Dixon deployment area.
- Citizens Utility Board (CUB) – collaborated to provide smart meter and energy efficiency education and outreach in Dixon deployment area.
- Shedd Aquarium – created interactive displays outside of 4D Theater to provide guests with education on smart grid, smart meter and smart-enabled community-of-the-future technologies.
- Northern Illinois University and University of Illinois Extension – met to provide outreach staff with information on smart meter-enabled and energy-efficiency tools and programs to support energy-management outreach efforts to seniors and low-income customers.

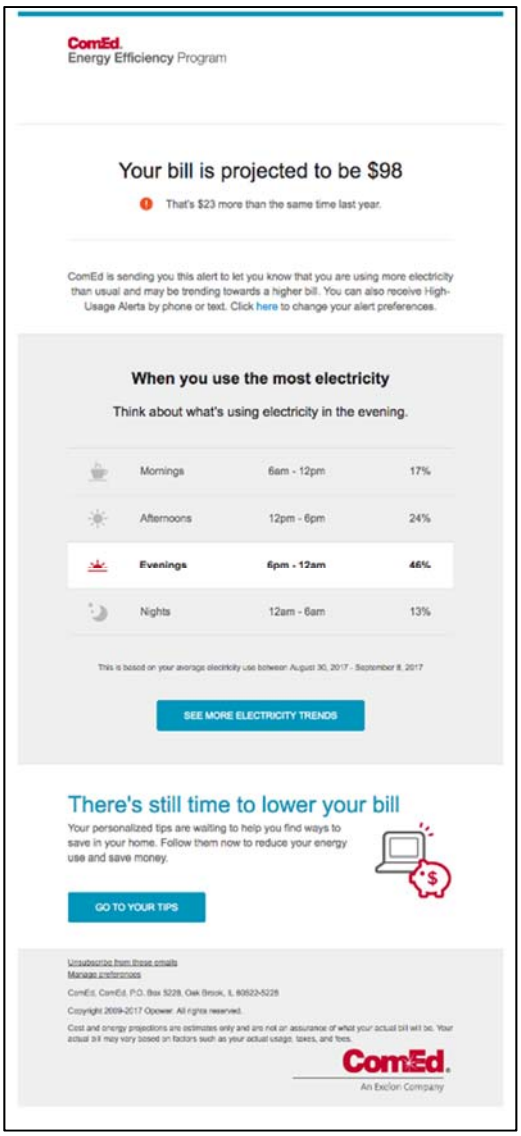
- SciTech Museum – created interactive display for museum guests to learn about energy generation and community of the future.

3. Customer Messaging Efforts

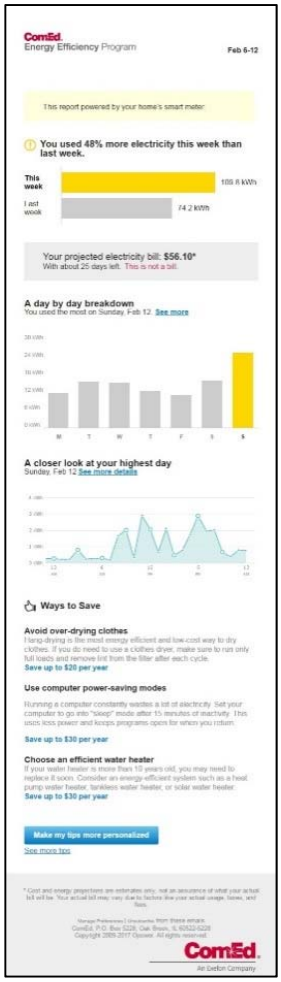
Throughout the outreach and education activities mentioned above, ComEd attended events, conducted presentations and distributed brochures to inform customers of the following initiatives and programs:

- My Account: Online energy-management tools that enable customers to compare their energy use against similarly sized homes in their areas, and get personalized energy-saving tips. Customers with smart meters have access to enhanced online features, including High-Usage Alerts and Weekly Usage Reports, which can help them manage their energy use. In July, ComEd took advantage of advanced features in My Account site to revise customer materials to promote the fact that eligible customers (those not on budget billing) could set a dollar threshold amount when signing up for High-Usage Alerts.

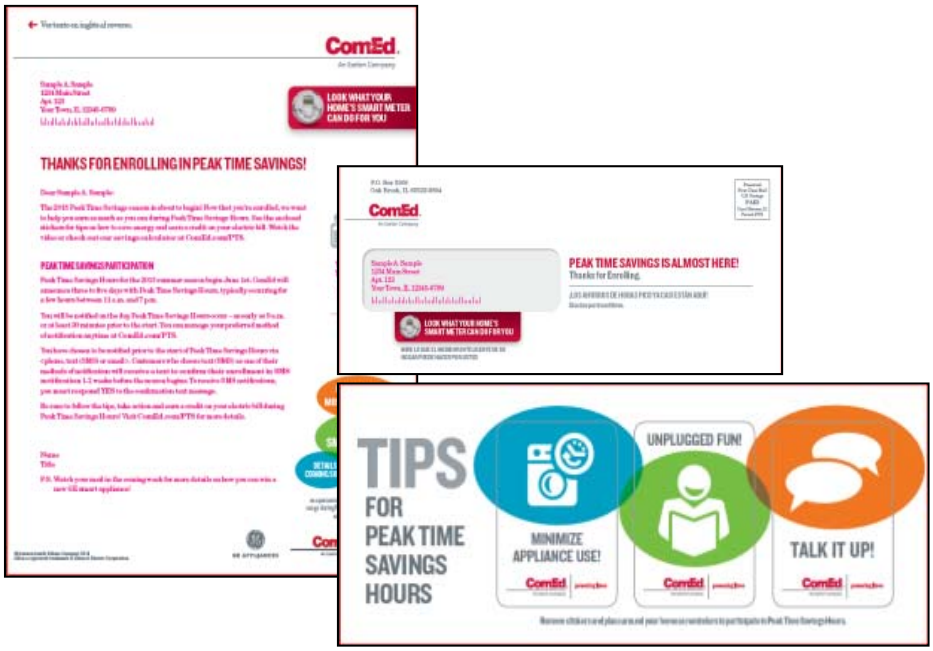
High-Usage Alert



Weekly Usage Report



- Peak Time Savings ("PTS"): This program, which began promotion in the fall of 2014 and launched in the summer of 2015, enables customers with smart meter to receive bill credits for using less electricity on select summer Peak Time Savings Hours when electricity demand is typically high. Outreach efforts focused on promoting enrollment in PTS for the summer 2017 season, reminding customers of their enrollment and alerting enrolled customers of PTS events.



PTS Reminder Materials

- Energy Efficiency: Tools, tips and offerings that provide both residential and business customers with practical cost-savings tips, such as turning off lights when leaving a room, replacing traditional light bulbs with energy-efficient light bulbs, and adjusting the temperature of the refrigerator.
- Hourly Pricing: Gives customers the option to pay the hourly, market price for energy and save money by shifting energy use to off-peak times when the price is lower, such as nights and weekends.

4. Market Research Efforts

Awareness Tracking Study

An ongoing quantitative awareness/education tracking study, initially launched in Q4 2013, continued through 2016. This phone-administered survey monitors residential customer awareness and perceptions of the smart grid and smart meters, along with awareness of the various communication sources and messages related to smart meter deployment. The latest results (Wave 3, based on interviews conducted September-to-December 2017) show positive results:

- Awareness of smart meters is 60%, up 29 significant points from the baseline study (31% in Q4 2013).
- While roughly four in 10 (38%) customers aware of smart meters reported feeling knowledgeable about smart meters, 49% of those aware felt smart meters will be of value to them personally. Smart meter value perceptions have increased 8 points compared to the baseline study (41% in Q4 2013).
- Peak Time Savings ("PTS") direct mail communications targeting customers with smart meters took place in Q1 2017. Peak Time Savings was the number-one message recalled in Wave 3 2017 (29%). Customers who recalled hearing about ComEd's PTS program

have higher smart meter knowledge levels and smart meter value perceptions compared to those unaware of PTS (knowledge: 43% vs. 32%, value: 57% vs. 44%).

Post-Installation Tracking Study

An ongoing quantitative post-installation satisfaction tracking study continued in 2017 to measure and track customer satisfaction with the smart meter installation process and communications surrounding the experience. The latest results (based on meters installed in Q2 2017 and interviews completed in Q3 2017) show that five out of the seven key satisfaction questions received a satisfaction rating at or above 90%.

- Satisfaction with the knock on your door before meter exchange 95%
- Satisfaction with entire installation process 92%
- Satisfaction with respect shown towards your property/landscaping 91%
- Satisfaction with door hanger 90%
- Satisfaction with all communications prior to the installation 90%

Peak Time Savings Post-Event Research

Between Sept. 26 and Oct. 12, 2017, ComEd conducted telephone interviews with 1,500 randomly selected residential customers enrolled in PTS after the third PTS event on Sept. 22, 2017. PTS was well received by participating customers, showing generally high levels of overall satisfaction, likelihood to participate during future Peak Time Savings Hours and likelihood to recommend PTS to family and friends.

- Overall, eight in 10 (79%) customers report being satisfied with PTS (customers who gave a rating of 6-10 on a 0-to-10-point scale).
- More than seven in 10 (72%) customers said they would be likely to recommend the program to family and friends.
- Nearly nine in 10 (87%) customers said they are likely to participate in future events.

Results point to the success of PTS in raising awareness of smart meters and strengthening value perceptions.

- Nearly seven in 10 (68%) PTS participants are aware that they have a smart meter at their household. This is notably higher than the Wave 3 2017 findings from ComEd's awareness tracking study (discussed previously), where an average of 32% of customers in areas where PTS was marketed were aware they have a smart meter.
- Of those aware they have smart meters, just over half (53%) feel having a smart meter is valuable to them (customers who gave a rating of 6-10).
- Additionally, PTS has a positive impact on customers' perceptions of the value of the smart meter installed at their homes, with four in 10 (41%) saying the program has made their smart meter more valuable.

5. AMI Deployment Communications

As described in the AMI filing,[11] ComEd developed a staged-messaging and communication plan to help educate customers throughout the smart meter installation process. After building awareness of smart meters, customers are provided information on what to expect during the installation process. They are then engaged on how they can take advantage of smart meter-enabled tools and programs to help them manage energy use to save money on their bills, as well as ComEd's CARE financial-assistance program that is designed to assist eligible customers pay their energy bills.

At each stage, ComEd incorporated ways to encourage customers to take actions to familiarize themselves with smart meters, prepare for installation, and take advantage of smart meter-enabled tools and programs to help them save energy. For example, the messages delivered to customers through materials and during face-to-face meetings included information that encouraged customers to access resources to learn more about smart meters and smart meter-enabled tools and programs. These "calls-to-action" included vanity website addresses, such as ComEd.com/OnlineTools or the phone number to a smart meter-dedicated call center.

Incorporating calls-to-action helped increase the number of customers participating in smart meter-enabled tools and programs:

	Approximate enrollments as of 12/31/2016	Approximate enrollments as of 12/4/2017
Peak Time Savings	150,000	237,000
Hourly Pricing	14,400	19,400
High-Usage Alerts	62,000	159,534*
Weekly Usage Reports	34,000	43,675

*** In the summer 2017, ComEd auto-enrolled 100,000 customers in emailed High-Usage Alerts.**

According to one customer who responded to ComEd's Smart Meter Installation Satisfaction Survey, "I got all the information I need in the mail and on the door. I think it was a very good process."

Table 1 below describes how ComEd implemented the staged-messaging approach for meter deployments. Smart-meter branding to PTS and Hourly Pricing customer materials are included to extend the awareness of smart meter-enabled tools and programs beyond the Engage stage of the staged-messaging approach.

[11] Revised AMI Plan at 104-5.

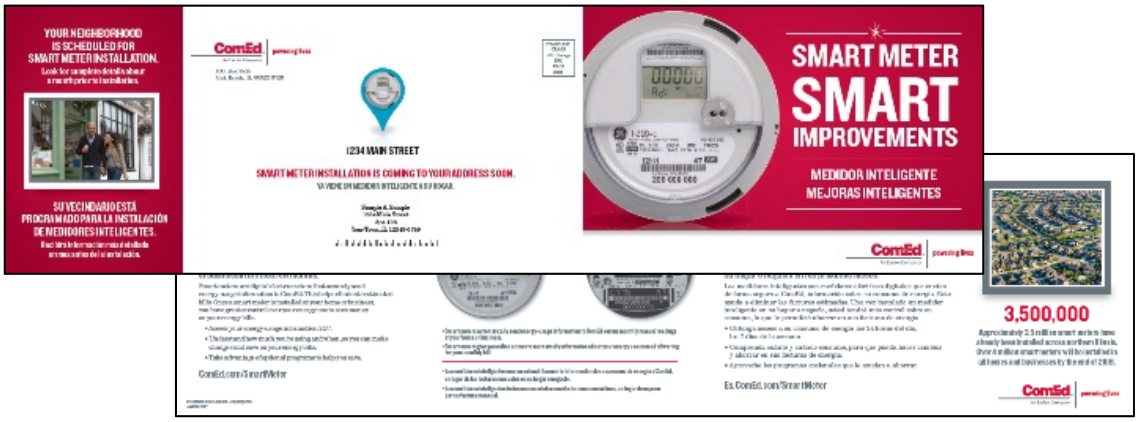
Timing	Channel	Message
Awareness **60-120** days prior to smart meter installation	• Bill Insert • Direct Mail • Community Events • Street Teams • Social Media/Website	• Awareness about smart meters and benefits • Awareness that meters will soon be installed in area • EE and CARE programs also available
Inform **7-30** days prior to smart meter installation	• Pre-deployment letter • Robo-call • Community Events • Social Media/Website	• Letter informs customer that a smart meter will be installed in the next 30-45 days • Automated call reminds customer of meter installation in one week • EE and CARE programs are available
Educate Day of installation	• Door knock at customer premise • Installation door hanger • "Missed You" door hanger • Social Media/Website	• Inform customer of meter installation • Inform that meter has been installed or "sorry we missed you" and need to reschedule • Educate about benefits and energy-management programs (i.e. My Account)
Engage **30 - 45 days +** after installation	• 30-day Post Mailer • 45-day Post Mailer • Peak Time Savings Direct Mail • Community Workshops • Social Media/Website	• Educate customers about tools and programs they can sign up now that customers have a smart meter

Table 1: Staged- Messaging Communications for Residential Customers

Detailed information on each of the communication touch points and materials is outlined below. Specific numbers for many of these tactics can be found in the Metrics section of this report:

a. Awareness Stage (pre-installation):
   - Open Houses. Typically held at local town halls, these events allow ComEd to answer customer questions and address concerns. Speakers explain what smart meters are, how the installation process will work, and how customers can benefit from them. Information on ComEd's CARE financial-assistance program is also provided.
   - Events. Held in municipalities where meters were scheduled to be deployed, encourages one-on-one dialogue with customers about smart meter installations and the benefits they provide. Descriptions of the CARE program, energy-efficiency programs and energy-management tips are also provided. In post-deployment areas, customers receive information specific to energy-management programs, including instructions on how to enroll.
   - Bill Insert. Included in the bills of customers who are scheduled for meter installations, this insert introduces smart meters and describes the benefits.
   - Introductory Mailing. Simple, direct language, along with a few high-level facts and minimal marketing educate customers that smart meters are coming.

Bill Insert



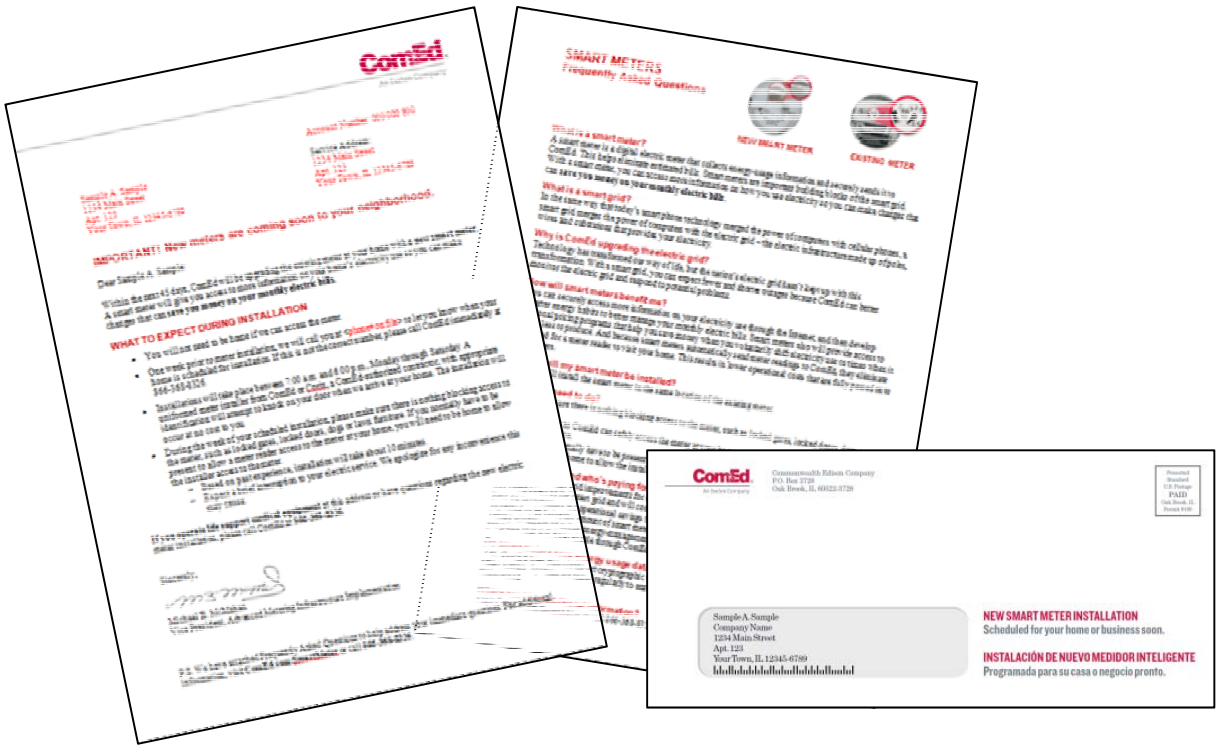
Introductory Mailing

- Street Teams. Trained personnel greet customers in high foot-traffic areas and have short, fun and engaging interactions describing smart meters and distributing information that encourages customers to visit ComEd's website to learn more.
- Advertising. Targeted toward smart meter deployment areas and included mass-reaching channels such as TV, radio, print, transit, billboards, online, and social media. Messaging focused on smart meter-enabled tools and programs designed to help customers save money.
- Website and Social Media. ComEd.com/SmartMeter undergoes continual revisions to include updated smart meter deployment schedules, electronic versions of customer communications, as well as fact sheets and videos about smart meters. The website also provides customers with a phone number for the dedicated AMI Call Center to ask questions regarding the smart meters. Social media messages are used to alert customers of upcoming events where they could ask smart meter-related questions and receive information on CARE, energy-efficiency programs and energy-management tips.

- Executive Town Hall Meetings. Representatives from ComEd's Smart Meter Deployment team meet with municipal officials, customers and key stakeholders to increase awareness about smart meters, provide education of the smart meter installation process, and provide information on smart meter-enabled tools and programs.

b. Inform Stage (pre-installation):

- Letter and FAQs. Mailed 7-30 days prior to smart meter installation, this mailing communicated what can be expected during smart meter installation and the actions they need to take to help ensure successful installation. The mailing also contains high-level benefits messages in an informational and factual tone. The FAQs provides more detailed instruction and refers customers to the website for more information.



Pre-Installation letter, FAQ and envelope

- Robo-call. Occurring approximately 7 days prior to meter installation, customers receive a short, succinct automated phone message reiterating the timing of meter installation and the actions customers should take.
- Website and Social Media. Continued to be used at this stage.

c. Educate Stage (day of installation):

- Door hanger. Installers attempt to contact customers to alert them of the upcoming installation and leave door hangers that introduce customers to the new smart meter. Because customers are more receptive to learning more at this stage,

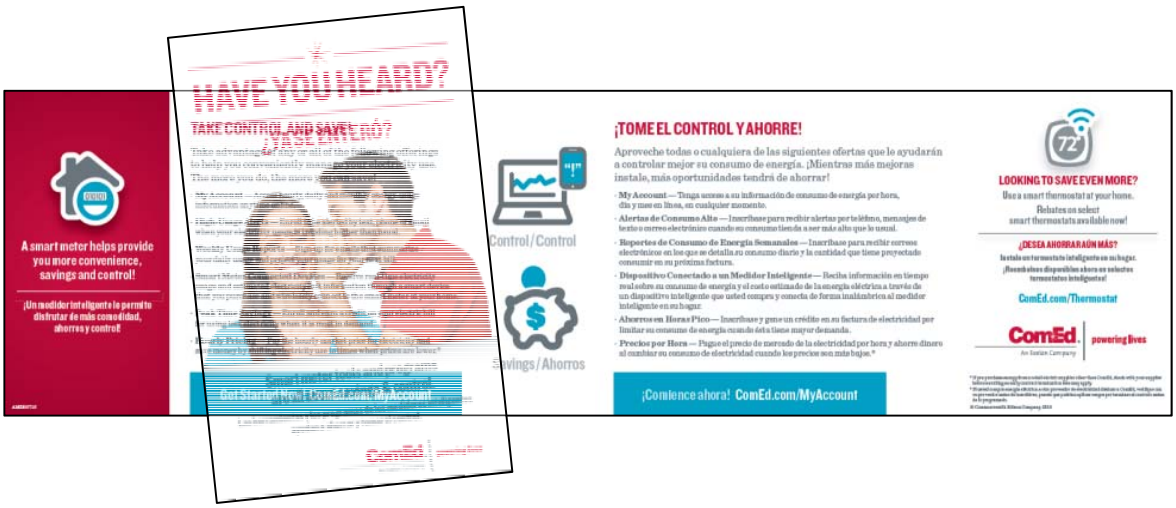
the door hangers focus on actions the customers could take, including looking at the meter, creating an online account to get energy-management information, and learning more about programs such as Hourly Pricing, PTS, and programs from other energy suppliers.

Door Hanger

- Website and Social Media. Also used at this stage to educate customers.

d. Engage Stage (post-installation):

- Welcome Mailing. Provide customers with information about the tools and programs available with smart meters and outlines the specific steps customers can take to save energy and money. Customers are encouraged to access My Account and consider enrollment in Hourly Pricing and PTS. To increase customer retention of this information, welcome mailings are delivered twice to customers – the first is delivered 30 days after installation and the second is delivered 45 days after installation.



30-Day Post Mailer (left), and Cover of 45-Day Post Mailer (right)

- Presentations. Held at local libraries to provide specific direction to customers about how they can benefit from smart meters. Representatives are also made available to answer customer questions.
- Municipal Outreach Meetings. As described in Section 2 of 2016 Activities and Accomplishments.

In July 2017, all AMI residential materials – including mailers, brochures, fact sheets and FAQs – were updated to provide customers with even more customer-friendly language as developed through industry-best practices. That same month, all customer documents posted to the ComEd.com website were reformatted to conform to new ADA guidelines for reading accessibility.

With Spanish being the second most prevalent language in the Chicago area, according to the 2013 U.S. Census Bureau survey, ComEd has made Spanish-language brochures and Spanish speakers available at events and presentations. The pre-installation introductory mailings, brochures, letters and FAQ mailings, door hangers, post-installation welcome mailings and PTS materials were all bilingual.

Throughout the smart meter installation process, ComEd's External Affairs managers meet with city alderman and local municipal officials and leaders to address questions and explain how smart meters provide customers with better service and more energy-saving options. These meetings align with the aforementioned communications.

In early summer 2017, as ComEd began installation efforts in the more rural areas of Illinois (western and southern portions of the service territory), ComEd encountered an increase in questions from local customers about the value and safety of smart meters. To address these concerns, and to mitigate an increase in refusals, ComEd launched an integrated outreach strategy consisting of the following tactics:

- Increase in outreach activities – smart meter billboard advertising, local advertising in print publications, community event appearances, town hall and council meeting presentations – scheduled more than two months in advance of the first meter install
- Attendance at local events by ComEd employees and Smart Grid Ambassadors who live in the area and can best respond to concerns of local customers

By the end of the summer, these efforts helped contribute to a leveling off of inquiries and refusals in rural communities scheduled for smart meter installations, and helped mitigate future inquiries and refusals in rural communities scheduled for installation in the late summer and fall. In addition, ComEd received positive comments for having local employees and retirees attend community events.

Meanwhile, small-business customers scheduled for smart-meter installations receive similar mailings and notifications through staged-messaging communications as described above that include information about Energy Insights Online, an online tool that allows businesses to track and manage their energy use.

To coincide with the installation of smart meters for larger Commercial & Industrial ("C&I") customers, ComEd employs a staged-messaging communications plan. The plan includes a combination of online advertising, pre-installation letters and emails, FAQs, on-site visits and post-installation mailers, depending upon the size and type of customers. The post-installation mailer promotes both Energy Insights Online and Business Energy Analyzer, an online tool that allows businesses who use more than 100 kilowatts ("kW") to analyze their energy use month-to-month and receive personalized energy-efficiency tips.

C&I customers have been segmented into two major groups: non-managed and managed customers. Non-managed customers are generally non-residential customers with peak demands under 500 kW. These customers receive staged-messaging communications analogous to residential customers. Managed customers are generally non-residential customers with peak demands at or above 500 kW and have an assigned ComEd representative. The staged-messaging communications plan is described in Table 2 below:

Tier 1 (> 2 MW)	
60-90 days prior to installation	In-person meeting to discuss smart meters, associated benefits, and upcoming installation process. Leave-behind document describes smart meter and benefits.
30 days prior to installation	Pre-deployment letter or email to alert customer of what to expect during the installation of smart meters.
7-30 days prior to installation	Meeting with customer to identify and discuss meter access or other special issues.
7-30 days prior to installation	Phone call to schedule appointment for meter installation.
7 days prior to installation	Phone call to remind customer of upcoming meter installation.
30 days after installation	Phone call to review meter installation and discuss smart meter benefits.
Tier 2 (1 MW - 2 MW)	
60-90 days prior to installation	In-person meeting to discuss smart meters, associated benefits, and upcoming installation process. Leave-behind document describes smart meter and benefits.
30 days prior to installation	Pre-deployment letter or email to alert customer of what to expect during the installation of smart meters.
7-30 days prior to installation	Phone call to schedule appointment for meter installation.
7 days prior to installation	Phone call to remind customer of upcoming meter installation.
30 days after installation	Phone call to review meter installation and discuss smart meter benefits.
Tier 3 (500 kW - 1 MW)	
60-90 days prior to installation	Phone call, letter or email to discribe smart meters, associated benefits and upcoming installation process.
30 days prior to installation	Pre-deployment letter or email to alert customer of what to expect during the installation of smart meters.
7-30 days prior to installation	Phone call to schedule appointment for meter installation.
7 days after to installation	Phone call to remind customer of upcoming meter installation.
30 days after to installation	Phone call to review meter installation and discuss smart meter benefits.
National Accounts (customers with headquarter locations and numerous other locations, e.g., McDonald's or Walgreens)	
60-90 days prior to installation	In-person meeting (for headquarters located in Northern Illinois) or phone call, letter or email (for headquarters outside Northern Illinois) to describe smart meters, associated benefits and installation process. Leave-behind document describing smat meter and benefits will be provided. Approach for disseminating information to non-headquarter locations will be established during the meeting.
During installation period	Phone call, letter or email to review meter installations and discuss smart meter benefits. Leave-behind document describing smart meter benefits will be provided.
Municipalities	
30 days prior to installation	Phone call to discuss smart meters, associated benefits and upcoming installation process. Note: Municipalities have already been informed about smart meters and associated benefits.

Table 2: Staged-Messaging Communications for Larger C&I Customers

Below are samples of the communication materials that managed and non-managed customers received through the staged-communication process:

(From left) Pre-Install Mailer, 90- and 30-Day Pre-Install Letters and FAQ

Throughout 2017, ComEd continued to execute its Multi-Unit Building strategy to enhance communications to customers living in apartment buildings and condominiums. Previous Post-Installation Tracking Studies show that residential customers who personally interacted with a ComEd technician on the day of installation were more satisfied with their smart meter installation than customers who did not. To ensure outreach to customers in multi-unit buildings, ComEd recruits employee volunteers to personally interact with tenants and answer customer questions – where possible – while smart-meter technicians complete building installations. ComEd also stations representatives in building lobbies, where customers can receive information on smart meters, energy-management tools and programs, and energy-efficiency. ComEd also offers property managers the option of having a ComEd representative address tenants at regularly scheduled building meetings.

6. Audience Segmented Customer Education & Awareness

In 2017, ComEd continued providing customized education and awareness materials to specific customer segments, such as seniors, Hispanic and small businesses. Moreover, ComEd provided information in Spanish for Spanish-speaking customers. This included Spanish-language

presentations conducted by trained Spanish speakers, and the availability of Spanish-language collateral materials at events and presentations.

a. Seniors

In 2017, ComEd continued to utilize materials developed for seniors, including brochures with large fonts and fact sheets that focused on information found to be most important to them:

- smart meters help eliminate estimated bills and the need for meter readers to visit their homes
- how to identify a smart meter
- how to create an online account to manage energy use; and
- where to access no-cost energy-saving tips that can be acted upon immediately

ComEd sponsored and hosted exhibit tables at senior-focused events – such as the Senior Lifestyle Expo in Oakbrook Terrace and the Senior Resource Center Expo in Freeport to further expand its reach to seniors and those who serve them.

ComEd hosted presentations at dozens of community senior centers such as Summit Senior Luncheon, Plainfield Township Community Center, The Founder's Center, Whiteside County Senior Center and Hanover Township Senior Center. For customers who do not have the means to receive information electronically, ComEd provides a variety of printed materials including bill inserts via mail to all customers, and brochures with large print at senior events and community centers where ComEd conducts presentations.

B. 2018 Planned Activities

1. Customer Education and Awareness

ComEd will continue engaging customers by targeting energy-management programs and services – all enabled by smart meter technology – to customers most likely to take advantage of these offers. Outreach, which may involve both direct mail and email, is designed to match customers with relevant energy-management offers, based on the customer's interest, current program participation and past energy-management actions.

Peak Time Savings Campaign: ComEd will apply lessons learned from its 2017 marketing campaign to improve overall marketing efforts in 2018. The goal is to continue to increase customer enrollment in ComEd's Peak Time Savings ("PTS") program, while improving preparedness and participation in Peak Time Savings Hours.

For the enrollment phase of its marketing efforts (which take place from February through April), ComEd will continue to send letters, promoting enrollment in PTS, to customers who most recently received smart meters. ComEd will also seek out additional demographic profiles that match customers who are most likely to enroll in PTS and send letters to those customers. These efforts will be supported by social media posts on Twitter and Facebook that promote participation in PTS.

Throughout the summer season, customers enrolled in PTS will receive reminder letters, supported by social media posts, to help prepare enrolled customers for upcoming Peak Time Savings Hours. These letters will include information on tools and programs that can help customers participate in and save energy during Peak Time Savings Hours. This includes information promoting ComEd's "If This Than That" (IFTTT) applet, as well as energy-management products available through the ComEd Marketplace. To further encourage participation in PTS, ComEd's letter campaign will be supported by emails to customers who have email addresses on file with ComEd.

Community Events & Outreach: ComEd plans to continue its customer outreach and education by focusing on community events and presentations. As learnings are analyzed from customer research and in-market findings from previous years, these efforts will be enhanced, revised, adjusted and modified to ensure effective communication to customers. Planned updates include:

My Account for Business Customers: In December, ComEd joined Exelon's other operating companies in launching a new suite of energy-management tools for all business customers. Accessible through ComEd's My Account page, all business customers could view a history of their energy use, sign up for usage reports and alerts, and benchmark their usage for analysis. In 2018, ComEd will market these new tools in its smart meter materials. This includes bill inserts to small businesses scheduled for smart meter installation, its post mailer to all business who received smart meters, and a fact sheet that is posted to ComEd.com/BizSmartMeter and used by account managers during their meetings with large customers.

Community Partners: In addition to the work outlined above, ComEd will continue to collaborate with the Illinois Science and Energy Innovation Foundation ("ISEIF") and support its new and existing grantees on outreach and education activities and projects. Outreach and education opportunities will be provided to keep organizations informed of smart grid and smart meter progress throughout the ComEd service territory, and facilitate collaboration among community organizations.

ComEd also plans to continue collaboration with additional community organizations as they provide energy-management and smart meter-benefit education to their audiences, constituents and citizens. These organizations include Chicago Public Schools, City of Chicago, Elevate Energy, Faith in Place, Shedd Aquarium and Northern Illinois University / University of Illinois SciTech. ComEd will work with each of these organizations to perform smart meter educational activities with their audiences, as needed.

V. METRICS AND MILESTONES

The following table contains the set of tracking measures the Commission approved for inclusion in the AMI Plan, including measures that ComEd agreed to report on via collaborative sessions with external stakeholders. The purpose of the table is to provide the required information and demonstrate the progress made during the prior calendar year regarding these measures. Results will be refreshed in the AIPR filing over the seven-year deployment period. As a baseline for each measure, ComEd has been using the 2012 AMI Metrics data results - or the first year a measure is reported if other than 2012.

As also noted in Chapter II.A of this Report, the data in the table below indicates that the overall AMI meter program is progressing as scheduled, and the plan for full deployment is being executed on-time and within-budget. None of the data points captured indicate that ComEd will be unable to execute the deployment according to the approved plan. As meter deployment progresses throughout the service territory, many of the measures identified will become more meaningful and indicative of quantitative progress towards completing full deployment of AMI meters.

ComEd mapped the measures below to the Revised AMI Plan to the extent possible given that all the measures in the Revised AMI Plan are not centrally located in one section. Additionally, multiple measures that are tracked relating to a single issue are all identified under one number consistent with the numbering in the June 2012 Order and the Revised AMI Plan. For example, there are four items tracked under Measure 1. For ease of identification, letters are used to differentiate these related items (e.g., 1a, 1b, 1c, and 1d are used). Further, Attachments 1-6 are specifically referenced when they can provide additional information regarding a certain measure.

2017 Tracking Metrics				
#	**Issue**	**Tracking Metrics Description**	**"Baseline Data" (2012 Data Unless Otherwise Indicated)**	**2017 Annual AMI Metrics Data**
1A	Customers enrolled in Peak Time Rebate, Real Time Pricing, and other dynamic/time variant prices	Residential Customers Number of customers on a time-variant or dynamic pricing tariff offered by ComEd. Expressed also as a percentage of customers in each delivery class.	The number of customers on a time-variant or dynamic pricing tariff offered by ComEd are as follows: Residential - Single: 8,473 (0.4%) Residential - Multi: 605 (0.1%) Residential - Single (Space Heat): 157 (0.5%) Residential - Multi (Space Heat): 155 (0.1%)	The number of customers on a time variant or dynamic pricing tariff offered by ComEd are as follows: Residential - Single: 14,619 (0.6%) Residential - Multi: 2,161 (0.2%) Residential - Single (Space Heat): 396 (1.1%) Residential - Multi (Space Heat): 697 (0.4%)
1B	Customers enrolled in Peak Time Rebate, Real Time Pricing, and other dynamic/time variant prices	Residential Customers Number of customers served by retail electric suppliers for which the supplier has requested monthly Electronic Data Interchange delivery of interval data. Expressed also as a percentage of customers taking supply from a retail electric supplier in each delivery class.	The number of residential customers served by retail electric suppliers for which the supplier has requested monthly Electronic Data Interchange delivery of interval data is zero (0% of customers taking supply from a retail electric supplier in each delivery class).	Please reference Attachment 1.

2017 Tracking Metrics				
#	**Issue**	**Tracking Metrics Description**	**"Baseline Data" (2012 Data Unless Otherwise Indicated)**	**2017 Annual AMI Metrics Data**
1C	Customers enrolled in Peak Time Rebate, Real Time Pricing, and other dynamic/time variant prices	Small Commercial Customers Number of customers on a time-variant or dynamic pricing tariff offered by ComEd. Expressed also as a percentage of customers in the delivery class.	Zero Watt-Hour customers are taking hourly service from ComEd out of 91,275 total customers in the Watt-Hour class (0% of the class). 1,946 Small Load Delivery (0-100kW) customers are taking hourly service from ComEd out of 247,581 total customers in the Small class (0.78% of the delivery class).	Zero Watt-Hour customers are taking hourly service from ComEd out of 86,774 total customers in the Watt- Hour class (0% of the class.) 3,032 Small Load Delivery (0-100kW) customers are taking hourly service from ComEd out of 267,628 total customers in the Small class (1.13% of the delivery class.)
1D	Customers enrolled in Peak Time Rebate, Real Time Pricing, and other dynamic/time variant prices	Small Commercial Customers Number of customers served by retail electric suppliers for which the supplier has requested monthly Electronic Data interchange delivery of interval data. Expressed also as a percentage of customers taking supply from a retail electric supplier in the delivery class.	The number of small commercial customers served by retail electric suppliers for which the supplier has requested monthly Electronic Data interchange delivery of interval data is zero (0% of customers taking supply from a retail electric supplier in the delivery class).	Please reference Attachment 1.

2017 Tracking Metrics				
#	**Issue**	**Tracking Metrics Description**	**"Baseline Data" (2012 Data Unless Otherwise Indicated)**	**2017 Annual AMI Metrics Data**
2	Customer-side-of-the-meter devices sending or receiving grid related signals	Number of ComEd AMI meters with consumer devices registered to operate with the Home Area Network ("HAN") chip by tariffs under which customer receives delivery.	The data provided for 2013 in the 2014 AIPR was the number of meters that were set up to join the device. For 2014 and subsequent years, the AIPR Metric for HAN connected devices will be the number of "live" devices due to software advances, now that the upgraded UIQ has this data. ComEd will also use the 2014 data for the number of live devices as the baseline data going forward due to the change in methodology and results. Residential – Single: 1 Residential – Multi: 1 Residential – Single (w/Space Heat): 0 Residential – Multi (w/Space Heat): 2 Consumer devices registered through the Green Button Initiative is zero.	Residential – Single: 240 Residential – Multi: 27 Residential – Single (w/Space Heat): 7 Residential – Multi (w/Space Heat): 3 Total: 277 Consumer devices registered through the Green Button Initiative is zero.

2017 Tracking Metrics				
#	**Issue**	**Tracking Metrics Description**	**"Baseline Data" (2012 Data Unless Otherwise Indicated)**	**2017 Annual AMI Metrics Data**
3	AMI Meter failures	Number of advanced meter malfunctions where customer electric service is disrupted. (A "malfunction" is a malfunction that causes the meter to become inoperable but does not include cases of tampering, service panel and service entry equipment issues, house fires, etc.) ComEd will be able to determine which of the advanced meter malfunctions were due to voltage outside design criteria.	The number of advanced meter malfunctions where customer electric service is disrupted is zero.	The number of advanced meter malfunctions where customer electric service is disrupted in 2017 is one, the AMI meter that caused this service disruption is 272934137.
4	AMI Meters replaced before the end of their expected useful life	Number of ComEd advanced meters replaced annually before the end of their expected useful life, including reasons for replacement that include ComEd errors. ("Replaced" means a replacement due to a malfunction that causes the meter to become inoperable, including	The number of ComEd advanced meters replaced annually before the end of their expected useful life, itemized by tamper versus non-tamper is as follows: 334 meters replaced before the end of their expected useful life due to tampering 164 meters replaced before the end of their expected useful life due to	The number of ComEd advanced meters replaced annually before the end of their expected useful life, itemized by tamper versus non-tamper is as follows: 6,952 meters replaced before the end of their expected useful life due to tampering. 13,759 meters replaced before the end of their expected useful life due to reasons other than tampering. TOTAL: 20,711 meters replaced

		tampering.)	reasons other than tampering TOTAL: 498 meters replaced before the end of their expected useful life Note: ComEd worked with the external stakeholders, and it was determined that ComEd does not have the system capability to show detailed reason codes by type. If this is needed in the future, an IT enhancement would be required.	before the end of their expected useful life. Note: ComEd worked with the external stakeholders, and it was determined that ComEd does not have the system capability to show detailed reason codes by type. If this is needed in the future, an IT enhancement would be required.
5	Customers with net metering	Number of customers enrolled on Net Metering tariff and the total aggregate capacity of the group.	The number of unique customers enrolled on Net Metering tariff, Rider POGNM – Parallel Operation of Retail Customer Generating Facilities with Net Metering (“Rider POGNM”), as of December 31st 2012 are as follows: TOTAL: 381 unique customers (3.450 MW) 345 Residential 59 commercial The breakdown of generators by customer class and generator type are as follows: Residential (Photovoltaic Source): 284 (1.216 MW) Residential (Wind Source): 61 (0.245 MW)	The number of unique customers enrolled on Net Metering tariff, Rider POGNM - Parallel Operation of Retail Customer Generating Facilities with Net Metering ("Rider POGNM"), as of December 31, 2017 are as follows: TOTAL: 1,160 customers (18.43 MW). 991 Residential 169 commercial The breakdown of generators by customer class and generator type are as follows: Residential (Photovoltaic Source): 952 (5.79 MW). Residential (Wind Source): 39 (0.29 MW).

			Commercial (Photovoltaic Source): 49 (0.756 MW) Commercial (Wind Source): 10 (1.234 MW) Note: Some unique customers have both photovoltaic and wind source generators	Commercial (Photovoltaic Source): 157 (9.80 MW). Commercial (Wind Source): 12 (2.55 MW). Note: 13 customers have both photovoltaic and wind source generators.
6A	Customer premises capable of receiving information from the grid	Number of installed AMI Meters as of the last day of the calendar year that communicate back to the head end system.	The number of installed AMI Meters as of the last day of the calendar year that communicates back to the head end system is 127,114.	The number of installed AMI Meters as of the last day of the calendar year that communicate back to the head end system is 3,854,111.
6B	Customer premises capable of receiving information from the grid	Number of installed AMI Meters as of the last day of the calendar year that communicate back to the head end system, divided by the total number of AMI meters installed.	The number of installed AMI Meters as of the last day of the calendar year that communicate back to the head end system, divided by the total number of AMI meters installed is 99.50%	The number of installed AMI Meters as of the last day of the calendar year that communicate back to the head end system, divided by the total number of AMI meters installed is 99.88%
6C	Customer premises capable of receiving information from the grid	Number of customers who have accessed the web-based portal as of the last day of the calendar year as a percentage of customers with AMI Meters and as a percentage of ComEd	Please reference Attachment 1.	Please reference Attachment 1.

		customers in that delivery class.		
6D	Customer premises capable of receiving information from the grid	Number of customers who can directly access their usage data as of the last day of the calendar year as a percentage of customers with AMI Meters and as a percentage of ComEd customers in that delivery class.	Please reference Attachment 1.	Please reference Attachment 1.
7	Peak load reductions enabled by demand response programs	Load impact in MW of peak load reduction from the summer peak due to AMI enabled, ComEd administered demand response programs such as the PTS program as a percentage of all demand response in ComEd's portfolio.	The load impact in MW of peak load reduction from the summer peak due to AMI enabled, ComEd administered demand response programs such as the PTS program as a percentage of all demand response in ComEd's portfolio is zero. The RRTP estimated peak load reduction is .5KW X 9,390 customers = 4,695 KW For the desired %, 4,695 KW is divided by 1,342.4 MW (the DR portfolios total peak load reduction potential): 4.695 MW / 1,342.2 MW	The PTS estimated peak load reduction is 33.89 MW during the 2017 Peak Time Savings Hours. The average KW reduction for Single Family PTS Customers is 0.19 KW X 141,794 customers = 26,941 KW = 26.94 MW. The average KW reduction for Multi Family PTS customers 0.08 kW X 86,906 customers = 6,952 kW = 6.95 MW. The RRTP estimated peak load reduction is 0.5 kW X 16,752 customers = 8,376 kW = 8.376 MW. The total estimated peak load reduction is the sum of PTS estimated peak load

			= .35%	reduction and RRTP estimated peak load reduction: 33.89 MW + 8.376 MW = 42.266 MW. For the desired %, 42.266 MW is divided by 1,042.7 MW (the DR portfolio's total peak load reduction potential): 42.266 MW / 1,042.7 MW = 4.1%.
8	Customer Complaints	Number of formal ICC complaints, informal ICC complaints, and complaints escalated to ComEd's Customer Relations or Customer Experience departments related to AMI Meter deployment, broken down by type of complaint and resolution. AMI Meter deployment includes AMI Meter installation, functioning or accuracy of the AMI meter, and HAN device registration.	Formal ICC Complaints: One Smart Meter Refusal; Complaint remains in progress with resolution pending. Informal ICC Complaints: Four Smart Meter Refusals; ComEd has completed process for customer contact and resolution for each. Complaints escalated to ComEd AMI Customer Relations or Customer Experience departments: 52 smart meter refusals; ComEd has completed process for customer contact and resolution for 51; 1 remains open with clear next steps identified for resolution.	Customer Relations handled 2 Formal ICC Complaints. Customer relations originally escalated to Customer Experience during Informal stage, but ultimately completed process for customer contact and resolution. Informal ICC Complaints: 40 Informal ICC Complaints were received by AMI Customer Experience. ComEd has completed process for customer contact and resolution. Customer Relations handled 40 Informal ICC Smart Meter Complaints without escalation to AMI Customer Experience. ComEd has completed process for customer contact and resolved all. Complaints escalated to ComEd AMI Customer Relations or Customer Experience departments: 2,719 total Complaints, 268 Complaints related to customer dissatisfaction (including ICC

				Complaints above) and ComEd has completed the process for customer contact and resolution for 267, while 1 remains in progress with the process started. 2,451 Smart Meter refusals (including ICC Complaints above); ComEd has completed process for customer contact and resolution for all.
9	Reduction in Greenhouse Gas Emissions enabled by smart grid	Reduction in Greenhouse Gas Emissions enabled by smart grid - ComEd worked collaboratively with CUB and EDF to operationalize this measure.	Please reference Attachment 1.	Please reference Attachement 1.
10A	Distributed generation projects	Number of locations and total MWs of customer owned distributed generation connected to the transmission or distribution system, broken down by connection to transmission and distribution system. ("Distributed generation" locations are those where customers take service under Rider POG – Parallel Operation of Retail Customer Generating Facilities ("Rider POG") or Rider	Number of locations of customer owned distributed generation connected to the distribution system, broken down by connection to the distribution system is 104 locations. Total MWs of customer owned distributed generation connected to the distribution system, broken down by connection to the distribution system is 2.40959 MWs.	Number of locations of customer owned distributed generations connected to the distribution system were 412 locations. Total capacity of customer owned distributed generation connected to the distribution system in 2017 was 21.3MW.

		POGNM or successor tariffs.)		<table><tr><th>Year Completed</th><th>2017</th><th></th></tr><tr><th>Energy Source</th><th>Count of Applications Closed</th><th>Total Capacity (KW)</th></tr><tr><td>Biomass</td><td>1</td><td>4,358</td></tr><tr><td>Diesel</td><td>1</td><td>625</td></tr><tr><td>Other</td><td>1</td><td>250</td></tr><tr><td>Solar</td><td>406</td><td>16,067</td></tr><tr><td>Solar & Wind</td><td>1</td><td>17</td></tr><tr><td>Wind</td><td>2</td><td>8</td></tr><tr><td>**Grand Total**</td><td>**412**</td><td>**21,325**</td></tr></table>
10B	Distributed generation projects	Number of locations and total MWs of customer owned distributed generation connected to the transmission or distribution system, broken down by connection to transmission and distribution system. ("Distributed generation" locations are those where customers take service under Rider POG or POG-NM or successor tariffs.)	Regarding customer owned generation connected to the transmission system, there were zero in 2012. There was generation added to the transmission system in 2012, but these generators were all wholesale generators in the business of generation. Based on ComEd's assumptions, these would not count as customer owned generation connected to the transmission system.	There was 1 (one) customer owned distributed generation project for a total of 306 MW that connected to ComEd's transmission system in 2017. Additionally, there are three customer owned distributed generation projects for a total of 451 MW in the PJM interconnection queue with executed Interconnection Service Agreements that are planned for interconnection with the ComEd transmission system in 2018 and 2019.
11	Load served by	Total sales of electricity to	Rider POG sold back to the grid from	RIDER POG sold back to the grid from

	distributed resources	the grid from distributed generation (Rider POG or POG-NM customers) divided by zone energy plus distributed generation sales, with all data provided in sortable format.	Distributed Generation: Rider POG Sales is 754,177 megawatt hours ("MWhrs") Residential Rider POG Sales is 100 MWhrs Non-Residential Rider POG Sales is 754,077 MWhrs TOTAL Zonal Energy plus Rider POG Sales is 102,367,754 MWhrs Percentage of Rider POG Sales to Total Zonal Energy is 0.74% The indicator of Distributed Generation that is behind the meter is going to be derived from the Annual Net Metering Report for Commonwealth Edison using the Average Capacity Factor data provided by EDF for 2013. Total Net Metering Solar Capacity = 1,460.14 kW * 18.5% Capacity Factor * 8760 Hours = 2,366 MWhrs Total Net Metering Wind Capacity = 1,462.31 kW * 18.5% Capacity Factor * 8760 Hours = 2,370 MWhrs Note: Further analysis and discussion will take place between ComEd and the external stakeholders to provide a fuller measure for future reports.	Distributed Generation: Rider POG Sales is 434,845 MWhrs Residential Rider POG Sales is 69 MWhrs Non-Residential Rider POG Sales is 434,776 MWhrs TOTAL Zonal Energy plus Rider POG Sales is 97,116,347 MWhrs Percentage of Rider POG Sales to Total Zonal Energy is 0.45% The indicator of Distributed Generation that is behind the meter is going to be derived from the Annual Net Metering Report for Commonwealth Edison using Average Capacity Factor data provided by EDF. Total Net Metering Solar Capacity = 15,590 kW * 18.5% Capacity Factor * 8760 Hours = 25,265 MWhrs Total Net Metering Wind Capacity = 2,840 kW * 18.5% Capacity Factor * 8760 Hours = 4,603 MWhrs Note: Further analysis and discussion will take place between ComEd and EDF to provide a fuller measure for future reports.

12	System load factor and load factor by customer class	Total annual consumption for AMI meters (including, separately, small commercial customers) divided by the average demand across all AMI meters over the 5 peak hours multiplied by 8760 hours by customer class.(ComEd will work collaboratively with CUB and EDF to establish a similar measure for all system load.)	Based on the AMI consumption data for 2012 and the 5 peak hours, the following results were calculated: Residential Load factor: 30.2% Commercial Load Factor: 50.5% Industrial Load Factor: 61.1% TOTAL Load Factor: 37.2%	Based on the AMI consumption data for 2017 and the 5 peak hours, the following results were calculated: Residential Load factor: 39.01% Commercial Load Factor: 67.50% Industrial Load Factor: 77.53% TOTAL Load Factor: 57.17%
13	Products with end-to-end interoperability certification	ComEd will conduct an annual survey through a third-party provider to evaluate how products are being introduced in the smart grid enabled marketplace.	In-depth interviews with industry participants on new product offerings of smart grid enabled products and secondary research will be conducted in 2013. This will be performed in lieu of a survey until the penetration of smart grid enabled products reaches a point that a survey produces meaningful data and becomes cost- effective. To date, no smart grid enabled products have been submitted for demonstration and evaluation through ComEd's Test Bed. Please reference Attachment 3 [to 2014 AIPR] for HAN Device Interoperability.	Please see Attachment 1 for the updated smart grid products and services industry assessment for 2017. Please see Attachment 3 for the report on test bed /technology demonstrations. Please see Attachment 5 for HAN Device Interoperability.

			ComEd will continue to work with the external stakeholders to further evaluate how products are being introduced in the smart grid enabled marketplace.	
14	Network nodes and customer interfaces monitored in "real time"	Network nodes and customer interfaces monitored in "real time"	ComEd worked collaboratively with CUB and EDF to operationalize this measure, which yielded the following: Grid-side Network Nodes Measured as Total Number of DA Devices: 12kV DA = 2,125 and 34kV DA = 971 (DA devices) connected to the grid. Customer-side Network Nodes Measured as Total Number of Devices Registered to a Meter: 841 HAN devices for meters, though they are not actively "Monitored."	Grid-side livened Network Nodes measured as a total number of DA devices: 12kV Devices= 4,805 34kV Devices= 1,237 Customer Interfaces Monitored in "RealTime" Residential – Single - 240 Residential – Multi - 27 Residential- Single (w/Space Heat) - 7 Residential- Multi (w/Space Heat)- 3 Total - 277
15A	Grid connected energy storage interconnected to utility facilities at the transmission or distribution system level	Number of locations and total MWs of utility owned or operated energy storage interconnected to the transmission or distribution system as measured at storage device electricity output	The number of locations and total MWs of utility owned or operated energy storage interconnected to the **distribution** system as measured at storage device electricity output terminals is zero. ComEd has not installed any storage on either the transmission or distribution system in	ComEd installed a utility owned 25kW energy storage unit on the SmartGrid distribution system in 2017, with an in-service date of 03/08/2017. There were 0 MW of customer owned energy storage interconnected to the Distribution system in 2017.

		terminals.	2012, nor has any energy storage been certified, tested or deployed in the ComEd test bed. The storage installed on the transmission and distribution system that is part of the PJM wholesale market is 1.5 MW at one location, and it participates directly as a supply resource as part of a wind development for 2012. Please note: concerning measuring the storage installed on the transmission or distribution system participating in PJM wholesale markets, there are limitations in obtaining the information for proprietary reasons. Storage assets directly participating in PJM markets will require interconnection agreements and ComEd will have the information to track if or when these types of supply resources enter the market. For behind-the-meter storage assets participating in the PJM through the demand response program, there is currently no requirement that PJM will share that information with ComEd. ComEd will only have knowledge of the customers that are participating in demand response, but not how	There are 2 (two) customer owned energy storage projects totaling 1.1 MW in the interconnection queue for connection to the ComEd Distribution system with executed Interconnection Agreements for participation in the PJM wholesale market.

			customers are achieving load reductions. In terms of measuring the storage installed on the distribution system as part of the PJM wholesale market (behind-the- meter) it may not be possible unless the installation requires an interconnection agreement.	
15B	Grid connected energy storage interconnected to utility facilities at the transmission or distribution system level	Number of locations and total MWs of utility owned or operated energy storage interconnected to the transmission or distribution system as measured at storage device electricity output terminals.	The number of locations and total MWs of utility owned or operated energy storage interconnected to the **transmission** system as measured at storage device electricity output terminals is zero. ComEd has not installed any storage on either the transmission or distribution system in 2012.	ComEd has not installed any utility owned or operated energy storage on the transmission system, nor has any utility owned or operated energy storage been certified, tested or deployed in the ComEd test bed in 2017. There were 0 MW of customer owned energy storage interconnected to the **Transmission** system in 2017. There was no customer owned energy storage projects in the interconnection queue for connection to the ComEd **Transmission** system for participation in the PJM wholesale market.

<table>
<tr><td>15C</td><td>Grid connected energy storage interconnected to utility facilities at the transmission or distribution system level</td><td>ComEd will conduct an annual survey through a third-party provider to estimate similar measures of non-utility storage units.</td><td>In-depth interviews with industry participants in non-utility storage markets and secondary research will be conducted in 2013. This will be performed in lieu of a survey until the penetration of non- utility storage units reaches a size that a survey produces meaningful data and becomes cost-effective.
ComEd will continue to work with the external stakeholders to further estimate similar measures of non-utility storage units.</td><td>Please reference Attachment 4.</td></tr>
<tr><td>16A</td><td>Time required to connect distributed resources to grid</td><td>ComEd’s response time to a distributed resource project application, and time from receipt of application until energy flows from project to grid (distribution.)</td><td>ComEd’s response time to a distributed resource project application can be referenced in the ICC guidelines, as follows: Title 83: Public Utilities - Chapter I: Illinois Commerce Commission - Subchapter c: Electric Utilities - Part 466 - Electric Interconnection of Distributed Generation Facilities.

Please reference Attachment 1 for the time from receipt of application (using the application complete date as the start date for 2012 reporting) until energy flows from project to grid (distribution.)</td><td>ComEd's response time to an Interconnect application is governed by the ICC Administrative Code Part 466/467. Refer to attached file for a detailed calculation of the average duration.
<table>
<tr><th>Energy Source</th><th>Count of Applications Connected</th><th>Average of Duration (Days)</th></tr>
<tr><td>Biomass</td><td>1</td><td>1,113.0</td></tr>
<tr><td>Diesel</td><td>1</td><td>224.0</td></tr>
<tr><td>Other</td><td>1</td><td>664.0</td></tr>
<tr><td>Solar</td><td>406</td><td>125.1</td></tr>
<tr><td>Solar & Wind</td><td>1</td><td>759.0</td></tr>
<tr><td>Wind</td><td>2</td><td>90.0</td></tr>
<tr><td>Grand Total</td><td>412</td><td>130.4</td></tr>
</table></td></tr>
</table>

16B	Time required to connect distributed resources to grid	ComEd's response time to a distributed resource project application, and time from receipt of application until energy flows from project to grid (transmission.)	This does not apply since there were zero projects to apply this measurement.	This does not apply since there were zero projects to apply this measurement.
17	Voltage and VAR controls	Number and percentage of distribution lines using sensing from an AMI meter as part of ComEd's voltage regulation scheme.	The number and percentage of distribution lines using sensing from an AMI meter as part of ComEd's voltage regulation scheme is as follows: Feeders that use sensing from an AMI meter as part of a voltage regulation scheme is 13 out of 5,456 (0.24%).	The number and percentage of distribution lines using sensing from an AMI meter as part of ComEd's voltage regulation scheme is as follows: Feeders that use sensing from an AMI meter as part of a voltage regulation scheme is 13 out of 5,456 (0.24%). The 13 original feeders are being transitioned from the original CVR control system, and are to be incorporated into our Voltage Optimization program and the new control system.
18A	Grid assets that are monitored, controlled, or automated	Number and percentage of ComEd substations (Distribution Center Substations ("DCs"), Substations ("SSs") Transmission Substations ("TSSs") and Transmission Distribution Centers ("TDCs")) monitored or controlled	The number and percentage of ComEd substations (Distribution Center Substations ("DCs"), Substations ("SSs") Transmission Substations (TSSs) and Transmission Distribution Centers ("TDCs")) monitored or controlled via Supervisory Control and Data Acquisition ("SCADA") systems is as follows:	Percentage of locations monitored by SCADA. TSS: 100% TDC: 100% SS: 100% DC: 99%

		via Supervisory Control and Data Acquisition ("SCADA") systems.	Number on SCADA: DC: 479 TDC: 115 SS: 51 TSS: 169 Generating Stations: 16 Relay Points: 5 Percentage on SCADA: DC: 99% TDC: 100% SS: 100% TSS: 100% Generating Stations: 100% Relay Points: 100%	ComEd monitors all of our ComEd owned TSS, TDC, SS, Gen Stations, Relay Points and DC's with the exception of one DC location. We plan to add SCADA monitoring at this remaining location in 2018.
18B	Grid assets that are monitored, controlled, or automated	Number and percentage of ComEd distribution circuits (4kV, 12kV and 34kV) equipped with automation or remote control equipment including monitor or control via SCADA systems.	The number and percentage of ComEd distribution circuits (4kV, 12kV and 34kV) equipped with automation or remote control equipment including monitor or control via SCADA systems is 5,168 distribution circuits (99% of total). Specifically, circuits with 12kV DA =1,169 circuits (24% of the system circuits.)	The number and percentage of ComEd distribution circuits (4kV, 12kV and 34kV) equipped with automation or remote control equipment including monitor or control via SCADA systems is 5,222 distribution circuits (99% of total). Specifically, circuits with 12kV DA =1,866 circuits (36% of the system circuits and 47% of the total 12kV circuits).

19	Customers connected per automated circuit segment	Average number of customers per automated three phase 12kV line segment. (An "automated line segment" is a segment of 12 kV three phase mainline circuit between automated devices which include circuit breakers, reclosers, automated switches, etc.; A "customer" is a ComEd account connected on the automated 12kV three phase line segment.)	The average number of customers per automated three phase 12kV line segment is 638.	The average number of customers per automated three phase 12kV line segment is 519.
20	Improvement in line loss reductions enabled by smart grid technology	Improvement in line loss reductions enabled by smart grid technology - ComEd will research the uncertainty in line loss measurement collaboratively with CUB and EDF.	ComEd will work with CUB and EDF to develop a full and practical measure of Line Loss Reductions as enabled by smart grid investments, by exploring the capability of calculating Line Loss reductions realized through items such as the following: More efficient equipment Increased use of distributed generation that is located closer to the load Optimized power flows Volt/VAR optimization	In 2017, plans were developed to implement Volt/VAR Optimization (VVO) at 22 substations. Voltage Optimization is part of Future Energy Jobs Act beginning in 2017.

			Improved power factor The parties will hold stakeholder workshops in 2013 to identify the best approach to achieve this measure in Illinois, including strategies for better data collection.	
21	Tracking Actual Costs	The actual cost of the AMI deployment costs that ComEd has incurred, including both one-time costs and on- going operating costs	The actual cost of the AMI deployment costs that ComEd has incurred, including both one-time costs and on-going operating costs is as follows: Actual Costs Incurred (000's) not including PTR: One-time CAP - $272 One-time O&M (if applicable) - $12,410 Ongoing CAP - $22 Ongoing O&M - $6,023 TOTAL- $18,728	The actual cost of the AMI deployment costs that ComEd has incurred, including both one-time costs and on-going operating costs is as follows: Actual Costs Incurred (000's): One-time CAP - $145,055 One-time O&M (if applicable) – $39,240 Ongoing CAP - $3,463 Ongoing O&M - $27,415 TOTAL- $215,174
22	Customer Applications	Bill impacts associated with the costs for implementation of ComEd's AMI Plan for	Please reference Attachment 1 for the metric data and Attachment 2 for supporting documentation.	Please reference Attachment 1 for the metric data and Attachment 2 for supporting documentation.

		low, average, and higher usage level customers pursuant to approved rates and surcharges. The usage level calculations will be values for a "typical" customer at the 25th, 50th, and 75th percentile of total usage for each applicable delivery service class.		
23	Customer Applications	Number of customers that have created and viewed an account on ComEd.com – by usage levels, customer class, and low income customers. An account on ComEd.com is necessary for viewing the web portal.	Please reference Attachment 1.	Please reference Attachment 1.
24	Customer Applications	Number of customers with ComEd.com accounts that have viewed the web portal - by usage levels, customer class, and low income customers	Please reference Attachment 1.	Please reference Attachment 1.
25	Customer Applications	Change in customers' energy consumption for	The My Energy Tools web portal became available to all ComEd	ComEd has continued to work with its web presentment vendor to

		customers that have viewed the web portal. ComEd will work with the web presentment vendor to define the business processes necessary to track an energy usage impact of accessing the web portal.	residential customers through their ComEd.com account in September 2012. Given the short timeframe this was available to customers and the time needed to discern savings from customer billing data following their access to the web tools and subsequent actions taken to reduce their usage, there are no savings to report at this time. More robust analytics are expected as a greater number of customers begin accessing the My Energy Tools web portal and additional billing data can be utilized to measure savings in the future.	develop and vet a methodology for measuring energy savings by customers that have viewed the web portal (ComEd.com/MyAccount). The 2017 methodology remains the same as the prior year. Please reference Attachment 1 for a full description of the methodology. **2017 Results** The tables below displays calendar year 2017 energy efficiency savings from web among ComEd customers who logged-in for the first time in calendar year 2017 and had sufficient data to be included in the analysis. Electric Savings Results •Percent savings (%): 0.24% +/- 0.22% •Savings per customer per day (kWh): 0.057 +/- 0.51 •Total customers: 67,449 •Total savings (MWh): 743 +/- 659 Note: Savings estimates are statistically significant at the > 90% level. Margin of error represents 90% confidence interval.
26	Customer	Number of customers	Please reference Attachment 1.	Please reference Attachment 1.

	Applications	enrolled in the Residential Real Time Pricing ("RRTP") program (ComEd's hourly pricing program) by usage levels, customer class, and low income customers.		
27	Customer Applications	Number of customers enrolled in any future Time of Use ("TOU") program that ComEd might offer by usage levels, customer class, and low-income customers.	The number of customers enrolled in any future Time of Use ("TOU") program that ComEd might offer by usage levels, customer class, and low-income customers is zero.	Number remains zero.
28	Customer Applications	Number of customers enrolled in ComEd's PTR program by usage levels, customer class, and low income customers.	The number of customers enrolled in ComEd's PTR program by usage levels, customer class, and low income customers is zero.	Please reference Attachment 1.
29	Customer Applications	Number of deposits required, disconnection notices, and disconnections for nonpayment for all customers and, if applicable, by low income customers. Other "key indicia associated with credit and collection activities targeted to low income customers" may be incorporated in the	Please reference Attachment 1.	Please reference Attachment 1.

		project plan's business process redesigns for future implementation.		
30	Customer Applications	If further information is required to allow ComEd to track vulnerable populations and that information is not easily available (or only at significant cost) then ComEd should provide an explanation of the barriers to tracking vulnerable populations.	Please reference Section IV of Appendix A to this Report - Vulnerable Customers.	Please reference Section IV of Appendix A to this Report - Vulnerable Customers.
31	Customer Applications	ComEd should further identify what measures would be necessary to protect consumer privacy in tracking vulnerable populations.	Please reference Section IV of Appendix A to this Report - Vulnerable Customers.	Please reference Section IV of Appendix A to this Report - Vulnerable Customers.
32	Customer Applications	The definition and identification of such groups should be discussed with stakeholders and Staff to develop a methodology to be included with the modified AMI Plan. To the extent that is not possible, it should be included with the first annual filing.	Please reference Section IV of Appendix A to this Report - Vulnerable Customers.	Please reference Section IV of Appendix A to this Report - Vulnerable Customers.

33	Customer Outreach & Education	Awareness and Education - Awareness and understanding of AMI technology and benefits (survey metric)	6,032 surveys were collected for awareness and understanding of AMI technology and benefits.	4,595 surveys were collected for awareness and understanding of AMI technology and benefits.
34	Customer Outreach & Education	Customer Experience and Engagement - Understanding of AMI Technology (Customer Experience/Engagement Research and Customer Experience Tracking).	74 Community Events were conducted about Understanding AMI Technology.	130 Community Events were conducted about Understanding AMI Technology.
35	Customer Outreach & Education	Community Outreach - # of community events and # of direct interactions	Community Outreach included: 74 Community Events conducted and 50,871 direct interactions.	Community Outreach included: 130 Community Events conducted and 41,984 direct interactions. 61 Smart Meter Outreach and Education Truck Events conducted and 15,445 direct interactions. 61 Street Teams conducted and 5,773 direct interactions.
36	Customer Outreach & Education	Local Media - # of articles that appear in local media	1,125 articles appeared in local media.	84 articles appeared in local media. 73 smart meter-related press releases were issued.

37	Customer Outreach & Education	Internal newsletter (# of articles in newsletter)	37 articles were included in the internal newsletter.	6 articles were included in the internal newsletter.
38	Customer Outreach & Education	Customer Experience and Engagement - Meter Installations complaints/claims (Rapid Response Situational Assessments)	55 Meter Installations complaints/claims.	Received in 2017: 2,719 Meter installation complaints. Please reference data source attachment for Metric 8 for additional information related to meter installation complaints. 56 AMI attempted Claims in total. 51 Claims were handled by Claims and Collections with proper customer contact and resolution. 5 Claims were handled by Customer Experience; 3 of which were denied, 2 of which were approved, and 0 pending all with proper customer contact and resolution. In 2017, the methodology in claim management for assumed AMI claims was aligned with normal process with the Claims department taking the lead in investigation and resolution including AMI if needed. As a result less claims were managed by AMI in 2017.
39	Customer	Customer Experience	Zero installation appointments.	There were 38,241 installations

	Outreach & Education	and Engagement - # of installation appointments (tracked by AMI Deployment team)		completed through appointments.
40	Customer Outreach & Education	Community Outreach - # of customer organizations contacted	1,098 organizations were contacted as part of Community Outreach.	642 organizations were contacted as part of community outreach.
41	Customer Outreach & Education	Community Outreach - # of customer communication methods deployed	17 communication methods employed as part of Community Outreach.	19 communication methods were employed as part of community outreach.
42	Customer Outreach & Education	Awareness and Education - # of advocates and ambassadors informed	70 Ambassadors were contacted and informed.	110 Ambassadors were educated and utilized.
43	Customer Outreach & Education	Awareness and Education - # of surveys completed at events	6,032 surveys were collected at events.	4,775 surveys were collected at events.
44	Customer Outreach & Education	Measurement of Energy Management Education & Outreach events + Interactive items	Community outreach included: 74 Community Events conducted and 50,871 direct interactions.	Community Outreach included: 130 Community Events conducted and 41,984 direct interactions. 61 Smart Meter Outreach and Education Truck Events conducted and 15,445 direct interactions. 61 Street Teams conducted and 5,773 direct interactions.

				AMI Residential Advertising included: 48,146,986 Out of Home Advertising Impressions. 44,283,128 Digital Advertising Impressions. 478,905 Digital Advertising Clicks. 5,964,198 Print Advertising Impressions. 71,244,020 Radio Impressions. 9,381,090 TV Impressions. 12,022,041 Mall Ad Impressions. AMI Business Advertising included: 25,616,869 Digital Advertising Impressions. 57,409 Digital Advertising Clicks.
45	Customer Outreach & Education	Measurement of the Speaker's Bureau Program	3,537 interactions related to the Speaker's Bureau Program.	A total of 140 AMI Workshops and Senior Outreach events and 11,293 direct interactions. A total of 19 CARE Workshops and table events and 6,395 direct interactions.
46	Customer Outreach & Education	Measurement of the Youth Ambassador Program	2,332 direct contacts in the Youth program; 70 Youth Ambassadors.	110 students participated in the Youth Ambassador Program and 6,748 direct interactions.
47	Customer Outreach & Education	Measurement of Faith- based and Low-Income Outreach	19 direct interactions; 900 organizations contacted for Faith-based and Low-Income Outreach.	A total of 19 CARE Workshops and table events and 6,748 direct interactions.

48	Customer Outreach & Education	Measurement of Email Marketing	378,315 email subscribers; 7 emails sent to customers; 6,287 clicks.	946,519 subscribers were sent 1 email resulting in 134 clicks.
49	Customer Outreach & Education	Measurement of Energy @ Home and Bill Inserts program	1 article developed for newsletter; 3.1M bill inserts for residential; 295,000 bill inserts for commercial as a part of the bill insert program.	473,094 bill inserts were sent to residential and commercial customers.
50	Customer Outreach & Education	Measurement of Direct Mail for PTR and Web Tools	This does not apply for 2012.	1,454,074 post-deployment welcome mailers were sent to residential and business customers.
51	Customer Outreach & Education	Measurement of Videos and Brochures	5 videos created with 22,093 views.	531,327 introductory mailers were sent to residential and business customers. 683,591 Pre-Deployment Letters were sent to residential and business customers.
52	Customer Outreach & Education	Measurement of Online and Social Media Outreach	Online and Social Media Outreach Measurements: Number of Stories Promoted on ComEd Facebook page is 26. Number of Likes on Facebook is 295. Number of Times a Story was Shared on another Facebook page is 16. Number of Engaged Facebook Users (the # of people who have clicked on a post) is 375. Number of Facebook Users who saw a Post from ComEd in 2012 is 72,789. Number of Blog	12 community event posts were promoted on Facebook and Twitter, resulting in 2,747 direct interactions with customers (likes, comments, retweets and favorites). 34,109 people visited the ComEd Smart Meter website. 50,973 people visited the ComEd Smart Grid website. 2,246 people visited the ComEd

			Stories and Conversations with Mommy bloggers is 1. Number of Facebook Interactions with Games is 4,489. Number of People who Visited ComEd.com/Smart Grid is 9,560.	Municipal website.
53	Customer Outreach & Education	Measurement of Teacher Partnership	This does not apply for 2012.	Completed 231 field trips at the Chicago and Rockford Training Centers, educating 6,415 attendees.
54	Customer Outreach & Education	Measurement of Municipal Toolkit and Experimental Marketing Materials	Municipal Toolkit and Experimental Marketing Materials Measurement is 120 Direct interactions.	Held 445 meetings with customer groups. Held 577 meetings with local officials. Led 3 field tours for local officials.
55	Customer Outreach & Education	Measurement of Municipal Event Speakers, Bureau Town Halls	For Municipal Event Speakers and Bureau Town Halls there were: 2,601 informational meetings with customers. 1,000 informational meetings with local officials. 30 field tours with local officials.	Held 445 meetings with customer groups. Held 577 meetings with local officials. Led 3 field tours for local officials.
56	Customer Outreach & Education	Measurement of Municipal Online Web	16,406 site visits to ComEd Municipal Website.	2,246 people visited the ComEd Municipal website.
57	Customer Outreach & Education	Measurement of Outreach Materials - Interactive items	38,752 interactive gameplay participants.	Games were discontinued in 2016.
58	Customer Outreach & Education	Measurement of Awareness Tracking	The 2012 Baseline measurements for awareness tracking were:	The 2017 measurements for awareness tracking are as follows: Percentage Aware of Smart Grid:

			Percentage aware of Smart Grid: 43% Percentage aware of Smart Meter: 26% Percentage Knowledgeable among those aware of Smart Grid: 29% Percentage Knowledgeable among those aware of Smart Meter: 33%	37%-39% Percentage Aware of Smart Meter: 57%-60% Percentage Knowledgeable Among Those Aware of Smart Grid: 32%-34% Percentage Knowledgeable Among Those Aware of Smart Meter: 34%-38% Percentage Valuable Among Those Aware of Smart Grid: 51%-56% Percentage Valuable Among Those Aware of Smart Meter: 48%-49%
59	Customer Outreach & Education	Measurement of Customer Experience and Message Testing	$200,000 spent on market research and customer experience tracking.	$130,200 spent on market research and customer experience tracking.
60	Customer Outreach & Education	Measurement of Staff dedicated to the program	4 dedicated FTEs for EIMA Program Customer Outreach.	3 dedicated FTEs for EIMA Program Customer Outreach.

Smart Grid
Advanced Metering Annual Implementation Progress Report

APPENDIX A – REPORT

I. Introduction

Pursuant to the June 2012 Order, ComEd was directed to submit information with its Annual Implementation Progress Report ("AIPR") concerning any updates since the submission of the AMI Plan to standards identified by the National Institute of Standards and Technology ("NIST"), including standards adopted by NIST's Smart Grid Interoperability Panel ("SGIP"), and how ComEd is addressing them.[12] In addition, in that same June 2012 Order, the Commission also directed ComEd to address in its 2013 AIPR: (1) if a Time-of-Use ("TOU") tariff will be proposed and the results of the dialogue with stakeholders regarding same; and (2) the development of a methodology to define and identify vulnerable customers and issues related to tracking information for vulnerable customers. ComEd did so, and in the order entered approving ComEd's 2013 AIPR, the Commission decided that any further discussion of these two issues was outside the scope of an AIPR proceeding[13]. Thus, while the TOU and potentially vulnerable customers are not issues in any proceeding that may be opened by the Commission to review ComEd's 2016 AIPR, ComEd does present, for informational purposes only, a discussion of its further efforts in 2015 to address these two issues.

Similarly, in the June 2012 Order, the Commission also directed ComEd to work with interested parties to implement a map showing where distributed generation ("DG") would be good or bad. While the Commission did not specifically direct ComEd to report on the progress of the DG mapping request with its AIPR and specifically indicated that any issues regarding DG mapping should be brought before the Commission in a separate filing or rulemaking, ComEd is reporting on the status of this effort for the convenience of the Commission and all interested parties.

A discussion of the status of each item described above is provided below.

II. Updated NIST Interoperability Standards

As noted above, in the June 2012 Order, the Commission directed ComEd to report on any updates to any applicable NIST standards and explain how it is addressing any such updates. The applicable NIST standards noted within the Revised AMI Plan are regularly reviewed by the Information Technology ("IT") team at ComEd for completeness and accuracy. Each standard is studied to identify any updates or changes, and to determine whether it has been superseded by newer or more appropriate standards.

NISTIR 7628 Guidelines for Smart Grid Cybersecurity include:

- Finalized combined cyber-physical attacks descriptions, which now includes physical impacts resulting from cyber-based attacks
- Supplementary cybersecurity testing and certification approaches and guidelines

[12] June 2012 Order at 25

[13] 2013 AIPR Order at 10 and 15.

- Best practices for 3rd parties to manage smart grid data and privacy concerns
- Cybersecurity issues associated with communications between electric plug-in vehicles and the smart grid
- New security awareness and training guides and templates (for both external consumers and internal personnel)
- Emerging privacy risks regarding the advent of new technologies and activities that could leverage the smart grid

Updates within NIST 7761 Priority Action Plan 2: Guidelines for Assessing Wireless Standards for Smart Grid Applications include:

- Extended approach and framework for modeling and evaluating wireless technologies
- Additional toolsets and templates for modeling and evaluating wireless technologies
- Sensitivity analysis and impacts for input parameters
- Further guidance, information, and considerations pertaining to wireless standards and implementing associated technologies for smart grid network designers/planners

The IT team reviewed these revisions accordingly and determined that the Revised AMI Plan remains aligned with the applicable NIST requirements detailed within the updated standards. This includes NIST recommendations related to customer data and privacy. Furthermore, the IT team continues to assess and evaluate any supplementary considerations that are mentioned by NIST for informational purposes.

Additionally, standard IT security management activities are completed by the IT team as a component of the required support of AMI systems. Security management activities are completed to align with ComEd policies and industry standards, and include activities such as deploying security system packages to allow for appropriate security and vulnerability monitoring, ensuring that deployed servers adhere to password and system control procedures, performing periodic server fixes and security updates, and performing vulnerability assessments as well as subsequent remediation steps to rectify any defects or findings.

III. Time of Use Rate

A. Consideration of Utility TOU Rates

As reported in Appendix A to ComEd's 2013 AIPR, which was investigated in ICC Docket No. 13-0285, ComEd met with the Smart Grid Advisory Council ("SGAC") and other stakeholders at that time to discuss the development of time-of-use ("TOU") rates within Illinois' competitive market and reported the results of its meetings with stakeholders.[14] As a result of those meetings, ComEd concluded that a utility-offered TOU rate would be a potential

[14] 2013 AIPR, App. A at 2-4.

disruption to the competitive market, and committed to continue to work with stakeholders to enable RES TOU offerings. The Commission agreed with ComEd's conclusion and in its 2013 AIPR Order declined to require ComEd to offer a TOU rate.[15]

On February 13, 2015, the Citizens Utility Board ("CUB") and Environmental Defense Fund ("EDF") filed a Petition to Initiate a Proceeding to Investigate the Adoption of a Utility Time of Use Rate that was assigned ICC Docket No. 15-0100. Interveners included Elevate Energy, ComEd, the Illinois Power Agency, the Illinois Competitive Energy Association ("ICEA"), Ameren Illinois Company ("Ameren"), and the Retail Energy Supply Association ("RESA"). A Final Order was entered by the Commission on September 16, 2015, and concluded that the Petition was premature and would unnecessarily disrupt the process previously adopted by the Commission.[16] The Commission pointed to written guidance offered on March 14, 2012, in which the SGAC clearly recommended that stakeholders first work to enable RES TOU offerings, and to consider utility-offered TOU rates afterwards. That guidance stated:

> Once the infrastructure and systems are in place to support TOU offerings by ARES, the initial question before the Illinois Commerce Commission ("ICC") will be how to determine whether the offerings of Illinois' alternative retail electric suppliers ("ARES") include a sufficient set of TOU rate options to adequately serve the public interest.[17]

The 15-0100 Order further stated that the competitive Retail Electric Supplier ("RES") market had not had an opportunity to develop and, thus, based on this SGAC Guidance, the Petition was premature. The Commission ultimately dismissed the matter, finding that to initiate an investigation at this stage in time, before the stakeholder process is complete, would be inappropriate.[18]

B. Facilitation of RES TOU Offerings

1. Background

In ICC Docket No. 12-0484, the Commission investigated ComEd's Petition to seek approval of tariffs implementing ComEd's Peak Time Savings ("PTS") program, pursuant to Section 16-108.6(g) of the PUA. In its Interim Order dated February 21, 2013, the Commission directed Staff to hold workshops with interested parties in order to address certain issues that arose during the investigation. Beginning in April 2013 and continuing on throughout 2014, 2015 and 2016, Staff hosted a series of "Enabling the Market" workshops that were attended by utilities, consumer groups, Retail Electric Suppliers ("RESs"), and other interested stakeholders. In addition to the items the Commission directed the parties to address, the

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[15] Docket No. 13-0285, final Order (June 26, 2013) at 15.

[16] Docket No. 15-0100, final Order (Sept. 16, 2015) ("15-0100 Order").

[17] ICC Docket 15-0100, Petition, Attachment A (March 14, 2012 Guidance Regarding Implementation of Time of Use Rates, Smart Grid Advisory Council) at 5-6.

[18] 15-0100 Order at 9.

workshops covered several AMI-related topics, including the release of customer-specific information by electric utilities and enabling RESs to offer TOU and other dynamic pricing products, which eventually led to the development of ComEd's Rider RMUD – Residential Meter Usage Data ("Rider RMUD"), which is discussed later in this section.

2. Release of Customer-Specific Information by Electric Utilities

Several of the initial issues discussed at the Staff-led workshops revolved around the question of electric utilities releasing customer-specific information to third parties. While one of those issues, i.e., identifying customers participating in ComEd's PTS program, had been raised in Docket No. 12-0484, additional issues were identified in the workshop discussions that focused on how Sections 16-122 and 16-108.6 of the PUA impacted a utility's ability to release customer-specific information to third parties.

Recognizing that these issues would not be resolved in the workshops, the Commission's Office of Retail Market Development ("ORMD") issued a report dated August 30, 2013 (the "Staff Report") requesting that the Commission investigate certain issues: (1) the release of aggregated, anonymous customer usage information; (2) the release of information identifying PTS and net metering customers; and (3) RES access to its customers' interval usage data that is not used for the purposes of billing a customer. The Commission initiated an investigation in these matters on September 4, 2013 in Docket No. 13-0506 ("Data Privacy Docket"), which culminated in a Commission Order on Rehearing dated July 30, 2014, effectively closing out this issue. ("Data Privacy Order on Rehearing").

a. Aggregated, Anonymous Data

In the Data Privacy Order on Rehearing the Commission held that Section 16-122 and Section 16-108.6 of the PUA do not prohibit the release of anonymous customer usage information in accordance with the data protocol adopted in the Final Order which protects customer privacy and is in the public interest.[19]

The Commission further found that, pursuant to Section 16-122, no fee is specifically required for this data; however, there is nothing in Section 16-122 to prevent the utilities from charging a reasonable fee when providing this information. Effective February 11, 2017, ComEd offers access to anonymous customer usage information as a data service. As of 2018, there are 12 third-parties who have received this service.

b. Identification of PTS and Net Metering Customers

From discussions during the workshops, there was an understanding that competitive suppliers have legitimate reasons to obtain certain information about individual customer accounts, and that freer access to various types of individual customer information could assist in realizing certain benefits available from the smart meter infrastructure. At the same time, ComEd and other parties expressed concerns related to customers' privacy interests – both in

[19] Data Privacy Order on Rehearing at 10-11.

the obvious interest of adhering to state law and also because data privacy had been cited as a reason for customer refusals of smart meter deployment.

The Commission ruled that a customer's participation in PTS or net metering programs is billing data and that verifiable authorization from individual customers is required under the PUA before disclosure may occur. In the Data Privacy Order dated January 28, 2014, the Commission also found that the electric utilities should not be required to provide lists of customers that are PTS or net metering participants, as this would contravene Section 16-122. The Commission also determined that possession of an account number should be considered customer authorization to receive certain information about such customer's account, including whether the customer is a PTS or net metering customer, or a participant in any supply related or demand response program offered by the utility. Effective June 13, 2014, new indicators were added to the Summary Data request report and the Interval Usage Data request report available on the comed.com website as well as to the Municipal Aggregation Customer Report provided to communities implementing aggregation programs. The indicators were also added to the Customer Supply List available to RESs through the supplier portal. The indicators provide notification of customers currently receiving service under the following riders: Rider POGNM – Net Metering, Rider PTR - Peak Time Savings, and Rider A/C - A/C Cycling. As of 2015, this issue is considered implemented and closed.

c. RES Access to Customer's Interval Data Not Used for Billing Purposes

The type of authorization required for RES access to non-billing interval data, as well as how RESs would verify to the electric utility that they obtained proper authorization, were discussed in the Enabling the Market workshops. These issues were or are being considered in two Commission proceedings, Docket Nos. 14-0701 and 15-0073. In Docket No. 14-0701, an investigation into the standard terms for customer authorization of access to interval usage data for non-billing purposes, the Commission approved standardized language that must be used to demonstrate RES authorization to access non-billing interval data. At Staff's direction, as a result of workshop discussions throughout 2014, the warrant forms and processes were developed to allow RESs to certify to the utilities that they have obtained such authorization. ComEd filed Rate DART - Data Access and Retrieval Tenants ("Rate DART") to provide the RESs access to up to twenty four consecutive months of AMI Historical Interval Usage not used for billing purposes for customers that they do not currently serve. The Illinois Commerce Commission approved the tariff on December 22, 2015 (Docket 15-0623). The warrant form is available to Retail Electric Suppliers for use of the data service and is available for their use in the Supplier Portal.

Docket No. 15-0073, an investigation into the customer authorization required for access to AMI interval data by third parties other than RESs. The Commission issued a Final Order on March 23, 2015 approving standardized authorization language that must be obtained by non-RES third parties from retail customers in order to access AMI interval data for non-billing purposes. The Commission also approved the Green Button method of authorization in its Order. To date, seventeen (17) third parties have completed the initial application process with five (5) third parties moving forward with IT testing.

The Enabling the Market workshops also resulted in Supplier Portal enhancements which provide historical customer data for customers the RES serves. These enhancements included the ability for suppliers that register for Rider RMUD to obtain non-billing interval data for their customers daily instead of at the end of each billing period. Suppliers are now able to utilize a Supplier Portal to view this non-bill quality interval data on a daily basis (i.e. the day after) in addition to a one-time 24-month look back. The Portal retains a rolling 35 day historical interval usage for each customer on RMUD if the supplier would like to view the data. Since this data is not bill quality it may differ from the billing usage sent at the end of the monthly billing period via Electronic Data Interchange (EDI).

ICC Docket 15-0073, filed on January 28, 2015, addresses the Investigation into the Customer Authorization Required for Access by Third Parties Other Than Retail Electric Suppliers to Advanced Metering Infrastructure Interval Meter Data, therefore any further comments on this topic should be addressed there.

3. RES TOU Offerings and Other Dynamic Pricing Products

a. Residential Meter Usage Data ("Rider RMUD")

As described in the 2015 AIPR, ComEd used the information and feedback from Enabling the Market workshop participants to design Rider RMUD – Residential Meter Usage Data ("Rider RMUD"). Beginning January 16, 2014, Rider RMUD authorized ComEd to provide granular residential meter usage data to authorized RESs taking service under Rate RESS – Retail Electric Supplier Service ("Rate RESS") serving those residential customers that they provide not only electric power and energy supply services, but also TOU pricing and/or demand response products, all as described in the tariff. Rider RMUD was initially filed and approved as a pilot tariff. ComEd completed the upgrade of the new meter data management system ("MDMS") in August of 2014, subsequently increased the number of customers for whom RESs could receive such data to 100,000 from 15,000 through the end of 2015, and eliminated the customer cap as of January 1, 2016 – at which point Rider RMUD is offered generally rather than on its original pilot basis. As of the end of 2017, 5 RESs were utilizing this service for a total of 312 customers; down slightly from the 343 customers at the end of 2016.

b. Peak Time Savings

Beginning in October 2014, and continuing through 2015, ComEd opened enrollment in the PTS program, which provided all customers with an AMI meter, regardless of supplier, the opportunity to begin receiving credits for energy curtailments during the summer months following enrollment. In March of 2016, ComEd filed tariff revisions related to the program, which were subsequently approved by the Commission and became effective on May 6, 2016, to allow for the ability to remotely control the temperature settings of Company-approved smart thermostats installed by individual residential customers to regulate their central air conditioning systems. The compensation provided to a residential customer is dependent upon measurements of actual reductions in the customer's demands for electric power and energy relative to a baseline level identified for the customer. As of the end of 2017, there were approximately 230,000 customers participating in this program.

4. Additional commitments to customized education related to TOU products:

ComEd's education and outreach efforts under the AMI Plan have included information on dynamic pricing products offered by ComEd and alternative suppliers and how customers can use them to achieve certain benefits. In addition to the customized education delivered to key customer segments describing ComEd offerings such as PTS, Hourly Pricing and web tools, the PlugInIllinois.com/smartmeter website continues to provide comprehensive details of RES offerings. As of December 2017, there were no TOU offerings presented on the PlugInIllinois site, however, ComEd has 5 RESs certified under Rider RMUD.

IV. Vulnerable Customers

As reported in previous AIPRs, stakeholders have agreed to define and identify vulnerable customers as customers belonging to the following customer groups:

1. Low income
2. Very young (from birth to age 5)
3. Older individuals (age 65 and older)
4. Those who have limited English proficiency or literacy
5. Individuals with a functional disability, such as impaired mobility
6. Persons who are socially isolated

ComEd makes best efforts to obtain information on vulnerable customers, but such information remains limited due to the unavailability of certain information – such as age and English fluency – that would enable identification of vulnerable customers based on the factors identified above. In addition, obtaining data on customers meeting any of the six criteria used to define vulnerable customers by zip code or census tract is not useful for purposes of the reporting requirements.

However, ComEd will continue to report on vulnerable customers using the limited information in its possession regarding low income customers (Group 1, above) and customers with qualifying life support equipment at the premises or having a certified medical condition in the household (Group 5, above) and will supplement such reports if additional verifiable data becomes available from other entities, such as DCEO. In addition, ComEd will continue to administer assistance programs and will engage in education and outreach for low income customers. Low income customers are defined as those customers who participate in the Low Income Home Energy Assistance Program ("LIHEAP"), the Residential Special Hardship Program the Percentage of Income Payment Plan ("PIPP"), and the CHA All Clear Program.

In 2017 there were no further developments in acquiring data for Groups 2, 3, 4 or 6. As in 2017, in 2018 ComEd will continue to evaluate outreach to customers in need, where there is data to identify such customers, through alerts, enhanced messaging and payment arrangements.

V. DG Mapping

In the June 2012 Order, the Commission determined that concerns raised by CUB and the ELPC about perceived barriers to the installation of DG needed to be addressed in a separate rulemaking. The Commission, however, directed ComEd to work with interested parties to implement their "request for a map showing where distributed generation would be good or bad."[20] Following meetings with interested parties, ComEd created and posted a map tool on its website and notified interested parties on August 15, 2013 of the posting.[21] ComEd last updated the map on August 10, 2017, and plans to update the map once per year. ComEd will consider more frequent updates if there is a large increase in DG interconnection activities in the future.

[20] June 2012 Order at 50.

[21] https://www.comed.com/customer-service/rates-pricing/interconnection/Pages/distribution-under-10000kva.aspx.

APPENDIX B - RIDER NAM BIANNUAL REPORT

Rider NAM Biannual Report

Introduction

ComEd's Rider NAM requires that each year, beginning in 2014, ComEd submit a report to the Commission on or before April 1 and October 1 that summarizes the operation of the Rider for the preceding period. The biannual report that is filed by April 1 is to be included in the AIPR and will cover the period of July 1 through December 31 of the preceding year. The report that is filed on October 1 will cover the period of January 1 through June 30 of the same calendar year.
The biannual report must provide (a) the number of retail customers to which Rider NAM is applicable; (b) a description of the Company's efforts to address such retail customers; and (c) identification of the Company's costs that are associated with providing service under Rider NAM.

Report

ComEd's Rider NAM Biannual Report for the period July 1, 2017 through December 31, 2017 is provided below.

Commonwealth Edison Company
Rider NAM Biannual Report
Reporting Period: 7/1/17 – 12/31/17

Commonwealth Edison Company
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Executive Summary

Overview

This Rider NAM Biannual report serves to fulfill the requirement of the Rider NAM tariff by providing the following:

(1) The number of retail customers to which Rider NAM is applicable;
(2) A description of the company's efforts to address such retail customers; and
(3) Identification of the company's costs that are associated with providing service under Rider NAM.

Summary

For the 7/1/17-12/31/17 reporting period total costs to provide service under Rider NAM were $2,050,133.72. This total reflects operational costs for refusal and no access-UTC customers. Compared to the previous biannual reporting period of 1/1/17-6/30/17, which reflected costs of $1,057,852, total costs increased by $992,282. The increase in costs are primarily attributed to the following:

- Deployment: Costs increased by $1,108,944, due to an increased effort to resolve UTCs. Changes included increasing the number of UTC technicians as well as increasing back office staffing.

For the 7/1/17-12/31/17 reporting period, gross refusals decreased by 118 (compared to the previous biannual reporting period of 1/1/17 – 6/30/17). 52.70% of refusal customers converted (customers that previously refused a meter, but subsequently decided to accept installation of an AMI meter), resulting in 535 net refusals for the reporting period; 40 fewer net refusals than the previous reporting period, all of which helped maintain a low program to date net refusal rate of 0.12%.

UTCs are installations that ComEd was Unable To Complete (UTC) due to a lack of access (e.g. dog in yard, gate locked, etc.). Project to date through 12/31/2017, ComEd has 8,352 UTCs compared to 21,178 UTCs at the end of the previous reporting period. This is due largely to the increased effort to resolve UTCs.

Commonwealth Edison Company
Rider NAM Refusal and UTC Statistics: **7/1/17 – 12/31/17**

Formula	a	b	c	d	e=a+(c-i)+(d-o)
Month	Meters Installed (1)	Gross Refusals (2)	Gross Refusals Inside Footprint(3)	Gross UTCs (4)	Meters Attempted (5)
Jul	64,004	207	207	3,927	63,246
Aug	67,071	304	304	4,723	65,791
Sep	60,155	172	172	3,819	59,989
Oct	73,795	225	225	3,440	72,630
Nov	36,053	98	98	3,333	33,158
Dec	15,448	125	125	1,413	14,000
Total	**316,526**	**1,131**	**1,131**	**20,655**	**308,814**

	Formula	f=b/a	g=b/e	h	i	j=h/b	k=(b-h)/a	l=(b-h)/e
Refusals	Month	Gross Refusal Rate vs. Installs	Gross Refusal Rate vs. Meters Attempted	Conversions (6)	Conversions Inside Footprint (7)	Conversion Rate	Net Refusal Rate vs. Installs	Net Refusal Rate vs. Meters Attempted
	Jul	0.32%	0.33%	91	91	43.96%	0.18%	0.18%
	Aug	0.45%	0.46%	126	126	41.45%	0.27%	0.27%
	Sep	0.29%	0.29%	119	119	69.19%	0.09%	0.09%
	Oct	0.30%	0.31%	111	111	49.33%	0.15%	0.16%
	Nov	0.27%	0.30%	81	81	82.65%	0.05%	0.05%
	Dec	0.81%	0.89%	68	68	54.40%	0.37%	0.41%
	Total	**0.36%**	**0.37%**	**596**	**596**	**52.70%**	**0.17%**	**0.17%**

	Formula	m=d/a	n=d/e	o	p=o/d	q=(d-o)/a	r=(d-o)/e
UTCs	Month	Gross UTC Rate vs. Installs	Gross UTC Rate vs. Meters Attempted	UTC Completions	UTC Completion Rate	Net UTC Rate vs. Installs	Net UTC Rate vs. Meters Attempted
	Jul	6.14%	6.21%	4,801	122.26%	-1.37%	-1.38%
	Aug	7.04%	7.18%	6,181	130.87%	-2.17%	-2.22%
	Sep	6.35%	6.37%	4,038	105.73%	-0.36%	-0.37%
	Oct	4.66%	4.74%	4,719	137.18%	-1.73%	-1.76%
	Nov	9.24%	10.05%	6,245	187.37%	-8.08%	-8.78%
	Dec	9.15%	10.09%	2,918	206.51%	-9.74%	-10.75%
	Total	**6.53%**	**6.69%**	**28,902**	**139.93%**	**-2.61%**	**-2.67%**

	Formula	s=(b+d)/a	t=(b+d)/e	u=h+o	v=u/(b+d)	w=(b+d-h-o)/a	x = (b+d-h-o)/e
ALL (Refusals and UTCs)	Month	Gross Combined Rate vs. Installs	Gross Combined Rate vs. Meters Attempted	Conversions and UTC Completions	Conversion and UTC Completion Rate	Net Combined Rate vs. Installs	Net Combined Rate vs. Meters Attempted
	Jul	6.46%	6.54%	4,892	118.34%	-1.18%	-1.20%
	Aug	7.50%	7.64%	6,307	125.46%	-1.91%	-1.95%
	Sep	6.63%	6.65%	4,157	104.16%	-0.28%	-0.28%
	Oct	4.97%	5.05%	4,830	131.79%	-1.58%	-1.60%
	Nov	9.52%	10.35%	6,326	184.38%	-8.03%	-8.73%
	Dec	9.96%	10.99%	2,986	194.15%	-9.37%	-10.34%
	Total	**6.88%**	**7.05%**	**29,498**	**135.40%**	**-2.44%**	**-2.50%**

Commonwealth Edison Company
Rider NAM Refusal and UTC Statistics: **Pilot – 12/31/17**

Formula	a	b	c	d	e=a+(c-i)+(d-o)
Total	Meters Installed (1)	Gross Refusals (2)	Gross Refusals Inside Footprint (3)	Gross UTCs (4)	Meters Attempted (5)
Pilot - 12/31/17	**3,772,290**	**8,432**	**8,432**	**274,304**	**3,794,868**

	Formula	f=b/a	g=b/e	h	i	j=h/b	k=(b-h)/a	l=(b-h)/e
Refusals	Total	Gross Refusal Rate vs. Installs	Gross Refusal Rate vs. Meters Attempted	Conversions (6)	Conversions Inside Footprint (7)	Conversion Rate	Net Refusal Rate vs. Installs	Net Refusal Rate vs. Meters Attempted
	Pilot - 12/31/17	**0.22%**	**0.22%**	**3,946**	**3,946**	**46.80%**	**0.12%**	**0.12%**

	Formula	m=d/a	n=d/e	o	p=o/d	q=(d-o)/a	r=(d-o)/e
UTCs	Total	Gross UTC Rate vs. Installs	Gross UTC Rate vs. Meters Attempted	UTC Completions	UTC Completion Rate	Net UTC Rate vs. Installs	Net UTC Rate vs. Meters Attempted
	Pilot - 12/31/17	**7.27%**	**7.23%**	**256,212**	**93.40%**	**0.48%**	**0.48%**

	Formula	s=(b+d)/a	t=(b+d)/e	u=h+o	v=u/(b+d)	w=(b+d-h-o)/a	x = (b+d-h-o)/e
ALL (Refusals and UTCs)	Total	Gross Combined Rate vs. Installs	Gross Combined Rate vs. Meters Attempted	Conversions and UTC Completions	Conversion and UTC Completion Rate	Net Combined Rate vs. Installs	Net Combined Rate vs. Meters Attempted
	Pilot - 12/31/17	**7.50%**	**7.45%**	**260,158**	**92.01%**	**0.60%**	**0.59%**

Commonwealth Edison Company
Rider NAM Refusal and UTC Statistics

(1) **Meters Installed** means the number of AMI Meters that have replaced analog meters. Meters installed is the standard denominator used in refusal and UTC rate equations due to simplicity, easier tracking, and universal understanding. All ComEd's relevant performance metrics are based on meters installed.

(2) **Refusals** refers to the number of retail customers who indicated to ComEd that they refuse(d) the installation of the AMI Meter through communication to a field technician, field supervisor, CSR, project manager, or other ComEd representative. This number includes both refusals from inside the deployment area and outside the deployment area

(3) **Refusals Inside Footprint** refers to the number of retail customers who indicated to ComEd that they refuse(d) the installation of the AMI Meter through communication to a field technician, field supervisor, CSR, project manager, or other ComEd representative and were located within the meter deployment area

(4) **UTCs** are installations that ComEd was Unable To Complete (UTC) due to a lack of access (e.g. dog in yard, gate locked, etc.)

(5) **Meters Attempted** refers to the number of unique meters that were intended to be installed - i.e. if a tech tried to install a meter on an account three times, each of which resulted in a UTC, this would count as one meter attempt. While more exact, **Meters Attempted** is not the standard denominator for rate equations. This is due to the margin of error associated with counting meters multiple times (UTC attempts and refusals).

(6) **Conversions** refer to customers who actively refused the installation of an AMI Meter but subsequently decided to accept installation of the AMI Meter. Conversions are recorded on the date the customer accepts installation of the AMI Meter. Activities that support a customer converting include: mailing notification letters and making outbound phone calls in an attempt to schedule appointments.

(7) **Conversions Inside Footprint** refers to customers who refused the installation of an AMI Meter, but subsequently decided to accept installation of the AMI Meter. These customers are specific to the area where meters are currently being installed and not those areas with future deployment dates.

Commonwealth Edison Company
Rider NAM Refusal and UTC Statistics (Continued)

Standard Refusal Process:

1. Refusal is received through the AMI Call Center or the Field
2. Call Service Representative / Field Technician attempts to educate the customer on AMI meters
3. If the customer continues to refuse, the refusal is escalated to the Customer Experience team. A supervisor/analyst speaks with the customer after their refusal in an attempt to get them to accept installation of the AMI meter by addressing their specific concerns around the installation
4. If the customer still continues to refuse, the supervisor/analyst notifies the customer of the fee associated with refusing the AMI Meter and that notifications will be sent to the customer confirming their refusal and the associated charges
5. Over the course of four months, two notification letters are sent to the refusal customer
6. After receiving the two notification letters, the charge is applied to the customer's bill on their fifth billing cycle

UTC Refusal Process:

1. Meter cannot be exchanged due to lack of access and a door hanger is left for the customer
2. AMI Deployment reaches out to customer via phone call to gain access to meter and makes a second attempt to gain access to the meter. If they are unable-to-complete a second time, a door hanger is placed and the customer is on track for the UTC Letters.
3. Customer will receive four notification letters, one for each month until access to meter is received.
4. After receiving the four notification letters, the charge will be applied to the fifth bill rendered since the first UTC letter.

Commonwealth Edison Company
Rider NAM Cost Report: Summary

Rider NAM Costs (7/1/17 – 12/31/17)

Summary of Costs by Department

Meter Reading	$	336,371.43	See Page 14
Field and Meter Services	$	10,044.69	See Page 16
Deployment	$	1,471,593.51	See Page 18
AMI Operations	$	-	See Page 19
Customer Experience	$	231,275.89	See Page 22
Billing	$	848.20	See Page 23
Total Cost*	**$**	**2,050,133.72**	

*Total cost includes adjusted labor rates for current reporting period.

Commonwealth Edison Company
Meter Reading Cost Breakdown

Meter Reading[1,2,3]

Variable	Formula	Value	Unit
Total Meter Reading Costs (DVA)	a1	$ 48,737.57	Dollars
Total Meter Reading Costs (CS)	a2	$ 205,266.47	Dollars
Total Meter Reading Costs (GSA)	a3	$ 63,224.04	Dollars
Total Meter Reading Costs (CRE)	a4	$ 82,028.10	Dollars
Total Meter Reading Costs (NWA)	a5	$ 70,463.72	Dollars
Total Meter Reading Costs (CN)	a6	$ 391,334.44	Dollars
Total Meter Reading Costs (LIB)	a7	$ 225,237.53	Dollars
Total Meter Reading Costs (NSA)	a8	$ 93,381.01	Dollars
Total Meter Reading Costs (ROC)	a9	$ 685,692.23	Dollars
Total Meter Reading Costs (BOL)	a10	$ 116,486.29	Dollars
Total Meter Reading Costs (UPA)	a11	$ 657,246.99	Dollars
Total Meter Reading Costs (AUR)	a12	$ 187,346.42	Dollars
Total Meter Reading Costs (ELG)	a13	$ 608,672.91	Dollars
Total Meter Reading Costs (JOL)	a14	$ 1,993,059.96	Dollars
Total Meter Reading Costs (DIX)	a15	$ 71,050.84	Dollars
Total Meter Reading Costs (FRE)	a16	$ 232,521.57	Dollars
Total Meter Reading Costs (STR)	a17	$ 307,326.66	Dollars
Total Meter Reading Costs (WDS)	a18	$ 932,388.50	Dollars
Total Meter Reading Costs (DEK)	a19	$ 670,478.13	Dollars

**Continued on following page*

[1] DVA = Maywood Operating Area, CS = Chicago South Operating Area, GSA = Glenbard Operating Area, CRE = Crestwood Operating Area, NWA = Mt. Prospect Operating Area, CN = Chicago North Operating Area, LIB = Libertyville Operating Area, NSA = Northbrook Operating Area, ROC= Rockford Operating Area, BOL = Bolingbrook Operating Area, UPA = University Park Operating Area, AUR = Aurora Operating Area, ELG = Elgin Operating Area, JOL = Joliet Operating Area, DIX = Dixon Operating Area, FRE = Freeport Operating Area, STR = Streator Operating Area, WDS = Woodstock/Crystal Lake Operating Area, DEK = Dekalb Operating Area

[2] Costs reflect the use of temporary meter readers, which reduces overall labor costs.

[3] Beginning in January 2017, ComEd began tracking Meter Reading costs through actual headcount working in each operating area, while in prior Rider NAM reports such Meter Reading costs were reported through time entries based upon their assigned operating area.

Commonwealth Edison Company
Meter Reading Cost Breakdown (Continued [1])

Total Meter Reads (DVA)	b1	1,389	Meter Reads
Total Meter Reads (CS)	b2	6,309	Meter Reads
Total Meter Reads (GSA)	b3	4,333	Meter Reads
Total Meter Reads (CRE)	b4	5,121	Meter Reads
Total Meter Reads (NWA)	b5	5,278	Meter Reads
Total Meter Reads (CN)	b6	22,493	Meter Reads
Total Meter Reads (LIB)	b7	14,422	Meter Reads
Total Meter Reads (NSA)	b8	7,705	Meter Reads
Total Meter Reads (ROC)	b9	295,479	Meter Reads
Total Meter Reads (BOL)	b10	8,089	Meter Reads
Total Meter Reads (UPA)	b11	132,675	Meter Reads
Total Meter Reads (AUR)	b12	30,606	Meter Reads
Total Meter Reads (ELG)	b13	96,644	Meter Reads
Total Meter Reads (JOL)	b14	989,999	Meter Reads
Total Meter Reads (DIX)	b15	5,105	Meter Reads
Total Meter Reads (FRE)	b16	96,839	Meter Reads
Total Meter Reads (STR)	b17	118,020	Meter Reads
Total Meter Reads (WDS)	b18	656,137	Meter Reads
Total Meter Reads (DEK)	b19	381,873	Meter Reads

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Commonwealth Edison Company
Meter Reading Cost Breakdown (Continued [2])

Cost per Meter Read (DVA)	a1/b1	$	35.09	Dollars/Meter Read
Cost per Meter Read (CS)	a2/b2	$	32.54	Dollars/Meter Read
Cost per Meter Read (GSA)	a3/b3	$	14.59	Dollars/Meter Read
Cost per Meter Read (CRE)	a4/b4	$	16.02	Dollars/Meter Read
Cost per Meter Read (NWA)	a5/b5	$	13.35	Dollars/Meter Read
Cost per Meter Read (CN)	a6/b6	$	17.40	Dollars/Meter Read
Cost per Meter Read (LIB)	a7/b7	$	15.62	Dollars/Meter Read
Cost per Meter Read (NSA)	a8/b8	$	12.12	Dollars/Meter Read
Cost per Meter Read (ROC)	a9/b9	$	2.32	Dollars/Meter Read
Cost per Meter Read (BOL)	a10/b10	$	14.40	Dollars/Meter Read
Cost per Meter Read (UPA)	a11/b11	$	4.95	Dollars/Meter Read
Cost per Meter Read (AUR)	a12/b12	$	6.12	Dollars/Meter Read
Cost per Meter Read (ELG)	a13/b13	$	6.30	Dollars/Meter Read
Cost per Meter Read (JOL)	a14/b14	$	2.01	Dollars/Meter Read
Cost per Meter Read (DIX)	a15/b15	$	13.92	Dollars/Meter Read
Cost per Meter Read (FRE)	a16/b16	$	2.40	Dollars/Meter Read
Cost per Meter Read (STR)	a17/b17	$	2.60	Dollars/Meter Read
Cost per Meter Read (WDS)	a18/b18	$	1.42	Dollars/Meter Read
Cost per Meter Read (DEK)	a19/b19	$	1.76	Dollars/Meter Read

**Continued on following page*

Note: Highlighted rows above represent nearly complete operating areas (i.e. at least 98% of meters are AMI).

Commonwealth Edison Company
Meter Reading Cost Breakdown (Continued [3])

Refusal Meter Reads (DVA)	c1	658	Meter Reads
Refusal Meter Reads (CS)	c2	1993	Meter Reads
Refusal Meter Reads (GSA)	c3	2595	Meter Reads
Refusal Meter Reads (CRE)	c4	1487	Meter Reads
Refusal Meter Reads (NWA)	c5	1918	Meter Reads
Refusal Meter Reads (CN)	c6	2404	Meter Reads
Refusal Meter Reads (LIB)	c7	2494	Meter Reads
Refusal Meter Reads (NSA)	c8	1694	Meter Reads
Refusal Meter Reads (ROC)	c9	1326	Meter Reads
Refusal Meter Reads (BOL)	c10	2405	Meter Reads
Refusal Meter Reads (UPA)	c11	1255	Meter Reads
Refusal Meter Reads (AUR)	c12	878	Meter Reads
Refusal Meter Reads (ELG)	c13	1674	Meter Reads
Refusal Meter Reads (JOL)	c14	1274	Meter Reads
Refusal Meter Reads (DIX)	c15	1074	Meter Reads
Refusal Meter Reads (FRE)	c16	222	Meter Reads
Refusal Meter Reads (STR)	c17	228	Meter Reads
Refusal Meter Reads (WDS)	c18	300	Meter Reads
Refusal Meter Reads (DEK)	c19	58	Meter Reads

**Continued on following page*

Commonwealth Edison Company
Meter Reading Cost Breakdown (Continued [4])

Refusal Meter Reading Costs (DVA)	(a1/b1)*c1	$	23,088.06	Dollars
Refusal Meter Reading Costs (CS)	(a2/b2)*c2	$	64,843.25	Dollars
Refusal Meter Reading Costs (GSA)	(a3/b3)*c3	$	37,864.38	Dollars
Refusal Meter Reading Costs (CRE)	(a4/b4)*c4	$	23,818.74	Dollars
Refusal Meter Reading Costs (NWA)	(a5/b5)*c5	$	25,606.18	Dollars
Refusal Meter Reading Costs (CN)	(a6/b6)*c6	$	41,824.92	Dollars
Refusal Meter Reading Costs (LIB)	(a7/b7)*c7	$	38,950.38	Dollars
Refusal Meter Reading Costs (NSA)	(a8/b8)*c8	$	20,530.49	Dollars
Refusal Meter Reading Costs (ROC)	(a9/b9)*c9	$	3,077.13	Dollars
Refusal Meter Reading Costs (BOL)	(a10/b10)*c10	$	34,633.39	Dollars
Refusal Meter Reading Costs (UPA)	(a11/b11)*c11	$	6,217.03	Dollars
Refusal Meter Reading Costs (AUR)	(a12/b12)*c12	$	5,374.44	Dollars
Refusal Meter Reading Costs (ELG)	(a13/b13)*c13	$	10,543.01	Dollars
Refusal Meter Reading Costs (JOL)	(a14/b14)*c14	$	2,564.81	Dollars
Refusal Meter Reading Costs (DIX)	(a15/b15)*c15	$	14,947.82	Dollars
Refusal Meter Reading Costs (FRE)	(a16/b16)*c16	$	533.05	Dollars
Refusal Meter Reading Costs (STR)	(a17/b17)*c17	$	593.72	Dollars
Refusal Meter Reading Costs (WDS)	(a18/b18)*c18	$	426.31	Dollars
Refusal Meter Reading Costs (DEK)	(a19/b19)*c19	$	101.83	Dollars

**Continued on following page*

Commonwealth Edison Company
Meter Reading Cost Breakdown (Continued [4])

Total Refusal Meter Reading Costs*	[(a1/b1)*c1]+[(a2/b2)*c2]+[(a3/b3)*c3]+[(a4/b4)*c4]+[(a5/b5)*c5]+[(a6/b6)*c6]+[(a7/b7)*c7]+[(a8/b8)*c8]+[(a9/b9)*c9]+[(a10/b10)*c10]+[(a11/b11)*c11]+[(a12/b12)*c12]+[(a13/b13)*c13]+[(a14/b14)*c14]+[(a15/b15)*c15]+[(a16/b16)*c16]+[(a17/b17)*c17]+[(a18/b18)*c18]+[(a19/b19)*c19]	**$ 336,371.43**	Dollars

Definitions

Total Meter Reads: The number of manual meter reads performed due to customer meter refusals, UTCs, or otherwise uninstalled AMI meters pending installation.
Refusal Meter Reads: The number of manual meter reads performed on those meters where customers have prevented us access or refused.

Commonwealth Edison Company
Basis of Cost Estimate

In accordance with the evidence presented to the Commission in the 2013 Docket approving Rider NAM, the cost of meter reading, meters read, and cost per meter read proposed in the original filing of Rider NAM represent an estimate of the costs ComEd will incur and that would otherwise be borne by other customers in an *end state* of AMI deployment (that is, after deployment is otherwise complete in a region or territory). As deployment proceeds in different operating areas, the variables that affect the cost of a meter refusal will fluctuate over time and by operating area. Additionally, these data include costs of UTC (Unable to Complete) installations because, during the rollout, disaggregating UTCs cost data from confirmed refusals is not practical. As a result, the actual costs data presented in this Rider NAM biannual report is likely to significantly understate the costs of a meter refusal by spreading that cost over a broader base of manual readings.

We can however approximate the effect by considering refusal rates. The current state (pilot through 12/31/17) of meter refusals puts ComEd at a 0.12% meter refusal rate against meter installs (also 0.12% against meters attempted). ComEd's efforts to minimize refusals have to date been effective, and based on ComEd's original Rider NAM filing, this refusal percentage is lower than any scenario presented to the ICC. The monthly refusal charge of $21.53 was based on a selected assumed meter refusal rate of 1.00%. Because the cost per meter read increases as the refusal rate decreases, if ComEd were to only include true meter refusals, the cost per read (at end state) would be higher than the currently-approved monthly charge of $21.53.

Through this reporting period, seven operating areas (i.e. Maywood (DVA), Glenbard (GSA), Mount Prospect (NWA), Chicago South (CS), Crestwood (CRE), Libertyville (LIB), and Dixon (DIX)) are considered nearly complete. The actual average meter refusal costs at these nearly complete operating areas track closely to the current fee of $21.53 (not including back office costs). As AMI deployment progresses, ComEd's Meter Reading department will continue to optimize resources and routing which can drive fluctuations in manual costs per read. These refusal costs will continue to be monitored as deployment continues and, if merited, ComEd may consider updating the monthly refusal charge over time.

Commonwealth Edison Company
Field and Meter Services Cost Breakdown

Field and Meter Services

Post-Install CMO

Variable	Formula	Value	Unit
Total Loaded Labor Cost per CMO	a	$ 52.59	Dollars/CMO
# of Post-Install CMO Performed	b	191	CMO
Total Post-Install CMO Cost	a*b	**$ 10,044.69**	Dollars

Definitions

CMO: Change Meter Order
Post-Install CMO: When a customer with an AMI meter installed requests to have a non-AMI meter reinstalled

Commonwealth Edison Company
Deployment Cost Breakdown

Deployment

FLS Refusal Time[4]

Variable	Formula	Value	Unit
Reporting Period Net Field Refusals	a	520	Refusals
Avg. FLS Refusal Time	b	0	Hours
Avg. Loaded FLS Labor Rate	c	$ 117.23	Dollars/Hour
Total Labor Cost	a*b*c	**$ -**	Dollars

UTCs – Techs

Variable	Formula	Value	Unit
UTC Tech Headcount	d	8	FTE's
Business Days in Reporting Period	e	130	Days
Avg. Daily Hours per Tech	f	8	Hours
Avg. Loaded Tech Labor Rate	g	$ 111.51	Dollars/Hour
Total Labor Cost	d*e*f*g	**$ 927,797.25**	Dollars

**Continued on following page*

[4] There were no FLS resources from AMI Deployment supporting the field refusal process for the 7/1/17-12/31/17 reporting period

Commonwealth Edison Company
Deployment Cost Breakdown (Continued)

UTCs – Planners[5]

Variable	Formula	Value	Unit
Tracked Deployment Management Labor Costs[4]	h	**$ 543,796.26**	Dollars

Total Costs

Variable	Formula	Value	Unit
Total Costs	(a*b*c)+(d*e*f*g)+h	**$ 1,471,593.51**	Dollars

Definitions

Field Refusals: The number of customers who refuse the Smart Meter installation when an installation tech arrives at their property. This number does not include customers who have accepted the meter after speaking with a field supervisor, a CSR, or a Customer Experience project manager
Average FLS Refusal Time: The average time a field supervisor spends speaking with a customer desiring to refuse the Smart Meter installation
UTC: Unable to complete
UTC Tech: A tech solely devoted to attempting to install meters on properties that were previously noted unable to complete
UTC Planner: A planner solely devoted to coordination with UTC installation techs and back office UTC work

[5] Tracked exactly through time entry using a specified Rider NAM code

Commonwealth Edison Company
AMI Operations Cost Breakdown

AMI Operations

UTC Time Allocation[6]

Variable	Formula	Value	Unit
Avg. E03 Headcount	a	5	FTE's
Avg. E03 Loaded Labor Rate	b	$ 117.23	Dollars/FTE
Total Hours Allocated to UTC	c	0	Hours
Total Labor Cost	a*b*c	**$ -**	Dollars

Definitions

UTC Time Allocation: The time associated with tracking down UTC customers, working with municipalities, filing information, data tracking, customer management, etc.

[6] Similar to the 1/1/17-6/30/17 reporting period, there were no resources from AMI Operations supporting the UTC process for the 7/1/17-12/31/17 reporting period.

Commonwealth Edison Company
Customer Experience Cost Breakdown

Customer Experience

Refusal Work – Management[7]

Variable	Formula	Value	Unit
Tracked Customer Experience Management Labor Costs[7]	a	**$ 206,657.43**	Dollars

Refusal/UTC Calls – CSRs

Variable	Formula	Value	Unit
Avg. Loaded CSR Labor Rate	x	$ 92.65	Dollars/Hour
Avg. Agent Time per Refusal Call	t	0.461	Hours
AMI Call Center Customer Refusals	j	377	Refusals
Total Labor Cost	x*t*j	**$ 16,105.99**	Dollars

Variable	Formula	Value	Unit
Avg. Loaded CSR Labor Rate	x	$ 92.65	Dollars/Hour
Avg. Agent Time per UTC Call	y	0.080	Hours
UTC Calls	z	143	Calls
Total Labor Cost	x*y*z	**$ 1,063.78**	Dollars

**Continued on following page*

[7] Tracked exactly through time entry using a specified Rider NAM code

Commonwealth Edison Company
Customer Experience Cost Breakdown (Continued [1])

Refusal/UTC Letters – CSRs

Variable	Formula	Value	Unit
Refusal Letters Mailed During Reporting Period	m	904	Letters
Avg. Time Allocation per Letter	n	0.083	Hours
Avg. Loaded CSR Labor Rate	x	$ 92.65	Dollars/Hour
Total Labor Cost	m*n*x	**$ 6,951.49**	Dollars

Postage Cost per Letter	k	$ 0.55	Dollars/Letter
Total Postage Cost	m*k	**$ 497.20**	Dollars

Total Cost of Refusal Letters	(m*n*x)+(m*k)	**$ 7,448.69**	Dollars

Variable	Formula	Value	Unit
UTC Letters Mailed During Reporting Period[8]	u	0	Letters
Avg. Time Allocation per Letter	n	0.083	Hours
Avg. Loaded CSR Labor Rate	x	$ 92.65	Dollars/Hour
Total Labor Cost	u*n*x	**$ -**	Dollars

Postage Cost per Letter	k	$ 0.55	Dollars/Letter
Total Postage Cost	m*k	**$ -**	Dollars

Total Cost of Refusal Letters	(u*n*x)+(m*k)	**$ -**	Dollars

**Continued on following page*

[8] UTC letters continue to be mailed through an automated system and therefore no longer incur manual charges.

Commonwealth Edison Company
Customer Experience Cost Breakdown (Continued [2])

Total Department Cost

Total Customer Experience Cost	a+(x*t*j)+(x*y*z)+[(m*n*x)+(m*k)] + [(u*n*x)+(u*k)]	**$ 231,275.89**	Dollars

Definitions

Refusal Work - Management: The time associated with speaking to customers and tracking refusal customers and data
AMI Call Center Customer Refusals: The number of customers who refuse the Smart Meter installation by calling into the AMI Call Center. This number does not include customers who have accepted the meter after speaking with a CSR or Customer Experience project manager
UTC Calls: The outbound calls made to UTC customers in an attempt to schedule an installation appointment
Refusal Letters: The letters mailed to customers that notify them of their recent decision to refuse the smart meter, the fees associated with refusing, and the timing of the fees
UTC Letters: The letters mailed to customers that notify them of ComEd's unsuccessful attempts to install the Smart Meter, the fees associated with refusing the meter due to no access, and the timing of the fees
Average Time Allocation per Letter: The average time spent populating, tracking, printing, and mailing customer letters

Commonwealth Edison Company
Billing Cost Breakdown

Billing

Applying Rider NAM Charges[9]

Variable	Formula	Value	Unit
Refusal/UTC Charges Manually Applied to Bills	a	143	Charges
Time Allocation per Refusal/UTC Charge	b	0.05	Hours
Avg. Loaded Billing Clerk Labor Rate	c	$ 118.63	Dollars/Hour
Total Billing Cost	a*b*c	**$ 848.20**	Dollars

[9] Refusal/UTC charge count includes the standard monthly charge ($21.53) and the one time truck roll charge associated with post-installation refusals.

Commonwealth Edison Company
Work Paper to Rider NAM Cost Report

Meter Reading (Costs & Reads)

Location	Financials JULY 2017	Financials AUG 2017	Financials SEPT 2017	Financials OCT 2017	Financials NOV 2017	Financials DEC 2017	Total 7.1.17 - 12.31.17 Costs
ChicagoNorth	$ 82,878	$ 78,670	$ 70,358	$ 54,057	$ 52,263	$ 53,107	***$ 391,334***
ChicagoSouth	$ 46,366	$ 39,905	$ 34,602	$ 29,281	$ 27,032	$ 28,080	***$ 205,266***
DeKalb	$ 111,857	$ 127,127	$ 100,923	$ 104,173	$ 117,741	$ 108,656	***$ 670,478***
Dixon	$ 11,591	$ 13,112	$ 10,957	$ 12,388	$ 12,014	$ 10,988	***$ 71,051***
Elgin	$ 127,505	$ 134,538	$ 119,378	$ 107,552	$ 72,087	$ 47,613	***$ 608,673***
Freeport	$ 49,263	$ 59,288	$ 57,094	$ 44,485	$ 12,014	$ 10,377	***$ 232,522***
Libertyville	$ 74,185	$ 48,456	$ 31,142	$ 32,097	$ 19,824	$ 19,534	***$ 225,238***
Mt. Prospect	$ 11,591	$ 13,112	$ 11,534	$ 11,825	$ 11,414	$ 10,988	***$ 70,464***
Rockford	$ 126,346	$ 108,314	$ 103,807	$ 117,687	$ 112,335	$ 117,202	***$ 685,692***
Skokie	$ 30,717	$ 19,383	$ 11,534	$ 12,388	$ 10,813	$ 8,546	***$ 93,381***
Woodstock	$ 153,006	$ 182,994	$ 158,594	$ 173,434	$ 148,378	$ 115,981	***$ 932,388***
Aurora	$ 37,092	$ 43,896	$ 33,449	$ 28,155	$ 25,831	$ 18,923	***$ 187,346***
Bolingbrook	$ 19,126	$ 29,644	$ 19,608	$ 20,272	$ 15,018	$ 12,819	***$ 116,486***
Bradley*	$ 70,128	$ 91,212	$ 65,168	$ 39,980	$ 42,051	$ 38,457	***$ 346,995***
Crestwood	$ 19,705	$ 13,682	$ 12,688	$ 12,951	$ 12,014	$ 10,988	***$ 82,028***
Glenbard	$ 11,591	$ 13,112	$ 12,688	$ 10,699	$ 7,809	$ 7,325	***$ 63,224***
Joliet	$ 295,001	$ 375,680	$ 354,097	$ 326,033	$ 335,203	$ 307,046	***$ 1,993,060***
Maywood	$ 11,591	$ 10,261	$ 9,227	$ 6,757	$ 5,406	$ 5,494	***$ 48,738***
Streator	$ 61,434	$ 70,689	$ 76,702	$ 48,989	$ 33,640	$ 15,871	***$ 307,327***
UPA*	$ 53,320	$ 74,110	$ 65,168	$ 37,728	$ 40,248	$ 39,678	***$ 310,252***
Total MR Costs	**$ 1,404,297**	**$ 1,547,186**	**$ 1,358,718**	**$ 1,230,931**	**$ 1,113,138**	**$ 987,674**	**$ 7,641,943**

Bradley + UPA = UPA Operating Area

Location	Meters Read	Meters Read	Meters Read	Meters Read	Meters Read	Meters Read	7.1.17 - 12.31.17 Total Meter Reads
ChicagoNorth	4,642	4,010	3,701	3,989	3,351	2,800	***22,493***
ChicagoSouth	1,538	1,184	1,068	978	784	757	***6,309***
DeKalb	65,972	65,883	63,896	62,286	61,985	61,851	***381,873***
Dixon	1,115	1,109	810	820	684	567	***5,105***
Elgin	44,746	27,271	14,207	5,792	3,156	1,472	***96,644***
Freeport	30,857	30,749	28,402	5,561	717	553	***96,839***
Libertyville	6,718	1,936	1,679	1,551	1,352	1,186	***14,422***
Mt. Prospect	1,158	1,140	881	758	782	559	***5,278***
Rockford	62,552	55,849	50,264	47,324	40,614	38,876	***295,479***
Skokie	2,090	1,341	1,130	1,068	1,042	1,034	***7,705***
Woodstock	118,888	116,010	114,629	112,752	101,083	92,775	***656,137***
Aurora	10,685	7,174	4,394	3,586	3,150	1,617	***30,606***
Bolingbrook	1,881	1,646	1,362	1,151	1,078	971	***8,089***
Bradley*	25,306	22,652	17,199	13,108	9,094	8,309	***95,668***
Crestwood	993	969	923	793	778	665	***5,121***
Glenbard	904	816	773	675	597	568	***4,333***
Joliet	199,548	185,227	167,938	159,130	143,080	135,076	***989,999***
Maywood	235	243	231	295	219	166	***1,389***
Streator	31,496	31,434	31,389	19,954	3,160	587	***118,020***
UPA*	9,303	7,530	6,345	6,115	4,366	3,348	***37,007***
Total Meter Reads	**620,627**	**564,173**	**511,221**	**447,686**	**381,072**	**353,737**	**2,878,516**

Bradley + UPA = UPA Operating Area

Commonwealth Edison Company
Work Paper to Rider NAM Cost Report

Field and Meter Services

Data Based on 2017 Budgeted Pay Rates and FMS Work Plan Version 2017 2.R 10-20-16	Rider Nam
Field Order Type	Exchange
Standard Time in Minutes to Complete Order Type	**15.8**
Travel Time (percent of each day spent in travel)	37.33%
Travel Time (in minutes per day)	179
Work Hours (in minutes per day)	300.8
# of orders that could be completed per day per field order type	19.1
Amount of travel time to apply (in minutes)	**9.4**
Total Time in Minutes (incl. travel)	25.1
Total Time to Complete Order Type in Hours (incl. travel)	0.42
% of work done by ET	34%
% of work done by SET	46%
% of work done by Primary Tech	9%
% of work done by Meter Reader	10%
check	*100.0%*
ET Avg. Hourly Pay Rate	$ 41.73
SET Avg. Hourly Pay Rate	$ 47.45
Primary Tech Avg. Hourly Pay Rate	$ 49.90
Meter Reader Avg. Hourly Pay Rate + Upgrade Premium	$ 23.69
Meter Reader Upgrade Premium	$ 19.06
Total ET Regular Time	$ 6.03
Total SET Regular Time	$ 9.17
Total Primary Tech Regular Time	$ 1.92
Total Meter Reader Regular Time	$ 1.01
Total Meter Reader Upgrade Premium	$ 7.98
Total Field Tech **Regular Time** Labor	**$ 18.13**
Total MR Upgrade Premium	**$ 7.98**
PTO (Actual/Take Rate)	**$ 3.19**
P&B Allocation	**$ 12.72**
Total Field Tech Labor **(Base/Prem/P&B)**	**$ 42.03**
Support Cost Reg Time (Managers, Supervisors, Analysts, Clerks, Mete	**$ 7.05**
UTC Cost Reg Time	**$ 2.18**
Total Support/UTC PTO/P&B	**$ 8.10**
Vehicle Charges	**$ 1.93**
Material Charges	**$ 0.53**
	Exchange
Total Cost Per Order Type Unit	**$ 52.59**

Commonwealth Edison Company
Work Paper to Rider NAM Cost Report

Labor Costs

	2017 LRP 2.0
PTO	17.17%
P&B, Incentive, Fringe	70.18%
Payroll Tax	10.96%
Total Labor allocation	98.31%

	GO 25
AIA Non Common Back Office	38.81%
AIA Common Back Office	7.34%
Total allocation to Reg time Rate	144.46%

Field Tech - AMI Deployment

Average Hourly Labor Rate	$	41.59
Average Rate for Pensions/Fringe Benefits/Payroll Taxes	$	40.89
AIA Non Common Back Office Rate	$	16.14
Sub Total	$	98.62
AIA Common Back Office Rate	$	7.24
Total Labor Cost	$	105.86
Vehicle	$	4.55
Other (material, travel, meals)	$	1.11
Total Cost per Hour	$	111.52

Commonwealth Edison Company
Work Paper to Rider NAM Cost Report

Supervisor - AMI Deployment

Average Hourly Labor Rate	$	43.69
Average Rate for Pensions/Fringe Benefits/Payroll Taxes	$	42.95
AIA Non Common Back Office Rate	$	16.96
Sub Total	$	103.60
AIA Common Back Office Rate	$	7.60
Total Labor Cost	$	111.20
Vehicle	$	4.92
Other (material, travel, meals)	$	1.11
Total Cost per Hour	$	117.23

CSR - Customer Experience

Average Hourly Labor Rate	$	36.40
Average Rate for Pensions/Fringe Benefits/Payroll Taxes	$	35.78
AIA Non Common Back Office Rate	$	14.13
Sub Total	$	86.31
AIA Common Back Office Rate	$	6.34
Total Labor Cost	$	92.65
Vehicle	$	-
Other (material, travel, meals)	$	-
Total Cost per Hour	$	92.65

Commonwealth Edison Company
Work Paper to Rider NAM Cost Report

Clerk - Billing

Average Hourly Labor Rate	$	46.61
Average Rate for Pensions/Fringe Benefits/Payroll Taxes	$	45.82
AIA Non Common Back Office Rate	$	18.09
Sub Total	$	110.52
AIA Common Back Office Rate	$	8.11
Total Labor Cost	$	118.63
Vehicle	$	-
Other (material, travel, meals)	$	-
Total Cost per Hour	$	118.63

Smart Grid Advanced Metering Annual Implementation Progress Report

APPENDIX C – REVISED SMART GRID ADVANCED METERING INFRASTRUCTURE DEPLOYMENT PLAN – 2018 AIPR UPDATES – REDLINED

(Including Updates Per 2018 Annual Implementation Progress Report)

(Redlined Version)

Revised Smart Grid Advanced Metering Infrastructure Deployment Plan

(Including Updates Per 2018~~7~~ Annual Implementation Progress Report)

Submitted by:
Commonwealth Edison Company

April 1, 2018~~7~~

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Chapter 1: Scope Function, Goals, and Purpose

The decade ahead will be marked with significant change in all facets of the energy industry, and perhaps nowhere will these transformations be more impactful than to the electrical grid itself.[1]

The Energy Infrastructure Modernization Act ("EIMA")[2] provides the blueprint for Illinois electric utilities, working with the Illinois Commerce Commission ("ICC" or "Commission") and stakeholders, to accomplish this decade-long transformation. The EIMA establishes policies and goals, calls for utilities to make the investments necessary to achieve them, defines investment timetables and performance metrics to measure that achievement, and provides the means to fund those investments.

Foremost among the actions called for by the EIMA is the deployment of Smart Grid technologies. ComEd shares the view that these smart grid technologies hold great promise to benefit customers by promoting improved reliability, operational efficiency, and improved customer service, which will benefit all customers. AMI and the Smart Grid will also provide customers with newfound levels of control over their own energy use and, ultimately, lower total energy costs than they otherwise would have borne. Smart Grid technologies can also benefit the entire State by promoting greater energy efficiency, assisting the market by enabling other innovative technologies (such as electric vehicles), and assisting in job creation.

The successful and cost-beneficial deployment of Advanced Metering Infrastructure ("AMI") is essential to the development of a mature Smart Grid. Many Smart Grid functions[3] cannot be fully implemented without the ability that AMI provides to measure granular data on customers' use of energy, and to communicate and interact in real time with other systems and devices. Operational efficiencies that AMI provides are also an important share of the delivery cost savings that a mature Smart Grid can deliver. A robust AMI communication system permits meters to interact directly with other utility systems, enabling reliability and operational benefits. The installation of AMI meters and facilities throughout ComEd's service territory thus benefits not just the individual customers receiving AMI meters, but customers and the State as a whole.

ComEd is a participating utility under the EIMA and is required to invest an estimated $1,300,000,000 in "Smart Grid electric system upgrades," including AMI, and a like sum to upgrade and modernize its transmission and distribution infrastructure.[4] The EIMA also requires

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[1] Illinois Smart Grid Regional Innovation Cluster, *Illinois Smart Grid Market Inventory* (Feb. 2012), at 1.

[2] Public Acts 97-0616 and 97-0646 established new Sections 8-108.5 – 16-108.8 of the Illinois Public Utilities Act ("PUA"). These laws are collectively referred to as the Energy Infrastructure Modernization Act.

[3] ComEd defines Smart Grid functions as including those enumerated in 220 ILCS 5/16-108.6(a) and other related functions associated with the deployment and operation of a Smart Grid as therein defined.

[4] EIMA, 220 ILCS 5/16-108.5(b)(1)(B).

participating utilities to file with the Commission a Smart Grid Advanced Metering Infrastructure Deployment Plan ("AMI Plan"). ComEd must, by law, plan for investments in AMI over a 10-year period to deploy AMI to all ComEd retail customers[5] across its entire service territory.[6]

While the requirement to deploy AMI is legislative and peremptory, it was not enacted unilaterally or hastily. The General Assembly directed the full deployment of AMI with a recognition that substantial knowledge and experience with AMI was already gained during ComEd's comprehensive and rigorous AMI pilot. The General Assembly also acknowledged the principles relating to AMI addressed during the Illinois Statewide Smart Grid Collaborative ("ISSCG"). Those contributions, which are described in greater detail below, illuminate the potential benefits of AMI and provide valuable information about how AMI and related technologies can be effectively deployed.

Therefore, ComEd submits to the Commission this AMI Plan, as called for by the EIMA. This Plan describes ComEd's proposal to deploy AMI and the associated investments. It sets out ComEd's vision for AMI, and how it can help create and support a cost-beneficial Smart Grid. The Plan is fully consistent with established standards, including current National Institute of Standards and Technology ("NIST") standards for Smart Grid interoperability. It also relies on open standards and architectures, including use of the internet protocol ("IP"), to the maximum extent possible consistent with security needs. ComEd also recognizes that many uses of AMI and the data it can deliver remain to be developed. Therefore, the Plan relies on a flexible smart meter platform that can accept remote device upgrades without the need for physical meter access. That platform is also capable of meeting the needs of evolving technologies such as home energy management, electric vehicle charging, and advanced distributed generation. ComEd is also aware of the need to provide for data security and privacy, while at the same time to permit customers to use and disclose the available personal energy information. The proposed AMI systems accomplish that, as well. Finally, the Plan includes components meeting each of the other enumerated requirements of the EIMA.

ComEd asks the Commission to approve this Plan.

A. <u>Vision Statement</u>

AMI meter deployment will significantly improve the customer experience and advance Northern Illinois as a leader in smart grid-enabled products and services. The network of advanced meters and communication systems can collect and distribute timely and accurate information to customers and other parties, expanding customer choice, empowering customers to take advantage of new, energy and money saving technologies.

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[5] EIMA, 220 ILCS 5/16-108.6(c)(3).

[6] EIMA, 220 ILCS 5/16-108.6(c).

ComEd envisions that AMI deployment will create long-term value for customers. It will enable new operational systems, practices, and efficiencies that can both improve reliability and reduce costs. Under the EIMA rate structure, cost reductions benefit all customers, even those who have not yet received their AMI meter. AMI meters allow better communication about, and faster response to, outages and better communication about restorations. AMI meters allow easier service changes to accommodate customer moves, and fewer estimated bills. They reduce the need to rely on utility vehicles to serve meters and yield a corresponding reduction in environmental impact. Customers also benefit from other Smart Grid functions that AMI enable—all as envisioned by the EIMA. AMI systems also enable developing technologies, such as electric vehicles and distributed resources, directly and by allowing ComEd and competitive suppliers to offer advanced rates. Both in the selection of technology and the implementation of information controls, ComEd envisions a secure and reliable system, which respects customers' privacy.

Our vision of the AMI-equipped Smart Grid is broader than operations. ComEd is, therefore, committed to tracking tangible measures of our success in enabling the robust growth of efficient demand response, energy efficiency, and distributed generation using the Smart Grid. Those measures must, however, be of ComEd's performance as a delivery company. ComEd must remain neutral in the competitive market, and cannot control our customers' choices, or the market for third-party devices and technologies. ComEd will also continue to work with key stakeholders both in the energy sector and throughout the communities we serve to boost the ability of our investment to unlock the broader environmental, economic, and consumer benefits that are a key part of the Smart Grid's potential. Finally, ComEd's vision is of informed and educated customers who will have sufficient knowledge to benefit from their new AMI meters immediately after they are installed. To that end, ComEd's AMI Plan has a robust customer outreach and education plan.

B. <u>Function and Objectives of the AMI Plan</u>

This AMI Plan sets out "a deployment schedule and plan that includes deployment of AMI to all [ComEd retail] customers."[7] It outlines how ComEd anticipates AMI meters and associated technology will be deployed and articulates the schedule on which those deployments are planned to be made. The Plan describes ComEd's prior and ongoing work to evaluate and prioritize technology choices to create customer value. In particular, it identifies (i) components of the proposed AMI systems; (ii) resources the deployment is anticipated to require; (iii) operational benefits achieved through efficient AMI deployment; and (iv) a range of innovative rates, enhancements to the provision of information, and education programs that benefit customers. The Plan also identifies how the deployment of AMI enables customers to take advantage of new and developing technologies not within ComEd's control, such as electric vehicles, home and appliance automation, and small distributed generation. The Plan further explains how AMI enhances and enables customers' ability to take advantage of Smart Grid functions beginning at the time an account has billed successfully on the AMI network. The data

[7] 220 ILCS 5/16-108.6(c)(3).

in the Plan also form the basis of the benefit-cost analysis submitted to the Commission along with the Plan.

1. Goals and Requirements of the EIMA

The EIMA establishes specific goals, objectives, and requirements for AMI technology and its deployment, as well as for the AMI Plan itself. ComEd's AMI Plan is itself required to meet five specific requirements.[8]

(1) *The participating utility's Smart Grid AMI vision statement that is consistent with the goal of developing a cost-beneficial Smart Grid.* This vision statement is included in Section I.A, above.

(2) *A statement of Smart Grid AMI strategy that includes a description of how the utility evaluates and prioritizes technology choices to create customer value, including a plan to enhance and enable customers' ability to take advantage of Smart Grid functions beginning at the time an account has billed successfully on the AMI network.* Chapter 2 of this Plan describes how ComEd evaluated and prioritized technology choices to create customer value, including by selecting and deploying the most flexible and interoperable systems available. Chapter 3 describes how the proposed AMI system also supports a variety of ComEd sponsored customer applications and rates as well as how it enables customers to take advantage of a variety of technologies currently in development.

(3) *A deployment schedule and plan that includes deployment of AMI to all customers.* The schedule for deploying AMI in all ComEd operating areas and making AMI meters available to all customers is set out in Chapter 2.

(4) *Annual milestones and metrics for the purposes of measuring the success of the AMI Plan in enabling Smart Grid functions and enhancing consumer benefits from Smart Grid AMI.* ComEd has identified three categories of milestones and metrics to measure the rate and extent to which Smart Grid functions are enabled and customer benefits enhanced. First, ComEd's progress in deploying AMI as planned (*e.g.*, meter installs, operating centers completed). Many Smart Grid functions and customer benefits derive directly from AMI deployment. Second, milestones that measure which Smart Grid functions, of those tied to AMI, that are enabled by ComEd's AMI system at the time. Most will be enabled immediately, but other programs (e.g., outage management) will become available during the Plan period. Third, whether developing potential consumer benefits are enabled. As new technologies and applications supportable by Smart Grid technology become extant in the consumer market, ComEd will assess its systems' ability to support those applications. Those milestones and metrics are

[8] 220 ILCS 5/16-108.6(c)(1)-(5).

discussed in Chapters 2, 3, and 4, depending upon whether they relate to operations, customer application, or education, respectively. In addition, various milestones and metrics were added to this Plan pursuant to the Commission's Order in Docket No. 12-0298.

(5) *A plan for the consumer education to be implemented by the participating utility*. This plan is set out in Chapter 4.

In addition, the EIMA requires that the "implementation of the AMI Plan will be cost-beneficial consistent with the principles established through the [ISSGC], giving weight to the results of any Commission-approved pilot designed to examine the benefits and costs of AMI deployment" on ComEd's system.[9] ComEd has conducted a detailed cost-benefit analysis of the planned AMI deployment. This analysis, which was conducted by Black & Veatch Corporation ("Black & Veatch") and Christensen Associates Energy Consulting LLC ("CA Energy"), demonstrates that the benefits of the AMI Plan measured on a present value basis far exceed the present value of all ComEd's costs reasonably associated with the Plan and its implementation. As required by the EIMA, the range of benefits studied include those inuring to customers through reductions in ComEd's operational costs and gains in its efficiency, and those accruing to customers directly, such as avoided electricity costs.[10] These savings include avoided consumer power, capacity, and energy costs, and avoided societal costs associated with the production and consumption of electricity. Also, "there is little doubt that a widely deployed smart grid would lead to more efficient energy use."[11] Other societal benefits studied include enabling the greater integration of economic and efficiently utilized renewable and distributed power resources, reductions in the emissions of harmful pollutants and associated avoided health-related costs, other benefits associated with energy efficiency measures, demand-response activities, and the enabling of greater penetration of alternative fuel vehicles.[12] This study has been submitted to the Commission along with this Plan.

Finally, the EIMA spells out technological and operational criteria for AMI systems. [13] The planned AMI systems and technologies meet all of these substantive and technical requirements of the EIMA, including:

- Consistency with NIST standards for Smart Grid interoperability that are in effect as of the filing of this Plan. Technical aspects of ComEd's planned AMI systems are discussed in Chapter 2.

[9] EIMA, 220 ILCS 5/16-108.6(c).

[10] EIMA, 220 ILCS 5/16-108.6(a).

[11] Illinois Statewide Smart Grid Collaborative: Collaborative Report (Sept. 30, 2010) (ISSGC Report) at 7.

[12] EIMA, 220 ILCS 5/16-108.6(a).

[13] 220 ILCS 5/16-108.6(c), (d).

- Use of open standards and internet protocol to the maximum extent possible consistent with cyber security. As noted, technical aspects of ComEd's planned AMI systems are discussed in Chapter 2.

- Maximizing, to the extent possible, a flexible smart meter platform that can accept remote device upgrades and contain sufficient internal memory capacity for additional storage capabilities, functions and services without the need for physical access to the meter. This is also a technical issue addressed in Chapter 2.

- Securing the privacy of personal information, including through compliance by the utility, its contractors, and agents, with the Personal Information Protection Act. Technical aspects of this issue are addressed in Chapter 2. How ComEd will handle and protect data once communicated is discussed in Chapter 3.

- Allowing consumers to consent to the disclosure of personal energy information to third parties through electronic, web-based, and other means in accordance with State and federal law and regulations regarding consumer privacy and protection of consumer data. This is discussed in Chapter 3.

- Employing an overall AMI strategy that creates customer value, including a plan to enhance and enable customers' ability to take advantage of Smart Grid functions beginning at the time an account has billed successfully on the AMI network. The benefits of ComEd's AMI plan are discussed throughout this Plan and in the testimony and materials supporting its adoption. In addition, Chapter 3 discusses how the planned systems can allow customers to themselves take advantage of Smart Grid functions.

2. <u>Transform Delivery System Operations</u>

ComEd's AMI Pilot demonstrated the potential of AMI technology to transform utility operations. Full deployment as proposed here will further improve operational efficiency and will also enable and support other technologies that improve reliability (*e.g.*, automated outage notification and restoration confirmation) and transform grid planning and operations (*e.g.*, ability to measure voltage along the entire length of a feeder, better transformer loading predictions, integration with intelligent distribution automation devices). AMI technology also provides a wealth of information (*e.g.*, regarding thorough process re-engineering) that ComEd and other suppliers alike can utilize to benefit customers.

To maximize those benefits, this AMI Plan calls for use of technologies that are interoperable, flexible, secure, and proven, and that provide reliable direct connectivity between the meter and smart devices in the home or place of business. These components were evaluated during the AMI pilot, and the criteria on which they were selected were vetted in by stakeholders both before and after the pilot. Many of these criteria were substantively incorporated in the EIMA itself (*e.g.*, the importance of interoperability, reliance on technologies using robust open communication standards; and system security).

ComEd's deployment effort will include re-engineering of both metering and customer operations processes, as well as providing continued support for the previously-designated Smart Grid Test Bed established pursuant to the EIMA,[14] and implementation of follow-on Smart Grid functions such as automated outage reporting and management. In addition, the use of open architecture and innovation-friendly protocols plays a major role in the ability of ComEd's AMI proposal to enable customers to use existing and developing energy technologies.

3. Create Professional and Craft Jobs Rapidly and Prudently

Recognizing the importance of creating skilled jobs emphasized in the EIMA, ComEd's deployment schedule has parallel work tracks. Business process redesign activities to develop the long term solution should proceed on a parallel track with "shovel ready" meter deployment (*i.e.*, using the successfully piloted technologies and systems). ComEd expects that AMI deployment will bring hundreds of news jobs to Illinois.

4. Provide Energy Information, Products, and Services that Help Customers Better Understand How and When They Use Electricity

AMI meters can record electricity usage in small intervals of time and deliver this information to ComEd via the integrated communications system rapidly and securely. ComEd's AMI Plan encompasses the recording, retrieval, storage and analysis of this usage data for customers to access and learn from via a web portal. Other energy information services will be explored and evaluated for future offerings, including creating the role of an energy advisor. In addition, these same systems are designed to facilitate access by future customer-deployed technologies (*e.g.*, Home Area Networks, or "HANs") and to be able to communicate with approved third parties.

5. Provide a Technology Platform that Enables Customers to Receive and Benefit from Additional Products and Services

ComEd's proposed AMI systems are designed to facilitate access by future customer-deployed technologies (*e.g.*, Home Area Networks, or "HANs") and to be able to communicate with approved third parties. While the development and commercialization of the range of smart devices and appliances that could communicate within a HAN is still in its infancy, ComEd relies on open and industry-standard protocols (*e.g.*, IP addressed data communication and ZigBee® HAN communications architectures). ComEd's proposal both supports the market for competing devices and enables the introduction of the broadest range of devices. This design also enables the integration, in a safe and cost-effective manner, a variety of additional customer-side technologies and applications including electric plug-in vehicles, distributed generation, and local storage. This same use of interoperability and open standards aids in the system's ability to communicate with approved third parties, such as RESs, and thereby also enables the

[14] *See* EIMA, 220 ILCS 5/16-108.8.

introduction by those suppliers of other innovative rates and service offerings, while at the same time aiding the protection of the privacy and security of customer data. To that end, ComEd's Plan also employs state of the art communication security and encryption, and hardened data processing systems at least as resistant to intrusion as current partially manual processes. Of course, ComEd cannot foresee which specific applications and devices will emerge and become accepted over this Plan's decade-long horizon. Market forces will drive those developments, and the specific processes for integrating those technologies with the AMI systems will be identified during deployment. But, ComEd's AMI Plan provides a solid interoperable foundation which can enable a range of those innovations.

C. Brief History of the Plan and its Development

ComEd, stakeholders, and the Commission have been considering automated meter reading ("AMR") and AMI options for years. There have been formal Commission proceedings, numerous public workshops, and other stakeholder discussions surrounding these topics throughout that period. ComEd's selection of AMI technologies and systems was itself the product of a detailed and public technology evaluation process, a pre-pilot RPF process, a full operational-scale pilot, and a legislative review of the entire process. These steps culminated in a statutory mandate to proceed to deploy AMI and other Smart Grid technologies on a brisk schedule. The deployment of AMI as set out in the EIMA and this Plan (and its counterpart for Ameren Illinois) is the next step in this multi-year process.

Broad deployment of Smart Grid and AMI in Illinois has been actively studied and considered in the regulatory processes since 2007. That year, ComEd proposed in its general rate case to begin evaluating, selecting, and implementing system modernization technologies, including broadly deployed AMI.[15] ComEd's final proposal there included both substantial stakeholder participation and specific Commission approval before undertaking any investment. The Commission's Order acknowledged the significant benefits of Smart Grid technologies, but it also concluded that further analysis, stakeholder input, a substantial AMI pilot, and additional Commission review and approval should precede any operational deployment. The Commission ordered ComEd to conduct stakeholder workshops and to seek Commission approval "of the [Pilot] goals, timelines, evaluation criteria, etc., that were developed in the workshops."[16]

Formal workshops, moderated by a third-party facilitator approved by the Commission's Executive Director, began on December 17, 2008. Consumer groups, municipalities, the Attorney General's office ("AG"), potential vendors, Ameren, and the Commission's Staff all participated. The issues addressed included the desired characteristics of an AMI system,

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[15] There were some earlier efforts, including by Illinois Power, to deploy automated meter reading schemes that did not provide for the same networked communication or other AMI benefits.

[16] *See Commonwealth Edison Co.*, Docket No. 07-0566 (Sept. 10, 2008), at 103-05, 137-40. The use of a rider to implement and fund the pilot was later reversed by the Illinois Appellate Court. *See Commonwealth Edison Co. v. Ill. Commerce Comm'n*, 405 Ill. App.3d 389 (2nd Dist. 2010). That decision, however, came after the Commission's subsequent decision in Docket No. 09-0263 to proceed with an expanded pilot under a revised tariff, and it did not address the merits or prudence of piloting AMI or using a stakeholder process.

including interoperability and flexibility to respond to technological change and evolution, and criteria for meter and network vendor selection. Discussions were substantive and detailed. During this time, ComEd also conducted a formal request for proposal ("RFP") process for AMI pilot vendors. "Stakeholders were involved during each step starting with the review of the RFP document and ending with the final review of the technical scoring for all of the RFP respondents."[17] That evaluation was driven by the priorities previously discussed in the workshops including security, network performance, obsolescence risk, and cost-effectiveness. The "maturity" of a technology, *i.e.*, if its capabilities were proven in a commercial-scale installation, was also considered. An IP-based mesh radio network architecture pioneered by Silver Spring Networks ("SSN") prevailed as the best overall choice. That choice was largely accepted by the stakeholder community.

On June 1, 2009, ComEd sought Commission approval of its pilot of over 130,000 meters using SSN network technology. Based in large part on stakeholder input, ComEd was also asked to pilot customer applications of AMI, including innovative rate designs and in-home applications. ComEd detailed "how the Request for Proposal was developed … and how the vendor responses were analyzed" and both identified the radio mesh technology and explained why it was "selected as the AMI technology provider." That justification included evidence that the specific technology choices best met the goals and criteria developed and vetted in the stakeholder process. ComEd also emphasized its "expectation that the communication capabilities of the Smart Grid will be an application-agnostic and future-proof platform." After considering the evidence, the Commission approved the AMI pilot, found that it should include a systematic study of a variety of customer applications and alternative rates, and specifically ordered that "[t]he selection of Silver Springs [sic] Networks as vendor of the AMI Network is hereby approved." *Commonwealth Edison Co.*, Docket No. 09-0263 (Oct. 14, 2009) at 58.[18] "No party … disputed the validity of the award of this contract to Silver Springs Networks." *Id*, at 7.

ComEd's AMI pilot began in November 2009. Approximately 128,000 AMI meters were installed in nine towns along the I-290 expressway, in the Humboldt Park area of Chicago, and in two buildings in downtown Chicago. The meters and back office systems communicated using the mesh radio network technology, and data from those meters communicated over that network and were used for billing as well as for the customer applications being piloted. Those meters remain in service and continue to support customer billing. The AMI pilot was publicly evaluated by ComEd and by both Black & Veatch (as to AMI systems and utility operations) and, as to customer applications and rates, by economists working with the Electric Power Research Institute ("EPRI"). B&V predicted that a 10-year rollout of the piloted technologies

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[17] *Advanced Metering Infrastructure (AMI) Evaluation Final Report*, Black & Veatch Corporation ("B&V") (July 2011), at 157. This document is referred to as the "B&V Report."

[18] Aspects of this decision relating to cost recovery were reversed by the Illinois Appellate Court, Second District on March 19, 2012. *See People v. Illinois Commerce Comm'n*, 2012 IL App (2d) 100024, but requests for further review of that decision remain pending and no mandate has been issued. That decision, in any event, focuses on the use of a rider to fund the pilot, not on the pilot itself, or the technology or vendor chosen, or the customer applications studied.

would require a capital outlay of approximately $1 billion and would result in nominal net benefits of $2.8 billion equating to a net present value of $1.15 billion, based on a 20-year time horizon. It also concluded that "ComEd found the network to be efficient and more than sufficient for the operational needs explored during the pilot." *Id.* at 71.

The ISSGC also addressed AMI. The ISSGC facilitator, EnerNex, compiled and submitted to the Commission (on September 30, 2010) a final report addressing issues including the parties varying positions on the use of certain technical capabilities of AMI (*e.g.*, remote disconnection and reconnection capabilities) and identifying potential costs and benefits of AMI deployment to parties other than utilities.[19] The Report concludes that "[b]y collaborating on smart grid issues prior to regulatory proceedings about smart grid investments, Illinois stakeholders have improved the prospects for successful grid modernization decisions. Participants in the Illinois Statewide Smart Grid Collaborative have built a foundation of common knowledge and a mutual understanding of their different perspectives." The Report acknowledged the Pilot,[20] and the additional information it would provide. ComEd considered appropriate recommendations from the ISSGC process, including with respect to the technical capabilities[21] of the AMI meter and the system's ability to enable other utility and customer applications.[22] ComEd also considered the ISSGC report and the positions of the participants concerning the assessment of benefits and costs[23] to the extent consistent with the requirements of the EIMA, including the recommendation that "the discount rates used in the analyses are not intended to affect the rate of return that the Commission may set for future cost recovery on the investment."[24] While the General Assembly made significant policy decisions in the EIMA and called for a very specific statutory filing, review, and approval process,[25] ComEd's analysis of the benefits and costs of this Plan remain "consistent with the principles established" therein and "give weight to the results of [ComEd's] Commission-approved pilot …."[26]

As required by the EIMA, ComEd has consulted with the Smart Grid Advisory Council ("SGAC") concerning this Plan and considered the input of the SGAC. In addition, ComEd informally distributed sections of this Plan to stakeholders and considered their input in revising the Plan for preparation first to SGAC and, then, the Commission.

D. <u>Overview of Plan Components / Outline of the Plan</u>

Chapter Two of this Plan describes how ComEd plans to deploy AMI meters. It describes the physical and operational steps that ComEd will undertake in order to deploy AMI meters in each of the operating areas throughout ComEd service territory. The chapter

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[19] ISSGC Report at 8.

[20] *Id.* at 10, fn. 15.

[21] *Id.* at 191-93.

[22] *Id*. at 194-204.

[23] *Id*., Ch. 7, "Cost-Benefit Framework", pp. 223-46.

[24] *Id*. at 224.

[25] EIMA, 220 ILCS 5/16-108.5(c).-

[26] EIMA, 220 ILCS 16-108.6(c).

articulates the steps required to communicate with those meters and to provide the required access to data in a secure, reliable, and cost-effective manner. Among the detail is a discussion of the various functional areas of ComEd where AMI deployment activity will be undertaken. In addition, a discussion of the order in which AMI meters will be geographically deployed is included. Also, there is a discussion of the radio mesh network communication technology that ComEd proposes, which is the only technology that can convincingly meet the requirements of the EIMA as to capability, reliability, and flexibility. Chapter Two also outlines how much ComEd anticipates the operational deployment of AMI will cost over the term of the investment program and what operational savings are expected. In addition, Chapter Two identifies annual milestones and metrics that measure the success of the AMI Plan at deploying AMI meters and supporting technology, and enabling added functionality, including time-based billing rates (*e.g.*, peak-time rebate), automatic outage detection, voltage measurement, and coordination with intelligent local DA devices.

Chapter Three of this Plan describes how the deployment of AMI meters and communication technology will deliver additional benefits to customers both directly and by enabling customers to take advantage of developing technologies. ComEd currently maintains a residential real-time pricing rate (Rate RRTP) and will, as required by the EIMA, be offering a new Peak-Time Rebate ("PTR") rate to customers with AMI meters. Both of these rates allow customers to better control their energy costs. They do this by conserving energy and by adjusting the times at which they use energy to reduce its cost and/or environmental impact. These types of advanced rates offer greater benefits with less effort and cost when meters can not only record interval use, but also provide data about that use to customers directly and electronically. In addition, as technology develops, the AMI system ComEd proposes will allow for delivery of use and, potentially, price data both to customers and, through an industry standard ZigBee® chip, directly to appliances and other devices. ComEd will also implement a web portal to facilitate access to usage, billing, and other data directly by customers. Because the data is available, other advanced rates can also be offered by competitive suppliers in the marketplace, further enhancing customer choice. Finally, because ComEd's proposed AMI system is designed for flexibility and interoperability, it also enables a variety of developing complimentary technologies, including electric vehicles, small distributed generation, distributed storage, and home automation.

Chapter Four of this Plan lays out ComEd's planned education and customer outreach efforts. In order to maximize benefits to customers, customers must understand the fundamentals of what AMI meters can measure and communicate to them, their utility, and other authorized energy vendors. To gain full value from AMI, customers must understand how the data and communication capabilities (uniquely provided by smart meters) not only helps their utility and other electric vendors provide better and lower cost service, but also empowers them to save money and help the environment through their own actions. ComEd has developed educational programs to assist customers in all these matters.

The AMI Plan has been determined to offer significant net benefits to customers. In sum, total currently quantified and monetized benefits flowing from the AMI Plan, before discounting, are forecast to exceed $4.6 billion. On a present value basis, ComEd projects the AMI Plan to

result in benefits, net of costs, totaling more than $1.271 billion. Moreover, in addition to those benefits that are readily quantifiable and capable of being monetized are other societal benefits that are difficult to quantify or reduce to a single dollar value. The Commission and stakeholders should keep in mind that even the qualitative benefits of the AMI Plan that are not readily monetized are nonetheless very real, and are of a type expressly identified by the EIMA as benefitting Illinois. When these benefits are considered, the net benefit is even greater.

This Plan, therefore, describes ComEd's roadmap to accomplish that deployment over a 7-year period and to implement a wide array of features and functionality, including those minimum functionalities and system characteristics specified in the EIMA. Of course, implementation activities will – and to achieve the goals of the EIMA must – evolve and adapt to changing circumstances. This is especially true for a system like AMI, that must interact with other technologies and systems still in their infancy. As called for by the EIMA, on April 1 of each year beginning in 2013, ComEd will, after consultation with the SGAC, submit a report regarding the progress it has made toward completing implementation of its AMI Plan. ComEd will address in these reports the evolution of its AMI deployment efforts.

This Plan will terminate after its completion, either at the end of its planned 7-year duration or any extended implementation period established by the Commission under those portions of the EIMA codified in Section 16-108.6(e) of the Public Utilities Act ("PUA"). In addition, this Plan will terminate should Section 16-108.6 of the PUA become inoperative, for example, under Section 16-108.6(h) thereof. [27] In such an event, ComEd would continue to exercise the right to deploy AMI, if determined at that time to be prudent, to the extent otherwise within its service authority.

Approval of this Plan is a critical next step in the successful implementation of AMI in Illinois and, ultimately, in supporting the successful and cost-beneficial implementation of a Smart Grid, generally.

> *The passage of … [the EIMA] legislation is just the beginning…. Tomorrow we begin the serious work of developing a Smart Grid and smart meter system. We intend to work closely and collaboratively with our partners and stakeholders to bring all perspectives to bear as we work to create an electric service model that is more reliable, more flexible, greener and more customer-focused.*[28]

[27] EIMA, 220 ILCS 5/16-108.6(h).

[28] Anne Pramaggiore, 10/26/11.

Chapter 2: AMI Operational Deployment

A. Introduction

As defined in the Public Utilities Act, AMI "means the communications hardware and software and associated system software that enables Smart Grid functions by creating a network between advanced meters and utility business systems and allowing collection and distribution of information to customers and other parties in addition to providing information to the utility itself." 220 ILCS 5/16-108.6(a). The operational deployment of AMI is not limited to the design and physical installation of the meters, communications network, and associated hardware / software necessary to provide a two-way communicating system between advanced electronic meters and utility back-office systems.[29] It also requires existing IT and business processes to be revised or updated and new IT and business processes to be developed to allow the efficient and effective use of the AMI solution, thereby enabling the anticipated benefits to customers. This chapter describes how ComEd plans to design, deploy, integrate, operate, and maintain the AMI solution leveraging the experience gained of systems, processes, and technologies from the successful AMI Pilot.

B. AMI Operational Deployment Plan Design

1. Management Approach

The project will have its own dedicated team complete with the necessary integration points with the other dedicated teams assigned to the Infrastructure Investment Program as defined in PA 097-0616. The AMI project structure includes six main functions:

1. Field Deployment
2. AMI Operations
3. Customer Experience
4. Project Management Office (PMO)
5. Business Transformation
6. Information Technology

A summary of the main responsibilities for each function is contained in the following table:

[29] 'Utility back-office systems' include the software applications and IT systems located at centralized ComEd locations, used to process and analyze data, and to send and receive messages and commands.

Field Deployment	AMI Operations	Customer Experience	Project Management Office	Business Transformation	Information Technology
o Meter deployment plan o Meter procurement and installation o Meter vendor management o Cross dock[30] operations o AMI network design, installation and optimization	o Meter read monitoring o Meter activation o Remote connect/ disconnect operations monitoring o Software as a Service vendor management o Meter event management o Data analytics support o Meter firmware[31] management	o Proactive research and management of technical issues o Customer education and outreach support o Voice of customer for process design o Customer issues management	o Governance and oversight o Smart Grid Advisory Council interface o ICC annual reports o AMI metrics tracking o Scope, schedule, budget, and issues management o Integration with EIMA Program Management Office (EIMA PMO) o Employee management	o Process design o User Acceptance Testing o Technology selection o Sourcing o New product, service, and application roadmaps o Change management and business readiness o Training	o AMI network planning and deployment o Network equipment procurement o Network Monitoring o System integration planning, implementation, testing, and deployment o Systems Testing o Systems maintenance o IT Vendor management o Radio frequency (RF) engineering for network and meter connectivity o Cyber security plan

Figure 1 – Project Team Functional Responsibilities

Figure 1 above describes the six functional areas, and the associated responsibilities. The organizational structure of the AMI Team will be flat with a lead over each of the six functions reporting directly or via dotted line to the AMI Lead. Due to its fundamental role within the

[30] A "cross dock" is a location where new meters and field network equipment are received from the manufacturers, stored for a short period of time, and loaded onto vehicles for the daily field installation activities, and where old meters are temporarily stored prior to disposal.

[31] Firmware is software that is embedded in memory in a piece of hardware that essentially functions as the "operating system" for the hardware.

project, a Business Transformation Team consisting of business and IT professionals will be created. Additional governance and oversight structure will be created to effectively execute the project, manage ongoing communication, mitigate risk, and maximize the net benefits to customers.

2. Technology Evaluation and Selection

The smart meter solution consists of smart meters, field devices, telecommunications equipment, and computer hardware and software that are integrated to form a real-time, two-way data network (see figure below).

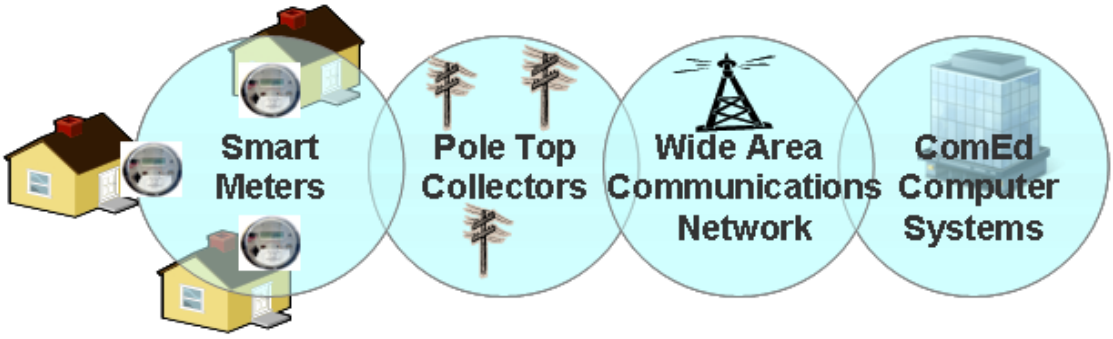

Figure 2 - Meter and Network Deployment Diagram

The high-level solution components are the smart meters and their associated capabilities, the network technology for two-way communication, and various other software and back office applications to effectively deploy the meters, operate the solution and fully leverage the solution to deliver operational benefits to customers. The network to enable the two-way communications between the Smart Meters and ComEd's Computer Systems will consist of multiple technologies. The portion of the network between the Smart Meter and the Pole Top Collectors will be a private network owned by ComEd and provided by SSN (see 'a~~)~~' below for further discussion). SSN provides a network interface card that is assembled into a solid-state meter provided by a separate meter manufacturer that enables the meter to send usage, events, and diagnostic data and to receive messages, commands, and firmware updates. The portion of the network between the Pole Top Collector and ComEd's Computer Systems may change over time based on cost, geographic location and availability of existing public or private network infrastructure. For the AMI Pilot and the initial deployment covered in this plan, ComEd will utilize ~~publically~~publicly available digital cellular networks. As detailed engineering design occurs over the course of the project, ComEd may utilize its own private network (e.g., fiber network).

To ensure that the related sourcing decisions are financially responsible, and in alignment with the functional and operational needs of the business, a procurement strategy was developed for all of the solution components and the services needed to install and integrate them.

a) AMI Network

The AMI Network technology is foundational to the deployment and overall project execution because it represents the key to the enablement of two-way communication between the meter and ComEd. The unique characteristics of the AMI network technology make it the highest priority for thorough analysis and review prior to selection. The process leading to the selection of the mesh technology provided by SSN started before the AMI Pilot. Through a series of interactive workshops in late 2008 and early 2009, ComEd sought and received input from external stakeholders on what criteria should be used in the selection of the AMI technology in order to achieve operational benefits (e.g., financial savings, improved reliability, improved customer experience) and enable other smart grid applications.

That collaborative engagement with external stakeholders resulted in the technical criteria used for evaluation of potential solutions listed and described in the figure below:

Technology Criteria	Description
Security	Security for the grid as well as consumer protections.
Network Performance	Flexibility in terms of networking technology. The solution will have to be able to accommodate a number of potential program designs including innovative pricing programs, home area networking, distribution automation, plug-in electric vehicles, etc. This may be quantified in bandwidth margin and application prioritization capability.
Obsolescence Risk	ComEd will evaluate technologies to ensure a solution with appropriate long-term value.
Flexibility & Scalability	Ability to adapt to smaller deployment increments, deployment to different service areas or types, deployment in more than one operating center (i.e., how easily the proposed solution scales for deployment throughout ComEd's service area).
Interoperability	A preference for non-proprietary solutions over proprietary solutions.
Capability	Ability to meet ComEd's operational goals in meter reading, meter servicing, theft detection, and outage management.
Maturity	The intent is to not use new technology that has not demonstrated capabilities elsewhere.

Figure 3 - AMI Pilot Technology Selection Criteria

As a result of the competitively bid process, SSN was selected as the provider of AMI Network technology for the AMI Pilot and approved by the Commission. Agreement on the selection of SSN was reached with key external stakeholders through an ongoing interactive and collaborative workshop process. Concurrently with the AMI Pilot rollout, the Illinois Statewide Smart Grid Collaborative (ISSGC) provided additional technical requirements against which smart grid technology will be evaluated in the future. The resulting 15 technical requirements

are embodied within the EIMA. With the assistance of two outside firms, West Monroe Partners and Black & Veatch, seventeen network technology providers[32] were analyzed across those 15 technical requirements, as noted below:

1. Flexibility of the smart meter platform to accept remote device upgrades.
2. Use of open standards and internet protocol to the maximum extent possible.
3. Internal Memory Capacity for Additional Storage Capabilities, Functions, and Services without the need for physical access to the meter (with a focus on additional capacity for the Metrology, HAN, and AMI communication software upgrades[33]).
4. Ability to develop, store, send, and receive digital information concerning or enabling grid operations, electricity use, costs, prices, time of use, etc.
5. Ability to develop, store, send, and receive digital information concerning electricity use, costs, prices, time of use, etc. to or from a computer or other control devices.
6. Ability to measure or monitor electricity use as a function of time of day and power quality characteristics, and to store, synthesize, or report that information by digital means.
7. AMI Interoperability (compliance with National Institute of Standards and Technology (NIST) Guidelines).
8. Ability to sense and localize disruptions or changes in power flows on the grid and communicate such information instantaneously, enabling automatic protective responses to sustain reliability and security of grid operations.
9. Ability to detect, prevent, communicate with regard to, respond to, or recover from system security threats, including cyber-security threats and terrorism, using digital information, media, and devices.
10. Ability of any device to respond to signals, measurements, or communications automatically without independent human intervention.
11. Ability to use digital information to operate functionalities on the electric utility grid that were previously electromechanical or manually controlled.

[32] The technology providers assessed included those that use private or public telecommunications networks as part of their system.

[33] The meters also need a limited amount of memory to temporarily store usage and other critical data as a contingency in case the meter needs to be read in person if for some reason the communication to/from the meter fails. Meters will hold approximately 3 to 4 months of interval data.

12. Ability to use digital controls to manage and modify electricity demand, enable congestion management, assist in voltage control, provide operating reserves, and provide frequency regulation.

13. Ability to support future electric plug-in vehicles, distributed generation, and storage in a safe and cost-effective manner on the electric grid.

14. Distribution Automation (DA) Interoperability (Meets NIST Guidelines).

15. Internet Protocol (IP) Interoperability (support End to End IP along with Key Protocols over IP including HTTPS, FTPS, TFTP).

The analysis of the available AMI Network solutions showed that the SSN was the only AMI Network provider that satisfied each and every one of the fifteen technical requirements. The best alternative vendors only met 12 of the requirements and did not have end-to-end secure IP-based communications.

Proceeding with SSN's technology is also supported by the history of the AMI process, the terms of the EIMA, SSN's unique capabilities and the competitive pricing:

- SSN is the only vendor that offers a proven AMI/network technology meeting the specific technical requirements of the EIMA, including being able to support the test bed. SSN uses an IP-based network which will support other 3rd party vendor IP-based products.

- SSN has not lost ground technically since the Commission approved it as the Pilot vendor. Based on the in-depth industry research and analysis completed, SSN continues to outperform other vendors on the same stakeholder-vetted criteria that led ComEd to select, and the Commission to approve, SSN as the pilot vendor.

- SSN has a proven track record of success, both generally and in ComEd's own pilot. Indeed, the successful use of SSN's technology in the pilot was a basis for Black & Veatch's modeling of the long-term benefits of AMI deployment and underlies many of the statutory performance metrics included in the formula rate.

- SSNs advantages lie in critical areas (e.g., security, IP protocol, and interoperability) that were emphasized in the stakeholder process.

- ComEd, with the assistance of Exelon's Supply organization within Exelon Business Services Company ("BSC"), demonstrated thorough pricing prudency throughout the negotiations with SSN. During the initial negotiations for the Pilot technology in 2009, SSN provided a full-deployment cost estimate. ComEd was able to leverage that estimate during final negotiations of the full deployment contract in conjunction with SSN pricing quotations for both PECO Energy Company's ("PECO") and Baltimore Gas and Electric's ("BG&E") AMI technology procurement processes.

b) Other technologies

To optimize the benefits to customers from smart meters, additional new technologies will be required. The figure below identifies the new solutions (outside of SSN) that have already been selected, along with the basis for their selection. The subsequent figure identifies the solutions that still need to be selected, as well as the process that will be followed for selection.

Already Selected Solution	Description	Basis for Selection
Meter Data Management System (MDMS)	Application to process and store meter data	Based upon ComEd Pilot results, ComEd and PECO completed an updated technical evaluation of MDMS suppliers. Based upon this evaluation, ComEd concurred in the selection of Oracle, and Exelon BSC Supply **competitively negotiated** an enterprise-wide agreement.
Handheld Device Interface	Meter work management system for handheld devices used by meter technicians	**Competitively bid** for ComEd's AMI Pilot. The Clevest solution will be extended for full deployment because it still meets ComEd's needs and performed well in the Pilot. The IT integration associated with this solution was completed as part of the Pilot and minimal work will be required for scaling to the full deployment.
Handheld Devices	Devices used by meter installers to support the meter exchange process	ComEd will reuse the hand-held devices purchased for the AMI Pilot and purchase additional devices, as dictated by the volume of meters deployed.
IT Hardware (outside of SSN's hosted solution)	Servers and other IT infrastructure required to run the applications	Routinely **competitively bid** at the Exelon enterprise level.

Figure 4 – IT Solutions Selected

Solution Not Yet Selected	Description	Process for Selection
Meters	The meters to be deployed throughout the service territory	This will be **competitively bid**. The vendors' meters will be required to work with SSN technology.
Theft Detection Solution	Tool and/or service to process and organize meter event data in support of suspected tampered meter services	This will be **competitively bid** once the associated business processes are designed and the business and technical requirements are determined. This could result in either a product purchased for use by ComEd or services performed by a third party
Meter Events Solution	Validate and organize all meter event data	This will be **competitively bid** once the associated business processes are designed and the business and technical requirements are determined. There is a possibility that ComEd may extend the "suite" of products already in house after an in depth technical evaluation.
Web Presentment Solution	Customer-specific energy information application (historical usage presentment, savings tips, neighbor comparison, etc.)	This will be **competitively bid**. The tool used for the pilot worked well and continues to be utilized and may be re-selected as part of the new bidding process.
Opt-in Peak Time Rebate Solution	Rebate calculator and billing interface for Opt-in Peak Time Rebate	Further analysis will be completed to determine whether the peak time rebate tool utilized during the pilot is appropriate for high customer participation rates. If another solution is required, a **competitive bid process** will be utilized based on business and technical requirements.
Data Analytics Solution	Processing and analyzing of meter data for business intelligence	This will be **competitively bid** once the associated business processes are designed and the business and technical requirements are identified. There is a possibility that ComEd may extend the "suite" of products already in house after an in depth technical evaluation.
Business Process and Systems Integrator	Professional services to redesign business processes and design, build, test, and implement IT solutions to support the new processes	This will be done through a **competitive process**. The business process design work may be awarded separately from the systems integration work.

Figure 5 – IT Solutions Not Selected

3. Deployment Approach

ComEd will execute parallel paths of short-term and long-term work streams. Short-term activities will allow ComEd to begin to deploy meters in September of 2013. ComEd's selection of SSN as the AMI Network solution provider is in alignment with this timeline. The short term deployment approach will utilize the existing processes and systems/tools currently in place to operate the AMI Pilot solution with minor enhancements based on the lessons learned from the AMI Pilot.

While the short-term work stream is being executed, other project team members will be focused on long-term solution activities, led by the Business Transformation Team. A sub-set of the long-term solution activities includes evaluation, selection, procurement, and implementation of the additional technologies required for full deployment (noted in the figures above).

4. Deployment Strategy

The ComEd service territory is broken down into 19 regional operating centers that will serve as deployment centers for the smart meter deployment. The following factors were used as the basis for the deployment strategy to prioritize the 19 Operating Centers for meter deployment:

Operational Factors

- Entire operating centers should be automated for cost and operational efficiency purposes and to maximize net benefits to customers.
- AMI mesh network technology is optimal for more dense urban and suburban environments.
- Growing outward from the existing pilot footprint within the Maywood operating center will maximize the performance of the network as well as ensure project efficiencies.
- Simultaneous deployment in non-contiguous multiple operating centers introduces operating inefficiencies for implementation and ongoing operations, including the provision of customer education efforts.
- Achievement of benefits in the business case ~~are~~ is best positioned to be preserved by the geographic deployment.

Participation in Customer-side Programs

- Operating centers with customers having a higher propensity to participate in demand side programs should be considered (e.g., peak time rebate). This determination will be made based on historical program participation.

Based upon these factors, and a desire to balance achievement of operational efficiencies, minimize costs to customers, and maximize participation of customers in the peak-time rebate

program, the deployment strategy is to install meters in two to four separate operating centers at any given time after completion of the Maywood operating center for residential customers. With the Maywood operating center as the hub of the AMI mesh network that was deployed during the AMI Pilot, the technology is optimized when growing outward to contiguous operating centers generally north through the Glenbard, Mt. Prospect, Chicago North and Skokie operating centers, and south generally through Chicago South, Crestwood and Bolingbrook operating centers. Participation in residential real time pricing and direct load control programs tends to be highest in the west, northwest and north regions. Therefore, based on the operational factors identified, a multiple-operating center deployment strategy radiating out from the Maywood footprint capitalizes on both prioritization elements, in alignment with the original strategy agreed to by ComEd and stakeholders. After completing the Maywood operating center, the Chicago South and Glenbard operating centers would be the next deployment areas. The figure below presents the deployment order of the 7-year deployment by operating center, maintaining the contiguous deployment sequencing to align with the overall deployment strategy.

Year	Meters Deployed	Operating Center(s)
Pilot	127,857	Maywood, Chicago North
2013	70,882	Maywood
2014	540,744	Maywood, Chicago South, Glenbard, Mount Prospect
2015	1,077,758	Maywood, Chicago South, Glenbard, Mount Prospect, Chicago North, Crestwood, Skokie, Rockford
2016	1,165,742	Chicago South, Mount Prospect, Chicago North, Crestwood, Skokie, Bolingbrook, Aurora, Libertyville, University Park, Elgin, Rockford, Maywood, Glenbard
2017	789,307 ~~722,900~~	Chicago North~~, Chicago South, Maywood, Glenbard~~, Bolingbrook, Aurora, Libertyville, University Park, Elgin, Joliet, Crystal Lake, Dixon, Rockford, Freeport, Streator
2018	~~400,675~~330,850	~~Bolingbrook, Aurora,~~ University Park, ~~,~~ Joliet, Crystal Lake, ~~Streator, Freeport, DeKalb, Dixon,~~ Rockford
2019	~~85,389~~102,810	Planned clean-up and ~~,~~ Rider NAM exchanges, and New Business Exchanges
TOTAL	**~~4,191,917~~4,205,950**	

Figure 6 - Meter Deployment Rollout[34]

This plan represents the current approach to geographic meter deployment over a 7-year period that is within the 10-year timeline specified in the PUA. *See* 220 ILCS 5/16-108.6(c). The timing and prioritization of the deployment may change as the plan progresses. The currently proposed deployment sequence is generally depicted in the figure below, showing that

[34] The overall meter count for the deployment is 4,029,000. The 4,~~157,000~~ 205,950total meter population includes the 128,000 AMI meters that are currently installed in the field via the AMI pilot. These meter counts do not take into account estimated meter growth of 20,000 meters per year, which growth is captured for financial purposes within the Black & Veatch model.

once the Chicago South and Glenbard operating centers are complete, the deployment would progress in a clockwise fashion, concluding with the outlying rural areas.

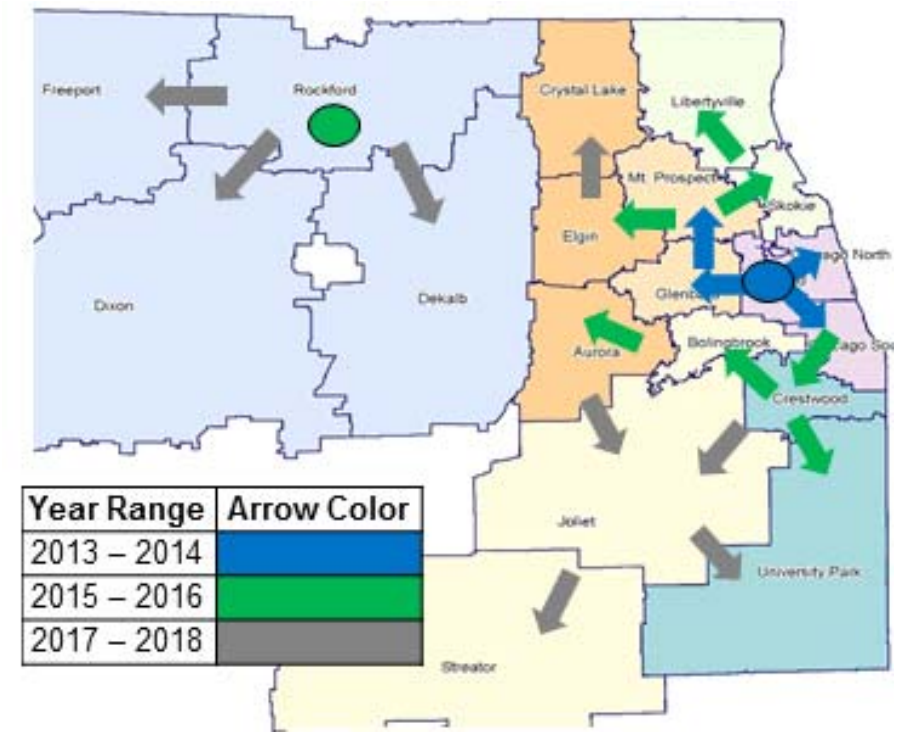

Figure 7 - Geographical Representation of the Meter Deployment Schedule

5. Incorporation of Statutory Operational Requirements

a) Technical Requirements Including Security

Throughout the development of the project, ComEd has maintained a focus on both interoperability and cyber security to ensure that the Smart Grid devices and associated software applications can be supported through the entire lifecycle of each device. ComEd has and will continue to identify all subsystem and application interfaces (physical, human, and application interfaces) and identify the key standards and cyber security policies to secure the data, including customer usage data, going across these interfaces from external and internal attacks. Furthermore, ComEd will ensure that all the security procedures, designs, implementations, and policies are supported throughout the life cycle of the project. The ComEd team will use this information to drive vendor RFP requirements for security and to drive the implementation of the Cyber Security Solution and Acceptance testing.

ComEd endorses and promotes alignment with open and interoperable standards as identified by the National Institute of Standards and Technology (NIST) and more specifically standards that have been adopted by NIST's Smart Grid Interoperability Panel (SGIP). ComEd is engaged and actively participates in the SGIP along with several subcommittees in order to be current on progress and standards adoption and approval. In an effort to define standards for the Smart Grid, the SGIP has created the Smart Grid Catalog of Standards (CoS). ComEd interprets "consistent with NIST standards" to be adoption of relevant standards contained in the Catalog of Standards for Smart Grid Interoperability as it exists today. ComEd has reviewed those standards that are relevant to AMI and concludes that it has selected technology that complies with them. The selection of other technologies will similarly include compliance with those standards. Furthermore, ComEd will continue to monitor the emergence of new standards out of the SGIP process for future adoption as necessary.

ComEd's strategy is for compliance with the following cyber security and interoperability standards identified within the NIST framework as of the filing date:

NISTIR 7628 Guidelines for Smart Grid Cyber Security

These guidelines present an analytical framework that organizations can use to develop effective cyber security strategies tailored to their particular combinations of Smart Grid-related characteristics, risks, and vulnerabilities. These guidelines were developed as part of a consensus document by the Cyber Security Working Group (CSWG) of the Smart Grid Interoperability Panel (SGIP) with participation by representatives of both ComEd and its AMI vendor, SSN.

SSN has designed its system with security embedded in the architecture, addresses all relevant cyber security requirements analyzed in the publication, and adheres to the specified guidelines for technology, system, and process controls included in the document. Specifically, SSN cryptography technology employs Federal Information Processing Standards (FIPS) 140-2 certified modules.

SGIP 2011-0008-1 (PAP 18 Transition from SEP 1 to SEP 2.0)

This standard is related to the HAN interoperability and functionality. It is important to follow this standard to ensure multi-vendor interoperability between the ComEd smart meters and the various HAN devices and manufacturers that will be supported.

The HAN gateway functionality is contained within SSN's network interface card that will be located inside the solid-state meter. SSN is scheduled to roll out software in the second quarter of 2012 that will meet compliance standards for Smart Energy Profile (SEP) SEP1.1. SSN plans a robust SEP2.0 Energy Services Interface implementation. SSN's approach to HAN communications is to use a generic 2.4 GHz radio so that as standards change, new firmware can be downloaded to the meter over the network without having to exchange the meter. In addition, SSN continues to develop new product features that will support other potential wireless and wireline HAN solutions.

NISTIR 7761: Guidelines for Assessing Wireless Standards for Smart Grid

These guidelines provide a fact-based assessment of emerging wireless standards and representative technology implementations of those standards for their ability to satisfy the business need for Smart Grid. It provides a comprehensive set of requirements for wireless technologies that are to be used within the Smart Grid.

SSN is compliant with the Field Area Network, Advanced Metering Interface and Home Area Network portions of the standard. ComEd will provide IP backhaul[35] services to the AMI solution in order to provide connectivity between the existing ComEd network and the AMI system. ComEd will ensure that all communications services used will meet the guidelines of this standard. Furthermore, ComEd will ensure that all communication solutions leverage standard IP protocols and cyber security solutions are consistent with the current NISTIR guidelines.

IETF RFC6272: Internet Protocol Standards for Smart Grid

This RFC is an informational document published by the Internet Engineering Task Force (IETF). The goal of the document is to catalog IETF standards that are applicable to Smart Grid, specifically identifying key infrastructure protocols within the Internet Protocol (IP) Suite for use in the Smart Grid. IP is the backbone of many modern communications systems and provides a platform that offers a mature model that highlights interoperability and security.

ComEd's AMI solution is based on IP and implements many of the IETF standards within the IP Suite, including:

- IP Security (IPSec)
- User Datagram Protocol (UDP)
- Transmission Control Protocol (TCP)
- Internet Protocol version 6 (IPv6)
- Domain Name System (DNS)
- Simple Network Management Protocol (SNMP)

These protocols and others are the foundation for the secure transmission of data between disparate systems relating to the AMI Network. The ComEd solution complies with the applicable sections of IETF RFC6272.

AMI field systems, as described above, rely on a backhaul network to transport the information to the head-end systems. ComEd is deploying communications systems and technologies that comply with the above mentioned standards. Interoperability and security are

[35] The backhaul portion of the network comprises the intermediate links between the core network, or backbone, of the network and the small sub-networks at the edge of the entire hierarchical network.

critical requirements that will be incorporated into the ComEd solution to assure customers the benefit of a secure and flexible AMI solution.

NEMA SGAMI 1: Requirements for Smart Meter Upgradeability

This standard delivers a key set of requirements for Smart Meter Upgradeability that can be used by suppliers, customers, and regulators. One of the main goals is to assist in the procurement of Smart Meters that will enable upgrades for future technological developments, with respect to the technology deployed within the meters themselves and the communications networks the data will traverse.

The SSN AMI Network enables ComEd to remotely manage (i.e., no field trip required) firmware updates on all meters deployed in the field. As newer meter firmware is available, ComEd will be able to tightly control the upgrade process. This will allow ComEd and its customers the ability to take advantage of advancements in technology/software, as well as providing a mitigation strategy for any security or interoperability issues that are identified after deployment.

ComEd intends to align with NIST guidelines and other industry best practices to develop a foundation for its customer information privacy policy.

ComEd corporate procedures related to data security, access, and transfer will be assessed against the following regulations and policies:

NISTIR 7628: Guidelines for Smart Grid Cyber Security: Vol. 2, Privacy and the Smart Grid

This document contains guidance for conducting a privacy impact assessment for the Smart Grid with a section focused on risk analysis and mitigation.

b) Privacy and Personal Energy Information

The designed and implemented AMI solution will secure the privacy of personal information. ComEd's digital meters do not store or transmit any personal identification information about customers, do not identify electrical devices within a home, do not identify an occupant's specific behavior or activities, and do not determine physical locations of persons within a home. These meters record only information on electricity usage – just as existing electromechanical meters do; they are not surveillance devices. Additional steps that ComEd will take to protect the privacy of personal energy information are discussed in Chapter 3.

C. Deployment Activities

There are a number of key activities that will be completed within each project functional area during the deployment. A PMO will be established to ensure that these activities are completed on-time and on-budget in order to minimize costs and maximize benefits to customers. The following activities for the over-seeing PMO, as well as each key functional area have been identified:

1. Program Management

Program Management consists of the overall management activities required to lead the multi-year smart meter project. Program Management is the responsibility of the PMO function and will serve as the central group responsible for overall project planning, coordination, and delivery of the smart meter project.

2. Network Design and Deployment

Network Deployment is a new activity that was developed for the AMI Pilot and will need to be enhanced for full network deployment. This activity encompasses the planning and execution of all of the work required for the field network design, the field communications network installation and the network optimization to support the full deployment of approximately four million smart meters. Field network devices include SSN's Access Points and Relays and associated telecommunications equipment such as digital cellular radios, fiber optic cable, and mounting equipment. IT, AMI Operations and the AMI network vendor are primarily responsible for this function with support from Supply (procurement and cross dock) and ComEd field construction work forces.

The critical activity is to initially conduct a radio frequency (RF) propagation study for each deployment location within the operating centers in conjunction with SSN, the AMI network vendor. The RF propagation study will provide the estimated counts of field devices and installation location coordinates to optimize the network from both a performance and cost perspective.

Propagation studies will be completed within each operating center based on the established schedule. The propagation studies, in conjunction with the geographic deployment plan and schedule, will then be utilized to develop the detailed AMI network deployment plan. Field installation activities will begin with the procurement of the field devices from SSN. Additionally, network optimization and RF troubleshooting activities will be required during the network deployment to mitigate areas with low RF signal strength or areas of lower reliability on the telecommunication network.

3. Meter Deployment

Meter Deployment is an existing activity that was revised for the AMI Pilot and will need to be enhanced for the full smart meter deployment. This activity encompasses the planning and execution of all of the work required for installing approximately four million additional smart meters over a 7-year period. The Field Deployment project team function is primarily responsible for this activity with support from Supply (procurement and cross dock), IT, AMI Operations, Customer Experience, and ComEd's External Affairs (customer outreach).

4. Cross Dock Operations

Cross Dock Operations is a new activity that was developed for the AMI Pilot and will need to be enhanced for the full smart meter deployment. This activity encompasses managing the supply chain activities required for installing four million smart meters and associated network communications field devices over the 7-year deployment period. A "cross dock" is a location where equipment (*e.g.* AMI meters, network communication devices) is received from the manufacturer, stored for a short period of time, and loaded onto vehicles for the daily field installation activities. Additional activities occur at the cross dock locations such as AMI meter pre-installation testing, support for installer handheld tools, disposition of old electromechanical meters, fleet vehicle management and general field operations support. Supply is primarily responsible for the cross dock activity with support from organizations including Field Deployment, Supply – Procurement, AMI Operations, and potentially an external meter installation vendor to supplement the internal installation workforce. ComEd expects to open 4 separate cross docks across the ComEd service territory during the peak deployment of AMI meters, but this number may increase or decrease based on on-going learning.

5. Meter Activation

Meter Activation is a new activity that was developed for the AMI Pilot and will need to be modified based on lessons learned for the full smart meter deployment. This activity consists of determining when a smart meter is operationally ready and can be activated to use the meter reads via the wireless network for billing (i.e., manual meter reading is no longer required). Major activities include validating smart meter communication performance in the field over a pre-defined time period and transferring eligible smart meters from the manual meter reading process to the AMI-based meter reading process in a systematic manner. The AMI Operations project team function is primarily responsible for these activation activities.

6. Business Transformation

Business transformation activities center on delivering to customers the benefits provided by smart meters and the associated AMI technology while driving value to the customer by enabling smart grid functions. The functionality provided by the AMI solution requires changes to the existing business processes, IT applications, departmental operating models and organizational structures. Additionally, given that the technology is relatively new and evolving rapidly, certain applications will be designed, developed and implemented over several years.

The newly created Business Transformation project team function consists of two primary activities required to lead the business from the "As-Is" to the "To-Be" state. The first set of activities relates to the business process redesign work which includes process redesigns, requirements gathering, technology evaluation and selection, IT testing, change management and employee training. The second set of activities relates to leading the development of new product/service/application roadmaps for items that require longer term planning horizons.

7. Systems Integration

Systems integration refers to the activities and processes of implementing new systems, as well as linking together legacy computing systems and software applications physically or functionally to act as a coordinated whole. System integration brings together discrete systems utilizing a variety of techniques such as computer networking, enterprise application integration, business process management or manual programming. The IT project team function is responsible for the systems integration. This consists of the activities required to analyze, design, develop, integrate to legacy systems, test, and implement the IT applications and tools required for the smart meter program and is responsible for any hardware and software procurement.

8. Automated Meter Reading

Automated Meter Reading is a new activity that was developed for the AMI Pilot. This activity consists of retrieving consumption and meter event data from activated smart meters for billing and other business purposes. The smart meter data is received by the back office utility systems via the AMI network on a scheduled and on-demand basis. The AMI Operations project team function is primarily responsible for this activity with support from organizations including Field Deployment and IT, as well as coordination with ComEd's Billing department.

The Automated Meter Reading activity fundamentally changes the manner in which customer billing data is obtained by utilizing the new AMI systems. The technology benefits customers by enabling the automated retrieval of meter data on all meters every day, including weekends and holidays in place of meter readers that attempt to read each meter once per month. This activity is critical to successfully generating accurate and timely customer bills after a smart meter is installed and activated.

9. Customer Engagement

Customer engagement activities include proactive issue identification and management, customer outreach and education support, and ensuring that the voice of the customer is accurately represented during business process redesign and technology evaluation and selection. This activity primarily involves the AMI Customer Experience project team function and ComEd's Customer Education and Products team with technical support from Field Deployment and IT.

Proactive Issue Identification and Management

The new functionality of smart meters will lead to the identification of new customer-related issues that will need to be addressed over the course of deployment. The team will be actively researching issues experienced by other utilities undergoing similar deployments and applying customer-related lessons learned to ComEd's AMI deployment. Responses and issue management techniques will be developed and communicated throughout the organization to promote a positive and consistent customer experience throughout the deployment.

Customer Outreach and Education Support

Due to the transformational impact that the smart meter deployment will have on customers, ongoing outreach and education will be required to ensure that they are aware of how they will be impacted from a day-to-day process standpoint. To the extent that they are impacted, customers will need to be provided with information accordingly. This activity will be tightly aligned with ComEd's customer outreach and education efforts discussed in Chapter 4.

Voice of the Customer in Business Process Redesign and Technology Evaluation and Selection

The transformation to a smart meter environment will require business process redesign efforts and new technology selection across the organization. Because of the impact these new business processes and the newly selected technologies will have on the customer, it is critical that their voice and impact are adequately represented during the redesign process and throughout technology evaluation and selection. To maintain ComEd's focus on the interest of customers in the business process redesign effort, ComEd personnel with knowledge and experience in direct interactions with customers will be included in the business process redesign effort.

10. Billing

Billing is an existing activity that was modified for the pilot and will be further modified for full deployment. Since smart meter technology enables the automated retrieval of meter data on all meters every day, including weekends and holidays, and allows every meter to be remotely reprogrammed to record usage in various time increments. Project activities include the installation of software tools validate, edit and estimate (VEE) the raw data retrieved by the AMI technology.

11. Remote Connect/Disconnect

The remote connect and disconnect activity is a new activity that consists of switching power on and off remotely when customers move in and move out of premises or do not pay their ComEd bill, in accordance with ICC rules. Each smart meter contains a service switch ("switch") that will be used to disconnect and connect service. The use of the switch for non-payment disconnect will be done in a manner that is compliant with ICC rules. The AMI Operations project team is primarily responsible for this activity.

12. Meter Events

Meter Events is a new activity that was developed for the AMI Pilot. This activity consists of the interpretation of meter data that falls outside of the established parameters (e.g. low voltage, tampering, and loss of power). The meter event data is received by the back office utility systems via the AMI network on a scheduled and real-time basis. The AMI Operations project team function is primarily responsible for this activity with support from the AMI IT project team function.

Given the significant volume of meter event data that will be generated by the smart meters and required for various operational purposes, automated back office processes and systems are required to monitor, analyze and correlate the data, and store this data for data analytics purposes associated with the new business processes.

13. Customer Inquiries

Customer Inquiries is an existing activity within ComEd's current operations. ComEd's Call Center organization is the primary group for direct interaction with customers along with account managers who are responsible for interactions with large commercial and industrial customers. Given the transformation of existing business processes expected with the smart meters, the primary activities involve training and change management for the Call Center personnel and account managers to better serve customers.

14. Electronic communications

a) Customer eServices

The Customer eServices is an existing activity that represents the manner and mechanism by which customers are communicated with via the web, mobile devices, social media, and interactive voice response (IVR). These channels are utilized to communicate directly with customers regarding information related to their account, energy usage, outage status (if applicable), and for Customer Education and Products and other communications announcements. The type and volume of data that will be captured by smart meters will enable new information services directly to the customer. This will provide customers with services such as access to interval energy usage data and dynamic reporting on a next-day basis, updated account information, outage status information, energy usage alerts, and smart meter deployment updates via the web or mobile device.

Additional application integration will be required between the Meter Data Management System, Outage Management System, ComEd's website, and third-party hosting companies to provide proper communication and information flow with other systems. Business process redesign and related training will also be required. A key initial outcome will be an evaluation of the current tools being utilized, and the identification of new tools, integration steps, and business processes required to achieve value to customers through improved functionality to the business over time.

b) Retail Electricity Supplier ("RES") eServices

Currently, the energy usage at accounts with demand greater than 100 kW is measured using interval data recording meters (IDRs) which measure energy and demand across 30-minute intervals. This interval data is used for billing, and provided to Retail Electric Suppliers (RES) via monthly EDI transactions, which is then used to settle the market.

The existing process also allows a RES to request IDR metering for accounts with demand less than 100 kW. While no RES has requested an IDR meter for an account with demand less than 100kW as of March 2012, switching activity for under 100 kW customers (i.e., switching from ComEd supply to RES supply) has become much more active within the industry and is expected to continue to grow in the next couple of years.

To accommodate the provisioning of an IDR meter, ComEd must dispatch a technician to exchange the meter and update the account accordingly. With the onset of AMI metering, ComEd will be able to continue to support these RES requests without the need of dispatching a technician. There are no plans, at this time, to provide billing data to third parties in any additional frequency. Further elaboration on plans to provide all customers and third parties with daily usage information can be found in Chapter 3.

15. Outage Management

Outage Management is an existing activity (though not currently used with smart meters) accountable for detecting and validating unplanned outages as well as coordinating the restoration effort and capturing data used to inform customers. This activity is also accountable for managing planned outages that are required to perform system maintenance on a periodic basis. This activity utilizes an Outage Management System (OMS) to manage all unplanned outage activity and for supplying the data used in calculating system reliability indices (e.g. CAIDI, SAIDI, MAIFI, SAIFI). ComEd's Distribution Systems Operations organization is responsible for this activity.

Smart meters provide near real-time power loss ("last gasp") [36] and power restoration messages to the utility. The implementation of smart meters, associated back-end IT systems and integration with existing legacy systems will improve the effectiveness of Outage Management, and potentially reduce the outage duration for individual customers.

There are six primary outage management dimensions (see below table). Smart meter technology can directly improve performance on all of those dimensions except restoration, and can facilitate the restoration dimension through more timely detection and validation of outages.

[36] 'Last Gasp' is defined as the near real-time final message that is sent from the meter to the ComEd system via the communication network that is coded to indicate loss of power.

Detection	Outage Validation	Customer Notification	Restoration	Restoration Confirmation	Updating Information
Use of AMI to detect outages via meter ping and "last gasp"	Determination of real outages vs. momentary outages / other causes	Proactively communicating with customers regarding an outage	Restoring the customer's power	AMI providing identification of nested outages and checking open outages	Canceling outages and determining the exact start and end times

Figure 8 - Primary Outage Management Dimensions

Based on ComEd's analysis and the evolving and relatively immature state of the industry and supporting technology in this area, eight levels of maturity were identified. The following product road map outlines the characteristics of each outage management dimension in terms of maturity level and the path to future functionality, including short and long-term functionality targets.

	Detection	Outage Validation	Customer Notification	Restoration	Restoration Confirmation	Updating Information
Levels 1-3	- Outage data collection and historical analysis	- Manual meter pinging		**NOT APPLICABLE TO AMI**	- Informational nested outage identification - Email, report, or viewable web page results	- Manual outage restore time updates
Level 4	- Automatic outage reporting in OMS	- Sustained outage validation - Planned outage detection and other system activity filtering				
Level 5					- Automatically re-issue outages that are still out	
Level 6	- Enhanced outage escalation and detection		- Notification to customers of an outage and a restoration			
Level 7	- Additional detection from grid devices					- Ticket cancellation confirmed "on"
Level 8					- Proactive confirmation checks - Restoration signals from grid devices	-Proactive event updates - Auto update restore times

Figure 9 - OMS Functionality Road Map

At this time, it is expected that the eight levels of functionality can be implemented in four phases:

Phase 1: Levels 1 through 3

Phase 2: Levels 4 and 5

Phase 3: Level 6

Phase 4: Levels 7 and 8

Phase 1 scope includes the functionality associated with achieving Level 1 (Meter Deployment and Network Setup), Level 2 (Meter Event Gathering) and Level 3 (Informational Outage Restoration Confirmation and Nested Outage Detection) maturity. This will enable operators to "ping" a meter in real-time to determine if a customer has power or not. This level of maturity was largely achieved during the AMI Pilot, and this functionality and its related benefits will be achieved as the AMI system is deployed throughout ComEd's service area. There is no significant system or IT enhancements required to support these changes.

There are two key benefit drivers associated with Phase 1. The first is a reduction in truck rolls and outbound phone calls associated with improved response to "single light out" complaints. The second, and much more significant driver of benefit realization are the improvements in storm response that impact ComEd overtime labor costs, contractor costs, and mutual aid costs. A reduction in the overall time duration of storm events will result in a decrease in organizational impact and improved efficiencies.

Phase 2 would include the functionality described in Level 4 (Basic Outage Detection with Simple Event Correlation) and Level 5 (Integrated Outage Restoration Confirmation and Nested Outage Detection) of the road map. With this functionality implemented, the OMS would receive real-time "last gasp" and "power on" messages from the smart meters to accelerate the outage detection and restoration activities. The system would be designed in a manner that would prevent data overloads within the OMS and with the dispatcher during periods of large outages. Additionally, the system would have the intelligence to distinguish between data associated with planned and unplanned outages. The activities required to execute Phase 2 scope include significant system and IT enhancements, business process redesign work, and training. The work required and associated costs for achieving the Phase 3 (Level 6) and Phase 4 (Levels 7 and 8) have not been determined at this time. It is anticipated that additional business process and system integration work will be required for Phase 3 and Phase 4. By implementing Phase 1 and Phase 2 and taking advantage of industry advancements and peer experiences, the scope and related costs/benefits for Phase 3 and Phase 4 can be more accurately determined.

16. Opt-in Peak Time Rebate Tariff

ComEd is statutorily required to offer to residential customers with smart meters the opportunity to participate and benefit from a peak-time rebate (PTR) program. ComEd tested a

PTR rate structure in the AMI Pilot's Customer Applications Program (CAP), and that experience will inform the design and implementation of the new program. PTR consists of designing and managing the overall PTR program including the business processes and supporting systems. Major activities required to support this include providing for customer enrollment in the PTR program, calculating and posting the credit amounts for participating customers, altering the physical bill layout to support the display of PTR credits, and interfacing with PJM Interconnection, LLC (PJM) markets. ComEd's Customer Education and Products organization is primarily responsible for this activity with support from organizations that include Billing, IT, AMI Operations project team, and potentially eChannel.

17. Cyber Security

Cyber Security is an existing activity that is required to analyze, design, develop, test and implement the necessary IT security controls for the AMI meter program. It is also required to ensure, for the benefit of customers, a secure and safe IT operating environment and to keep the program in alignment with industry standards and statutory requirements. It also includes establishing a continuing cyber security support model and the governance surrounding that model, including roles and responsibilities. In addition, Cyber Security will support the system vendor procurement process related to cyber security such as security software, tools, and consulting services to ensure that proper controls are in place and that the vendor incorporates the appropriate industry standards in their offerings.

Cyber Security activities include the analysis, design, development, testing and implementation of the cyber security controls for the smart meter program. This activity shall identify, understand and apply the relevant cyber security standards and regulations (e.g., NIST, FERC, etc.) in implementing the cyber security solution and is accountable for providing the technical expertise for cyber security related procurement activity.

The cyber security approach and controls established for the AMI Pilot will remain in place for the short-term portion of the project. This activity will be focused on developing the long-term cyber security solution as described by the detailed activities outlined below.

IT Telecommunications and Network Engineering will assume responsibility for monitoring the security of the smart meter network and systems as well as managing and updating the cyber security controls to maintain a secure smart meter network after the systems are moved into production.

18. Training

Proper training of process owners and new system users is required to realize the full benefits of smart meters and the associated AMI technology for customers. The functionality provided by smart meters will drive changes to the existing business processes, IT applications, departmental operating models, and organizational structures. These system and process changes will impact the roles and tasks performed by ComEd personnel, thereby creating additional training requirements. Given the evolving nature of the technology and the long-term

road maps that are being developed for many functional areas, a long-term training plan will be developed and maintained to ensure that the skills and capabilities of ComEd personnel are properly aligned with the desired functionality.

Training includes those activities required to provide ComEd personnel with the skills, knowledge, and job aids they need to perform the roles and tasks they will be responsible for in the To-Be state, in support of the smart meter deployment. The specific training plans, content, and sequencing will be defined once the business process redesign work is completed by the AMI Business Transformation project function.

19. Procurement

The size and scope of the proposed smart meter deployment requires that a variety of products and services be procured and scheduled over the course of the 7-year smart meter implementation, with the bulk of procurement activities occurring in the first year of the project. Periodic re-assessment of the marketplace relative to the procurement needs will take place over the course of the deployment to ensure that advances in technology and potential pricing benefits are taken advantage of to minimize costs to customers. The procurement plan must align with the detailed deployment schedule and support both the short-term and long-term solution work streams.

Procurement represents the standard activities by which resources (hardware, software, and services) are purchased to support the organization. This centralized support activity is utilized to ensure that departments and work streams have the resources they need to execute projects and operate in the steady-state. This activity also helps the business manage contracts and resolve the related issues that can arise. The BSC Supply organization has responsibility for this activity.

In addition to these standard activities, Procurement will investigate opportunities to leverage spending, with collaborative support from business representatives across ComEd and other Exelon business units, such as PECO and BG&E. This collaboration will be a component of the procurement strategy, and will need to be factored into the overall project schedule.

20. Milestones and Metrics

Pursuant to the Commission's Order in Docket No. 12-0298, ComEd has modified this Plan to include additional milestones and metrics. As part of the metric and measurement tracking process, the program management team will be responsible for ongoing monthly, quarterly, and yearly data reporting, including data provided through the annual reports pursuant to Section 16-108.6(e) of the PUA, 220 ILCS 5/16-108.6(e). As directed by the Commission in its Order in Docket 12-0298, and subject to the protection of consumer privacy, the results of the milestones and metrics tracked pursuant to this Plan will be provided to the Commission and stakeholders.

Milestones and metrics to be tracked pursuant to this Plan include the following:

No.	Issue	Operational Tracking Measure
1	Customers enrolled in Peak Time Rebate, Real Time Pricing, and other dynamic/time variant prices	<u>Residential Customers</u> 1. Number of customers on a time-variant or dynamic pricing tariff offered by ComEd. Expressed also as a percentage of customers in each delivery class. 2. Number of customers served by retail electric suppliers for which the supplier has requested monthly Electronic Data Interchange delivery of interval data. Expressed also as a percentage of customers taking supply from a retail electric supplier in each delivery class. <u>Small Commercial Customers</u> 1. Number of customers on a time-variant or dynamic pricing tariff offered by ComEd. Expressed also as a percentage of customers in the delivery class. 2. Number of customers served by retail electric suppliers for which the supplier has requested monthly Electronic Data Interchange delivery of interval data. Expressed also as a percentage of customers taking supply from a retail electric supplier in the delivery class.
2	Customer-side-of-the-meter devices sending or receiving grid related signals	Number of ComEd AMI meters with consumer devices registered to operate with the Home Area Network (HAN) chip by tariffs under which customer receives delivery.
3	AMI Meter failures	Number of advanced meter malfunctions where customer electric service is disrupted. A “malfunction” is a malfunction that causes the meter to become inoperable but does not include cases of tampering, service panel and service entry equipment, house fires, etc.
4	AMI Meters replaced before the end of their expected useful life	Number of ComEd advanced meters replaced annually before the end of their expected useful life, including reasons for replacement that include ComEd errors. “Replaced” means a replacement due to a malfunction that causes the meter to become inoperable, including tampering.
5	Customers with net metering	Number of customers enrolled on Net Metering tariff and the total aggregate capacity of the group.
6	Customer premises capable of receiving information from	Number of installed AMI Meters as of the last day of the calendar year that communicate back to the head end system. Number of installed AMI Meters as of the last day of the calendar year

No.	Issue	Operational Tracking Measure
	the grid	that communicate back to the head end system, divided by the total number of AMI meters installed. Number of customers who have accessed the web-based portal as of the last day of the calendar year as a percentage of customers with AMI Meters and as a percentage of ComEd customers in that delivery class. Number of customers who can directly access their usage data as of the last of the calendar year as a percentage of customers with AMI Meters and as a percentage of ComEd customers in that delivery class
7	Peak load reductions enabled by demand response programs	Load impact in MW of peak load reduction from the summer peak due to AMI enabled, ComEd administered demand response programs such as the Peak Time Rebate program as a percentage of all demand response in ComEd's portfolio.
8	Customer Complaints	Number of formal ICC complaints, informal ICC complaints, and complaints escalated to ComEd's customer relations department related to AMI Meter deployment, broken down by type of complaint and resolution. AMI Meter deployment includes AMI Meter installation, functioning or accuracy of the AMI meter, and HAN device registration.
9	Reduction in Greenhouse Gas Emissions enabled by smart grid	ComEd will work collaboratively with CUB and EDF to operationalize this measure.
10	Distributed generation projects	Number of locations and total MWs of customer owned distributed generation connected to the transmission or distribution system, broken down by connection to transmission and distribution system. "Distributed generation" locations are those where customers take service under Rider POG or POG-NM or successor tariffs.
11	Load served by distributed resources	Total sales of electricity to the grid from distributed generation (Rider POG or POG-NM customers) divided by zone energy plus distributed generation sales, with all data provided in sortable format.
12	System load factor and load factor by customer class	Total annual consumption for AMI meters (including, separately, small commercial customers) divided by the average demand across all AMI meters over the 4 peak hours multiplied by 8,760 hours by customer class. ComEd will work collaboratively with CUB and EDF to establish a similar measure for all system load.
13	Products with end-to-end	ComEd will conduct an annual survey through a third-party provider to evaluate how products are being introduced in the smart grid enabled

No.	Issue	Operational Tracking Measure
	interoperability certification	marketplace.
14	Network nodes and customer interfaces monitored in "real time"	ComEd will work collaboratively with CUB and EDF to operationalize this measure.
15	Grid connected energy storage interconnected to utility facilities at the transmission or distribution system level	Number of locations and total MWs of utility owned or operated energy storage interconnected to the transmission or distribution system as measured at storage device electricity output terminals. ComEd will conduct an annual survey through a third-party provider to estimate similar measures of non-utility storage units.
16	Time required to connect distributed resources to grid	ComEd's response time to a distributed resource project application, and time from receipt of application until energy flows from project to grid.
17	Voltage and VAR controls	Number and percentage of distribution lines using sensing from an AMI meter as part of ComEd's voltage regulation scheme.
18	Grid assets that are monitored, controlled, or automated	Number and percentage of ComEd substations (Distribution Center Substations (DCs), Substations (SSs) Transmission Substations (TSSs) and Transmission Distribution Centers (TDCs)) monitored or controlled via Supervisory Control and Data Acquisition (SCADA) systems. Number and percentage of ComEd distribution circuits (4kV, 12kV and 34kV) equipped with automation or remote control equipment including monitor or control via Supervisory Control and Data Acquisition (SCADA) systems.
19	Customers connected per automated circuit segment	Average number of customers per automated three phase 12kV line segment. An "automated line segment" is a segment of 12 kV three phase mainline circuit between automated devices which include circuit breakers, reclosers, automated switches, etc. A "customer" is a ComEd account connected on the automated 12kV three phase line segment.
20	Improvement in line loss reductions enabled by smart	ComEd will research the uncertainty in line loss measurement collaboratively with CUB and EDF.

No.	Issue	Operational Tracking Measure
	grid technology	
21	Tracking Actual Costs	The actual cost of the AMI deployment costs that ComEd has incurred, including both one-time costs and on-going operating costs.

D. Operating Considerations by Department

Section C described the activities necessary to deploy and implement the AMI solution. This section describes how ComEd's departments are affected by the AMI solution during the implementation period and after the solution is fully deployed.

1. AMI Operations

AMI Operations was established for the AMI Pilot to operate and maintain the network to support billing operations and other business activities. It will function as both a project team and as an operating department. During the deployment period, the function is responsible for activating smart meters and monitoring the status of the activated meters. At the conclusion of the installation of the final AMI meter, the AMI Operations project team responsibilities will transition to full time responsibility for the day to day operation of the AMI system. The function will need to be scaled-up in both size and capabilities to support the full meter deployment and perform the ongoing operational activities post-deployment.

As the AMI network and smart meters are installed and activated in each operating center across the service territory, the AMI Operations organization will assume an operational role related to the automated meter reading data flow and management, Meter Activation (for smart meter-to-smart meter exchanges), meter events processing and management, and meter/network health monitoring and troubleshooting (in conjunction with the AMI IT Operations organization).

2. AMI IT Operations

The implementation of smart meters and the associated technologies and systems will require IT monitoring, support, and maintenance in order to enable and sustain the desired functionality. The AMI IT Operations organization was formed during the AMI Pilot, and will serve as both a part of the project team and an operating department responsible or supporting the day to day operation of the AMI system. It will expand as necessary to support full deployment.

3. Field and Meter Services

The Field and Meter Services (F&MS) department is responsible for performing various work orders related to meters (e.g., inspections, testing, sampling, connections, disconnections, meter exchanges, theft investigations, and repairs). The advanced functionality provided by the smart meters and AMI network will change both the type and volume of activities performed by the F&MS organization. Over the course of the 7-year deployment, the set of F&MS activities will change as smart meters are deployed. There are three fundamental changes to the work activities.

1. The remote connect/disconnect functionality provided by the AMI system reduces the number of field visits required to perform that function on premises. The use of the remote disconnect capability for non-payment disconnects will be done in a manner that is compliant with ICC rules.

2. Inspections of smart meter installations, performance of manual reads for smart meters when consumption data cannot be accessed remotely, and performance of smart meter safety inspections based on specific account activity criteria.

3. The planned retirement of three legacy remote meter reading solutions eliminates the activities required to maintain those solutions.

4. IT Telecom, Cyber Security

The implementation of smart meters and the associated telecommunications equipment will require ongoing network monitoring and support, and end-to-end cyber security to operate efficiently, sustain the desired functionality, and meet the requirements of the overall program.

IT Telecommunications & Network Engineering Department will be responsible for managing backhaul communications. These activities include:

- Engineering and design of the required specifications, including security
- Ongoing monitoring of performance
- Network enhancements
- Procurement of telecommunications-related resources (products, services)
- Vendor management

During the Pilot, AMI network operations were handled by the AMI Operations project team, and were very manual in nature. These activities included:

- Monitoring the performance of the AMI network

- Identifying issues related to performance of the AMI network
- Coordinating issue resolution through the submission of trouble tickets
- Ongoing assessment of AMI network performance and configuration

Currently, Cyber Security is centralized within the existing IT organizational structure and the specific plans are developed and executed within the context of the applications in use. There are a limited amount of dedicated resources allocated to ensuring Cyber Security is implemented throughout the applications impacted by the smart meter deployment. This will be addressed by the IT group once the specifics of the operating model are finalized.

During the AMI Pilot, the resources dedicated to AMI IT project team were responsible for ensuring thorough and sound Cyber Security for the applications in use. In some cases, this was provided by external contractors through their application implementation and ongoing support, including the AMI Head-End.

The model and structure of the IT Telecommunications & Network Engineering Department that will support the smart meter environment is currently under development. Once finalized, it will address:

- Maintenance, monitoring, and support of the AMI Network via a network management system
- Monitoring of endpoint meter connectivity
- Vendor Management of AMI network systems and services providers
- SaaS management (if applicable)
- Support and resolution of systems issues and trouble calls related to the AMI Network
- Provide centralized RF Engineering support
- Identify and implement network enhancements
- Support ongoing assessment of network systems, vendor performance, and future needs
- Support network procurement needs, including RFP creation and evaluation (as required)
- Firmware download and execution
- Develop and execute comprehensive Cyber Security Strategy and Implementation Plan across Smart Grid and Smart Meter Projects
- Perform ongoing security event testing

- Monitor and report on Cyber Security performance and key metrics
- Identify and implement Cyber Security enhancements

5. Meter Reading

The advanced functionality of smart meters, specifically the automated meter reading capability via the AMI network, will fundamentally change the manner in which customer energy usage data is obtained. The Meter Reading group will no longer be responsible for manually gathering all customer energy usage data on a monthly basis, though a small level of meter reading activities will be performed by the remaining inspectors.

6. Billing

Smart meters and the two-way communications enabled by the AMI system will benefit customers by improving meter reading performance in both the percentage of meters read and the accuracy of the meter reading which will improve the efficiency of the Billing department.

Over the course of the 7-year deployment, the Billing department will migrate from the current billing systems and processes utilized to support manual meter reading to new systems and processes based on the AMI technology that will better serve customers. The primary change to the billing operations is the use of a different editing tool for accounts that require manual intervention.

7. Call Center

The implementation of smart meters impacts the type and volume of calls received by the Call Center organization. During the deployment period, there will be calls related to the program as a whole, or to specific topics such as when the meter will be installed or how the power will be re-connected to the premises. The process for responding to customer inquiries will not fundamentally change in the smart meter environment. However, the Customer Service Representatives will experience a learning curve related to all of the business process redesigns that they will need to understand in order to better serve customers.

8. eChannel

The advanced functionality of smart meters, specifically the type and volume of data captured, will enable new information services directly to the customer. The eChannel group will be responsible for providing customers with access to interval energy usage data and dynamic reporting on a next-day basis, updated account information, outage status information, energy usage alerts, and smart meter deployment updates via the web, mobile device, and social media outlets.

9. Revenue Protection

The Revenue Protection organization is impacted in the areas of Theft and Consumption on Inactive Meters (CIM).

The current practice for identifying and investigating theft is manual in nature. Revenue Protection obtains tamper leads primarily through the field personnel from Meter Reading and Field Operations, or from third party provider specializing in the identification of unaccounted for energy usage.

The current practice for monitoring and eliminating CIM is manual in nature. Minimum usage thresholds are established for inactive premises, and a report is generated for those locations where the threshold is exceeded.

Once the installed smart meter's event detection capability (e.g. tamper flags) is enabled, those events, along with related information, will be correlated to identify potential theft situations.

CIM investigation and reduction will become a much more automated process once the remote disconnect functionality is enabled. When a customer moves out, the power will be disconnected, or a new account may be created in the property owner's name if elected by the owner.

10. Revenue Management

When customers are unwilling or unable to honor their bill payment obligations, an order is generated to disconnect electric service. With the implementation of smart meters and the associated systems integration, the process to disconnect power (in compliance with ICC rules) and the corresponding reconnection of electric service will be effected using the remote service switch and without the associated time lag required for manual reconnection.

The core activities performed by Revenue Management do not fundamentally change in the "To-Be" state. The manual tasks in the process will remain manual; however, the technology utilized to execute the disconnection and connection of power will replace the field visit to disconnect and re-connect service, in compliance with ICC rules.

11. Marketing - Peak Time Rebate Tariff and Program

Current meter technology provides a limited capability to provide innovative rate programs to ComEd consumers without a meter replacement, as has been the case with Residential Real Time Pricing. The implementation of smart meters and the associated data acquisition capabilities benefit customers by enabling the implementation of innovative time varying and dynamic rates and demand response programs, such as PTR. Smart meters will be capable of collecting the data required to settle more complex transactions at a very low incremental cost to customers. As called for in PA 97-0616, the PTR tariff and program will

provide consumers with an opportunity to receive a financial incentive, in the form of a rebate, by lowering their consumption on event days.

Currently, a residential customer that elects a dynamic rate structure (RRTP now and PTR in the future) have to wait up to 3 monthly billing cycles for the meter exchange and rate change to take effect. With AMI, customers can be switched to a dynamic rate much faster.

12. Distribution System Operations

The implementation of smart meters, new applications and/or enhancements to legacy systems such as the Outage Management System (OMS) will benefit customers by improving the effectiveness of the Outage Management function within Distribution System Operations (DSO). As the functionality is implemented over the course of the 7-year deployment, the OMS will be more effective at predicting the sources of outages, automatically opening/closing outage tickets, and more accurately reporting outage durations. The specific timeline and details of the OMS roadmap for implementation will be finalized in conjunction with the work completed by the Business Transformation Office and incorporated into future functionality and IT waves.

Currently, DSO personnel have an outage management process that relies heavily on customers calling to report outages at their premises, field resources assessing the extent of damage, and field crews reporting restoration activities. Customer-provided outage information is utilized by the outage management system to predict the outage type and location as well as to generate outage tickets for manual dispatching. Outage restoration activity reported by field crews allows DSO office personnel to effectively manage the restoration process.

Over the course of the 7-year deployment, DSO will obtain the additional outage management functionality provided by the smart meters, associated backend IT systems and integration with existing legacy systems. As many of the enhancements involve improving the existing OMS automation through the use of real-time smart meter data, DSO personnel will require minimal awareness training to understand the new system functionality. The core accountabilities and activities performed by the DSO personnel remain, in large part, unchanged.

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E. Project Schedule and Cost Estimates

1. Schedule

The following section contains the anticipated schedule for the 7-year deployment period, as summarized in the figures below, and the related key takeaways. The schedule includes a monthly view for 2012-2013, and an overall annual view for the duration of the deployment.

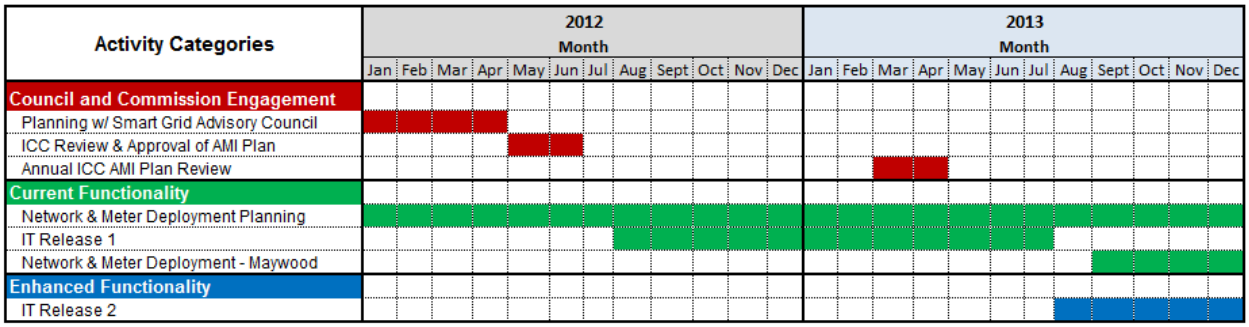


Figure 10 - 2012-2013 Monthly Schedule

Key Observations and Milestones for 2012-2013 include:

- IT Release 1 refers to the initial IT work to be completed to enhance the AMI Pilot solutions to commence the short-term deployment activities.
- IT Release 2 refers to the next set of functionality to be managed by the AMI Business Transformation Project Team.

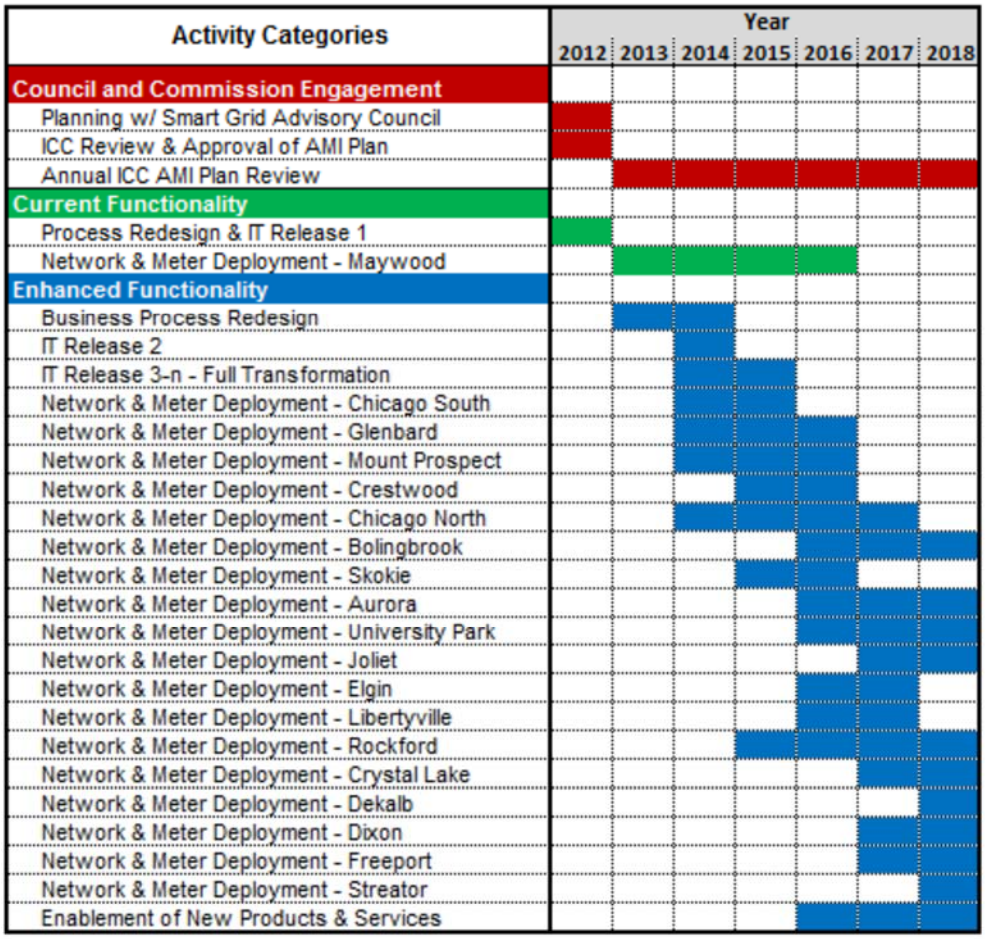


Figure 11 - Overall Deployment Schedule

Key Annual Schedule Observations and Milestones include:

- IT Release 1 refers to the initial IT work to be completed to enhance the AMI Pilot solutions to commence the short term deployment activities.

- IT Release 2 refers to the next set of functionality to be managed by the AMI Business Transformation Project Team.

- IT Release 3-n refers to the subsequent IT work that will be associated with enabling the full smart meter functionality. The specific components and quantity of releases will be managed by the AMI Business Transformation Project Team.

- The full business transformation (business process redesign, change management, functionality realization, etc.) will take place over a period of three years.

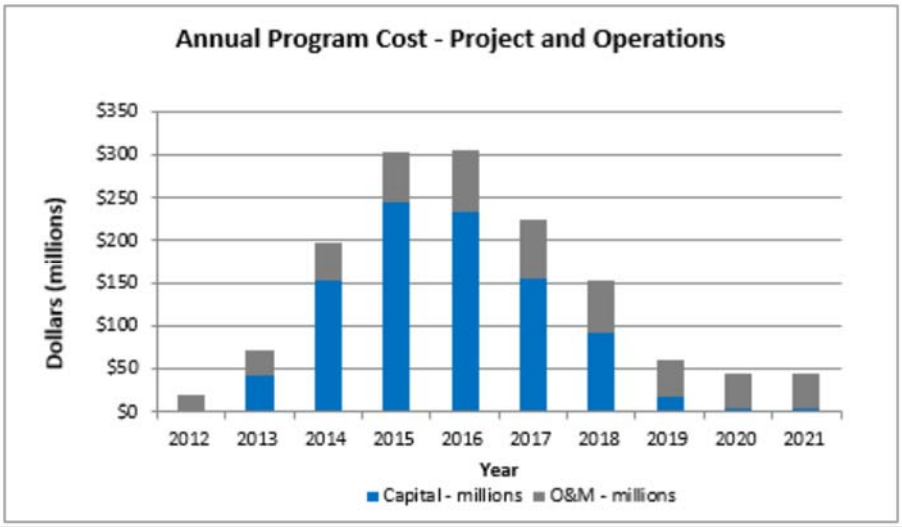
- The full deployment plan includes having multiple separate operating centers active for deployment at any given time.

- The smart meters and associated technology represent a platform for future enablement of new products and services that will drive long-term benefits to ComEd and their customers.

2. Estimated Costs

The following section outlines the overall program costs, in terms of anticipated O&M and Capital costs. The annual program costs by Capital and O&M is depicted in the figures below[37]:

[37] The amounts in these figures exclude the sunk costs associated with the AMI Pilot (i.e., $54.7 million of Capital and $7.6 million of O&M) as well as the costs associated with a Peak Time Rebate ("PTR") program included in the PTR cost benefit analysis.



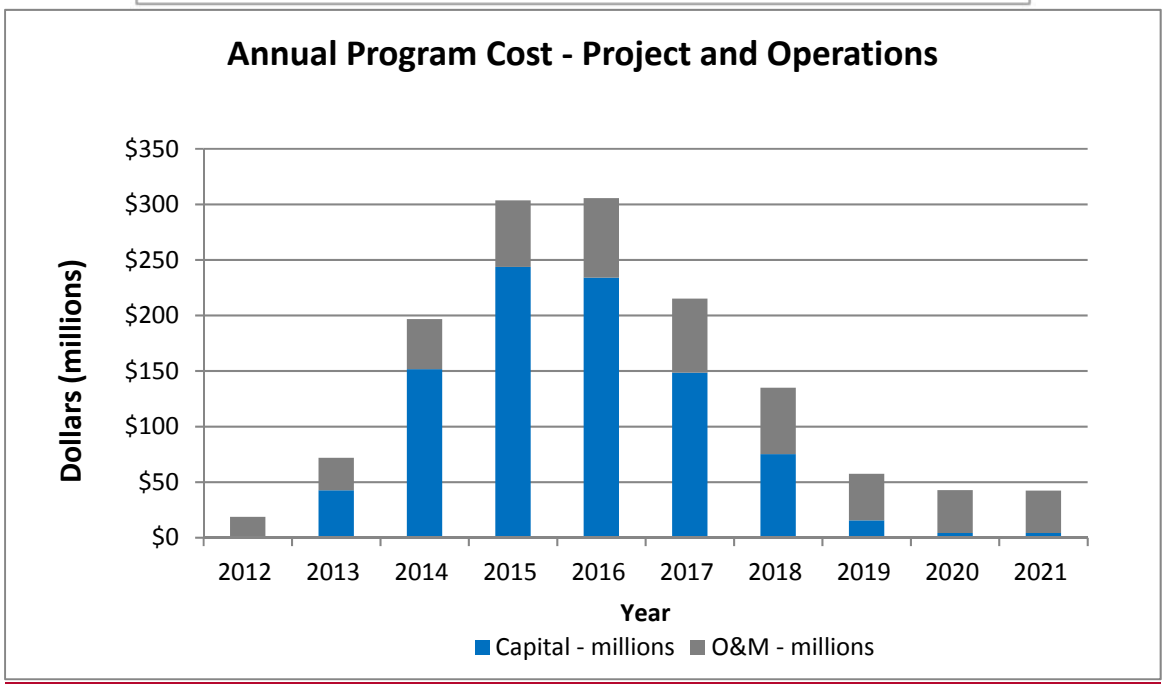


Figure 12 - Annual Program Costs ($ in millions)

Caiptal Cost Category	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Capital - millions	0.3	42.6	151.6	243.6	234	155	91.2	16.5	4.2	4.2	**943.2**

Caiptal Cost Category	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Capital - millions	0.3	42.6	151.6	243.6	234	155	91.2	16.5	4.2	4.2	**943.2**

Figure 13 - Capital Cost Detail ($ in millions)

O&M Cost Category	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
O&M - millions	18.4	29.3	45.1	59.9	71.5	70.5	62.2	43.5	40.4	40.9	**481.7**

O&M Cost Category	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
O&M - millions	18.4	29.3	45.1	59.9	71.5	70.5	62.2	43.5	40.4	40.9	**481.7**

Figure 14 - O&M Cost Detail ($ in millions)

ComEd estimates that the unrecovered cost of the non-AMI meters is approximately $258 million, as of January 1, 2014. Of this amount, ComEd estimates that the accelerated depreciation resulting from the early retirement of the non-AMI meters over the AMI meter deployment period will be approximately $180 million. This amount includes the impact of estimated removal costs.

ComEd plans to record monthly the accelerated depreciation costs resulting from the early non-AMI meter retirement as a regulatory asset, and to amortize each such respective amount over a 10-year period. As a result, the regulatory asset is expected to be established gradually over the period 2012 through 2018, and will be amortized over the period of 2012 through 2028. ComEd would recover the amortized amounts of the retired meters through the revenue requirements established in response to the annual formula rate updates, or in the absence of a formula rate, through its delivery services revenue requirement. The unamortized balance of the regulatory asset will be included in ComEd's delivery service rate base and will earn a return equivalent to the return earned on its other distribution assets. The unrecovered cost of the non-AMI meters is included in the cost-benefit analysis of this AMI Plan.

3. Benefits

There are a number of key benefits for customers that will be realized from the smart meter deployment. These benefits are aligned with the following six plan objectives:

1. Financial payback

Customers will benefit based on operational savings (*i.e.*, the categories of benefits described in the Black & Veatch Report) in the following areas:

- Reduction in manual meter reading
- Reduction in meter field work
- Reduction in manual billing
- Reduction in outage management effort
- Reduction in call center effort
- Reduction in consumption on inactive (CIM) meters

- Reduction in energy theft
- Reduction in bad debt
- Avoided capital investment in equipment

These operational savings will flow back to customers through ComEd's performance-based formula rates.

2. Peak time financial rebates

Customers will receive "rebates" (rate reductions) when their energy usage is reduced during peak time events. ComEd will offer an opt-in peak time rebate tariff (voluntary to customers) that incentivizes customers to reduce their consumption when energy costs are high. These events are likely to occur on hot summer days when demand for electricity is at its highest points of the year.

3. More informed customers

Customers will benefit by having access to energy usage and cost information regarding how much energy is being consumed, and the time of day of usage. Similar to the AMI pilot, ComEd plans to make available a web-based application that provides a variety of charts and graphs of the customer's historical usage based on different time dimensions (i.e., hourly, daily, and monthly). This data will be updated on a daily basis to reflect the prior day's usage. In addition, the application will compare the customer's usage to neighbors for benchmarking purposes.

4. Foundation for more products and services

Customers will benefit by additional product and service offerings from ComEd and other companies to help them manage their electricity costs, keep them informed during power outages, and improve their overall experience with ComEd. As an example, every meter will have a second radio to communicate usage to smart in-home devices for real-time access and/or control.

5. Improved customer experience

Customers will benefit from the implementation of more effective business processes associated with a variety of customer operations transactions, including more effective outage management. As an example, every meter will be read every day by the system, thereby reducing the number of bills created from estimated readings.

6. New professional and skilled trades jobs

Additional local jobs will be created in a variety of fields such as meter assembly, meter installations, data analytics, information technology, operating technology, network engineering, network management, RF engineering, and cyber security.

The benefit details can be found in the Black & Veatch Advanced Metering Infrastructure Evaluation Final Report, and the Black & Veatch Update and Explanation of Changes ~~To The~~to the Cost and Benefit Analysis in Support of the Commonwealth Edison AMI Plan Due to Revised Meter Deployment Schedule.

Chapter 3: Customer Applications

A. Introduction

This section builds on Chapter 2 by explaining how the AMI system ComEd proposes will benefit customers by enabling specific functionalities of the Smart Grid that were previously unavailable. In addition, this section explains the specific customer applications that ComEd plans to offer once the AMI system is in place, as well as the process ComEd will use to identify, evaluate, and implement future customer applications that will utilize the AMI system.

The AMI system that ComEd installs will provide the foundation for enabling many of the Smart Grid functionalities identified by the EIMA. However, AMI is only one component necessary to deliver some of the functionalities. Other future applications and technologies that can benefit customers – such as distributed renewable generation, battery storage, plug-in electric vehicles, and HAN- technologies – will help customers unlock the full value of the Smart Grid. As a result, ComEd has developed a two-pronged plan to directly meet certain key functionalities, while also enabling the widest range of future Smart Grid applications that promise to deliver value to customers. First, ComEd has designed its AMI system around leading specifications to meet these functionalities and support as many future Smart Grid applications as possible. Second, ComEd has developed a process for identifying and evaluating future Smart Grid applications in order to enable or implement those applications that prove to be valuable to customers. The remainder of this section provides details around the two parts of ComEd's plan to create customer value through technology selection.

B. Plan to Deliver Smart Grid Functionalities through AMI System Selection

The first and most fundamental way that ComEd is creating value for its customers through the Smart Grid is by selecting technologies for its AMI system that meet industry-leading specifications and standards. These technologies and the criteria used to select them are described in detail in Chapter 2 of this plan. What follows in this section builds upon the previous description by explaining how the specific standards and specifications of ComEd's AMI system will benefit customers by enabling key functionalities of the Smart Grid identified by the EIMA.

1. How ComEd's AMI System Enables Smart Grid Functionalities

a) Data Collection, Analysis, and Communication Capabilities

Language from the EIMA:

- The ability to develop, store, send, and receive digital information concerning or enabling grid operations, electricity use, costs, prices, time of use, nature of use, storage, or other information relevant to device, grid, or utility operations, to or from or by means of the electric utility system through one or a combination of devices and technologies

- The ability to measure or monitor electricity use as a function of time of day, power quality characteristics such as voltage level, current, cycles per second, or source or type of generation and to store, synthesize, or report that information by digital means.

1. Potential to enhance data collection, analysis, and communication capabilities

The Smart Grid holds the potential to benefit customers by improving data analysis pertaining to electricity use and system monitoring/management. While a Smart Grid provides greater data availability at all points in the transmission and distribution system, some of the greatest enhancements in data analysis are made possible by AMI meters capable of digital monitoring and two-way wireless communication.

AMI meters can measure usage at hourly and sub-hourly levels. In addition, these AMI meters are capable of collecting peak demand as well as voltage information. AMI meters can then send this detailed data back to the utility at daily or hourly intervals via the AMI network, so that data can be analyzed and used for a variety of utility and customer applications.

Given the wireless communication capabilities of AMI meters, utilities will also be able to send data to the AMI meter in a way that was previously not possible. For example, utilities can send AMI meters pricing information at an interval level. As a result, hourly rates with prices that change daily can be communicated to the AMI meter. In addition, time of use tiers and peak event periods can also be sent to the Ami meter, along with accompanying text messages. AMI meters are then capable of sending this information to compatible Home Energy Management (HEM) devices so that customers can benefit by understanding and managing their energy use in the home.

2. How ComEd's AMI network enables those functionalities

ComEd's AMI system will enable all of the functionalities discussed above. First, ComEd's AMI meters will capture hourly interval usage data. However, the AMI meters will have enough memory pre-installed to capture sub-hourly intervals, and ComEd will be able to remotely re-program the AMI meters to collect this shorter interval data if required. The meters, however, will send data back to ComEd through the SSN wireless mesh network every four hours, so ComEd has significant flexibility in how much data needs to be stored by the AMI meter. Given that the wireless mesh network makes it unlikely that ComEd will lose contact with the AMI meter for a significant period of time, ComEd can store the data within the AMI meter for a shorter period of time if it begins to run into memory limitations when storing shorter interval usage data or more detailed power quality, voltage, or other system condition data. The AMI meters will also be capable of measuring voltage, current, and power quality at the interval level, giving ComEd better visibility for its planning and grid operations to better serve its customers.

Second, the AMI meters will be fully capable of communicating with each other and the ComEd's centralized AMI IT systems using the SSN wireless mesh AMI network. The AMI

meters will be able to use the AMI network to benefit customers by sending usage data, as well as receive meter re-programming signals, prices, time of use and peak notifications, and text messages.

Third, ComEd is installing a MDMS capable of storing and processing the data it will receive from AMI meters. ComEd's MDMS, as well as the other IT systems it is installing as part of the AMI system, will enable ComEd to operate more effectively for the benefit of customers by managing the amount of data collected by the AMI system for billing and other operational purposes.

b) Energy Monitoring, Management, and Automation Applications

Language from the EIMA:

- The ability to develop, store, send, and receive digital information concerning electricity use, costs, prices, time of use, nature of use, storage, or other information relevant to device, grid, or utility operations to or from a computer or other control device

- The ability of any device or machine to respond to signals, measurements, or communications automatically or in a manner programmed by its owner or operator without independent human intervention

1. Potential of energy monitoring, management, and automation applications

The amount of data collected by the AMI meters (as described in the previous section) will enable a number of new applications designed to benefit customers by helping them control and automate energy use in their homes. Examples of these applications follow in Figure 15, Figure 17, Figure 18, and Figure 19.

One of the most immediate ways customers can benefit from having an AMI meter is to be able to view their interval usage online. By viewing their hourly interval usage online within a day of the actual usage, residential customers are able to better understand how much energy they, or a communicating appliance they enable, use and the associated costs. Hourly data helps customers know how much energy they were consuming during a specific time period, and having this data presented within a day of the actual usage helps customers remember what they were doing during a specific interval that led to changes in their energy consumption. Furthermore, vendors have developed websites that are capable of letting customers set a goal for how much energy they want to consume each month, and a website with daily refreshes of interval data can help the customer understand if they are on track for that goal. To help customers set a goal, some vendors' websites show customers how much energy a similar premises uses each month. Once the goal is set, the website can suggest tips and tricks to reduce energy consumption based on actual interval usage patterns of that customer. These services can be integrated with other functions of utility websites – such as online bill pay and energy audit tools – to help reduce costs and save energy for customers.

Figure 15 - Sample Web Portal Screenshots

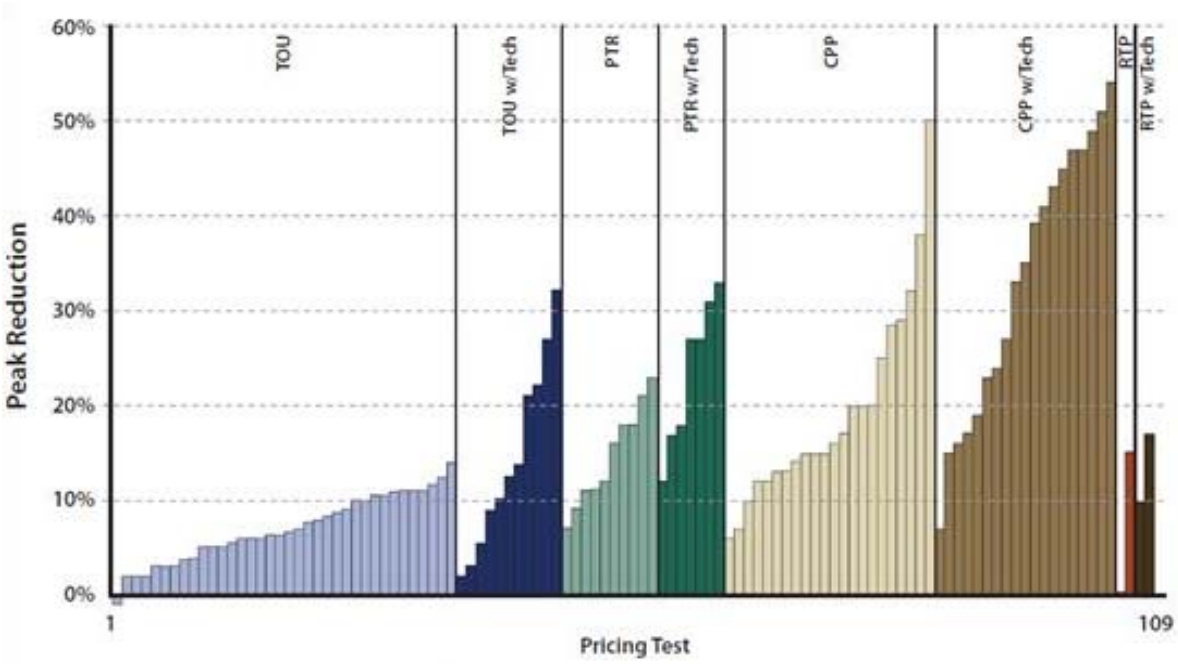
The availability of interval data also enables suppliers to offer customers a much wider range of rate options. Many of these new rates are dynamic, in that they will vary to reflect the fact that energy costs different amounts based on the time period in which it is consumed. There are many different types of dynamic rates that can be offered once a customer has an AMI meter installed (see Figure 16).

First, in certain dynamic rates, the customer's cost of energy during a critical event changes. One example of this rate is a critical peak pricing (CPP) rate, where the customer receives a small discount on energy consumed during normal times, but pays a significant premium for energy consumed during a peak event (which usually lasts a few hours and only occurs a few days a year).

Another example of this type of rate is a peak time rebate (PTR), which ComEd will offer as a demand response program. The PTR program that ComEd will offer will be a voluntary, e.g. opt-in, program funded by revenues from the PJM energy and capacity markets. The program will be open to all residential customers (regardless of their electricity supplier) with an installed and certified AMI meter, and will offer the customer a rebate for reducing their usage during peak events compared to a projected baseline. ComEd will "call" PTR events – during which customers can benefit by receiving a rebate for reducing their usage – for a period of several hours on select days of the year in which reduced demand will help improve system reliability (capacity). There will be no cost to enroll in the program, and there will also be no penalties for customers who do not reduce usage during the peak event – they will only forego the opportunity to receive a rebate during that period.

The next class of dynamic rates includes time of use (TOU) rates, in which energy costs vary by time of day (usually costing less during low demand off-peak hours and costing more during the high demand on-peak hours). TOU rates can have more than two tiers in which prices change, but the price of energy in each tier usually remains the same within a single day.

Hourly or real-time pricing (RTP) rates vary the price of energy in each interval measured, typically as a function of the hourly market prices for that energy. The day-ahead and real-time markets in PJM are used to determine the price of energy in each interval, and as a result, energy prices change daily for each interval. ComEd's Residential Real Time Pricing (RRTP) program is an example of a RTP rate.



Note: TOU=time-of-use pricing; Tech=technology; PTR=peak-time rebate; CPP=critical peak pricing; RTP=real-time pricing.

Source: A. Faruqui, "The Tao of the Smart Grid," presentation to the Michigan Smart Grid Collaborative, Lansing, MI, August 24, 2011, http://www.brattle.com/_documents/UploadLibrary/Upload973.pdf.

Figure 16 - Peak Load Reduction from Dynamic Pricing Pilot Programs by Rate Design and Technology. Source: MIT study "The Future of the Electric Grid"

In addition to dynamic rates, AMI meters will enable a wide range of HEM devices intended to help customers understand and control their energy use in the home. HEM technologies achieve these goals in a number of ways, including providing access to information that encourages customers to reduce or shift energy consumption, by enabling dynamic rates, and by automating appliances to use energy during less expensive time periods.

HEM technology devices fall largely into three broad categories. First, In-Home Displays (IHDs) are the broad class of devices used to monitor near-real time energy use in the home. Most IHDs are built to communicate directly with the AMI meter to show the customer exactly how much energy that customer is currently consuming, and many can store a history of energy use to show consumption on a daily or monthly level. IHDs also frequently have the ability to show on- and off-peak tiers or peak event notification either through a text message or through a device that contain a light that changes color, e.g. an illuminated orb.

Figure 17 - Sample IHDs

Second, Programmable Communicating Thermostats (PCTs) are the class of HEM devices that are able to change a customer's Heating Ventilation and Air Conditioning ("HVAC") usage based on price signals from the utility, but (except, potentially, if the customer has agreed to an automatic rate) pursuant to the customer's direction and programming. PCTs frequently have many of the same capabilities as IHDs – like the ability to display price, usage, and messages sent from the AMI meter – but are also capable of automating the HVAC system to adjust to price signals from the utility. This ability includes turning off or cycling cooling during peak periods in the summer. PCTs enable customers to benefit by taking full advantage of dynamic rate structures that provide incentives for off-peak energy usage, as a customer's HVAC system frequently consumes the most energy in the home.

Figure 18 - Sample PCTs

The third class of HEM devices includes "smart" appliances. These appliances function much like PCTs in that they can receive price signals from the AMI network or Internet and can be automated to run during low-priced time periods. "Smart" washers, dryers, and dishwashers are some of the examples of the appliances being developed to help customers control when they use energy.

Figure 19 - Sample Smart Appliances

In addition to HEM tools that customers can use themselves to monitor and control their energy usage, a number of Direct Load Control (DLC) devices are being developed that enable customers to allow the utility or third-party service provider to control some of their heavy-use appliances. DLC devices will allow the utility or third-party service provider to turn off heavy use appliances like HVAC systems and pool pumps during times of high energy use, in exchange for a rebate or other financial inducement. DLC devices have the capability of reducing peak demand, energy, providing frequency regulation, and other ancillary services to the grid.

Taken together, all of the previous components can be integrated with other media, security, and healthcare applications to create a "Smart Home." In the GSM Association of mobile operators report titled "Vision of Smart Home: The Role of Mobile in the Home of the Future," they lay out a vision for "an integrated smart home that extends beyond the electric utility… with other data from providers of media, security, and healthcare. Through a wireless connection, all of these areas could be integrated into a seamless experience for the consumer."

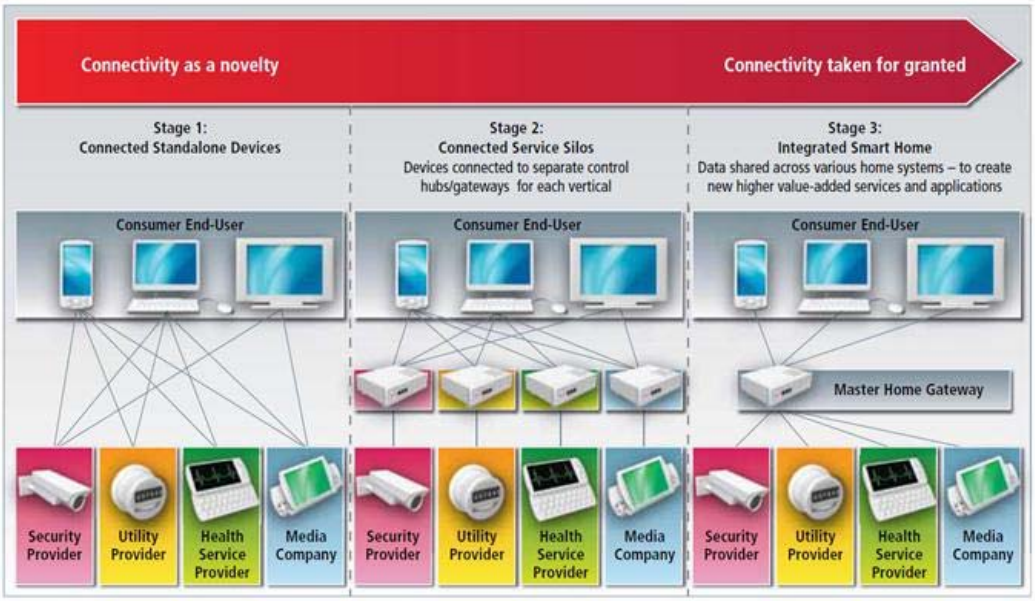


Figure 20 - Smart Home Services Evolution Scenario from GSMA Report "Vision of Smart Home: The Role of Mobile in the Home of the Future"

2. Challenges in implementing Smart Home vision

While the Smart Home offers a myriad potential benefits for the customer and the electric grid as a whole, a number of key developments are necessary before many of these benefits can be realized. First and foremost, standards for communication between devices need to be implemented across the range of technologies that comprise the Smart Home. For example, while the ZigBee® wireless protocol is the most widely accepted standard for HEM technologies, a plethora of other standards still exist for wireless communication (see Figure 21).

Technology	Verticals classification	Key design/ application features	Network Type	Technology classification
Mobile WAN	General purpose	Secure, high-scale wide area connectivity	WAN	3GPP technology standards; Connectivity
Femtocell	General purpose	Extension of mobile connectivity into the home	LAN/HAN	Connectivity
Wi-Fi	General purpose	Local-area connectivity	LAN/HAN	802.11a/b/g/n; Branded standard for wirelessly connecting electronic devices
Bluetooth	Multiple depending on Bluetooth profile	Low power wireless protocol for Personal Area Networking, high levels of security	PAN	Technology standard 2.40 – 2.48 GHz
Bluetooth Low Energy	Healthcare	Subset of Bluetooth v4.0 For very low power applications running off a coin cell	PAN	As Bluetooth
DECT/CAT-iq 2.0	General purpose	Next generation of DECT technology. For smart home and m2m applications	LAN/HAN	Connectivity
ZigBee	Multiple. Dominant in the smart energy verticals: smart metering and home automation	Low power wireless protocol for Personal Area Networking	PAN	Low power communication protocol, wireless network standard; operates in ISM (868MHz/915MHz/2.4GHz)
HomePlug, Multimedia over Coax (MoCA), Home PNA	Home entertainment, smart metering and home appliances	Wired home networking	HAN	IEEE 1901. Powerline communications standard; Connectivity
Wireless M-Bus	Smart metering	Connectivity between smart meters and head-end	NAN	Connectivity
6LoWPAN i.e. IPv6 over Low power WPAN	Smart objects that are IP enabled – extending the Internet of Things	Simplifies IPv6 connectivity, defining very compact header formats and taking nature of wireless network characteristics (e.g. packet loss, congestion etc.) into account.	PAN	Standard

Note: WAN, LAN, NAN, and HAN correspond to wide area, local area, neighbourhood area and home area networks respectively.

Figure 21 - Wide- and Home-Area Networking Standards from GSMA Report "Vision of Smart Home: The Role of Mobile in the Home of the Future"

Furthermore, even once standards have been agreed upon, devices frequently have to be certified on an ad hoc basis by the meter manufacturers to communicate all of the data necessary to deliver the full value of the HEM technologies to customers. The same holds true for many potential stand-alone gateway devices that promise to wirelessly connect all of the technologies in the Smart Home.

3. How ComEd's AMI network enables those potential capabilities

Despite the challenges in connecting the Smart Home, ComEd's AMI network will enable the full range of potential solution options. At the heart of this solution lies ComEd's AMI meters, which are capable of recording interval data needed to enable dynamic rates – and thus provide customers with opportunities for savings on their energy bills. The AMI meters are also capable of communicating price, usage, and messaging information into the home via the

ZigBee® radio installed in each AMI meter. As ZigBee® is the leading communications protocol for HEM technology and the AMI meters will be able to broadcast to any certified device or gateway built to the ZigBee® specification. The ZigBee® connection is encrypted to ensure security of customer data transmitted over ZigBee® network. ZigBee® has established itself as a leading wireless communication standard primarily due to its low cost, low power demand, and ease and reliability of adding devices.

The AMI meters will also be remotely programmable, which will allow firmware updates to the ZigBee® radio to ensure that the AMI meter will be able to communicate with any devices using future iterations of the standard. The AMI network also will enable ComEd to send price and DLC signals to the AMI meter, which then will be capable of broadcasting those signals to other Smart Home technologies.

Once AMI meters are installed, customers will be able to benefit from the latest Smart Home applications. For example, they will be able to participate in any supplier's dynamic rate offerings and/or any curtailment service (demand response) provider's or ComEd's DLC programs, such as the PTR program discussed earlier in this chapter. ComEd is also in the process of enhancing the existing web portal, which was used in the Pilot to enable all of the potential value for customers from this application, including:

- Viewing hourly interval usage data within 24 hours of that consumption
- Setting a goal for reducing energy usage, setting up a plan/budget to meet that goal, viewing progress towards that goal, and receiving optional proactive communications if not meeting the goal.
- Comparing energy use to similar anonymous customers
- Viewing tips for reducing energy consumption
- Encrypted data transfer to ensure security of customer usage data
- The web portal ComEd is developing will also be built with a "Green Button" functionality. Further description of this functionality can be found in the "Data Privacy" section of this chapter.

c) Digitization and Automation of Electric Grid Functionalities

Language from the EIMA:

- The ability to use digital information to operate functionalities on the electric utility grid that were previously electro-mechanical or manual.

1. Potential abilities to automate previously electro-mechanical or manual steps

The Smart Grid holds the promise of automating many functions of grid operations and electricity delivery that were previously not possible with an analog grid. A key function that the AMI system provides is a way for the utility to read the AMI meter remotely. Usage data collection can thus be automated, and conducted at daily or even hourly intervals.

The AMI network also allows utilities to upgrade the AMI meter firmware remotely. Updates to the AMI meter firmware can be sent via the AMI network to ensure that the AMI meter has the most up-to-date software and communications capability. This capability allows the utility to connect diagnostics and fix problems with the AMI meter, as well as keep the AMI meters as up-to-date as possible.

AMI meters also enable the utility to detect theft in a more robust manner that will benefit customers. First, analysis of customers' interval data can reveal patterns typical of theft in ways that monthly data from analog meters would not permit. Second, the new AMI meters are physically more difficult for potential thieves to manipulate in a way that would evade detection by utility systems.

Next, the utility is able to remotely connect and disconnect customers using the AMI system. This ability benefits customers by eliminating the need for a manual visit to a home to turn on or off ~~a~~an AMI meter when the customer moves in or out of a premises, or when a customer stops/starts paying any overdue bills.

Finally, AMI systems are capable of assisting in the automatic detection of outages. The backend IT systems supporting the AMI network can automatically determine which AMI meters have power flowing to them, and which do not. As a result, when AMI meters are fully integrated into an automated Outage Manage System, customers benefit by not having to call ComEd to report an outage, and storm crews can restore service faster by isolating any problems more quickly and targeting their repair work in the most efficient manner possible.

2. How ComEd's AMI network enables those potential capabilities

ComEd's AMI network benefits customers by enabling all of the automation capabilities discussed above. The AMI network will allow two-way communication between ComEd and the AMI meter. This two-way communication enables ComEd to receive usage information from the AMI meter at regular intervals, and to send the AMI meter signals to update its firmware and turn the electricity on or off at a premises. Furthermore, the AMI meter design and the interval data collected will make it more difficult for energy theft, and will enable ComEd to detect outages automatically.

d) Integration of Electric Plug-In Vehicles, Distributed Generation, and Storage

Language from the EIMA:

- The ability to integrate electric plug-in vehicles, distributed generation, and storage in a safe and cost-effective manner on the electric grid.

1. Plug-in Electric Vehicles (PEVs)

Consumer adoption of PEVs

PEVs have a great potential to transform the automotive industry and the way we drive. As PEV technologies continue to improve and come down in cost, and automotive manufacturers continue to provide additional PEV choices, more and more consumers will have the opportunity to adopt PEVs and transition to domestically-produced electricity to fuel their driving at a fraction of the cost of gasoline.

Consumers will have a wide array of PEV types from which to choose. These range from plug-in hybrid electric vehicles (PHEVs) which include both a battery and an internal combustion engine to power the vehicle, to battery electric vehicles (BEVs) in which the sole source of power is the battery. This range of PEV options will enable consumers to choose the PEV type that best fits their lifestyles. For example, the BEV, with a typical driving range of 100 miles or less between charges, may be ideally suited as a true "zero emissions" commuter vehicle, but limited in its capability for longer trips without significant build-out of inter-regional charging infrastructure. PHEVs, on the other hand, generally offer driving range similar to conventional vehicles because of the onboard internal combustion engine. As such, a PHEV can be a consumer's "only car". As intra-regional and inter-regional PEV charging infrastructure continues to be deployed, consumers will have greater flexibility with respect to their PEV choices, and the ability to charge their PEVs at home, at work, while shopping, or in other public places when it best suits their needs and lifestyles. Figure 22, included in a recent publication from the Edison Electric institute (EEI), "The Utility Guide to Plug-In Electric Vehicle Readiness", illustrates the anticipated launches of commercial passenger PEVs in the United States.

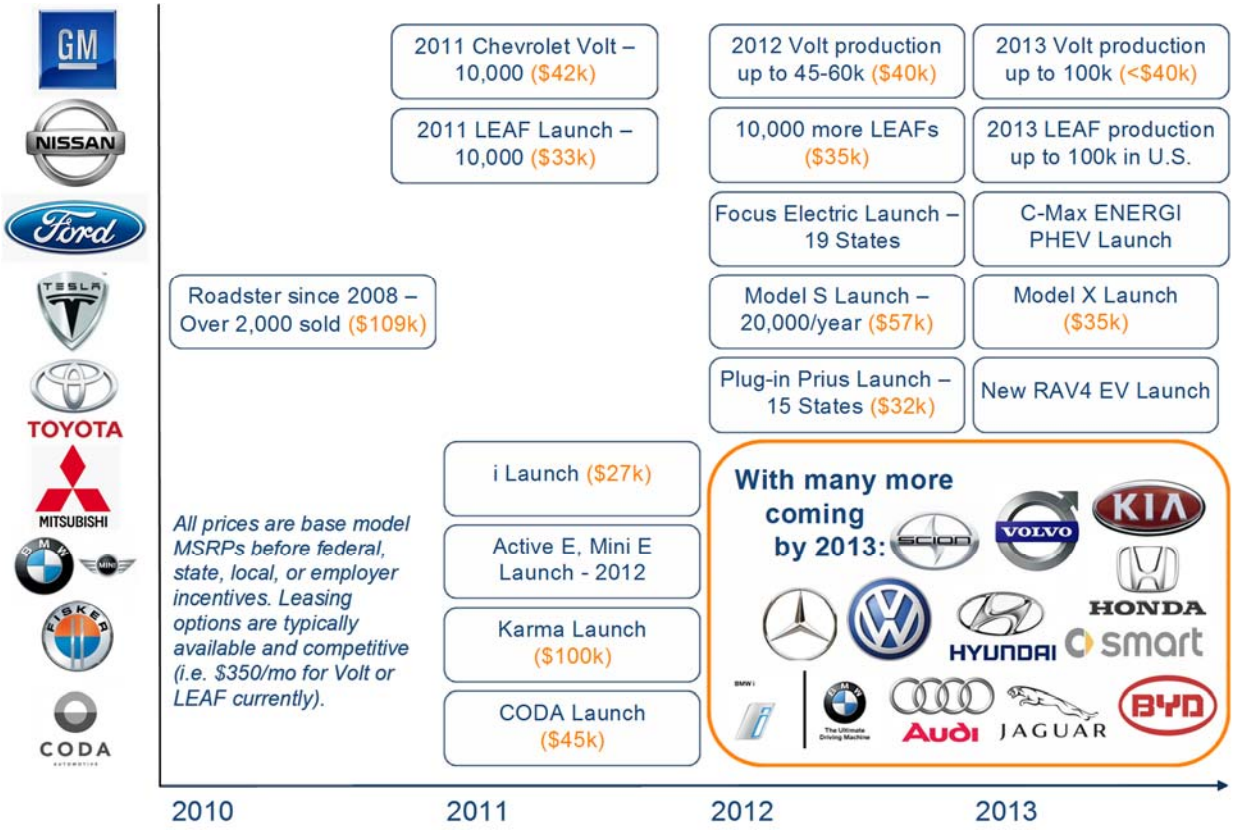


Figure 22 - Anticipated U.S. Commercial Passenger PEV Launches. Source: EEI report titled "The Utility Guide to Plug-In Electric Vehicle Readiness"

The current Presidential Administration has set a goal of having one million PEVs on the road by 2015, and research such as that conducted by the Electric Power Research Institute (EPRI) suggests the potential for 15 million to over 65 million PEVs on the road in the U.S. by 2030, representing about 4% to 18%, respectively, of the total vehicles on the road in the U.S. (see Figure 23 and Figure 24 below)[38].

[38] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, Figure 4-2

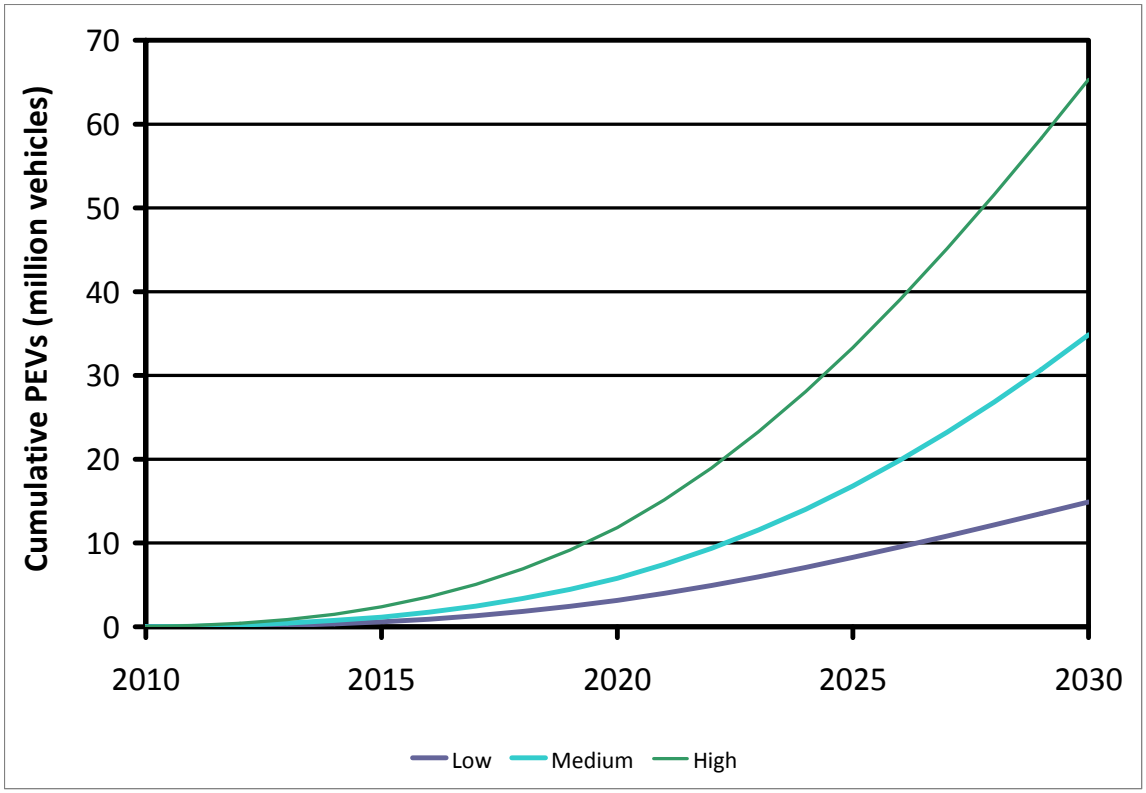


Figure 23 - Projected Electric Vehicles on the Road by 2030. Source: EPRI report titled “Transportation Electrification, A Technology Overview”

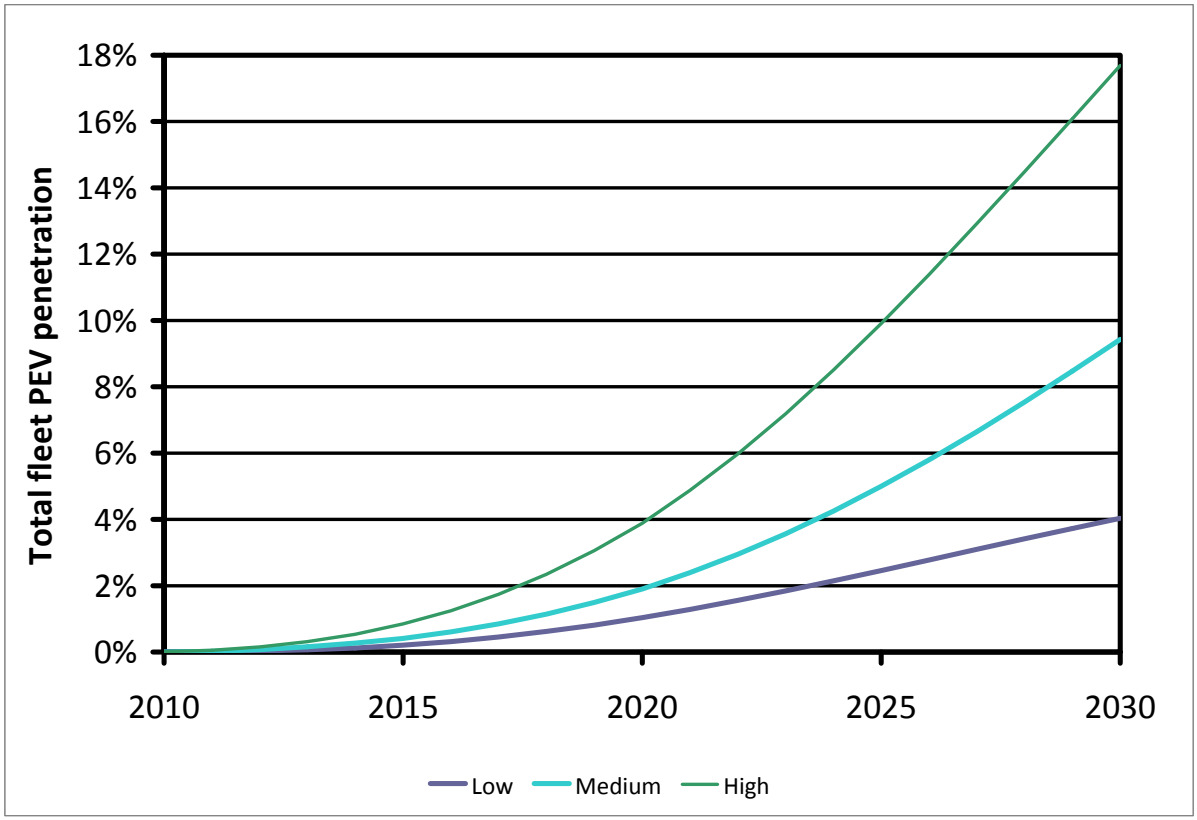


Figure 24 – Penetration of PEVs as a percentage of total U.S. vehicles. Source: EPRI report titled "Transportation Electrification, A Technology Overview"

Projections of PEV adoption are highly uncertain, and actual penetration could be significantly higher or lower than these estimates depending on a number of factors, such as battery costs, gasoline prices, charging infrastructure availability, competition from other vehicles, and government policy. Compared to other advanced vehicles like hybrid electric vehicles (HEVs), PEVs are generally more expensive and more technologically risky for vehicle manufacturers, which reduce the likely rate of introduction. However, more manufacturers are introducing vehicles at the same time, in more vehicle classes, and with a much higher level of government and consumer support.[39]

Potential grid impacts of PEVs

The charging of PEVs has the potential for both positive and negative impacts to the electric grid. Understanding and addressing potential PEV impacts to the electric grid is a critical role for the electric utility and a key enabler of both widespread PEV adoption and maximizing the benefits of transportation electrification. The timing of PEV charging can create either positive or negative impacts on electric generation and transmission systems. A significant

[39] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, p 4-1

amount of PEV charging coincident with the system peak would create a need for additional generation. On the other hand, charging performed consistently during off-peak hours could reduce system costs.[40]

The extent of PEV charging impacts will depend on the degree and density of PEV penetration, charging requirements, and the time of day PEVs are charged. A significant amount of PEV charging coincident with a system peak load could create the need for additional capacity. Large concentrations of PEVs charging in concentrated geographic areas (also known as "clustering") – especially residential areas - could require upgrades to local electric distribution system equipment to ensure continued reliability of service. As Figure 25 below illustrates, PEV charging can represent an electric load greater than a house.

	Tesla Roadster	Nissan Leaf	GM Chevy Volt	Toyota Plug-in Prius
Type	Battery	Battery	Plug-in hybrid	Plug-in hybrid
Electric Range	245 miles	100 miles	35 miles	15 miles
Battery Size	53 kWh	24 kWh	16 kWh	4.4 kWh
Onboard Charger	9.6 kW	3.3 kW	1.44 kW	1.44 kW
Quick Charger	16.8 kW	60 kW	3.3 kW	3.3 kW
Charging Time	6 hours (onboard) 3.5 hours (quick)	6 hours (onboard) 0.5 hours (quick)	10 hours (onboard) 4 hours (quick)	3 hours (onboard) 1.5 hours (quick)
U.S. Launch	March 2008	December 2010	December 2010	Spring 2012
Price (MSRP)	$109,000	$35,200	$40,280	$32,000

Source: Tesla Motors Inc., "Roadster Features and Specifications," http://www.teslamotors.com/roadster/specs; Nissan Motors Company Ltd., "Nissan Electric Leaf Car: 100% Electric. Zero Gas. Zero Tailpipe," http://www.nissanusa.com/leaf-electric-car/; J. Wiesenfelder, "Cars.Com Field Trial: Mobile EV Quick-Charging," *Kicking Tires*, July 26, 2011, http://blogs.cars.com/kickingtires/2011/07/carscom-field-trial-mobile-ev-quick-charging-.html; General Motors Company, "2011 Chevrolet Volt," http://www.gm.com/content/gmcom/home/vehicles/browseByBrand/baseball_cards/chevrolet/volt.html; General Motors Company, "Chevrolet Volt's 240V Home Charging Unit Priced at $490," press release, October 6, 2010, Detroit, MI, http://gm-volt.com/2010/10/06/gm-announces-chevrolet-volt-240v-charger-pricing-and-installation-service-provider; Toyota Motor Sales, USA, Inc., "Toyota Introduces 2012 Prius Plug-in Hybrid," press release, September 16, 2011, Richmond, CA, http://pressroom.toyota.com/releases/toyota+introduces+2012+prius+plug-in+hybrid.htm.

Figure 25 - Comparison of PEVs Commercially Available in US Market. Source: MIT report titled "The Future of the Electric Grid"

Vehicle home arrival times are generally correlated with ~~with~~ electric system peak load. If PEV charging is not managed appropriately (i.e., uncontrolled charging), it could add to existing system peaks. In its analysis of grid impacts from PEVs, EPRI studied three patterns of residential EV charging: uncontrolled, set-time controlled, and managed off-peak controlled. Figure 26 illustrates potential U.S. EV charging load in 2030 under the medium adoption

[40] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, p 5-1

scenario shown in Figure 26 for each of the three charging patterns. Note that if all PEVs used set-time control, the charging load would most likely create an additional system peak at the designated set time (in this example, start at 9 PM). Uncontrolled charging would most likely cause an increase in the overall system peak. However, managed off-peak charging would shift PEV charging load into off-peak hours.[41]

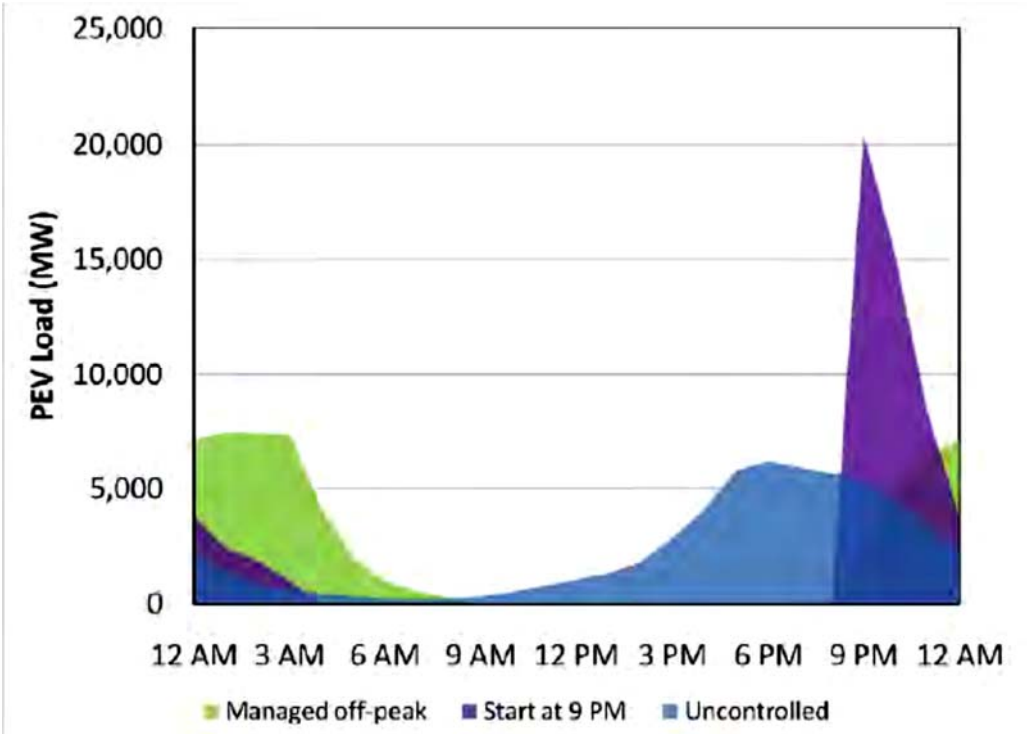


Figure 26 - PEV charging load in 2030, medium adoption scenario. Source: EPRI report titled "Transportation Electrification, A Technology Overview"

To further understand PEV charging impacts, EPRI conducted a System Impacts Assessment, designed to capture potential near term distribution system impacts in response to consumer adoption of PEVs. EPRI used a three-stage methodology, shown in Figure 27, consisting of the following types of analysis:

Asset Deterministic Analysis – Examined the ability of each asset to safely supply the worst-case projected load base. Existing capacity and number of customers serviced is determined using the circuit model and compared with the projected PEV load derived from probabilistic evaluations of PEV projections.

System Level Deterministic Analysis – This provides qualitative sensitivity information on system wide behaviour to worst-case charging conditions at various penetration levels.

[41] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, p 5-5

Additionally, the analysis provides a quick evaluation of the boundaries for potential impacts to the system.

Stochastic Analysis – Evaluated both the system as well as PEV charging across not only the full calendar year but hundreds of different spatial and temporal variations. The results of this analysis provide insights into impact likelihood and severity as well as information concerning the conditions under which these particular impacts occurred.[42]

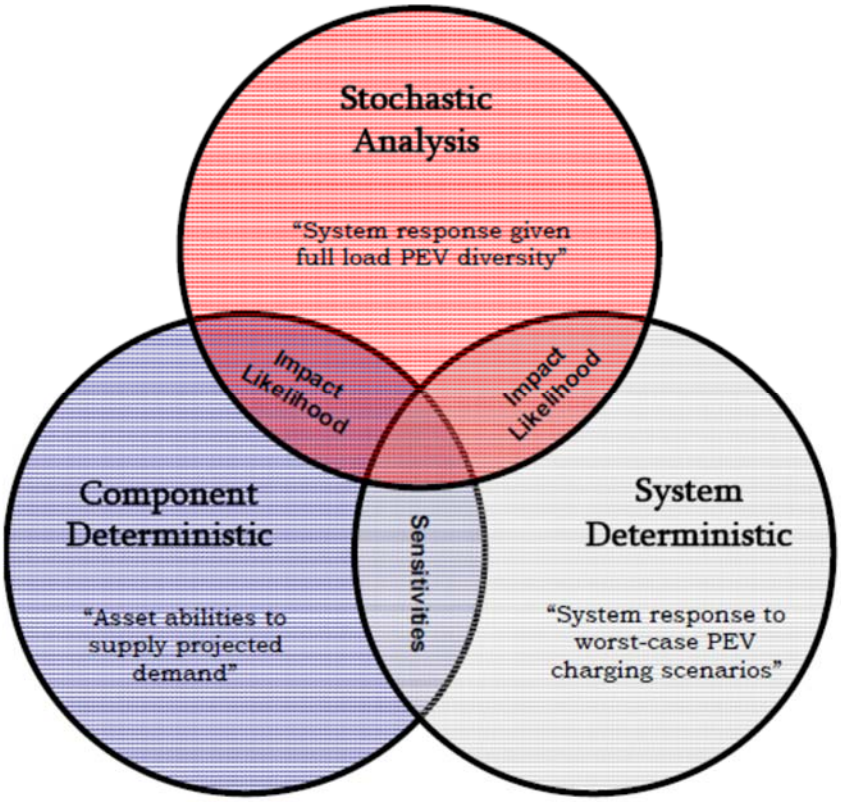


Figure 27 - PEV distribution impact evaluation methodology. Source: EPRI report titled "Transportation Electrification, A Technology Overview"

Deterministic and stochastic analyses of the potential load impacts on an actual distribution circuits are being conducted as part of a multi-utility project. The results to date, however, generally show the following:

- The extent of system impacts depends upon the PEV penetration and charge behaviors of PEV adopters.

[42] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, p 5-15

- Due to diversity, the expected aggregate addition to system peak loads is 700-1000 Watt per PEV in a given utility territory. Based on typically daily driving statistics, the average energy delivered to a vehicle during a charge is 5-8 kWh for a midsize sedan.

- Recognizing that all distribution circuits will not realize the same level of PEV adoption, the extent of system impacts depends upon the PEV penetration and charge behaviors of PEV adopters

- The short-term impacts for most utilities studied should be minimal and localized. There is a possibility, however, of isolated impacts on some distribution transformers and secondary drops, particularly in neighborhoods with older distribution systems including underground systems.

- By system design, per-capita load growth (PEV or otherwise) will first impact devices closest to the customer

- Components closer to the customer are the most likely to be impacted as they do not benefit as greatly from PEV load diversity

- Low capacity per customer ratios combined with low PEV load diversity (assets closer to the customer) are the most likely to be impacted as they do not benefit as greatly from PEV load diversity

- The remaining capacity per customer can be used as a means for evaluating possible risk of impact due to customer adoption of PEVs

- The assets near the load are most susceptible to PEV clusters as the potential benefit of spatial diversity decreases. Older distribution systems (including underground systems), initially designed for much lower per-customer load than its current operation, it is likely that the PEV impacts are more severe and impactful than to a relatively newer infrastructure.

- Based on system configuration and customer adoption, PEV clustering will occur randomly throughout the system. While PEV clustering may indicate an increased risk higher than average loading levels, PEV clustering alone does not signify the likelihood of negative impact occurrence as the other PEV load characteristics must also be taken into account

- Transformers characterized by low capacity per customer ratios are the most likely to be impacted by PEV adoption. Furthermore, transformers lower than 25 kVA nameplates are expected to be the most susceptible to becoming overloaded as these transformers typically have lower amounts of existing capacity which can be quickly consumed by one or more PEV.

- Likelihood of a given system component becoming overloaded is a function of the remaining capacity on the element and the number of customers served from the element that are potential charging locations for PEVs. The increased loading on the substation transformer tends to be tempered by the diversity in charging times for the many PEVs that are served across the entire feeder. Conversely, a single service transformer serving 5-10 customers may become overloaded with 1 or 2 higher charge current PEVs.

- Stochastic results show that the temporal and spatial diversity of PEVs charging on the system mitigates mass overloads of any particular asset class for penetration levels in the 2-8% range.

- Controlled charging can defer projected impacts due to load growth to later years, but care must be taken to ensure that the control strategy does not create secondary system peaks.[43]

Opportunities for managing grid impacts from PEV charging

With a wide ~~a~~ range of potential outcomes for PEV development, the possible courses of action a utility could take are also widely varied. Time-variant rates are one example of managed off-peak control that can be offered to customers to encourage PEV charging during the least expensive hours, typically overnight. Since the price of electricity generally follows available capacity, time variable rates can be especially effective for encouraging PEV charging when capacity is typically more than sufficient to meet increases in demand. Overnight PEV charging also supports use of renewable generation sources such as wind, which is typically more available during night time hours.

The Illinois Commerce Commission's "Initiative on Plug-In Electric Vehicles Rates Working Group Report" helps to narrow the possible outcomes by suggesting that key market players focus on "encouraging PEV owners to charge their vehicles primarily during off-peak hours – whether through time-variant supply service offerings, demand response, or other load management programs." The report specifically suggests that:

- Time-variant rates, whether provided by the utility or a RES, can provide PEV owners with the opportunity to save on their energy costs by moving vehicle charging and other electricity usage off peak, when electricity prices on such rates are typically lower.

- Moving the PEV charging load to off-peak hours could help defer the need to increase the capacity of electric distribution system assets, particularly in areas where several PEVs may be clustered on the same local distribution equipment.

[43] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, pp 5-32, 5-33

- Moving PEV charging off-peak could lower or mitigate the impact on the marginal cost of electricity for all consumers by achieving more efficient utilization of generating capacity.

- Through battery storage, off-peak PEV charging can help integrate energy from intermittent renewable resources (*e.g.*, nighttime wind) onto the electric grid.

How ComEd's AMI network enables these capabilities

ComEd has designed its AMI network to accommodate this wide range of possible capabilities, impacts, and timelines for PEV development, and to enable the suggested path forward for developing PEVs.

First, ComEd's AMI infrastructure enables the entire range of charging rates offered by suppliers that will facilitate PEV deployment. AMI meters that gather hourly data will allow suppliers to offer time-variant rates that are low during off-peak hours but are higher during on-peak hours. Suppliers will be able to offer such low price, off-peak charging rates to customers as soon as the customer receives and AMI meter.

Second, ComEd's AMI communications network enables the integration of smart EVSE (electric vehicle supply equipment, a.k.a. charging equipment), to perform functions such as the transmittal of pricing signals directly to the EVSE. Functionality such as this allows PEV owners to fully automate the management of their PEV charging based on a desired price point in a "set it and forget it" manner.

Third, the ability to associate AMI meters with distribution system assets, such as transformers, provides the ability to continuously track the loading of such assets by aggregating data from the associated AMI meters. This, in turn, enables real-time alarms and notification when the loading on such assets exceeds a pre-determined threshold, allowing the asset to be addressed proactively, before it fails. This capability will be especially beneficial for monitoring the load on transformers in residential areas with higher rates of PEV adoption, but is equally applicable to any type of load that a customer may add at his or her premises.

2. Distributed Generation (DG)

Potential abilities of DG

The MIT report titled "The Future of the Electric Grid" defines DG as "relatively small-scale generators that produce several kilowatts (kW) to tens of megawatts (MW) of power and are generally connected to the grid at the distribution or substation levels." The report identifies a wide range of DG generation technologies, "including gas turbines, diesel engines, solar photovoltaics (PV), wind turbines, fuel cells, biomass, and small hydroelectric generators. Some DG units that use conventional fuel-burning engines are designed to operate as combined heat and power (CHP) systems that are capable of providing heat for buildings or industrial processes using the "waste" energy from electricity generation."

The potential benefits of DG are myriad, and are explained in detail in the MIT report (summarized in Figure 28).

Reliability and Security Benefits	Economic Benefits	Emission Benefits	Power Quality Benefits
• Increased security for critical loads • Relieved transmission and distribution congestion • Reduced impacts from physical or cyberattacks • Increased generation diversity	• Reduced costs associated with power losses • Deferred investments for generation, transmission, or distribution upgrades • Lower operating costs due to peak shaving • Reduced fuel costs due to increased overall efficiency • Reduced land use for generation	• Reduced line losses • Reduced pollutant emissions	• Voltage profile improvement • Reduced flicker • Reduced harmonic distortion

Source: U.S. Department of Energy, *The Potential Benefits of Distributed Generation and Rate-Related Issues that May Impede Their Expansion: A Study Pursuant to Section 1817 of the Energy Policy Act of 2005* (Washington, DC, 2007); and P. Chiradeja and R. Ramakumar, "An Approach to Quantify the Technical Benefits of Distributed Generation," *IEEE Transactions on Energy Conversion* 19, no. 4 (2004): 764–773.

Figure 28 - Theoretical Benefits of DG. Source: MIT study "The Future of the Electric Grid"

Many of the benefits in the above table will accrue directly to the consumer who owns/operates the DG source. For example, the consumer will get a reduced energy bill for any power supplied by their DG system. The consumer will also get a monetary benefit for any demand response service provided by the DG system or for any energy sold back to the grid.

Potential consequences of DG on the electric distribution system

While DG has the potential to bring a number of benefits to both consumers and the operators of the electric grid, it presents grid operators with a number of challenges. First and foremost, the variability of renewable resources creates a potential problem for voltage and frequency regulation when a large amount of DG is connected to the electric grid. In particular, solar PV resources have varied output, as demonstrated in Figure 29.

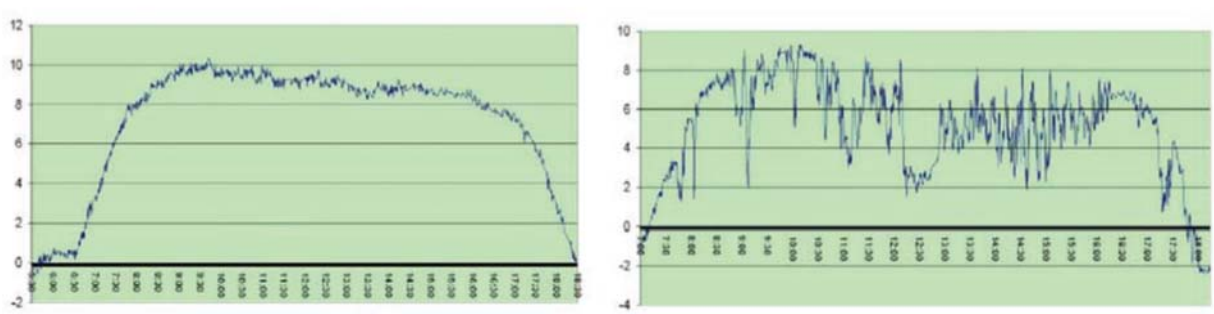


Figure 29 - Nevada Solar Photovoltaic (PV) Plant Output on a Sunny Day (Left) and a Partly Cloudy Day (Right) in 2008. Source: MIT study "The Future of the Electric Grid"

The variability of DG resources can have a particularly adverse effect on grid voltage and frequency stability when significant amounts of DG capacity are added in geographically concentrated areas. When large DG applications are connected to an already at-capacity substation, the variability issue can lead to significant reliability concerns.

Uncertainties surrounding DG development

Furthermore, DG cost-competitiveness – and thus likelihood of its proliferation – faces a number of significant uncertainties. Currently, a number of state and Federal tax incentives help make DG costs affordable to customers. The future of the Federal incentives remains very uncertain, which could contribute to a significant increase in installed costs for DG units. On the other hand, DG manufacturers are improving manufacturing efficiency in a consistent manner, which eventually could lead to DG proving cost-effective when compared to large-scale utility generation (see projection in Figure 30).

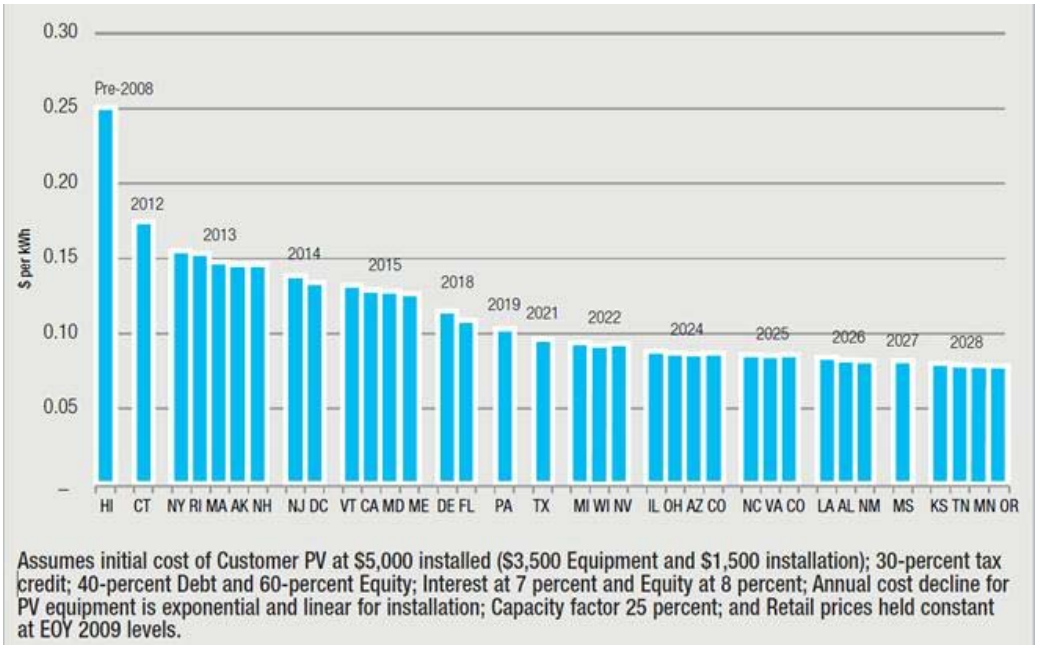


Figure 30 - Grid Parity of Solar PV Forecast by State. Source: Accenture

How ComEd's AMI network enables these capabilities

ComEd's AMI network will enable full integration of DG resources with the electric grid. First, ComEd's AMI meters will all be equipped with net metering capability. As a result, customers will benefit by receiving a bill credit for any energy of a DG system sold back to the grid.

Second, ComEd's AMI meters will enable dynamic rates that take advantage of DG systems by collecting hourly interval usage from the AMI meters to use in billing. As a result, customers with peak-coincident DG systems (such as solar) will be able to benefit significantly from dynamic rates offered by suppliers that charge high prices for usage during peak hours.

Third, ComEd's IT systems will be capable of communicating with DG systems through the AMI network infrastructure. This enables DG systems to provide frequency regulation and other ancillary services to the grid where possible, providing an additional financial benefit to consumers.

Finally, the AMI network can be used to remotely shut off output of DG when system conditions dictate the need to reduce system supply or when sections of the network need to be safely shut down for maintenance of the grid or emergency work.

3. Storage

Potential impacts of storage

Energy storage technologies hold significant promise for making electricity cheaper, more reliable, and more environmentally friendly for customers. That promise spans the electricity value chain, as can be seen in Figure 31. The Smart Grid and AMI networks in particular have the potential to facilitate growth in many of the applications for energy storage identified by EPRI.

Value Chain	Application		Description
Generation & System-Level Applications	1	Wholesale Energy Services	Utility-scale storage systems for bidding into energy, capacity and ancillary services markets[1]
	2	Renewables Integration	Utility-scale storage providing renewables time shifting, load and ancillary services for grid integration
	3	Stationary Storage for T&D Support	Systems for T&D system support, improving T&D system utilization factor, and T&D capital deferral
•	4	Transportable Storage for T&D Support	Transportable storage systems for T&D system support and T&D deferral at multiple sites as needed
	5	Distributed Energy Storage Systems	Centrally managed modular systems providing increased customer reliability, grid T&D support and potentially ancillary services
T&D System Applications	6	ESCO Aggregated Systems	Residential-customer-sited storage aggregated and centrally managed to provide distribution system benefits
	7	C&I Power Quality and Reliability	Systems to provide power quality and reliability to commercial and industrial customers
•	8	C&I Energy Management	Systems to reduce TOU energy charges and demand charges for C&I customers
	9	Home Energy Management	Systems to shift retail load to reduce TOU energy and demand charges
End-User Applications	10	Home Backup	Systems for backup power for home offices with high reliability value
T&D = Transmission and Distribution; C&I = Commercial and Industrial; ESCO = Energy Services Company; TOU = Time of Use			

Figure 31 - Energy Storage Value Chain. Source: EPRI, "Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits"

AMI networks can increase the value of energy storage applications for both utilities and for customers. On the distribution side, storage is capable of providing valuable ancillary services to keep the grid functioning efficiently and reliably. Especially as intermittent renewable resources become more prevalent, applications that can quickly store and discharge energy with minimal energy loss will prove more important for grid operators in keeping load and supply balanced. On the customer side, storage will provide an opportunity for customers to fully monetize the benefits of renewable DG systems by storing energy when the resource is available. And as a simultaneous benefit to the customer and the utility, distributed energy storage applications will provide a key demand response and frequency regulation resource that will improve system reliability and bring a monetary benefit to the consumer.

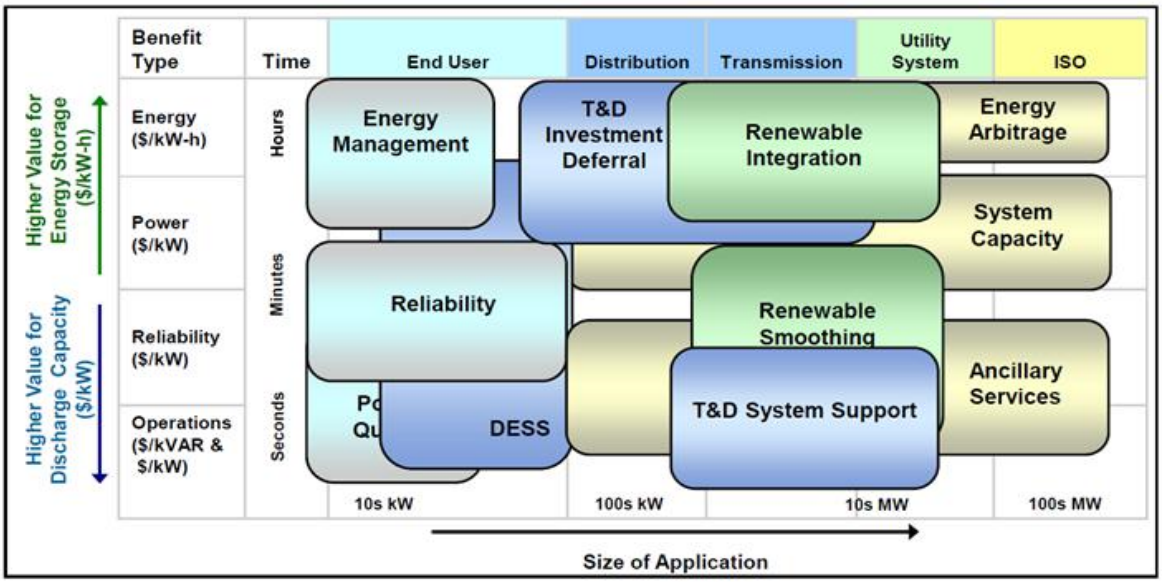


Figure 32 - Energy Storage Benefits Summary. Source: EPRI, "Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits"

The technology options available for energy storage are also very diverse, and have benefits for different applications (as summarized in Figure 32). That said, AMI networks are capable of integrating all types of storage applications.

Technology Option	Maturity	Capacity (kWh)	Power (kW)	Duration (hrs)	% Efficiency (total cycles)	Total Cost ($/kW)	Cost ($/kW-h)
Energy Storage for Distributed (DESS) Applications							
Advanced Lead-Acid	Demo-Commercial	100-250	25-50	2-5	85-90 (4500)	1600- 3725	400- 950
Zn/Br Flow	Demo	100	50	2	60 (>10000)	1450-3900	725-1950
Li-ion	Demo	25-50	25-50	1-4	80-93 (5000)	2800-5600	950-3600
Energy Storage for Residential Energy Management Applications*							
Lead-Acid	Demo-Commercial	10	5	2	85-90 (1500-5000)	4520-5600	2260
		20		4			1400
Zn/Br Flow	Demo	9-30	3-15	2-4	60-64 (>5000)	2000-6300	785- 1575
Li-ion	Demo	7-40	1-10	1-7	75-92 (5000)	1250-11,000	800-2250

1. Refer to the full EPRI report for important key assumptions and explanations behind these estimates. All systems are modular and can be configured in both smaller and larger sized not represented. Figures are estimated ranges for the total capital installed cost estimates of "current" systems based on 2010 inputs from vendors and system integrators. Included are the costs of power electronics if applicable, all costs for installation, step-up transformer, and grid interconnection to utility standards. Smart-grid communication and controls are also assumed to be included. For batteries, values are reported at rated conditions based on reported depth of discharge. Costs include process and project contingency depending on technical maturity. The cost in $/kW-h is calculated by dividing the total cost by the hours of storage duration.
2. For CAES and Pumped Hydro, larger and smaller systems are possible. For belowground CAES the heat rate may range from ~3845-3860 Btu/kWh and the energy ratio is 0.68-0.78; for aboveground CAES the heat rate is ~4000 Btu/kWh and the energy ratio is ~1.0.

Figure 33 - Energy Storage Characteristics by Application (Kilowatt-scale). Source: EPRI, "Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits"

How ComEd's AMI network enables these capabilities:

ComEd's AMI network enables energy storage applications through three key channels: net metering for distributed applications;~~,~~ measuring interval energy usage to enable dynamic rates;~~,~~ and through two-way communication and control of storage devices through the AMI network. All of the AMI meters will be net metering enabled, so in combination with a dynamic rate offered by a supplier, a customer could benefit by storing energy during off-peak periods and discharge energy during the more expensive peak period. The hourly intervals measured by the AMI meters will also be critical to enabling such dynamic rate offerings (as discussed earlier in this chapter). Finally, the two-way communications capabilities of the AMI network will enable DLC and other demand response or ancillary service~~s~~ programs that utilize energy storage applications.

C. Data Privacy

1. ComEd's Plan to Protect Customers' Data Privacy

ComEd is dedicated to maintaining the highest level of communications security to help ensure that customer-related energy data remains confidential and secure at all times.

As noted earlier, the AMI meters do not store or transmit any personal identification information about customers, do not identify electrical devices within a home, do not identify an occupant's specific behavior or activities, and do not determine physical locations of persons within a home. These AMI meters record only information about electricity usage at a premises – just as existing mechanical meters do; they are not surveillance devices.

ComEd will also permit consumers to consent to the disclosure of personal energy information to third parties through electronic, web-based, and other means in accordance with state and federal law and regulations regarding consumer privacy and protection of consumer data. Therefore, any applications discussed previously that will provide individual data to third parties, such as the "Green Button" web initiative, will require direct consent from the customer before any data is transmitted by ComEd to the third party.

In particular, the "Green Button" web initiative mentioned earlier in this chapter provides an example of how ComEd will provide for customer control of data regarding their electricity usage. On March 22, 2012, ComEd joined a number of other utilities across the US to announce their participation in the "Green Button" initiative, a voluntary effort by utilities to provide energy usage data to customers in a standard format to help them make informed decisions about how to reduce energy consumption and save money. "Green Button" is based on a consensus industry standard that was created through a public-private partnership with the Commerce Department's National Institute of Standards and Technology. [44] "Green Button" is expected to foster innovation by third-party apps developers and providers of energy management services. This will enable customers to take advantage of the following:

- customizing thermostats for savings and comfort;
- community and student energy efficiency competitions;
- improved decision-support tools to facilitate energy efficiency retrofits;
- measurement of structural energy efficiency investments; and
- optimizing the size of rooftop solar panels.

Customers can provide energy usage data to energy suppliers and other energy companies to participate in programs that can further reduce their energy costs. While the "Green Button" provides a standardized and easy manner for the customer of provide this data to third parties, these third parties aren't able to access this data without express permission from the customer.

The Illinois Consumer Fraud and Deceptive Business Practices Act requires that an electric service provider maintain customers' personal information "solely for the purpose of generating the bill for such services". This requirement will not change under ComEd's AMI

[44] http://www.whitehouse.gov/blog/2011/11/21/empowering-customers-green-button

plan. Furthermore, in accordance with relevant laws and regulations, ComEd will not disclose or sell any personally identifiable information about a customers' energy use without approval, except as required by regulatory agencies or governmental authorities. If ComEd is able to track vulnerable customers for the purpose of milestones and metrics set forth in this Plan, this data will remain confidential and secure at all times. ComEd will not disclose or sell any personal information about vulnerable customers, or their self-identified vulnerability, except as required by regulatory agencies or governmental authorities.

Additionally, ComEd will fully comply with the Illinois Personal Information Protection Act. This Act states that: "any data collector that owns or licenses personal information concerning an Illinois resident shall notify the resident at no charge that there has been a breach of the security of the system data following discovery or notification of the breach." ComEd will fully comply with this requirement by contacting all customers to inform them if there is a breach of data security

D. Plan to Enable Existing and Future Smart Grid Technologies and Applications that Deliver Value to Customers

ComEd believes it should emphasize the benefits and value customers receive from the AMI deployment. ComEd believes its position is to establish itself as a leader in setting the vision of an AMI-enabled customer and clearly articulate these messages to its customers. While ComEd's AMI system will enable all of the Smart Grid functionalities identified above, there are still many uncertainties about what level of additional action ComEd will need to take in the future to facilitate ~~yet~~-undeveloped, cost-effective technologies and applications. In order to enable these future applications once they become mature enough to deliver customer value, ComEd has developed a process for researching and tracking future customer-side Smart Grid applications in order to identify those in which ComEd should invest more heavily to provide additional functionalities directly to customers.

1. ComEd's Process for Enabling Future Smart Grid Applications

Specifically, ComEd has developed a three-stage process to identify, evaluate, and implement customer applications that will unlock key functionalities of the Smart Grid.

First, ComEd proposes to track the availability and demand for potential customer applications through customer-centric technology research. ComEd also proposes to conduct a detailed technology market assessment and technology provider analysis for the various customer-side technologies. This type of analysis is designed to help ComEd understand where potential customer applications fall on the maturity curve (see Figure 34). This knowledge will also enable the development of service offerings in a manner that is most beneficial to customers.

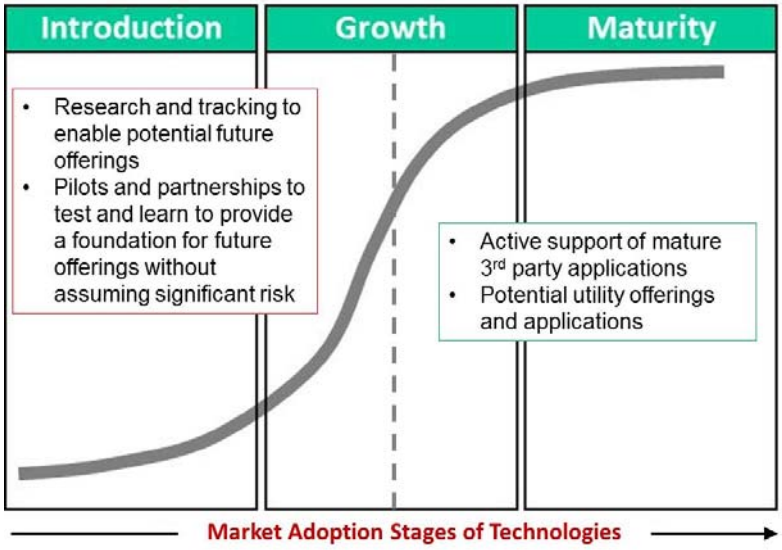


Figure 34 - Maturity Curve for Smart Grid Applications

This market assessment and research identifies technologies that demonstrate potential to unlock Smart Grid functionalities for customers and will allow ComEd to test Smart Grid applications through pilots to learn how to best enable them for the benefit of customers. In addition, ComEd proposes to develop a model to help systematically identify entities interested in testing and deploying AMI-enabled technologies in the introduction and growth phases. Furthermore, ComEd proposes to develop a roadmap to facilitate piloting a broad range of customer-side technologies, including: distributed renewable generation, battery storage technologies, plug-in electric vehicles, and HAN technologies.

Third, ComEd will facilitate future customer applications as they become required or prove to deliver value. The primary way that ComEd will accomplish this goal is working with third parties that want to leverage ComEd's AMI network to enable key Smart Grid functionalities for the benefit of ComEd's customers. ComEd's Test Bed will allow third parties to use ComEd's system to test programs, technologies, business models, and other Smart Grid-related activities, provided those third parties qualify to use the AMI system.

Furthermore, as discussed earlier in this chapter and in the previous chapter, ComEd has already begun to deploy a number of programs designed to deliver immediate value from its AMI system investment. For example, ComEd is enhancing a web portal that allows customers to view and manage their interval electricity usage, as well as view tips and tricks to help them set an energy reduction goal and save energy. In addition, ComEd is designing an opt-in, market-funded, Peak-Time Rebate (PTR) program (as explained in earlier in Chapter 3).

2. ComEd's Planned Activities to Facilitate Future Customer Applications

ComEd believes its role will vary by each product or service and be aligned to one of these five strategies:

- Enable – support third party development of new applications (products/services) that run on ComEd platform. Enable in a variety of ways – e.g. providing data, or technology (test bed)

- Partner – work with 3rd parties to demonstrate their products and services

- Facilitate – make it easy for customers to find and make use of third party products and services that are compatible with the ComEd AMI network. For example, we could adopt the approach used by SDG&E to provide a consumer's guide to in-home devices on the company's web site.

- Promote – actively market programs that are available in the market that can benefit ComEd customers

- Deliver – ComEd designs and deliver projects (i.e. PTS, demand response, energy efficiency)

In addition, ComEd intends to establish a "Co-Creation" process to engage customers and third parties in enablement of new products and services. In 2014 we intend to sponsor one or more design competitions for products and services that can help hard-to-reach customers access the value of the AMI network.

As stated previously, ComEd has committed to delivering a number of products and services in 2013 – 2014 that directly deliver value to customers derived from the AMI Implementation. ComEd is actively looking to expand the number of products and services offered in 2014. ComEd can help bring to the market either through partnerships, promotions, or direct delivery products and services that will have a meaningful impact across the various ComEd customer segments. ComEd is currently reviewing an initial set, developing project charters, identifying partnerships and establishing a 2014 release schedule for these products / services.

ComEd's current plan for enabling future customer applications includes the following:

Peak Time Rebate Program	Opt-in, market funded rebate for customers with AMI meters that reduce usage during peak events
Web Portal	Website that displays interval usage, energy saving tips and tricks, and comparison of energy usage to

	anonymous neighbors.
Smart Grid Test Bed	Platform for third parties to test applications over ComEd's AMI network
Smart Grid Technology Tracking	Track development of technologies capable of enable Smart Grid functionalities for consumers
Customer Research: Smart Grid Technology Value Proposition to Customers	Understand customer demands and value from developing technologies
Contracts with Vendors of Maturing Smart Grid Technology	Executed when technology that will deliver Smart Grid functionalities to customers is identified
Implementing New Programs to Facilitate Future Customer Applications	Executed when application/program that will deliver Smart Grid functionalities to customers is identified

Figure 35 - ComEd Planned Activities to Facilitate Smart Grid Functionalities

ComEd's approach to enabling future customer applications and technologies focuses on shifting the cost for developing these applications to the third-party vendors where possible. The Test Bed, for example, provides third-parties vendors with access to the AMI network, provided those third-party vendors qualify to use the Test Bed. The Test Bed is designed to let outside parties test new technologies and services that leverage the AMI network to deliver value to customers without cost to the customer for that development.

E. Milestones and Metrics

Many of the functionalities unlocked through ComEd's deployment of AMI will be available to the customer as soon as the AMI meter is installed at their premises and activated pursuant to the AMI deployment schedule described in Chapter 2. ComEd's AMI meters will unlock key functionalities as described earlier in this chapter, including:

- Suppliers' ability to offer dynamic rates and PEV charging rates
- Net metering for DG and storage
- Wireless communication from the AMI meter through the ZigBee® standard
- Interval data available for viewing and download on the web portal
- Ability to enroll in the PTR program
- Faster and simpler enrollment for the RRTP program

Therefore, the milestones for enabling these foundational capabilities will be realized immediately as AMI meters are deployed and activated pursuant to the AMI deployment schedule (see Figure 36).

Year	Meters Deployed	Operating Center(s)
Pilot	127,857	Maywood, Chicago North
2013	70,882	Maywood
2014	540,744	Maywood, Chicago South, Glenbard, Mount Prospect
2015	1,077,758	Maywood, Chicago South, Glenbard, Mount Prospect, Chicago North, Crestwood, Skokie, Rockford
2016	1,003,200	Chicago South, Mount Prospect, Chicago North, Crestwood, Skokie, Bolingbrook, Aurora, Libertyville, University Park, Elgin, Rockford
2017	830,000	Chicago North, Bolingbrook, Aurora, Libertyville, University Park, Elgin, Joliet, DeKalb, Crystal Lake, Dixon, Rockford
2018	506,559	Bolingbrook, Aurora, University Park, Joliet, Crystal Lake, Streator, Freeport, DeKalb, Dixon, Rockford
TOTAL	4,157,000	

Figure 36 - Meter Deployment Rollout

Key AMI Meter Deployment Milestones and Metrics (see Chapter 2 for full list)

- IT Release 1 scheduled for completion by the end of July 2012
- First AMI meter installed Q3 2013
- From approximately 71,000 to 930,000 meters installed each full year as per roll out schedule set forth in Figure 36.
- Last non-AMI electro-mechanical meter replaced with AMI meter in 2018
- IT Release 2 to support Full Deployment scheduled to start in August of 2013 and be completed by the end of 2016
- IT releases 3 through "n" to support Full Transformation to be completed by the end of 2016 (see **Error! Reference source not found.** in Chapter 2 for full details)

Key Research Milestones and Metrics

- Quarterly: Provide refresh of technology tracking outlook
- Quarterly: Update customer research to understand how preferences and demand for Smart Grid-related applications are developing

Key PTR Milestones and Metrics

- Key milestone: A proposed tariff will be filed with the ICC within 60 days of the ICC's approval of ComEd's AMI Plan
- Key milestone: Customers with installed and certified AMI meters will be eligible to enroll in PTR consistent with the PTR tariff when approved by the ICC
- Key milestone: The first PTR event is expected take place in the summer of 2015
- After the fourth year of the PTR program, ComEd will submit a report detailing:
    - Number of customers eligible for the PTR program
    - Number of customers enrolled in the PTR program
    - Average peak reduction for enrolled customers
    - Average rebate for enrolled customers
    - Total events called by year
    - Total program energy and bill savings by year

Key Web Portal Milestones and Metrics

- Customers will have access to a monthly usage web portal in 2012 and an interval usage web portal as soon as their AMI meter is installed and certified
- Customers will have access to "Green Button" functionality as soon as they have access to the web portal
- Key milestone: launch the following new web features by Q4 2014:
    - Launch new mobile-friendly version of Weekly Energy Breakdown emails
    - Fully integrate My Energy Tools into customers' ComEd.com accounts
    - Integrate My Energy Tools functionality into the ComEd mobile app and mobile site for smart phone access

- Launch Unusual Usage Alerts via SMS (text)

Metrics Related to "Vulnerable" Customers to Track Impact of Costs, AMI Deployment and Customer Benefits

The Commission's Order in Docket No. 12-0298 directed ComEd to discuss with stakeholders and Staff the methodology to define and identify "vulnerable" customers. ComEd met with numerous stakeholders in the second half of 2012 to exchange views on defining and identifying vulnerable customers. Consistent with the consensus reached with stakeholders in these meetings, vulnerable customers are defined, for purposes of this Plan, as customers belonging to the following customer groups:

(1) Low income

(2) Very young (from birth to age 5)

(3) Older individuals (age 65 and older)

(4) Those who have limited English proficiency or literacy

(5) Individuals with a functional disability, such as impaired mobility

(6) Persons who are socially isolated

Also consistent with the consensus reached with stakeholders in these meetings, metrics reported for each of the above-named subgroups will be conducted or presented individually for each of the six subgroups. ComEd will identify customers as belonging to each of the subgroups based on information available to ComEd from customer energy assistance programs. Information is not currently available for all subgroups, but ComEd will report data for the metrics identified herein based on data that is or becomes available and can be verified at the account level.

The Commission's Order in Docket No. 12-0298 also states that "[i]f further information is required to allow ComEd to track vulnerable populations and that information is not easily available (or only at significant cost) then ComEd should provide an explanation of the barriers to tracking vulnerable populations." ComEd interprets this directive to require such information to be included in this Plan. There remain significant barriers to tracking vulnerable populations. ComEd's customer files do not include income, age, disability, or other information placing customers into the subgroups used to define vulnerable customers. Such "vulnerability" indicators would be considered highly personal and private by customers. One method to attempt to compile this personal information would be surveys conducted among customers. Customers would have to identify themselves as "vulnerable" based on their responses to the questions. A census survey of all 3.4 million residential customers would likely be very costly. Further, ComEd assumes that stakeholders and the Commission would intend for responses to the survey to be voluntary, meaning customers would not be obligated to complete the survey. Thus, many customers will elect to not answer questions posed on behalf of ComEd that reveal personal information. Many customers may find certain questions of a personal nature to be

intrusive or offensive. Therefore, such a survey may be impractical as well as costly, and ComEd will continue to explore other more efficient and productive means of obtaining this data. These and other issues will need to be addressed in ongoing discussions with stakeholders and Staff.

For purposes of this Plan, ComEd will track the following metrics for all customers by customer class, by usage level for the residential, watt hour, and small load delivery service classes, and for the six vulnerable customer subgroups that are potentially identifiable through energy assistance programs. For purposes of this Plan, "low income customers" will be defined as those customers participating in the Low Income Home Energy Assistance Program (LIHEAP), the Residential Special Hardship Program, the CHA All Clear program, or the Percentage of Income Payment Program (PIPP). For purposes of this Plan, "customer class" will be defined as ComEd's 15 delivery classes as defined in its General Terms and Conditions (Sheets 135 -138).

- ComEd initially will report the following metrics on an annual basis:
    - Bill impacts associated with the costs for implementation of ComEd's Smart Grid Advanced Metering Infrastructure Deployment Plan for low, average, and higher usage level customers pursuant to approved rates and surcharges. The usage level calculations will be values for a "typical" customer at the 25th, 50th, and 75th percentile of total usage for each applicable delivery service class.
    - Number of customers that have created an account on ComEd.com – by usage levels, customer class, and low income customers. An account on ComEd.com is necessary for viewing the web portal.
    - Number of customers with ComEd.com accounts that have viewed the web portal – by usage levels, customer class, and low income customers.
    - Change in customers' energy consumption for customers that have viewed the web portal. ComEd will work with the web presentment vendor to define the business processes necessary to track an energy usage impact of accessing the web portal.
    - Number of customers enrolled in the Residential Real Time Pricing (RRTP) program (ComEd's hourly pricing program) by usage levels, customer class, and low income customers.
    - Number of customers enrolled in any future Time of Use (TOU) program that ComEd might offer by usage levels, customer class, and low income customers.
    - Number of customers enrolled in ComEd's Peak Time Rebate ("PTR") program by usage levels, customer class, and low income customers.

- Number of deposits required, disconnection notices, and disconnections for nonpayment for all customers and, if applicable, by low income customers. Other "key indicia associated with credit and collection activities targeted to low income customers" may be incorporated in the project plan's business process redesigns for future implementation.

Of course, these metrics are subject to further revision and refinement based on discussions with Staff and stakeholders regarding the tracking of "vulnerable" populations. ComEd plans to ensure that any data used to further identify accounts as belonging to the vulnerable customer groups will be accurate, sufficiently detailed, and maintained as customer confidential information.

Chapter 4: Customer Outreach and Education

A. Overview

ComEd's AMI deployment initiative, enabled by PA 07-0616, will impact the ~3.8 million customers served by ComEd for the next 10 years and beyond. As the AMI Deployment Plan investment begins in 2013, the objective of the education and outreach effort is to help customers capture value from the investment, enhance the customer experience by providing actionable information, easy access to information and simple enrollment in Residential Real Time Pricing (RRTP)[45] or Peak Time Rebate (PTR) programs, and proactively address negative experiences and perceptions.

The customer education and outreach plan has been developed to take customers through a journey that seeks to build awareness, strengthen understanding, promote engagement through participation, and encourage customers to advocate beneficial programs facilitated by the advanced meter technology such as RRTP and PTR. We recognize that not all customers will complete the entire journey, but we are committed to engaging as many customers as possible, and helping them move through the steps of the journey over the next ten years to facilitate the realization of customer benefits.

This education and outreach plan leverages customer research, best practices and lessons learned from previous implementations of advanced meter technology by the Pilot and by other utilities. The key audiences in this plan are residential and small business customers. We will utilize readily available data such as type of building and energy usage at the onset of our education and outreach program. As implementation progresses, audiences will be differentiated by demographics, geography and behavioral data, allowing us to test the effectiveness of both benefit messaging and marketing methods.

The education and outreach plan will use a targeted messaging strategy to deliver the messages that will most easily resonate with residential and small business customers, with initial message themes of control / empowerment, savings, reliability, service, and future preparedness for future technology enabled by smart meters.

Messages will be delivered via a staged messaging approach. Initial customer messages are intended to enhance comprehension of smart meters and explain the benefits of the pricing programs. Messages will also be tailored to audiences based on data and ethnic composition. Targeted messages delivered via strategies by audience with specific methods will support our efforts to move customers along their journey. The outreach and education will communicate to customers the benefits of the smart meters by signing up for pricing plans, such as residential real time pricing (RRTP) and Peak Time Rebate (PTR) or a pricing program developed by a RES, and how they can manage their energy with these programs and save money.

[45] The Residential Real-Time Pricing (RRTP) program is currently under review in Docket No. 11-0546 where the Illinois Commerce Commission is considering the modification or termination of the program

Leveraging other utilities' best practices, methods have been identified to support each of the strategies in this plan. Chapter 2 contains the anticipated smart meter deployment schedule by year and operating center. In addition, an extensive program of primary and secondary research will be employed to support planned initiatives, as well as to measure the overall success of the customer education and outreach initiatives.

This Plan reflects the acceleration of AMI meter deployment approved by the Commission in Docket Nos. 14-0212, 13-0285, 12-0298 (cons.). ComEd will continue, under this accelerated deployment schedule, to perform all planned customer education and outreach activities including providing all customers the staged-messaging AMI deployment materials prior to, during, and after installation of AMI meters. In addition, post-installation efforts and activities under this accelerated deployment schedule will continue to be utilized in the same manner to continue educating customers about tools and programs enabled by AMI meters and engage customers to take action to realize their benefits. ComEd will accelerate AMI customer outreach and education utilizing the same amount of resources to match accelerated deployment levels.

B. Background

As a result of PA 97-0616, AMI deployment is expected to impact virtually all ~3.8 million ComEd customers through meter upgrades, infrastructure upgrades in the community, system improvements and new information and programs. This section summarizes the key learnings from the Pilot and the information about other advanced meter deployments.

1. AMI Pilot Lessons

ComEd deployed "advanced meters" and an AMI Network for approximately 130,000 residential and non-residential customers as part of the Pilot from November 2009 through May 2011.

The meter installation communication protocol for the pilot included four steps: a pre-installation letter sent out three weeks prior to the week of installation, a pre-installation automated outbound call one week prior to installation, a personal notification immediately prior to meter exchange, and a door hanger after the installation of the advanced meter was completed explaining the benefits of advanced meters (or explaining why a new meter couldn't be installed).

Recommendations Based on Key Customer Communication Learnings from the AMI Pilot:

- Recommendation to continue the pre and post meter installation communication methods used, as customer satisfaction with the installation process was high at 90%.

- Reinforcement of the use of the door hanger even if the customer is home at the time of the installation.

- Revision to the treatment of multiple occupancy buildings to include leaving multiple door hangers at the main entrance.

- The web site, www.comed.com\smartmeter, was updated for usability and contained information including: the installation process, a pilot overview, FAQ, and how to read the new meters.

- Community advanced meter awareness and education events should take place prior to and during advanced meter deployment to raise awareness of the meter installations within communities

2. Information from Other U.S. Deployments

Many U.S. utilities have already embarked upon mass deployments of advanced meters in their service territories. A number of the utilities recognize the importance of communicating effectively with their customers about the benefits of AMI deployment. Each utility faces a different political and cultural environment, ComEd will consider the strategies and methods employed by other utilities to identify approaches to better educate and engage its customers.

As a result, interviews were conducted with subject matter experts in education and outreach at some of the larger utilities that deployed advanced meters (and grid modernization) in their service territory including CenterPoint Energy (CPE), Detroit Edison (DTE), Florida Power & Light (FPL), Oncor, Pacific Gas & Electric (PG&E), Portland General Electric (PGE), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E). ComEd obtained information about deployment messaging, general communication methods, meter installation communication methods, issue management methods, meter accuracy and high bill mitigation methods, media efforts and employee communication methods.

Deployment Messaging

- FPL's key messages focused on customer benefits, emphasizing reliability and control

- Oncor's messaging emphasized customer control; secondary messages revolved around environmental savings and energy efficiency

- SCE's messages that focused on cost savings resonated with customers

- SCE, Oncor and CPE provided messaging to target specific regions (e.g., demographic) of their service territory and / or segments

Communication Methods

- SDG&E developed a 90/60/30/7/0 day communications plan to educate each community prior to meter deployment.

  - At 90 days, SDG&E met with community leaders and influencers; at 60 days, they attended community events; at 30 days, direct mail was sent to citizens; at 7 days, outbound calls were made to residents

  - SDG&E also had an "in-field team" (made up of retirees) that went door to door after the meter installation to survey them about their experience and answer questions (e.g., energy efficiency).

- CPE's deployment communication methods included publishing a quarterly customer newsletter, website updates, automated emails to customers before meter installation, pre and post meter installation door hangers, and instructional videos and brochures.

  - CPE's installers took pictures of the final reading on a customer's old meter before exchanging it with a two-way communicating digital meter as part of their installation process.

  - CPE hosted online public chat forums for customers to ask questions regarding their deployment.

- FPL's post-installation communications demonstrated how to get value from its Energy Dashboard.

- SCE's communication material (e.g., notice letters, door hangers) had a 3-layered approach: two-second tagline, elevator pitch, detailed fact sheet. SCE also developed and offered a budget assistant tool to provide customers with energy use data, budget goals and alerts.

- PGE developed and used four separate door hangers during the installation process; "successful installation," "we missed you," "we've caused a problem on your property and will fix it," and "we need to talk to you."

Media Efforts

- SCE issued a press release to the local media shortly before deployment in every community that received the new meters.

- Oncor was able to better address customer concerns when they were more proactive with correcting and educating the media.

- SDG&E and CPE actively monitored traditional and social media sites for issues and addressed them directly as they arose.

- After re-vamping its communications strategy in 2010, PG&E started using several media outlets including broadcast, newspapers, social media and bus station kiosks for its "advanced meter" (and subsequently grid modernization) communications

C. Objective

The **objectives** of the Education and Outreach Plan are to:

- Provide customers with practical instruction, analysis, and information to enable and encourage customers to capture economic benefits as quickly as possible, especially to produce immediate bill savings to customers.

- Provide customers with the information that will help them capture value from the AMI deployment

- Enhance the customer experience by providing actionable information, easy access to information, and simple enrollment in pricing programs such as (PTR and RRTP)

To support these objectives ComEd will increase customers' awareness, acceptance and engagement in the AMI deployment initiative through education and outreach activities employing targeted messages throughout the implementation.

D. Strategy

To support the objectives stated earlier, several strategies will be utilized based on audience and the implementation cycle. Methods will be aligned with audience specific strategies. Strategies will drive the selection of which methods should be utilized, to which audience, and at what time based on the customers' knowledge of advanced meters.

1. Core Strategies

- Build awareness of the value and benefits of advanced meter deployment among customers.

- Inform about benefits of advanced meters and pricing programs (such as PTR and RRTP).

- Educate to ensure that customers understand how to manage energy from advanced meters.

    - Focus customer education on specific actions customers with AMI meters can take to realize economic benefits from AMI meters (e.g., how to use the meter's capabilities) and actions that customers without meters can take to offset their AMI-related charges while awaiting AMI meter installation. Customer education content will include specific information on how customer can use their AMI data to produce immediate bill savings.

- Increase engagement with planned implementation activities.

- Collaborate with community leaders to ensure customers are engaging in PTR and RRTP

2. Guiding Principles

The following guiding principles apply to residential and small business customers, and are based on what we have learned from our benchmarking and discussions with other utilities and independent parties.

- **Build Relationships to Facilitate Engagement** – Establish platforms for ongoing dialogue to ensure that customers are aware of the **AMI deployment.**

- **Gain Customer Acceptance** –Through collaborative work with stakeholders, improve customer utilization and acceptance.

- **Tap into the Power of Community** – Understand the power of human social networks. Personal learning comes through communication with friends, neighbors and coworkers.

- **Commit to Creating Mutually Beneficial Outcomes** – Build "what's in it for me" messages to ensure that we are focusing on customer's needs.

- **Demonstrate Responsiveness** – Be transparent through continual education and information provided to customers and communities.

- **Proactively and Responsibly Engage** –Provide information on potential issues that may arise and suggested responses to external facing teams, employees, community leaders and organizations.

- **Meet People Where They Are** – Don't wait for customers to connect, rather, take AMI deployment information to them to effortlessly take them on the journey leading to engagement and advocacy.

- **Be Open to Feedback and Continued Improvement –** Expect requests for communication and process improvements, and be flexible to accommodate continual change.

3. Customer Journey

	Uninformed	Aware	Informed	Educated	Engaged	Advocate
	IDLE	INQUISITIVE	LISTENING	ACCEPTING	ENJOYING	REVEALING
FEELINGS						
	Indifferent, I don't know what you're talking about	Uninterested, mildly curious, what is this again?	Interested, curious, I want to learn more about this	Accepting, excited, hmm this could really be beneficial	Enthusiastic, this really makes a difference for me	Love it! This is so great, you have to try it
ACTIONS						
	Passive, no action	Saw an ad or bill insert	Attended an event, looked for more info after seeing ad	Logged on to portal	Using PTR, web tools	Telling friends about it

A customer journey is an illustration of the steps customers experience in engaging with a company, whether it is a product, an experience, or a service. Sometimes customer journeys are "cradle to grave" looking at the entire arc of engagement. At other times, customer journeys are used to look at very specific customer-company interactions (for example, the purchase of an iPad™). We have developed a customer journey for ComEd's AMI deployment initiative. As advanced meters are deployed by city and neighborhood, ComEd will take customers through a journey that seeks to build awareness, strengthen understanding, engage through participation and collaborate with community leaders to ensure customers are engaging in mutually beneficial programs facilitated by advanced meters, like RRTP and –PTR, or other pricing programs delivered by a RES. Not every customer will complete the entire journey. In some cases simple neutrality or indifference will be as far as some customers are able to move. However, we would like as many customers as possible to move through most steps on the journey through participation in programs facilitated by advanced meters over ten years. The goal of the journey is to demonstrate value and enhance the customer experience. Through the journey, the customer will see the growth of local business and innovative new products and services such as new pricing programs.

4. Customer-Specific Strategies

- Utilize a phased communication approach so that customers receive relevant information when it counts; customers are most often responsive when they receive information that they can immediately act on.

- Incorporate customer behavioral and demographic data points to target messaging; not all customers have the same concerns about advanced meters.

- Foster customer goodwill through community outreach, environmental events, and partnering with trusted community groups.

- Set clear expectations about what customers can expect through a steady feed of relevant news and information.

- Leverage public influencers to deliver messages to constituents.

  - Partner with local community organizations and advocacy groups to communicate the grid modernization messages and to provide trusted third parties as additional voices. Work with the public influencers to educate customers on smart meters, pricing programs and tools to reduce energy use and cost

- Customize education to focus on key customer segments based on available demographic data.

  - Deliver low-income education and support programs to help seniors and economically disadvantaged understand how to manage energy effectively using smart meters and pricing programs (such as RRTP and PTR)

  - Because some customers may not have access to a computer and / or internet access, ComEd is exploring the ability to also facilitate information and data access through personal mobile devices, which may provide less expensive internet access for customers most in need of savings opportunities, by incorporating internet applications that accommodate use of smart phones or other mobile devices.

  - Further, for customers who may not have means to receive information through electronic channels, ComEd will facilitate information and data access through face to face communications. That will be done with the Speakers Bureau, teacher partnerships, small business neighborhood canvases, and outreach through faith-based and environmental non-profits. Each of these programs is described in more detail below in section I(6).

  - Make sure that education regarding cost savings under AMI is reaching all customers including low-income customers participating in PIPP, LIHEAP or a DPA. Include education around PTR, RRTP and web tools. If a TOU rate becomes available in the future, ComEd will also include that tariff in its education efforts. How ComEd will educate customers is detailed below in subsection F under the marketing campaign for low income and senior customers. How ComEd will measure the effectiveness of these education efforts is described in subsection J.

- Utilize traditional (out-of-door, print and online media, public relations), non-traditional (grassroots, community events, social media) and one-to-one channels (direct mail and email) to reach customers throughout the communication cycle.

The communication wheel below illustrates the core strategies and how they will be implemented at each stage of deployment. As this plan is further developed, additional sections will be added to the wheel to illustrate how each component of the plan ties together.

E. <u>Audiences</u>

The objective of the customer education and outreach plan will be realized through strategies tied to specific residential and small business audiences. The audiences will be approached based on their current state of understanding, their interest in further education, and their receptivity to engage and realize the benefits of advanced meters. This section will describe

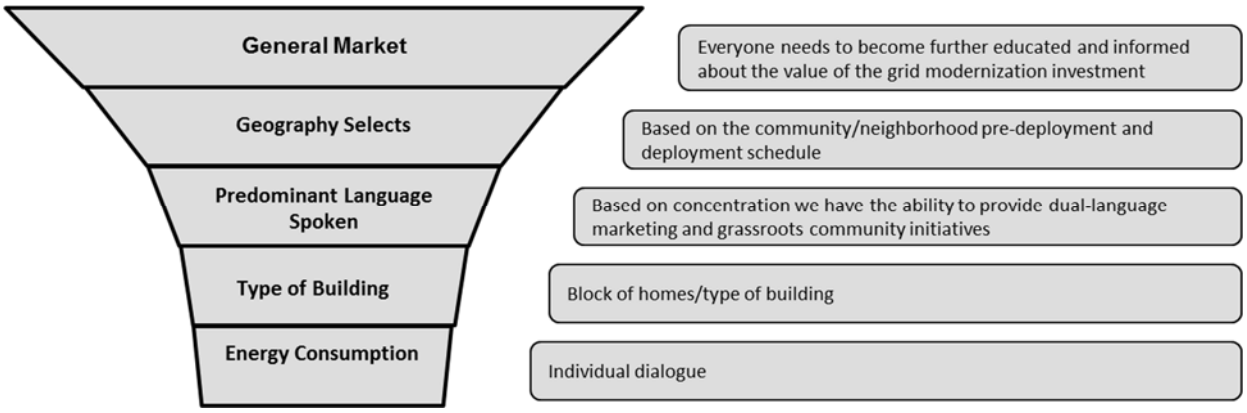
how ComEd plans to utilize the current data available on our customers, and the behavioral data that will be available in the future, to target outreach and education efforts.

Audience Approach

The customer journey overlaps with the operational and implementation activities that customers will experience. Regardless of who the customer is, where they live and how they consume energy, they need to hear the same basic, informational messages at the beginning of the program touching their community.

ComEd will differentiate the audiences based on geographic and demographic data. ComEd will test the effectiveness of utilizing various data or different segments to target communications at each phase of the customer's journey. What works in traditional energy efficiency education and outreach may not be as effective with this plan due to the diversity of the customer base and the complexity of tailoring messaging to different customer segments. In addition, ComEd will consider the fact that all customers will eventually have an advanced digital meter and many will experience a lag time between messaging and meter deployment over a 7-year deployment schedule.

The approach that will be used to define audiences and link the tactical marketing plan can be visualized as a funnel and supported by the readily available internal data. The graphic shown below is for illustrative purposes only, and suggests a way available data will be used to target communications.



Readily Available Data for Initial Audience Segments

The table below provides a partial listing of readily available data that can be captured from internal database systems and then overlaid with geographic information in the advanced meter deployment plan. This data will allow for a deeper understanding of customers' experiences with ComEd, particularly with energy usage, bill payment and power outage experiences. The following information will likely be used for the initial audience segmentation for both residential and business customers.

Data from Internal Systems	
Residential Customers	Business Customers
• **Address** • **Single Family / Multi-Family** • **kWh Usage**	• **Address** • **kWh Usage**

F. Low Income Customer Assistance Programs

The data and programs provided by AMI meters have the potential to change the way we relate with customers who are on the verge of disconnection by helping them reduce their energy consumption. However if customers find themselves experiencing a hardship, there are customer assistance programs for low-income customers for the primary purpose of avoiding imminent disconnection.

ComEd will provide $10M per year for five years pursuant to Section 16-108.5(b-10) to fund low income programs which are listed below. These programs will be designed to assist customers who are either in arrearages or who are about to be disconnected, as well as customers who have been disconnected. The allocation for the $10M for these programs in 2012 is expected to be as follows:

- $8M for Residential Special Hardship: This program will ~~Program will~~ provide relief to the customers who need it most, by assisting them to regaining the ability to manage their electricity bills successfully. Eligible[46] residential customers who are experiencing a hardship (senior hardship, job loss, medical issue, etc.) can receive a grant of up to $500 each. ComEd will educate customers about no-cost and low-cost ways they can decrease their future electric bills.

- $1M for Non-Profit Special Hardship: This program will focus on assisting non-profit organizations in need that provide basic life needs (senior centers, homeless shelters, Veteran organizations). A requirement to participate will include participating in energy management education.

- $0.5M for C.H.A.M.P. (ComEd Helps Active Military Personnel):~~;~~ This program serves our nation's active military, and veterans (including disabled veterans) experiencing a hardship. Grants up to $1000 and/or various other benefits (deposit refund, late payment charges waived, etc.). We will identify and partner with military organizations, such as the American Legion and Marine Corps League that have existing ~~touch~~ points of contact and utilize their communication channels to reach eligible customers. We will use a channel mix of marketing and communications to increase program awareness and enrollment. Methods will include: newsletter content, brochures, posters/counter cards,

[46] Customers eligible if income is at or below 250% of poverty level ($57,625 for family of four), and if they are not PIPP participants. LIHEAP customers are eligible for grants *after* LIHEAP funds have been applied.

fact sheets, email templates, talking points and events. These methods will also provide information about no-cost and low-cost ways to decrease future electric bills

- $0.25M for Educational Classes: ComEd will conduct first time homebuyer classes through the Chicago Urban League and LUCHA organizations. In addition, non-profit energy management education will be developed and implemented with CNT.

- $0.25M for Outreach and Marketing: Outreach will entail targeted participation with a variety of communities. This includes the following: participation in Energy Fairs with LIHEAP, participation in- local community events, Energy Fairs participation with local community agencies, partnerships or pilots with local housing authorities to target senior population on energy management. Specifically, ComEd will expand the outreach efforts to include the City of Chicago Department of Aging. For marketing, traditional communications methods to include: general and minority market radio, press conferences in key communities & news releases, face book & twitter, ComEd CARE website, a monthly fact sheet and a program fact sheet for community distribution in municipalities and with legislators.

In addition, the statutorily-authorized Percentage of Income Payment Plan ("PIPP") will be available to an estimated 260,000 of ComEd's low income customers.

- The PIPP is administered by the Department of Commerce and Economic Opportunity ("DCEO") who also administers the Low Income Home Energy Assistance Program ("LIHEAP").

- PIPP is designed to attempt to change and reward the good payment behavior of low-income customers with program participants paying no more than 6% of their income for home energy charges. Each customer can receive up to $1,800 in energy assistance benefits per year.

- DCEO subsidizes a participant's remaining service charges year-round with funding from State and Federal Appropriations. The State component is partially funded through the Supplemental Low-Income Energy Assistance Fund, a component of the ComEd customer charge.

- PIPP includes an Arrearage Reduction Program (ARP) component that rewards participants for regular, on-time bill payments – "arrearage forgiveness". This results in a 1/12 credit toward pre-program arrears for each on-time monthly payment up to $1,000 per year for each utility. ARP is limited to maximum funds available per utility. In addition, Section 16-108.5(b-10) funds will be used to assist customers in arrearages.

In order to proactively provide for the foreseeable effects on low-income customers from increased disconnections for nonpayment in an effective and focused manner, the following enhanced communication methods will be available for low income customers:

- **CARE** – ComEd will add reference to the availability of the customer assistance programs in existing outgoing collection activity communication channels. The enhanced communication will direct customers to ComEd.com/CARE or to call ComEd's CARE hotline at 888-806-2273:

- **Proactive Call** – ComEd will change the call message script on the existing proactive calls to state the availability of customer assistance programs, including LIHEAP, PIPP, and Residential Special Hardship.

- **Written Disconnection Notice** – While the current disconnection notice does mention the availability of Customer Assistance Programs, the reference to the programs will be modified to include the website and CARE hotline phone number to use to apply for the programs. Additionally, ComEd will improve the visibility of this language on the disconnection notice.

- **Field Notification Call** – ComEd will change the call message script on the field notification calls to identify the availability of customer assistance programs, including LIHEAP, PIPP, and Residential Special Hardship.

- **Municipal Notification** – ComEd will notify the City of Chicago and other municipalities of impending disconnections on a zip code (or comparable) basis after developing a business process to accomplish same, as permitted by customer information privacy constraints. ComEd is currently exploring its capability to report impending service disconnection information on a zip code by zip code basis. ComEd will solicit input from the City of Chicago and other municipalities on a new process to provide notice of disconnection of customers for nonpayment on a geographic basis for customers who have received an AMI meter, as permitted by customer information privacy constraints.

The company will take the following actions to enhance communication for situations where the customer contacts ComEd:

- **Phone Greeting:** The Call Center and Revenue Management will work together to determine how the IVR and CSR call scripts could be altered to better proactively provide customer assistance information over the phone to customers in credit distress, including communication regarding the availability of LIHEAP, PIPP, and Residential Special Hardship.

- **Web:** Customer Operations will change existing web messaging to better emphasize the availability of customer assistance programs, including PIPP, LIHEAP, and Residential Special Hardship.

ComEd will also coordinate with social service agencies, local governments and other sources of customer assistance via the following:

- ComEd Customer Assistance has engaged and will continue to engage the following organizations ~~in discussion to develop the~~to discuss the development of Customer Assistance Program guidelines (i.e., customer eligibility, program design, timing of program rollout, etc.):

    - DCEO
    - Housing Authorities (CHA, Aurora, Rockford, Metropolitan, Kankakee)
    - CNT Energy

Additionally, Customer Assistance has engaged and will continue to engage in the following outreach efforts in connection with the availability of assistance programs:

- ComEd held media awareness events in Chicago, Rockford and Will County

- In partnership with Ameren and DCEO, ComEd participated in the Housing Authority Conference held April 2012 for the purpose of providing Customer Assistance information

- ~~Program information~~ English/Spanish translation of program information has been shared with the Chicago Housing Authority for distribution to their residents

- ComEd will be hosting a senior night in Saratoga Towers (Kendall-Grundy) with participants receiving Customer Assistance Program information, energy efficiency information, and entertainment

- Customer Assistance, Marketing, Corporate and Communications are coordinating efforts to provide Customer Assistance program and energy efficiency information to seniors through the meals on wheels program throughout the territory (Dept. of Aging)

- LAA's will receive energy efficiency packets via a marketing drop shipment. Customers applying for Residential Special Hardship will be provided with a packet for their use.

- External Affairs will work with United Way to distribute information regarding the Non-Profit Special Hardship program.

- Coordinating a conference with St Vincent De Paul, Lake County LAA and Lake County Housing authority to align efforts to get information to customers seeking assistance.

- The Customer Assistance team participated in the Welcome Home Celebration for Military Veterans in May. CHAMP information was distributed along with giveaways for military families

The marketing plan for low income and senior populations will also include energy management to help customers manage and reduce their energy usage.

- As part of the promotion on CARE, ComEd will educate low income customers on energy management providing customers with information to help them lower their future energy bills. Energy efficiency tips will be included on all CARE collateral, such as brochures and flyers, and at events where CARE is promoted.

- Energy efficiency tips will focus on low-cost and no-cost ideas that can help low income customers save money immediately.

- Build energy efficiency knowledge among existing low-income advocates and organizations (such as LIHEAP and CIDA offices) so they can help communicate energy management information to their constituents.

- Host speakers bureau events for low-income customers via low-income advocates and organizations offering in-person education about energy efficiency.

- Messages will be used as a supplement to primary messaging about CARE assistance in paying electric bills. Messaging will focus on no-cost and low-cost energy-saving tips and will include:

    - In addition to the financial assistance programs ComEd offers, here are some small changes you can make to have a noticeable impact on your energy bill.

        - Adjust your refrigerator settings

        - Keep your refrigerator's coils clean

        - Use a power strip to power off unused electronics

        - Use window shades

        - Turn off lights when you leave a room

        - You've got the power to save.

        - For more no-cost and low-cost energy-saving tips, visit ComEd.com/Tips

The table below outlines some methods and tactics to be used for low income audiences:

Tactic	Strategies	Description	Audience(s)
Enhanced Speakers Bureau	▪ Use CARE channels ▪ Promote directly ▪ Build knowledge among advocates	▪ Partner w/LIHEAP and CEDA offices to host Speakers Bureau presentations to low income customers ▪ Partner w/Housing Authorities to host Speakers Bureau presentations	▪ Supporting orgs ▪ Customers
Brochures	▪ Use CARE channels	▪ Distribute EE brochures (leave behind packets) to all LIHEAP and CEDA offices (quantity-31,700) – complete ▪ Distribute CARE brochure w/EE tips through Meals on Wheels program	▪ Supporting orgs ▪ Customers
Workshop/ webinar	▪ Build knowledge among advocates	▪ Develop workshop/webinar presentation on energy management for Non-profit Assistance program (required attendance for grant recipients) ▪ Attend LIHEAP conference (end of June), partake in panel discussion on energy management	▪ Non-profit orgs ▪ LAAs
Newsletter Templates	▪ Use CARE channels	▪ Short template that can be sent by supporting organizations	▪ Supporting orgs ▪ Housing Authorities
Events	▪ Use CARE channels	▪ Small number of select events to generate general awareness	▪ Customers

The following table provides additional details for Speakers Bureau for low income customers:

Audience	Description	Message(s)
LIHEAP/CEDA offices	▪ Hold energy management sessions for LAAs to educate them and arm them with information to share with customers ▪ Partner w/LIHEAP and CEDA offices to host Speakers Bureau presentations to low income customers ▪ Attend LIHEAP conference (end of June), partake in panel discussion on energy management	▪ Low cost/no cost tips ▪ CARE programs
Housing Authorities	▪ Partner w/Housing Authorities to host Speakers Bureau presentations	▪ Low cost/no cost tips ▪ CARE programs
CNT	▪ Develop workshop/webinar presentation on energy management for Non-profit Assistance program (required attendance for grant recipients)	▪ Low cost/no cost EE tips ▪ Encourage employee participation
Senior Centers	▪ Host Speakers Bureau presentations to senior citizens	▪ Low cost/no cost tips ▪ CARE programs
Faith-based Organizations	▪ Host Speakers Bureau presentations to low income customers	▪ Low cost/no cost tips ▪ CARE programs
Community Centers (i.e., Urban League, LUCHA, etc.)	▪ Host Speakers Bureau presentations to first-time homebuyers	▪ Low cost/no cost tips ▪ CARE programs ▪ Select Smart Ideas incentives

G. Vulnerable Populations

As noted in Chapter 3(E), the Commission's Order in Docket No. 12-0298 directed ComEd to discuss with stakeholders and Staff the methodology to define and identify "vulnerable" customers. As noted in Chapter 3(E), ComEd contacted stakeholders and Staff to

attempt to initiate discussions, but there was insufficient time to resolve the methodology to define and identify "vulnerable" customers by the filing of this modified Plan, and ComEd will work with stakeholders and Staff to include a proposal for the methodology to define and identify "vulnerable" customers in the first annual report to be submitted on April 1, 2013. For purposes of this modified Plan, ComEd will track its education metrics for low income customers as defined above in Chapter 3(E).

Subject to the barriers to tracking vulnerable populations discussed in Chapter 3(E), one approach to measuring the effectiveness of the education and outreach efforts is to conduct a tracking survey among customers (as described in detail in Section J). This survey would include demographic questions that would allow us to evaluate the response by various vulnerable populations such as seniors and low-income customers. ComEd commits to protecting consumer privacy regarding any responses to demographic questions and personnel information provided by the consumer. The survey might also ask about awareness of PTR, the use of web tools and RRTP.

H. Messaging

Messaging will be developed to support the objectives and strategies outlined earlier in this plan. One of the keys to success will be delivering the right message, to the right person, at the right time. Targeted messaging works since it does not overwhelm customers with irrelevant information, but only provides them with what they need to know at the time they need to take action. Messaging for the education and outreach plan will be targeted by audience, but will continue to include general information about advanced meters and their benefits throughout the initiative.

The messaging used for AMI deployment education and outreach initiatives will revolve around the functions and benefits of advanced meters. Themes will focus on how customers can derive value from the advanced meters; controlling costs, giving customers choices and control, and an enhanced customer experience.

There are several distinct ways that targeted, relevant messaging will be used:

- Messaging will be used to communicate the benefits of advanced meters, as a way to educate customers but also as a way to address potential negative perceptions/beliefs, ideally before they occur or become ingrained.

- Messaging will be used to communicate specific, factual information about AMI deployment details – for example, when a specific customer's meter is being installed.

- Messaging will be used to clearly articulate the tangible customer benefits and value derived from advanced meters, RRTP and PTR.

A key purpose of the messaging is to reiterate the benefits of AMI deployment which fall into several themes, developed using secondary research and prior ComEd market research:

- Control/Empowerment
- Savings
- Reliability
- Service
- Future Preparedness

Research is underway to understand which themes, and their associated benefits statements, resonate most with customers. The research will enable us to refine the content and tone of benefit statements. Both qualitative and quantitative customer research will be conducted in three phases.

- Phase I: In December 2011 initial research was conducted via the Customer Roundtable and an e-newsletter survey. This initial research was used to guide early education and awareness communication planning, offer support for rollout of smart meter research activities, and screen out those messages that do not resonate from further, more robust research activities planned in early 2012.

- Phase II: Leveraging the findings from Phase I, a series of focus groups was conducted among customers In March 2012. Initial findings are as follows:

    - Marketing by electricity suppliers, municipality's role in choice, and outages are top-of-mind issues in electric utility space. Grid modernization is not.

    - Customers know little about the smart grid and smart meters and do not envision spending much time to inform themselves, not surprising given electricity's low-involvement category. Customers may not learn much more unless impelled by self-interest or concerns.

    - Customers will not credit claims about grid modernization's prospective benefits. ComEd will have to earn trust by improving performance, as it did prior to launching the Recommitted campaign.

    - Unsure if the smart grid and smart meter would actually benefit them and skeptical of what their actual costs would be, customers want to know "what's in it for me." ComEd will need to improve comprehension by communicating benefits rationally, not emotionally.

    - Customers expect future communications to coordinate with ComEd's physical work of improving reliability. Informational graphics help customers visualize the grid modernization work.

  - Recommendation: Deliver a staged messaging approach. Offer customers messages that are rational and enhance comprehension while offering more aspirational messages to employees, legislators and community officials in the early years.

- A quantitative online study will be fielded that leverages the findings from the Phase II focus groups.

- Phase III: Awareness and education quantitative tracking research will be conducted to monitor customer awareness of AMI deployment work and assess the effectiveness of the information communicated to customers.

Over the 7-year course of the AMI deployment project, ComEd may continue to conduct research to refine messages and proof points, especially as new issues of importance emerge.

Current messages are under development and research review. Preliminary examples of messages that will be validated include:

- We're improving our customers' experience by giving them more information, more power to control their electric bills and more ways to save money.

- At ComEd, we are changing the way we operate in order to provide our customers with better service, more choices and greater control over the size of their electric bill.

- Two-way communication through smart meters will eventually mean customers won't have to call when they're without power, ComEd can restore power more quickly.

Proof points, Q&A and other information are under development and will also be validated by customer research. Preliminary examples of the information that will be used for customer education and outreach efforts are:

- What is a smart meter?

  - A smart meter is a digital electric meter that is equipped with wireless communication capabilities to allow customers to track their electricity consumption more frequently.

- How will this benefit customers?

  - With more timely information on electricity usage, customers can better manage their energy use to save money on their electric bills. Customers can take advantage of pricing plans that will include rebates to reward customers for reducing consumption during peak usage times.

- Are there other benefits?

- Eventually, smart meters will be able to immediately send a signal to ComEd when power in a home or business has been lost, enabling ComEd to respond to outages more quickly and efficiently.

- Smart meters will make it easier to incorporate renewable energy sources, such as wind and solar power.

- When is this happening?

  - The installation of smart meters ~~will begin~~began in 2015 with four million meters to be installed through 2021.

  - ComEd will provide customers and local municipalities with updates prior to any improvements taking place.

- I won't get a smart meter right away. How will I benefit?

  - All customers will immediately realize savings due to operational efficiencies and reduced cost. As customers receive smart meters, they will have the ability to monitor their electricity usage more frequently and enroll in new incentive programs. This new technology will help customers manage their electricity use better and reduce their monthly electric bills.

- Compared to analog meters, smart meters provide a wider range of benefits:

  - They reduce utility operating costs (e.g., manual meter reading, manual meter disconnections and reconnections, manual bill creation)

  - They help pinpoint outages and verify power restoration to allow faster outage restoration

  - They make move-in/move-out changes in service much faster and more efficient

  - They reduce unbilled electricity usage that occurs between tenants

  - They reduce electricity theft by identifying irregularities

  - They provide customers with hourly energy-usage data that can help them manage electric bills

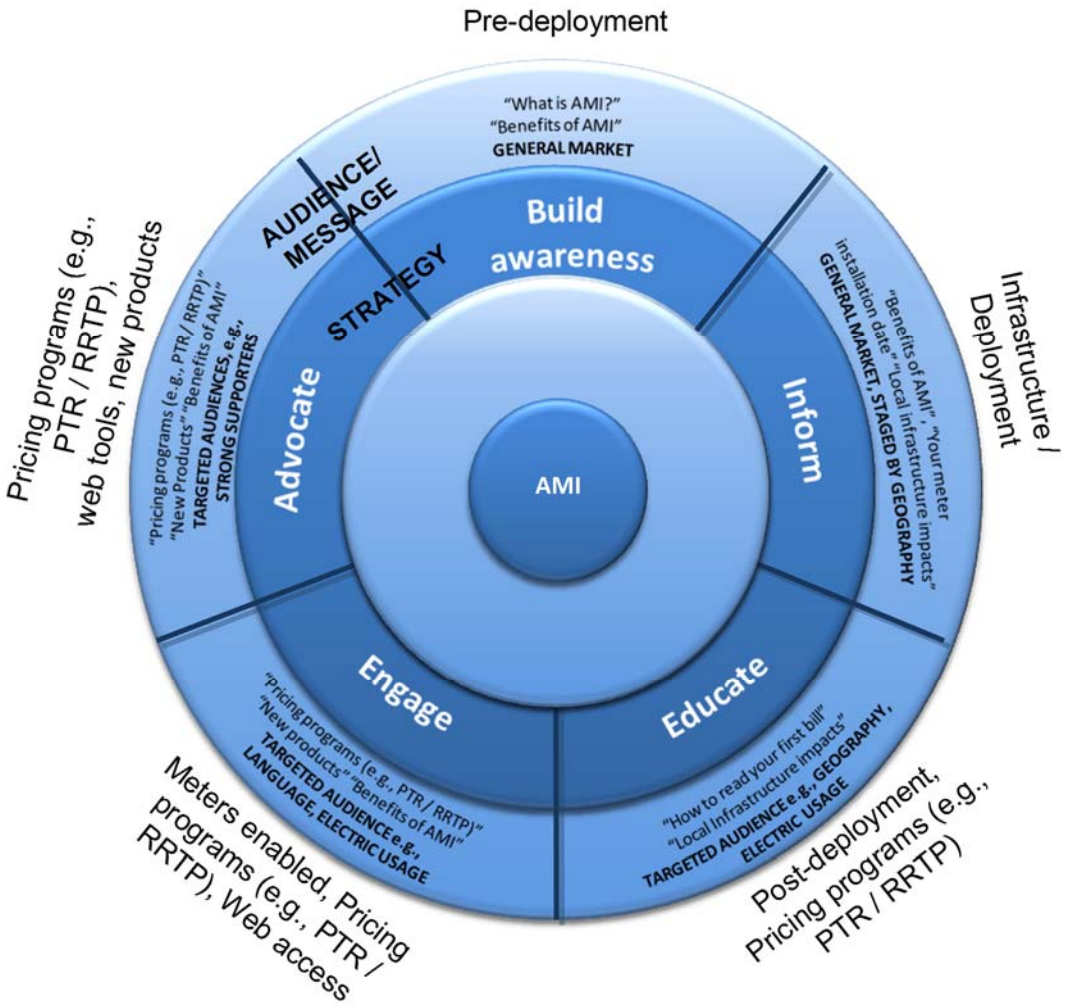
1. Staged Messaging Approach

Studies have shown that utilizing a "staged messaging approach" effectively addresses customer expectations during pre-deployment, deployment and post-deployment implementation phases. When the education and outreach campaigns focus on the "what, when and how" of the deployment and installation, implementation occurs with few issues. Staged messaging should

follow specific timed period outreach initiatives such as 90, 60, 30 and 7 days prior to deployment to educate and inform customers about specific activities they will experience, and reiterate initial or near-term benefits. Post installation, messages will be tailored for AMI customers to focus on pricing programs such as RRTP and PTR; others will receive general energy efficiency messaging.

The initial education and informational messages will lay the foundation for future dialogue about future benefits enabled by the technology. Promising too early or communicating misinformation can lead to lowering of expectations, and even lower future support and participation. For example, one of the first points of communication will include factual information about "what is an advanced meter", and how the systems work.

The communication wheel below has been enhanced to include audience and messages. The messages provide an illustration of "what" will be communicated at each stage.



I. Methods

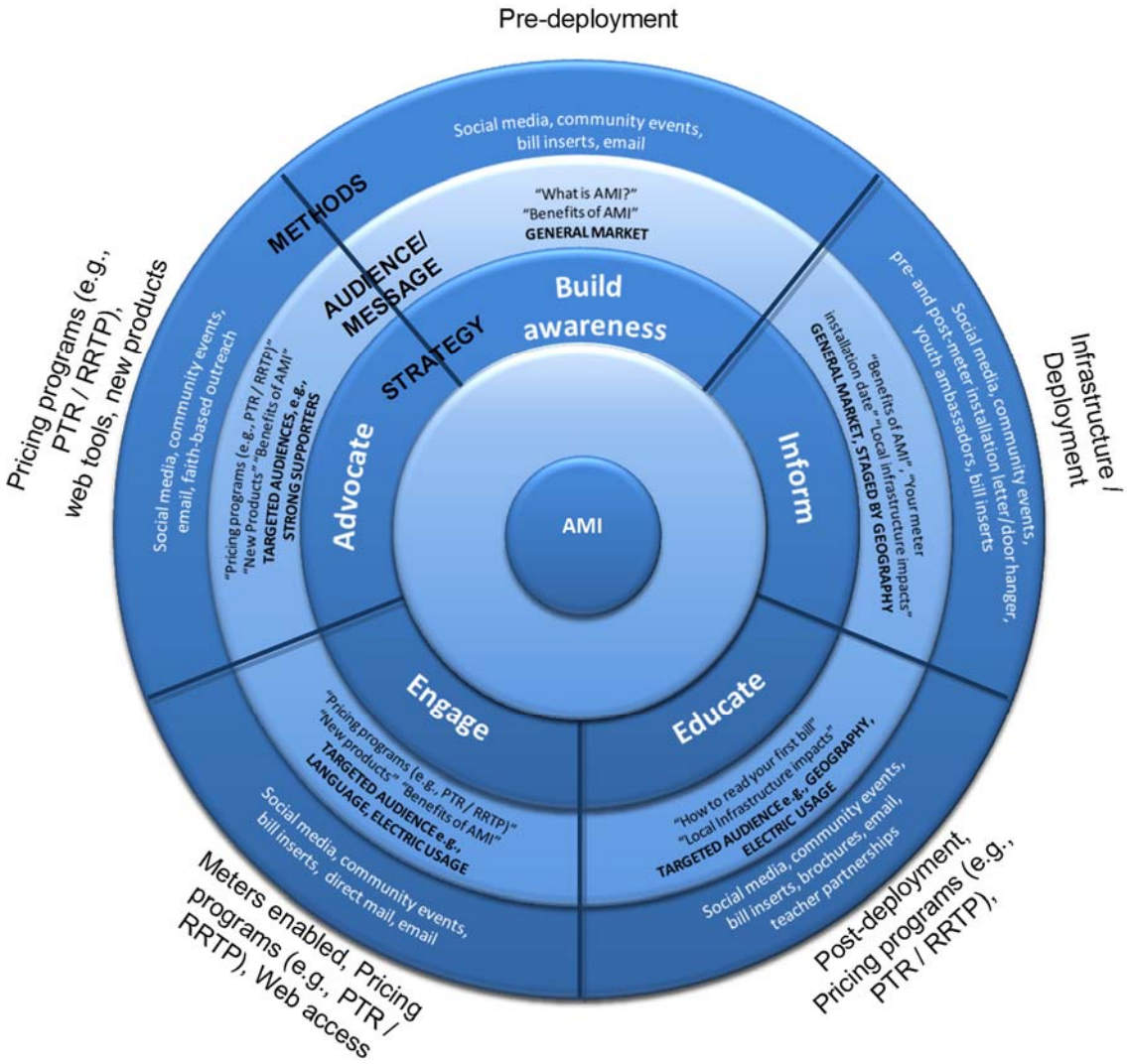
Using key lessons from the Pilot as well as best practices from other utilities, methods have been created to execute each core strategy as shown earlier in the plan. Messaging and audience segmentation will also be incorporated into these customer and small business methods.

ComEd will install advanced meters on homes and businesses throughout its entire service territory on a rolling geographic basis over a 7-year period. ComEd will also offer customers the opportunity to participate in ~~a~~ voluntary pricing programs (such as PTR and RRTP) and take advantage of energy management tools and services on a parallel rolling geographic basis.

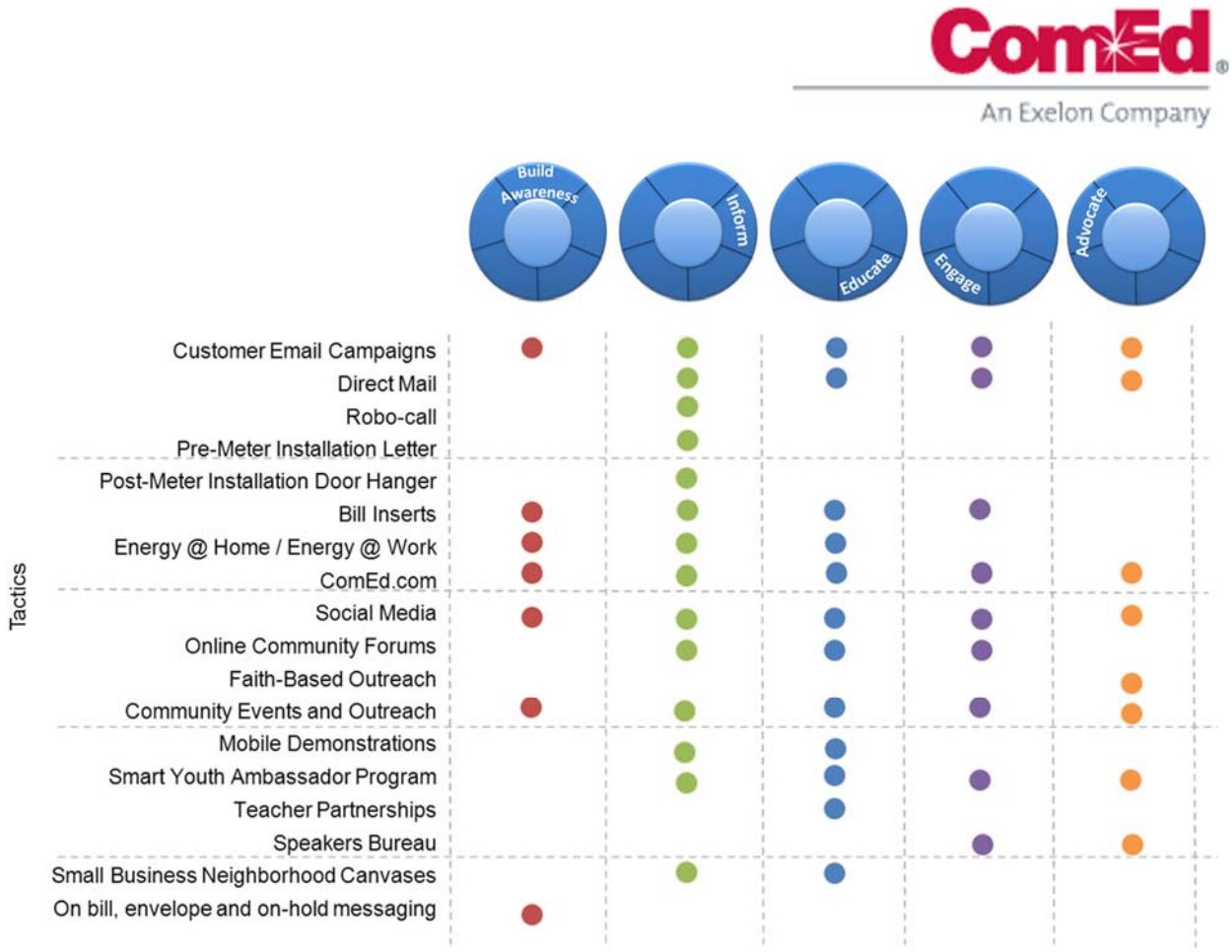
Given this geographic deployment plan, ComEd has the opportunity to tailor its messages about the meter exchange and the benefits of advanced meters, RRTP and PTR program participation to fit the unique characteristics of its customer base within defined geographic boundaries. Because deployment will occur over 7 years, there will be an opportunity to revise the methods and messaging based on experiences and results from the initial deployment. Details regarding timing of methods related to deployment and meter installation by geography is shown in the timeline section of this document.

This plan will be executed in a collaborative fashion with other internal ComEd departments as well as external vendors and partners.

The communication wheel shown earlier in this Chapter has been enhanced to include methods. The methods below provide an illustration of "how" messages will be communicated at each stage of deployment and to support each strategy. Messages shown will be modified based on research results and throughout the stages of deployment to avoid message fatigue. The methods shown in this communication wheel are illustrative (not comprehensive) of the methods that will be used at each stage.



A summary of methods by strategy is shown in the chart below, with details following.



1. <u>Build Awareness</u>

Building awareness is the first step in the education and outreach process. ComEd will promote AMI benefits and progress through paid and earned media.

Communication Topics and Targeting

Building awareness within ComEd's service territory will occur prior to meter deployment and before much infrastructure work has begun, so communication messages will cover general topics such as:

- Value of AMI meters
- What is an advanced meter?
- Benefits of AMI "what's in it for me?"
- How can I manage my energy information differently?
- Access to energy information and budget tools, including information specifically for customers without internet access

- Program progress/timeline
- Low-income customer assistance programs

Methods

Specific methods to support the Build Awareness strategy include:

- Customer email campaigns
- Direct mail
- Bill inserts, brochures, fact sheets
- Energy @ Home / Energy @ Work
- Updates on ComEd.com
- Social media including Facebook, Twitter, YouTube and blogs
- Community events and outreach
- No cost messaging including bill messaging, on-hold messaging and envelope messaging

2. <u>Inform</u>

This strategy involves informing customers about the benefits of AMI, RRTP and PTR. Informing customers will occur prior to and during meter deployment.

Communication Topics and Targeting

Customers within initial meter deployment areas may have already received specific information about grid modernization occurring in their area. Beyond those affected customers, the general market will also be informed about topics including:

- Benefits of AMI "what's in it for me?"
- Customer commitment details
- Program progress/timeline/milestones
- Your meter installation date is approaching – for customers in affected geographies
- Coming soon – the ability to manage electricity use more effectively using PTR and other pricing programs such as RRTP.

Methods

Specific methods to support the Inform strategy include:

- Customer email campaigns
- Pre-meter installation letter
- Post-meter installation door hanger
- Unable to Complete installation (UTC) door hanger
- Bill inserts, brochures, fact sheets
- Energy @ Home / Energy @ Work
- ComEd.com
- Social media
- Online community forums
- Community events and outreach
- Mobile demonstrations
- Smart Youth Ambassador Program
- Small business neighborhood canvasses

3. Educate

As customers become aware and informed about AMI deployment, they are more receptive to education about implementation plan activities and the benefits of advanced meters. At this stage, deployment has occurred and customers have received their new meters. Infrastructure improvements are underway as well, so customers are ready to start the education process.

Communication Topics and Targeting

Several communication topics will be covered to educate customers about AMI deployment and how it will benefit them:

- How to read your first bill – to customers on a rolling basis as their new meters are activated
- Get acquainted with your advanced meter

- Access your usage details online and via personal mobile devices as new meters are activated
- Local infrastructure impacts
- Benefits of AMI "what's in it for me?"
- Call to action: visit web to view data, analyze usage, and sign up for a voluntary pricing program (e.g., PTR or RRTP)

Messages about the bill and accessing usage data online will be targeted to specific geographies as the new meters are activated and as information becomes available. In addition, these messages and methods may be further customized by amount of electric usage or by type of home (single family or multi-family).

Methods

Specific methods to support the Educate strategy include:

- Customer email campaigns
- Direct mail
- Bill inserts, brochures, fact sheets
- Energy @ Home / Energy @ Work
- ComEd.com
- Social media
- Online community forums
- Community events and outreach
- Mobile demonstrations
- Smart Youth Ambassador Program
- Teacher partnerships
- Neighborhood canvases to small businesses

4. **Engage**

Engaging customers will occur as customers are continually exposed to advanced meter messages and improvements. This strategy focuses on how customers can use the advanced meters and become engaged through the tools facilitated by the advanced meter. At this stage, deployment has occurred and meters have been verified and are now fully functioning. PTR/RRTP and other web tools will be strongly promoted.

Communication Topics and Targeting

ComEd will strive to ensure all customers are informed about the new web tools and pricing programs, however not all customers will be able or willing to actually utilize every tool available. Methods and communications may be customized by language, electric usage, and type of home, and how customers will access the web tools (online or mobile). If additional behavioral data is available, this will also be used to further target customers most likely to be interested and receptive to engage in the new tools. Specific topics that will be communicated include:

- Benefits of PTR and RRTP
- How to view usage
- New innovative products and services
- Benefits of AMI "what's in it for me?"
- Program progress/timeline/milestones

Methods

Specific methods to support the Engage strategy include:

- Customer email campaigns
- Direct mail
- Bill inserts
- ComEd.com
- Social media
- Online community forums
- Community events and outreach

- Smart Youth Ambassador Program
- Speakers bureau

5. Advocate

Personal learning comes from communication with friends, family, neighbors and co-workers. ComEd will encourage customers who realize the value of new tools and programs to talk to others about becoming active users and strong supporters.

Communication Topics and Targeting

Customers will receive messaging promoting ComEd's pricing programs (PTR/RRTP), web tools and new products. Additional behavioral data, if available, will be used to further target customers and small businesses. Specific topics communicated will include:

- ComEd's customer ePortal
- Use of a Home Area Network (HAN)
- Use of energy management tools
- Use of ancillary or supplemental energy management tools via other retailers
- Savings earned through PTR and RRTP
- Benefits of AMI "what's in it for me?"
- Program progress/timeline/milestones

As customers learn more about these tools and benefits, they will become empowered and supportive and naturally advocate concerning the benefits of AMI.

Methods

Specific methods to support the Advocate strategy include:

- Customer email campaigns
- Bill inserts, brochures, fact sheets
- Direct mail
- ComEd.com
- Social media

- Community events and outreach
- Smart Youth Ambassador Program
- Speakers' bureau
- Outreach to faith-based organization and environmental non-profts

6. Additional Information about Methods

Some methods require additional detail and explanation, provided below.

ComEd.com

ComEd's website will be used as a repository of content related to the AMI deployment program as a supplement to the information being disseminated through other channels. This will include general advanced meter details and customer benefits, as well as deployment and infrastructure details. ComEd will provide information from the website, in the form of hyperlinks and documents, to customers and others who wish to have more information about the program. In addition, customers and others will be able to go to a specific page on ComEd's site to obtain information in the form of fact sheets, frequently asked questions ("FAQs"), testimonials, videos and more. Customers will also have access to the energy management tools via ComEd.com and via mobile applications.

Online Community Forums

Online Community Forums will be used as another channel to inform and educate customers about AMI meters. ComEd would seek out or create specific "online communities" of like-minded customers that have a particular interest in smart grid, advanced meters, energy efficiency or new technologies. ComEd could post content in these forums to help customers learn more in an interactive environment.

Influential Moms and Parents Online Forums

Moms today are on the cutting edge of technology and are constantly seeking new tools to help them carry out their duties more efficiently and effectively in the home. A 2010 Forbes study found that 61% of women influence household technology buying decisions, and that nearly half want more green choices. ComEd will develop content appropriate blogs to engage these groups and initiate conversations pertaining to AMI. Blogs may include Mom Central, a national social media and blog network that engages influential moms to become brand ambassadors and evangelists for leading products and services.

Environmental Nonprofit Groups

We will also look to establish a dialog with environmental non-profit groups such as National Resources Defense Council, Environmental Defense Fund and Global Green USA. We will also identify and engage in a conversation with local green community groups such as Illinois Solar Energy Association, and the Sierra Club. By harnessing their credibility and

influence, we will help advance the smart grid in Illinois by reaching consumers through authentic and trusted advocates for environmental issues.

Community Events and Outreach

Education and outreach will be performed at community events throughout the course of AMI deployment. These events include festivals, fairs, and other events. Multi-cultural outreach activities will also be included. We will be mindful of languages spoken in specific geographies where events will be attended, and tailor the event staff and collateral to these and other cultural nuances. Event staff will be equipped with toolkits including FAQs, fact sheets, talking points, etc. in order to effectively communicate with customers regarding the benefits of the new meters. Interactive devices, brochures and fact sheets will be available to facilitate customer engagement. As part of community outreach, faith-based organizations will be engaged to discuss AMI benefits among their congregations through one-on-one conversations, hosted coffee hours, and distribution of educational leave-behind displays. Additional details are in development.

The **Mobile Demonstration Units** and the **ComEd Classroom** will support the ComEd education outreach program by providing customers with a hands-on opportunity to learn more about the advanced meter capabilities and energy efficiency.

Games

By building the games in an iPad application, the units can be used in combination with a kiosk to allow for higher visibility and branding at large events or as standalone assets at small events. This strategy allows for an equally effective experience, whether the event is large or small.

~~Follows~~ Below is a description of two of the games to be deployed at events and can also ~~sit~~ be found on ComEd.com and ComEd's Facebook page. The **Smart Home** game will focus on smart meters and Energy Efficiency. With the installation of Smart Meters, customers will be able to see exactly how they are using energy and where there are potential savings opportunities. In the Smart Home demonstration, players will interact in a fun and engaging way. They will learn exactly how the AMI Meter benefits them and how they can reduce energy use to save money.

HOW IT WORKS:

- The game begins in a "house" where the Smart Meter has recently been installed.
- As the months/climates change, players must manage a number of factors to minimize energy use including heating/cooling costs, lighting, television and computer use, while balancing their family's happiness at the same time (i.e., temperature is comfortable, they can watch TV when they want to, etc.).

- In order to maintain the balance of energy efficiency and family happiness, players must constantly check their energy usage while monitoring their family's happiness meter shown within the game.

- By referring to the meter, players will be able to see which electronics draw the most energy and can then make the necessary decisions/adjustments to use less energy, including unplugging the vacuum while the blender is running or turning off lights, etc.

- The more the players reduce their energy consumption in the cold and hot weather months, the larger the rebate they will receive at the end of the game. This rebate will be exchanged for an increase in their point total.

- Players can also determine how much electricity each appliance/electronic item draws by scrolling over the star located at these locations. *Smart Ideas for Your Home* tips and facts will also pop up to guide players through the experience and help them make the best decisions.

- Once time expires, the player's score will be posted on the screen. The top five highest scores at the end of each event day will receive a premium prize. The collection of contact information at the beginning of the game allows for identification of the winner and easy delivery of the prize when applicable.

- To replicate the onsite event experience, customers are able to access the Smart Home game from the ComEd Facebook page

The **Energy Efficiency** game will focus on providing customers with an opportunity to test and add to their energy efficiency knowledge.

HOW IT WORKS:

- Customers will attempt to answer a series of trivia questions relating to energy efficiency. If they don't know the answer, they can click "Hint" to receive an info-morsel to help them answer the question correctly.

- Based on the number of questions answered correctly, customers will receive a "score" in the form of a name identifying their level of energy efficiency knowledge (i.e., "Congratulations! You are an energy expert!").

- To further their commitment, customers will then be encouraged to sign a pledge showing their dedication to becoming more energy efficient by incorporating ComEd's "nudges" into their everyday lives. This pledge, along with their level of energy efficiency knowledge, will be uploaded and shared via their Facebook wall.

- Once posted on Facebook, friends can also sign up to take the pledge agreeing to ComEd's "nudges" for becoming more energy efficient.

Classroom

A portion of the space will be allocated to the ComEd Classroom (for demonstration areas with sufficient space). Here, customers can learn and ask questions about smart meters from live ComEd experts. Customers will receive a premium (t-shirt, plugs for sockets, screen cleaner, seeds) for participation;

Signage, brochures and collateral (interchangeable given demographic) will supplement the experience and provide additional information

Social Media Integration

To drive traffic to ComEd's Facebook and website page, customers will have access to all mobile demonstration unit content and games online. This provides an added touch point and an opportunity to direct customers to additional online resources where they can learn more about smart meters.

All games will be highly integrated into social media platforms such as Facebook, with the ability to post game results, view leader boards and challenge friends to play.

To drive viral buzz and generate more awareness during the live events and beyond, prizes and sweepstakes will be integrated into each game.

Text-to-Talk

The Text-to-Talk display enables one-~~to~~on-one communication by providing customers without Internet access a platform to text in their questions, concerns and feedback about Grid Modernization and Smart Meters directly to a ComEd representative. While some customers are currently able to text in power outage reports, the Text-to-Talk program takes it one step further by encouraging two-way dialog.

Smart Youth Ambassador Program

As part of the Customer Education and Outreach Plan, ComEd will utilize a Smart Youth Ambassador Program to help turn ComEd customers into advocates. The ambassador program will consist of primarily high-school students who reside within ComEd's service territory. The goal of the program will be to educate customers on energy efficiency and smart meters and dispel myths and concerns customers may have, ultimately creating advocates for energy management.

This program will be executed in collaboration with Faith in Place, The Chicago Urban League and ComEd. It will support the Smart Meter rollout schedule as determined by ComEd.

- Seventy students ages 15-19 will work from four sites (three Faith in Place partner congregations and The Urban League) located throughout the ComEd service territory.

- Students will participate in predetermined ComEd events scheduled during the summer.

- A core group of 15 students will continue through the school year with Faith in Place, and will provide the core of the summer 2013 Smart Youth Ambassador program.

- The program will also include a career day at ComEd, in which the youth will be invited to consider the different career options open to them in the field of energy and energy conservation. Career Day may include all 70 youth on a single day or be divided into smaller groups on different days, based on the needs of ComEd to coordinate.

- Each summer student will receive a stipend of $800.

- Faith in Place will perform background checks on the students and supervisors.

- A photo authorization and a hold harmless agreement will be signed by each young person or their parent or guardian.

- On completion of the summer project, there will be a culminating celebration for all 70 youth at The Urban League.

Small Business Neighborhood Canvases

In addition to attending local events the local marketing teams will conduct Neighborhood Canvassing by delivering messaging and collateral to customers through local businesses where customers live.. These locations will include libraries, community centers, grocery stores and more. The neighborhood canvassing efforts also include creating partnerships with local restaurants to allow ComEd to include collateral on food packaging (ie. Pizza box). The collateral serves a dual purpose: 1. provides ComEd messaging about Smart Meters, and 2. Invites customers to a ComEd social at a local community center or church. As an added incentive for residents to attend the social and as a marketing opportunity for the local restaurant they will provide food for all to enjoy.

Teacher Partnerships

Through Teacher Partnerships, ComEd will educate students and teachers on advanced meters and PTR -and how they address our energy challenges. Using a list of teachers interested in energy efficiency (collected from past energy efficiency work), ComEd will distribute emails to teachers soliciting interest in advanced meters and PTR, offering ways they can get involved. Options for their involvement include classroom involvement, teacher education, environmental student club participation, and events at the school. Packets of information will be provided to interested teachers for them to use when creating curriculum and student activities.

Speakers Bureau

The Speakers Bureau program already in place will be used as a method to engage communities in ComEd AMI deployment. ComEd receives regular requests from external affairs and local communities and organizations to attend an event and provide a speaker. Events are generally well attended and serve as another opportunity to provide information about AMI

deployment. In addition, an enhanced Speaker's Bureau will target low-income customers through events hosted at low-income advocate organizations such as LIHEAP, offering them education on energy management tips and tools.

Faith-Based and Environmental Non-Profit Outreach

A key component of advocacy involves leveraging existing, influential non-virtual networks to share information among customers and discuss the benefits of ComEd's AMI and PTR programs. ComEd will provide these organizations with information such as fact sheets, talking points, research and testimonials about energy management and its benefits. Through this work, we hope to develop a network that becomes informed and tells others about the benefits of AMI deployment and its programs, products and services.

J. Metrics

ComEd will include metrics to measure the effectiveness of customer education and outreach. This will measure the use of community organizations, and awareness of AMI and customer engagement and experiences. ComEd's key metrics will measure the following:

- Awareness of AMI technology and benefits (Awareness and Education study).
- Understanding of AMI technology (Customer Experience/Engagement Research and Customer Experience Tracking).
- Number of community outreach events and number of attendees (Event Tracking)
- Number of articles that appear in local media (traditional media tracking)
- Number of articles in internal newsletter
- Number of meter installations complaints/claims (Rapid Response Situational Assessments)
- Number of installation appointments (tracked by AMI deployment team)
- Number of customer organizations contacted
- Number of customer communication methods deployed
- Number of advocates and ambassadors informed
- Number of surveys completed at events

These metrics are outlined in the following chart:

Metric Category	Key Metric	Calculation	Results Year Y	Comment
Awareness and Education	Awareness and understanding of AMI technology and benefits (survey metric)	3rd party survey	x%, verbatims, etc	
Customer Experience and Engagment	Understanding of AMI technology (Customer Experience/Engagement Research and Customer Experience Tracking).	3rd party survey	x%, verbatims, etc	
Community Outreach	# of community events and # of direct interactions	Event Tracking	Conducted XX, Interactions YY	
Local Media	# of articles that appear in local media	Traditional media tracking; articles that appear as a result of press releases	xx	
Internal Media	# of articles in internal newsletter	Count of articles in newsletter	xx	
Customer Experience and Engagment	Meter Installations complaints/claims (Rapid Response Situational Assessments)	Count of installation complaints	xx	
Customer Experience and Engagment	# installation appointments (tracked by AMI deployment team)	Count of installation appointments	xx	
Community Outreach	# of customer organizations contacted	Count of number of organizations	XX	
Community Outreach	# of customer communication methods deployed	Count of number of items	XX	
Awareness and Education	# of advocates and ambassadors informed	Count of number of ambassadors	XX	
Awareness and Education	# of surveys completed at events	Count of number of surveys completed	XX	

The measures listed above will be tracked through the metrics listed in the table below to account for the $27.7 million in customer education planning over the next ten years. The following table gives an example for year 2012.

Tactic	Target	Budget for 2012	Direct Interactions / Impressions^	Clicks	Organizations contacted	Premiums Given away	Articles internal newsletter	Enrollments	Surveys Collected	Emails Collected	Cost/per Interaction (CPI)
Energy management Education & Outreach events + interactive items	General Market (residential)	$337,500	xx	n/a	n/a	xx	n/a	n/a	xx	xx	
Speakers' Bureau	General Market (residential)	$5,000	xx	n/a	xx	n/a	n/a	n/a	xx	n/a	
Youth Ambassador program	Faith based organizations & End customers	$111,000	xx	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Faith Based and Low Income outreach	Faith based organizations & low income populations	$31,500	xx	n/a	xx	n/a	n/a	n/a	n/a	n/a	
Email Marketing	General Market (residential)	$8,500	xx	xx	n/a	n/a	n/a	n/a	xx	n/a	
Energy @ Home & Bill inserts	General Market (residential)	$145,000	xx	n/a	n/a	n/a	xx	n/a	n/a	n/a	
Direct Mail for PTR & web tools	General Market (residential)	$95,000	xx	xx	n/a	n/a	n/a	xx	n/a	n/a	
Videos & Brochures	General Market (residential)	$75,000	xx	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Online and Social Media outreach	General Market (residential)	$17,500	xx	xx	n/a	n/a	n/a	n/a	n/a	n/a	
Teacher Partnership	General Market (residential)	$20,000	xx	n/a	xx	n/a	n/a	n/a	n/a	n/a	
Municipal Toolkit & Experiential marketing materials	Municipalities, Legislators, Community Leaders	$106,500	xx	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Municipal Events Speakers Bureaus Townhalls	Municipalities, Legislators, Community Leaders and constituents	$61,000	xx	n/a	n/a	n/a	n/a	n/a	n/a	na	
Municipal online web	Municipalities, Legislators, Community Leaders and constituents	$0	n/a	xx	n/a	n/a	n/a	n/a	n/a	n/a	
Outreach materials/interactive items	Municipalities, Legislators, Community Leaders and constituents	$25,000	xx	n/a	n/a	xx	n/a	n/a	n/a	na	
Awareness tracking	Market research	$137,500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Customer Experience + Message testing	Market research	$200,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
FTE's (4 people)	Staff	$ 381,358	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
	Summary	$1,757,358									

The Messaging section outlines qualitative and quantitative customer research that launched in December 2011 and follow-on research that is planned to commence in early 2012 to test and refine the content and tone of messages and benefit statements to potentially communicate to customers. This research will be used to develop a preliminary set of benefit statements that resonate most favorably with customers, supporting ComEd's overarching objective stated earlier.

An extensive program of primary and secondary market research will be employed to assist ComEd's AMI deployment initiatives and to measure the success of customer education and outreach efforts. Prior to conducting each primary research project, a research plan will be prepared to include the following elements:

- Explanation of the need for the research
- Description of specific research objectives
- Description of the intended uses of research findings
- Discussion of the research methodology
- Examples of topics and questions to be included in questionnaires and discussion guides
- Project timeline
- Estimated budget requirements

An integrated set of research projects has been identified as necessary to support meter deployment and PTR initiatives (broadly characterized as the installation of advanced digital two-way communicating meters, and the offer of a peak time rebate pricing program). These projects are designed to:

- Measure and track the success of customer education and outreach efforts
- Better understand customers and their evolving needs and service expectations
- Assess customer interest in, and the viability of, the PTR pricing program and other services and tools enabled by the presence of an advanced digital meter

1. Secondary Research

Secondary research is often based on information from studies previously performed by government agencies, industry organizations, trade associations, and other organizations. U.S. Census Bureau information and studies made available by other energy companies are examples of secondary market research. Secondary research data are typically easy to find and either free or available at a relatively low cost. For the purposes of this Plan, past ComEd primary market research and actual ComEd data, such as from public events and sponsorships, will be classified as secondary research.

Several forms of secondary research will be employed to support the objectives of this Plan.

1. Traditional Media Tracking – Monitor traditional media channels to capture reactions and feedback from customers and external stakeholders on matters pertaining to reliability improvement initiatives, advanced digital meters, and the PTR pricing program.

2. Audience Reach and Frequency Tracking – Measure the number of customers exposed to information in the media about the AMI deployment initiative as well as the number of exposures from each major communications channel.

3. Social Media Tracking – Monitor social media channels to capture reactions and feedback from customers and external stakeholders on matters pertaining to reliability improvement initiatives, advanced digital meters, and the PTR pricing program and to engage customers to allay concerns, dispel misconceptions, and foster positive impressions.

4. Benchmarking / Best Practices Assessments – Canvas the education and outreach efforts undertaken by other energy companies to capture lessons learned and best practices.

5. Macro-Environmental Assessments – Track broad, environmental developments to understand impacts on customers and how those impacts could shape or affect our communications messages.

6. Rapid Response Situational Assessments – Monitor the number and intensity of rapid response situations and how and how well they are handled.

7. Events Tracking – Track the number and types of events sponsored by the company, the number of people attending each event, and feedback from attendees.

8. Existing Body of Research – Build upon existing and newly completed research, such as segmentation research and customer satisfaction research, to guide future research efforts and jumpstart message platform development.

2. Primary Research

Primary market research typically refers to custom quantitative and qualitative research methods.

Quantitative research methods involve large numbers of randomly-selected respondents and yield results that are representative of the total population under study. Data collection methods commonly include telephone-administered surveys, mail surveys, web-based surveys or some combination of these methods. By contrast, qualitative research methods involve a small number of respondents and yield results that are viewed as directional, not conclusive. Common methods include focus groups led by a trained moderator and in-depth one-on-one interviews conducted in person or by phone by a highly skilled professional interviewer. ComEd anticipates employing an integrated body of primary research to support the company's AMI deployment initiatives and to assess and measure the success of customer education and outreach efforts.

A number of prospective primary research projects are outlined below. Recognizing this early stage of developing a multi-year research program of work, a partial list of preliminary research objectives and intended uses of research findings are also listed. Importantly, for cost management purposes, it may be possible to group individual projects into a single research project.

1. Message Testing Research – Employ qualitative and quantitative research techniques to define and hone the content and tone of communications messages.

   Research Objectives:

   - To gather customer perceptions and reactions to the company's more recent advertising and marketing messages related to AMI deployment and smart grid
   - To assess the appeal of existing messages and themes, particularly with respect to dimensions of trust, believability and credibility
   - To explore customer reactions to message themes pertaining to AMI deployment
   - To test alternative benefit statements pertaining to AMI deployment and identify those that have the greatest appeal to customers
   - To hone the content and tone of messages and benefit statements to potentially communicate to customers
   - To test the appeal of advertisements and marketing communications materials
   - To refine the content of advertisements and marketing communications materials

   Intended Uses of Research Findings:

   - To develop a message platform compatible with a value proposition that appeals to customers
   - To help develop the key messages and benefit statements to communicate to customers on AMI deployment benefits of advanced digital meters, and the peak time rebate pricing program
   - To help shape the development of advertisements and marketing communications materials

2. Awareness / Education Tracking Research – Employ a tracking survey to monitor customer awareness of the company's main communications messages pertaining to AMI deployment and to assess the effectiveness of those communications in shaping attitudes and behaviors.

   Research Objectives:

- To measure customer awareness of the company's general AMI deployment plans, events and initiatives
- To measure customer awareness of the benefits of AMI
- To measure customer understanding and the appeal of AMI benefits
- To measure awareness of other messages and events that are not supported by ComEd
- To measure customers' attitudes and beliefs regarding AMI
- To measure customers' expressed intent to enroll in the PTR pricing program or to engage in other potential services enabled by advanced digital meters
- To measure the perceived value of the investment in AMI

Intended Uses of Research Findings:

- To uncover obstacles to the effectiveness of the company's communications to customers
- To track the effectiveness of the company's communications in breaking through to customers with respect to awareness and resonance
- To establish a basis for making mid-course adjustments in the messages communicated to customers

3. Customer Experience / Engagement Research – Employ qualitative research techniques to identify the optimal customer experience, such as dynamic pricing offer, as defined by customers, to incorporate into education and outreach activities.

   Research Objectives:

   - To identify the requirements for driving customer acceptance of the company's AMI deployment plans, particularly with respect to offering a PTR pricing program option
   - To assess customer receptivity to having a digital meter and taking advantage of the PTR pricing program
   - To understand customers' expectations, preferences and priorities around having a digital meter and participating in the PTR pricing program
   - To capture customers' anticipated and expected touch-points in the experience of having a digital meter and participating in the PTR pricing program

Intended Uses of Research Findings:

- To identify the most critical touch-points in the customer experience
- To define and map the experience most preferred by customers
- To help shape the company's processes and programs to deliver a positive customer experience

4. Customer Experience / Engagement Tracking Research – Employ quantitative research techniques to measure and track customer satisfaction with new customer experiences and to use the findings to help calibrate activities and ensure a positive customer experience.

   Research Objectives:

   - To measure satisfaction with the PTR pricing program, ranging from the initial program offer through program stages of program participation and engagement

   Intended Uses of Research Findings:

   - To monitor the company's performance in managing the PTR pricing program
   - To support any needed course corrections in the administration and implementation of the meter exchange process and the PTR pricing program

5. Motivational Research – Employ qualitative research techniques to identify underlying motivators for customers to engage in the PTR pricing program or any other service enabled by two-way communicating digital meters.

   Research Objectives:

   - To uncover customers' underlying motivations for enrolling in the PTR pricing program or taking advantage of other services enabled by advanced digital meters
   - To understand the benefits of PTR pricing as defined by customers
   - To understand customers' decision to enroll in the PTR pricing program relative to other options that could achieve customers' goals

   Intended Uses of Research Findings:

   - To support the development of a messaging strategy in support of the company's PTR pricing program
   - To help develop specific messages to communicate to prospective PTR pricing program customers that align with their needs

3. Data Collection Tool

ComEd will evaluate employing its Customer Roundtable as a vehicle for engaging customers in market research.

Customer Roundtable – Employ the existing Customer Roundtable program to enable a dedicated focus on topics pertaining to advanced digital meters, and the PTR pricing program and related information tools and services. Facilitated by an experienced moderator, the Customer Roundtable offers unique advantages:

- Provides a forum for a free, two-way exchange of information between customers and ComEd
- Enables the exploration of a myriad of topics of mutual interest to the company and participating Roundtable customers
- Provides an opportunity for ComEd executives and managers to hear first-hand customers' thoughts, opinions and reactions to topics pertaining to AMI
- Secures session-to-session progressive feedback from customers
- Allows probing on specific issues and, more importantly, allows ComEd managers to secure immediate, honest feedback on their answers to customers' questions
- Offers an opportunity to request participating customers to do "homework" prior to a session to jumpstart the discussion
- Focuses on solutions to problems and issues, going beyond probing

K. Timeline

The following section contains a timeline to deploy end customer and employee education and outreach methods through Q4 2015 of the AMI deployment program. The tasks within the timelines are segmented into months, with cells of varying colors. The color of each cell indicates the ComEd team responsible for executing each task. If a cell is white, that means the specific task has no activity for that month or that the month can be used as contingency.

Team Responsible	
Marketing	
Combined Effort	

		2012										
Audience/Activity		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
End Customers													
Traditional													
Customer Email Campaigns													
Direct Mail													
Robo-Call													
Pre-Meter Installation Letter													
Post-Meter Installation Door Hanger													
Welcome Letter & PTR Enrollment (pending research outcome and open enrollment date)													
Welcome Letter web tools only (pending research outcome and open enrollment date)													
Direct Mail - PTR Enrollment for Existing Smart Meters													
Robo Call - PTR Enrollment for Existing Smart Meters													
Bill Inserts													
Bill messaging													
Envelope messaging													
Energy @ Home / Energy @ Work													
On-Hold Messaging													
ComEd.com													
Non-Traditional													
Social Media													
Online Community Forums													
Faith-Based Outreach													
Outreach													
Community Events and Outreach													
Smart Youth Ambassador Program													
Teacher Partnerships													
Speakers Bureau													
Small Business Neighborhood Canvasses													
Research													
Value-focused quantitative research													
Exploratory qualitative message testing research													
Exploratory qualitative/quanitative Small Business research													
Awareness tracking													

Figure 37 - 2012 End Customer Methods Timeline

Team Responsible	
Marketing	
Combined Effort	

		2013											
Audience/Activity		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
End Customers													
Traditional													
Customer Email Campaigns													
Direct Mail													
Robo-Call													
Pre-Meter Installation Letter													
Post-Meter Installation Door Hanger													
Welcome Letter & PTR Enrollment (pending research outcome and open enrollment date)													
Welcome Letter web tools only (pending research outcome and open enrollment date)													
Direct Mail - PTR Enrollment for Existing Smart Meters													
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Research													
Value-focused quantitative research													
Exploratory qualitative message testing research													
Exploratory qualitative/quanitative Small Business research													
Awareness tracking													

Team Responsible	
Marketing	
Combined Effort	

							2014						
Audience/Activity		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
End Customers													
Traditional													
Customer Email Campaigns													
Direct Mail													
Robo-Call													
Pre-Meter Installation Letter													
Post-Meter Installation Door Hanger													
Welcome Letter & PTR Enrollment (pending research outcome and open enrollment date)													
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Exploratory qualitative/quanitative Small Business research													
Awareness tracking													

Team Responsible													
Marketing													
Combined Effort													
		2015											
Audience/Activity		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
End Customers													
Traditional													
Customer Email Campaigns													
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Online Community Forums													
Faith-Based Outreach													
Outreach													
Community Events and Outreach													
Smart Youth Ambassador Program													
Teacher Partnerships													
Speakers Bureau													
Small Business Neighborhood Canvasses													
Research													
Value-focused quantitative research													
Exploratory qualitative message testing research													
Exploratory qualitative/quanitative Small Business research													
Awareness tracking													

Figure 38 – 2013- 2015 Customer Methods Timeline

Smart Grid Advanced Metering Annual Implementation Progress Report

APPENDIX D – REVISED SMART GRID ADVANCED METERING INFRASTRUCTURE DEPLOYMENT PLAN – 2018 AIPR UPDATES

(Including Updates Per 2018 Annual Implementation Progress Report)

ComEd
An Exelon Company

Revised Smart Grid Advanced Metering Infrastructure Deployment Plan

(Including Updates Per 2018 Annual Implementation Progress Report)

Submitted by:
Commonwealth Edison Company

April 1, 2018

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Chapter 1: Scope Function, Goals, and Purpose

The decade ahead will be marked with significant change in all facets of the energy industry, and perhaps nowhere will these transformations be more impactful than to the electrical grid itself.[1]

The Energy Infrastructure Modernization Act ("EIMA")[2] provides the blueprint for Illinois electric utilities, working with the Illinois Commerce Commission ("ICC" or "Commission") and stakeholders, to accomplish this decade-long transformation. The EIMA establishes policies and goals, calls for utilities to make the investments necessary to achieve them, defines investment timetables and performance metrics to measure that achievement, and provides the means to fund those investments.

Foremost among the actions called for by the EIMA is the deployment of Smart Grid technologies. ComEd shares the view that these smart grid technologies hold great promise to benefit customers by promoting improved reliability, operational efficiency, and improved customer service, which will benefit all customers. AMI and the Smart Grid will also provide customers with newfound levels of control over their own energy use and, ultimately, lower total energy costs than they otherwise would have borne. Smart Grid technologies can also benefit the entire State by promoting greater energy efficiency, assisting the market by enabling other innovative technologies (such as electric vehicles), and assisting in job creation.

The successful and cost-beneficial deployment of Advanced Metering Infrastructure ("AMI") is essential to the development of a mature Smart Grid. Many Smart Grid functions[3] cannot be fully implemented without the ability that AMI provides to measure granular data on customers' use of energy, and to communicate and interact in real time with other systems and devices. Operational efficiencies that AMI provides are also an important share of the delivery cost savings that a mature Smart Grid can deliver. A robust AMI communication system permits meters to interact directly with other utility systems, enabling reliability and operational benefits. The installation of AMI meters and facilities throughout ComEd's service territory thus benefits not just the individual customers receiving AMI meters, but customers and the State as a whole.

ComEd is a participating utility under the EIMA and is required to invest an estimated $1,300,000,000 in "Smart Grid electric system upgrades," including AMI, and a like sum to upgrade and modernize its transmission and distribution infrastructure.[4] The EIMA also requires

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[1] Illinois Smart Grid Regional Innovation Cluster, *Illinois Smart Grid Market Inventory* (Feb. 2012), at 1.

[2] Public Acts 97-0616 and 97-0646 established new Sections 8-108.5 – 16-108.8 of the Illinois Public Utilities Act ("PUA"). These laws are collectively referred to as the Energy Infrastructure Modernization Act.

[3] ComEd defines Smart Grid functions as including those enumerated in 220 ILCS 5/16-108.6(a) and other related functions associated with the deployment and operation of a Smart Grid as therein defined.

[4] EIMA, 220 ILCS 5/16-108.5(b)(1)(B).

participating utilities to file with the Commission a Smart Grid Advanced Metering Infrastructure Deployment Plan ("AMI Plan"). ComEd must, by law, plan for investments in AMI over a 10-year period to deploy AMI to all ComEd retail customers[5] across its entire service territory.[6]

While the requirement to deploy AMI is legislative and peremptory, it was not enacted unilaterally or hastily. The General Assembly directed the full deployment of AMI with a recognition that substantial knowledge and experience with AMI was already gained during ComEd's comprehensive and rigorous AMI pilot. The General Assembly also acknowledged the principles relating to AMI addressed during the Illinois Statewide Smart Grid Collaborative ("ISSCG"). Those contributions, which are described in greater detail below, illuminate the potential benefits of AMI and provide valuable information about how AMI and related technologies can be effectively deployed.

Therefore, ComEd submits to the Commission this AMI Plan, as called for by the EIMA. This Plan describes ComEd's proposal to deploy AMI and the associated investments. It sets out ComEd's vision for AMI, and how it can help create and support a cost-beneficial Smart Grid. The Plan is fully consistent with established standards, including current National Institute of Standards and Technology ("NIST") standards for Smart Grid interoperability. It also relies on open standards and architectures, including use of the internet protocol ("IP"), to the maximum extent possible consistent with security needs. ComEd also recognizes that many uses of AMI and the data it can deliver remain to be developed. Therefore, the Plan relies on a flexible smart meter platform that can accept remote device upgrades without the need for physical meter access. That platform is also capable of meeting the needs of evolving technologies such as home energy management, electric vehicle charging, and advanced distributed generation. ComEd is also aware of the need to provide for data security and privacy, while at the same time to permit customers to use and disclose the available personal energy information. The proposed AMI systems accomplish that, as well. Finally, the Plan includes components meeting each of the other enumerated requirements of the EIMA.

ComEd asks the Commission to approve this Plan.

A. <u>Vision Statement</u>

AMI meter deployment will significantly improve the customer experience and advance Northern Illinois as a leader in smart grid-enabled products and services. The network of advanced meters and communication systems can collect and distribute timely and accurate information to customers and other parties, expanding customer choice, empowering customers to take advantage of new, energy and money saving technologies.

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[5] EIMA, 220 ILCS 5/16-108.6(c)(3).

[6] EIMA, 220 ILCS 5/16-108.6(c).

ComEd envisions that AMI deployment will create long-term value for customers. It will enable new operational systems, practices, and efficiencies that can both improve reliability and reduce costs. Under the EIMA rate structure, cost reductions benefit all customers, even those who have not yet received their AMI meter. AMI meters allow better communication about, and faster response to, outages and better communication about restorations. AMI meters allow easier service changes to accommodate customer moves, and fewer estimated bills. They reduce the need to rely on utility vehicles to serve meters and yield a corresponding reduction in environmental impact. Customers also benefit from other Smart Grid functions that AMI enable—all as envisioned by the EIMA. AMI systems also enable developing technologies, such as electric vehicles and distributed resources, directly and by allowing ComEd and competitive suppliers to offer advanced rates. Both in the selection of technology and the implementation of information controls, ComEd envisions a secure and reliable system, which respects customers' privacy.

Our vision of the AMI-equipped Smart Grid is broader than operations. ComEd is, therefore, committed to tracking tangible measures of our success in enabling the robust growth of efficient demand response, energy efficiency, and distributed generation using the Smart Grid. Those measures must, however, be of ComEd's performance as a delivery company. ComEd must remain neutral in the competitive market, and cannot control our customers' choices, or the market for third-party devices and technologies. ComEd will also continue to work with key stakeholders both in the energy sector and throughout the communities we serve to boost the ability of our investment to unlock the broader environmental, economic, and consumer benefits that are a key part of the Smart Grid's potential. Finally, ComEd's vision is of informed and educated customers who will have sufficient knowledge to benefit from their new AMI meters immediately after they are installed. To that end, ComEd's AMI Plan has a robust customer outreach and education plan.

B. <u>Function and Objectives of the AMI Plan</u>

This AMI Plan sets out "a deployment schedule and plan that includes deployment of AMI to all [ComEd retail] customers."[7] It outlines how ComEd anticipates AMI meters and associated technology will be deployed and articulates the schedule on which those deployments are planned to be made. The Plan describes ComEd's prior and ongoing work to evaluate and prioritize technology choices to create customer value. In particular, it identifies (i) components of the proposed AMI systems; (ii) resources the deployment is anticipated to require; (iii) operational benefits achieved through efficient AMI deployment; and (iv) a range of innovative rates, enhancements to the provision of information, and education programs that benefit customers. The Plan also identifies how the deployment of AMI enables customers to take advantage of new and developing technologies not within ComEd's control, such as electric vehicles, home and appliance automation, and small distributed generation. The Plan further explains how AMI enhances and enables customers' ability to take advantage of Smart Grid functions beginning at the time an account has billed successfully on the AMI network. The data

[7] 220 ILCS 5/16-108.6(c)(3).

in the Plan also form the basis of the benefit-cost analysis submitted to the Commission along with the Plan.

1. Goals and Requirements of the EIMA

The EIMA establishes specific goals, objectives, and requirements for AMI technology and its deployment, as well as for the AMI Plan itself. ComEd's AMI Plan is itself required to meet five specific requirements.[8]

(1) *The participating utility's Smart Grid AMI vision statement that is consistent with the goal of developing a cost-beneficial Smart Grid.* This vision statement is included in Section I.A, above.

(2) *A statement of Smart Grid AMI strategy that includes a description of how the utility evaluates and prioritizes technology choices to create customer value, including a plan to enhance and enable customers' ability to take advantage of Smart Grid functions beginning at the time an account has billed successfully on the AMI network.* Chapter 2 of this Plan describes how ComEd evaluated and prioritized technology choices to create customer value, including by selecting and deploying the most flexible and interoperable systems available. Chapter 3 describes how the proposed AMI system also supports a variety of ComEd sponsored customer applications and rates as well as how it enables customers to take advantage of a variety of technologies currently in development.

(3) *A deployment schedule and plan that includes deployment of AMI to all customers.* The schedule for deploying AMI in all ComEd operating areas and making AMI meters available to all customers is set out in Chapter 2.

(4) *Annual milestones and metrics for the purposes of measuring the success of the AMI Plan in enabling Smart Grid functions and enhancing consumer benefits from Smart Grid AMI.* ComEd has identified three categories of milestones and metrics to measure the rate and extent to which Smart Grid functions are enabled and customer benefits enhanced. First, ComEd's progress in deploying AMI as planned (*e.g.*, meter installs, operating centers completed). Many Smart Grid functions and customer benefits derive directly from AMI deployment. Second, milestones that measure which Smart Grid functions, of those tied to AMI, that are enabled by ComEd's AMI system at the time. Most will be enabled immediately, but other programs (e.g., outage management) will become available during the Plan period. Third, whether developing potential consumer benefits are enabled. As new technologies and applications supportable by Smart Grid technology become extant in the consumer market, ComEd will assess its systems' ability to support those applications. Those milestones and metrics are

[8] 220 ILCS 5/16-108.6(c)(1)-(5).

discussed in Chapters 2, 3, and 4, depending upon whether they relate to operations, customer application, or education, respectively. In addition, various milestones and metrics were added to this Plan pursuant to the Commission's Order in Docket No. 12-0298.

(5) *A plan for the consumer education to be implemented by the participating utility*. This plan is set out in Chapter 4.

In addition, the EIMA requires that the "implementation of the AMI Plan will be cost-beneficial consistent with the principles established through the [ISSGC], giving weight to the results of any Commission-approved pilot designed to examine the benefits and costs of AMI deployment" on ComEd's system.[9] ComEd has conducted a detailed cost-benefit analysis of the planned AMI deployment. This analysis, which was conducted by Black & Veatch Corporation ("Black & Veatch") and Christensen Associates Energy Consulting LLC ("CA Energy"), demonstrates that the benefits of the AMI Plan measured on a present value basis far exceed the present value of all ComEd's costs reasonably associated with the Plan and its implementation. As required by the EIMA, the range of benefits studied include those inuring to customers through reductions in ComEd's operational costs and gains in its efficiency, and those accruing to customers directly, such as avoided electricity costs.[10] These savings include avoided consumer power, capacity, and energy costs, and avoided societal costs associated with the production and consumption of electricity. Also, "there is little doubt that a widely deployed smart grid would lead to more efficient energy use."[11] Other societal benefits studied include enabling the greater integration of economic and efficiently utilized renewable and distributed power resources, reductions in the emissions of harmful pollutants and associated avoided health-related costs, other benefits associated with energy efficiency measures, demand-response activities, and the enabling of greater penetration of alternative fuel vehicles.[12] This study has been submitted to the Commission along with this Plan.

Finally, the EIMA spells out technological and operational criteria for AMI systems. [13] The planned AMI systems and technologies meet all of these substantive and technical requirements of the EIMA, including:

- Consistency with NIST standards for Smart Grid interoperability that are in effect as of the filing of this Plan. Technical aspects of ComEd's planned AMI systems are discussed in Chapter 2.

[9] EIMA, 220 ILCS 5/16-108.6(c).

[10] EIMA, 220 ILCS 5/16-108.6(a).

[11] Illinois Statewide Smart Grid Collaborative: Collaborative Report (Sept. 30, 2010) (ISSGC Report) at 7.

[12] EIMA, 220 ILCS 5/16-108.6(a).

[13] 220 ILCS 5/16-108.6(c), (d).

- Use of open standards and internet protocol to the maximum extent possible consistent with cyber security. As noted, technical aspects of ComEd's planned AMI systems are discussed in Chapter 2.

- Maximizing, to the extent possible, a flexible smart meter platform that can accept remote device upgrades and contain sufficient internal memory capacity for additional storage capabilities, functions and services without the need for physical access to the meter. This is also a technical issue addressed in Chapter 2.

- Securing the privacy of personal information, including through compliance by the utility, its contractors, and agents, with the Personal Information Protection Act. Technical aspects of this issue are addressed in Chapter 2. How ComEd will handle and protect data once communicated is discussed in Chapter 3.

- Allowing consumers to consent to the disclosure of personal energy information to third parties through electronic, web-based, and other means in accordance with State and federal law and regulations regarding consumer privacy and protection of consumer data. This is discussed in Chapter 3.

- Employing an overall AMI strategy that creates customer value, including a plan to enhance and enable customers' ability to take advantage of Smart Grid functions beginning at the time an account has billed successfully on the AMI network. The benefits of ComEd's AMI plan are discussed throughout this Plan and in the testimony and materials supporting its adoption. In addition, Chapter 3 discusses how the planned systems can allow customers to themselves take advantage of Smart Grid functions.

2. <u>Transform Delivery System Operations</u>

ComEd's AMI Pilot demonstrated the potential of AMI technology to transform utility operations. Full deployment as proposed here will further improve operational efficiency and will also enable and support other technologies that improve reliability (*e.g.*, automated outage notification and restoration confirmation) and transform grid planning and operations (*e.g.*, ability to measure voltage along the entire length of a feeder, better transformer loading predictions, integration with intelligent distribution automation devices). AMI technology also provides a wealth of information (*e.g.*, regarding thorough process re-engineering) that ComEd and other suppliers alike can utilize to benefit customers.

To maximize those benefits, this AMI Plan calls for use of technologies that are interoperable, flexible, secure, and proven, and that provide reliable direct connectivity between the meter and smart devices in the home or place of business. These components were evaluated during the AMI pilot, and the criteria on which they were selected were vetted in by stakeholders both before and after the pilot. Many of these criteria were substantively incorporated in the EIMA itself (*e.g.*, the importance of interoperability, reliance on technologies using robust open communication standards; and system security).

ComEd's deployment effort will include re-engineering of both metering and customer operations processes, as well as providing continued support for the previously-designated Smart Grid Test Bed established pursuant to the EIMA,[14] and implementation of follow-on Smart Grid functions such as automated outage reporting and management. In addition, the use of open architecture and innovation-friendly protocols plays a major role in the ability of ComEd's AMI proposal to enable customers to use existing and developing energy technologies.

3. Create Professional and Craft Jobs Rapidly and Prudently

Recognizing the importance of creating skilled jobs emphasized in the EIMA, ComEd's deployment schedule has parallel work tracks. Business process redesign activities to develop the long term solution should proceed on a parallel track with "shovel ready" meter deployment (*i.e.*, using the successfully piloted technologies and systems). ComEd expects that AMI deployment will bring hundreds of news jobs to Illinois.

4. Provide Energy Information, Products, and Services that Help Customers Better Understand How and When They Use Electricity

AMI meters can record electricity usage in small intervals of time and deliver this information to ComEd via the integrated communications system rapidly and securely. ComEd's AMI Plan encompasses the recording, retrieval, storage and analysis of this usage data for customers to access and learn from via a web portal. Other energy information services will be explored and evaluated for future offerings, including creating the role of an energy advisor. In addition, these same systems are designed to facilitate access by future customer-deployed technologies (*e.g.*, Home Area Networks, or "HANs") and to be able to communicate with approved third parties.

5. Provide a Technology Platform that Enables Customers to Receive and Benefit from Additional Products and Services

ComEd's proposed AMI systems are designed to facilitate access by future customer-deployed technologies (*e.g.*, Home Area Networks, or "HANs") and to be able to communicate with approved third parties. While the development and commercialization of the range of smart devices and appliances that could communicate within a HAN is still in its infancy, ComEd relies on open and industry-standard protocols (*e.g.*, IP addressed data communication and ZigBee® HAN communications architectures). ComEd's proposal both supports the market for competing devices and enables the introduction of the broadest range of devices. This design also enables the integration, in a safe and cost-effective manner, a variety of additional customer-side technologies and applications including electric plug-in vehicles, distributed generation, and local storage. This same use of interoperability and open standards aids in the system's ability to communicate with approved third parties, such as RESs, and thereby also enables the

[14] *See* EIMA, 220 ILCS 5/16-108.8.

introduction by those suppliers of other innovative rates and service offerings, while at the same time aiding the protection of the privacy and security of customer data. To that end, ComEd's Plan also employs state of the art communication security and encryption, and hardened data processing systems at least as resistant to intrusion as current partially manual processes. Of course, ComEd cannot foresee which specific applications and devices will emerge and become accepted over this Plan's decade-long horizon. Market forces will drive those developments, and the specific processes for integrating those technologies with the AMI systems will be identified during deployment. But, ComEd's AMI Plan provides a solid interoperable foundation which can enable a range of those innovations.

C. Brief History of the Plan and its Development

ComEd, stakeholders, and the Commission have been considering automated meter reading ("AMR") and AMI options for years. There have been formal Commission proceedings, numerous public workshops, and other stakeholder discussions surrounding these topics throughout that period. ComEd's selection of AMI technologies and systems was itself the product of a detailed and public technology evaluation process, a pre-pilot RPF process, a full operational-scale pilot, and a legislative review of the entire process. These steps culminated in a statutory mandate to proceed to deploy AMI and other Smart Grid technologies on a brisk schedule. The deployment of AMI as set out in the EIMA and this Plan (and its counterpart for Ameren Illinois) is the next step in this multi-year process.

Broad deployment of Smart Grid and AMI in Illinois has been actively studied and considered in the regulatory processes since 2007. That year, ComEd proposed in its general rate case to begin evaluating, selecting, and implementing system modernization technologies, including broadly deployed AMI.[15] ComEd's final proposal there included both substantial stakeholder participation and specific Commission approval before undertaking any investment. The Commission's Order acknowledged the significant benefits of Smart Grid technologies, but it also concluded that further analysis, stakeholder input, a substantial AMI pilot, and additional Commission review and approval should precede any operational deployment. The Commission ordered ComEd to conduct stakeholder workshops and to seek Commission approval "of the [Pilot] goals, timelines, evaluation criteria, etc., that were developed in the workshops."[16]

Formal workshops, moderated by a third-party facilitator approved by the Commission's Executive Director, began on December 17, 2008. Consumer groups, municipalities, the Attorney General's office ("AG"), potential vendors, Ameren, and the Commission's Staff all participated. The issues addressed included the desired characteristics of an AMI system,

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[15] There were some earlier efforts, including by Illinois Power, to deploy automated meter reading schemes that did not provide for the same networked communication or other AMI benefits.

[16] *See Commonwealth Edison Co.*, Docket No. 07-0566 (Sept. 10, 2008), at 103-05, 137-40. The use of a rider to implement and fund the pilot was later reversed by the Illinois Appellate Court. *See Commonwealth Edison Co. v. Ill. Commerce Comm'n*, 405 Ill. App.3d 389 (2nd Dist. 2010). That decision, however, came after the Commission's subsequent decision in Docket No. 09-0263 to proceed with an expanded pilot under a revised tariff, and it did not address the merits or prudence of piloting AMI or using a stakeholder process.

including interoperability and flexibility to respond to technological change and evolution, and criteria for meter and network vendor selection. Discussions were substantive and detailed. During this time, ComEd also conducted a formal request for proposal ("RFP") process for AMI pilot vendors. "Stakeholders were involved during each step starting with the review of the RFP document and ending with the final review of the technical scoring for all of the RFP respondents."[17] That evaluation was driven by the priorities previously discussed in the workshops including security, network performance, obsolescence risk, and cost-effectiveness. The "maturity" of a technology, *i.e.*, if its capabilities were proven in a commercial-scale installation, was also considered. An IP-based mesh radio network architecture pioneered by Silver Spring Networks ("SSN") prevailed as the best overall choice. That choice was largely accepted by the stakeholder community.

On June 1, 2009, ComEd sought Commission approval of its pilot of over 130,000 meters using SSN network technology. Based in large part on stakeholder input, ComEd was also asked to pilot customer applications of AMI, including innovative rate designs and in-home applications. ComEd detailed "how the Request for Proposal was developed … and how the vendor responses were analyzed" and both identified the radio mesh technology and explained why it was "selected as the AMI technology provider." That justification included evidence that the specific technology choices best met the goals and criteria developed and vetted in the stakeholder process. ComEd also emphasized its "expectation that the communication capabilities of the Smart Grid will be an application-agnostic and future-proof platform." After considering the evidence, the Commission approved the AMI pilot, found that it should include a systematic study of a variety of customer applications and alternative rates, and specifically ordered that "[t]he selection of Silver Springs [sic] Networks as vendor of the AMI Network is hereby approved." *Commonwealth Edison Co.*, Docket No. 09-0263 (Oct. 14, 2009) at 58.[18] "No party … disputed the validity of the award of this contract to Silver Springs Networks." *Id*, at 7.

ComEd's AMI pilot began in November 2009. Approximately 128,000 AMI meters were installed in nine towns along the I-290 expressway, in the Humboldt Park area of Chicago, and in two buildings in downtown Chicago. The meters and back office systems communicated using the mesh radio network technology, and data from those meters communicated over that network and were used for billing as well as for the customer applications being piloted. Those meters remain in service and continue to support customer billing. The AMI pilot was publicly evaluated by ComEd and by both Black & Veatch (as to AMI systems and utility operations) and, as to customer applications and rates, by economists working with the Electric Power Research Institute ("EPRI"). B&V predicted that a 10-year rollout of the piloted technologies

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[17] *Advanced Metering Infrastructure (AMI) Evaluation Final Report*, Black & Veatch Corporation ("B&V") (July 2011), at 157. This document is referred to as the "B&V Report."

[18] Aspects of this decision relating to cost recovery were reversed by the Illinois Appellate Court, Second District on March 19, 2012. *See People v. Illinois Commerce Comm'n*, 2012 IL App (2d) 100024, but requests for further review of that decision remain pending and no mandate has been issued. That decision, in any event, focuses on the use of a rider to fund the pilot, not on the pilot itself, or the technology or vendor chosen, or the customer applications studied.

would require a capital outlay of approximately $1 billion and would result in nominal net benefits of $2.8 billion equating to a net present value of $1.15 billion, based on a 20-year time horizon. It also concluded that "ComEd found the network to be efficient and more than sufficient for the operational needs explored during the pilot." *Id.* at 71.

The ISSGC also addressed AMI. The ISSGC facilitator, EnerNex, compiled and submitted to the Commission (on September 30, 2010) a final report addressing issues including the parties varying positions on the use of certain technical capabilities of AMI (*e.g.*, remote disconnection and reconnection capabilities) and identifying potential costs and benefits of AMI deployment to parties other than utilities.[19] The Report concludes that "[b]y collaborating on smart grid issues prior to regulatory proceedings about smart grid investments, Illinois stakeholders have improved the prospects for successful grid modernization decisions. Participants in the Illinois Statewide Smart Grid Collaborative have built a foundation of common knowledge and a mutual understanding of their different perspectives." The Report acknowledged the Pilot,[20] and the additional information it would provide. ComEd considered appropriate recommendations from the ISSGC process, including with respect to the technical capabilities[21] of the AMI meter and the system's ability to enable other utility and customer applications.[22] ComEd also considered the ISSGC report and the positions of the participants concerning the assessment of benefits and costs[23] to the extent consistent with the requirements of the EIMA, including the recommendation that "the discount rates used in the analyses are not intended to affect the rate of return that the Commission may set for future cost recovery on the investment."[24] While the General Assembly made significant policy decisions in the EIMA and called for a very specific statutory filing, review, and approval process,[25] ComEd's analysis of the benefits and costs of this Plan remain "consistent with the principles established" therein and "give weight to the results of [ComEd's] Commission-approved pilot …."[26]

As required by the EIMA, ComEd has consulted with the Smart Grid Advisory Council ("SGAC") concerning this Plan and considered the input of the SGAC. In addition, ComEd informally distributed sections of this Plan to stakeholders and considered their input in revising the Plan for preparation first to SGAC and, then, the Commission.

D. <u>Overview of Plan Components / Outline of the Plan</u>

Chapter Two of this Plan describes how ComEd plans to deploy AMI meters. It describes the physical and operational steps that ComEd will undertake in order to deploy AMI meters in each of the operating areas throughout ComEd service territory. The chapter

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[19] ISSGC Report at 8.

[20] *Id.* at 10, fn. 15.

[21] *Id.* at 191-93.

[22] *Id*. at 194-204.

[23] *Id*., Ch. 7, "Cost-Benefit Framework", pp. 223-46.

[24] *Id*. at 224.

[25] EIMA, 220 ILCS 5/16-108.5(c).-

[26] EIMA, 220 ILCS 16-108.6(c).

articulates the steps required to communicate with those meters and to provide the required access to data in a secure, reliable, and cost-effective manner. Among the detail is a discussion of the various functional areas of ComEd where AMI deployment activity will be undertaken. In addition, a discussion of the order in which AMI meters will be geographically deployed is included. Also, there is a discussion of the radio mesh network communication technology that ComEd proposes, which is the only technology that can convincingly meet the requirements of the EIMA as to capability, reliability, and flexibility. Chapter Two also outlines how much ComEd anticipates the operational deployment of AMI will cost over the term of the investment program and what operational savings are expected. In addition, Chapter Two identifies annual milestones and metrics that measure the success of the AMI Plan at deploying AMI meters and supporting technology, and enabling added functionality, including time-based billing rates (*e.g.*, peak-time rebate), automatic outage detection, voltage measurement, and coordination with intelligent local DA devices.

Chapter Three of this Plan describes how the deployment of AMI meters and communication technology will deliver additional benefits to customers both directly and by enabling customers to take advantage of developing technologies. ComEd currently maintains a residential real-time pricing rate (Rate RRTP) and will, as required by the EIMA, be offering a new Peak-Time Rebate ("PTR") rate to customers with AMI meters. Both of these rates allow customers to better control their energy costs. They do this by conserving energy and by adjusting the times at which they use energy to reduce its cost and/or environmental impact. These types of advanced rates offer greater benefits with less effort and cost when meters can not only record interval use, but also provide data about that use to customers directly and electronically. In addition, as technology develops, the AMI system ComEd proposes will allow for delivery of use and, potentially, price data both to customers and, through an industry standard ZigBee® chip, directly to appliances and other devices. ComEd will also implement a web portal to facilitate access to usage, billing, and other data directly by customers. Because the data is available, other advanced rates can also be offered by competitive suppliers in the marketplace, further enhancing customer choice. Finally, because ComEd's proposed AMI system is designed for flexibility and interoperability, it also enables a variety of developing complimentary technologies, including electric vehicles, small distributed generation, distributed storage, and home automation.

Chapter Four of this Plan lays out ComEd's planned education and customer outreach efforts. In order to maximize benefits to customers, customers must understand the fundamentals of what AMI meters can measure and communicate to them, their utility, and other authorized energy vendors. To gain full value from AMI, customers must understand how the data and communication capabilities (uniquely provided by smart meters) not only helps their utility and other electric vendors provide better and lower cost service, but also empowers them to save money and help the environment through their own actions. ComEd has developed educational programs to assist customers in all these matters.

The AMI Plan has been determined to offer significant net benefits to customers. In sum, total currently quantified and monetized benefits flowing from the AMI Plan, before discounting, are forecast to exceed $4.6 billion. On a present value basis, ComEd projects the AMI Plan to

result in benefits, net of costs, totaling more than $1.271 billion. Moreover, in addition to those benefits that are readily quantifiable and capable of being monetized are other societal benefits that are difficult to quantify or reduce to a single dollar value. The Commission and stakeholders should keep in mind that even the qualitative benefits of the AMI Plan that are not readily monetized are nonetheless very real, and are of a type expressly identified by the EIMA as benefitting Illinois. When these benefits are considered, the net benefit is even greater.

This Plan, therefore, describes ComEd's roadmap to accomplish that deployment over a 7-year period and to implement a wide array of features and functionality, including those minimum functionalities and system characteristics specified in the EIMA. Of course, implementation activities will – and to achieve the goals of the EIMA must – evolve and adapt to changing circumstances. This is especially true for a system like AMI, that must interact with other technologies and systems still in their infancy. As called for by the EIMA, on April 1 of each year beginning in 2013, ComEd will, after consultation with the SGAC, submit a report regarding the progress it has made toward completing implementation of its AMI Plan. ComEd will address in these reports the evolution of its AMI deployment efforts.

This Plan will terminate after its completion, either at the end of its planned 7-year duration or any extended implementation period established by the Commission under those portions of the EIMA codified in Section 16-108.6(e) of the Public Utilities Act ("PUA"). In addition, this Plan will terminate should Section 16-108.6 of the PUA become inoperative, for example, under Section 16-108.6(h) thereof. [27] In such an event, ComEd would continue to exercise the right to deploy AMI, if determined at that time to be prudent, to the extent otherwise within its service authority.

Approval of this Plan is a critical next step in the successful implementation of AMI in Illinois and, ultimately, in supporting the successful and cost-beneficial implementation of a Smart Grid, generally.

> *The passage of … [the EIMA] legislation is just the beginning…. Tomorrow we begin the serious work of developing a Smart Grid and smart meter system. We intend to work closely and collaboratively with our partners and stakeholders to bring all perspectives to bear as we work to create an electric service model that is more reliable, more flexible, greener and more customer-focused.*[28]

[27] EIMA, 220 ILCS 5/16-108.6(h).

[28] Anne Pramaggiore, 10/26/11.

Chapter 2: AMI Operational Deployment

A. Introduction

As defined in the Public Utilities Act, AMI "means the communications hardware and software and associated system software that enables Smart Grid functions by creating a network between advanced meters and utility business systems and allowing collection and distribution of information to customers and other parties in addition to providing information to the utility itself." 220 ILCS 5/16-108.6(a). The operational deployment of AMI is not limited to the design and physical installation of the meters, communications network, and associated hardware / software necessary to provide a two-way communicating system between advanced electronic meters and utility back-office systems.[29] It also requires existing IT and business processes to be revised or updated and new IT and business processes to be developed to allow the efficient and effective use of the AMI solution, thereby enabling the anticipated benefits to customers. This chapter describes how ComEd plans to design, deploy, integrate, operate, and maintain the AMI solution leveraging the experience gained of systems, processes, and technologies from the successful AMI Pilot.

B. AMI Operational Deployment Plan Design

1. Management Approach

The project will have its own dedicated team complete with the necessary integration points with the other dedicated teams assigned to the Infrastructure Investment Program as defined in PA 097-0616. The AMI project structure includes six main functions:

1. Field Deployment
2. AMI Operations
3. Customer Experience
4. Project Management Office (PMO)
5. Business Transformation
6. Information Technology

A summary of the main responsibilities for each function is contained in the following table:

[29] 'Utility back-office systems' include the software applications and IT systems located at centralized ComEd locations, used to process and analyze data, and to send and receive messages and commands.

Field Deployment	AMI Operations	Customer Experience	Project Management Office	Business Transformation	Information Technology
o Meter deployment plan o Meter procurement and installation o Meter vendor management o Cross dock[30] operations o AMI network design, installation and optimization	o Meter read monitoring o Meter activation o Remote connect/ disconnect operations monitoring o Software as a Service vendor management o Meter event management o Data analytics support o Meter firmware[31] management	o Proactive research and management of technical issues o Customer education and outreach support o Voice of customer for process design o Customer issues management	o Governance and oversight o Smart Grid Advisory Council interface o ICC annual reports o AMI metrics tracking o Scope, schedule, budget, and issues management o Integration with EIMA Program Management Office (EIMA PMO) o Employee management	o Process design o User Acceptance Testing o Technology selection o Sourcing o New product, service, and application roadmaps o Change management and business readiness o Training	o AMI network planning and deployment o Network equipment procurement o Network Monitoring o System integration planning, implementation, testing, and deployment o Systems Testing o Systems maintenance o IT Vendor management o Radio frequency (RF) engineering for network and meter connectivity o Cyber security plan

Figure 1 – Project Team Functional Responsibilities

Figure 1 above describes the six functional areas, and the associated responsibilities. The organizational structure of the AMI Team will be flat with a lead over each of the six functions reporting directly or via dotted line to the AMI Lead. Due to its fundamental role within the

[30] A "cross dock" is a location where new meters and field network equipment are received from the manufacturers, stored for a short period of time, and loaded onto vehicles for the daily field installation activities, and where old meters are temporarily stored prior to disposal.

[31] Firmware is software that is embedded in memory in a piece of hardware that essentially functions as the "operating system" for the hardware.

project, a Business Transformation Team consisting of business and IT professionals will be created. Additional governance and oversight structure will be created to effectively execute the project, manage ongoing communication, mitigate risk, and maximize the net benefits to customers.

2. Technology Evaluation and Selection

The smart meter solution consists of smart meters, field devices, telecommunications equipment, and computer hardware and software that are integrated to form a real-time, two-way data network (see figure below).

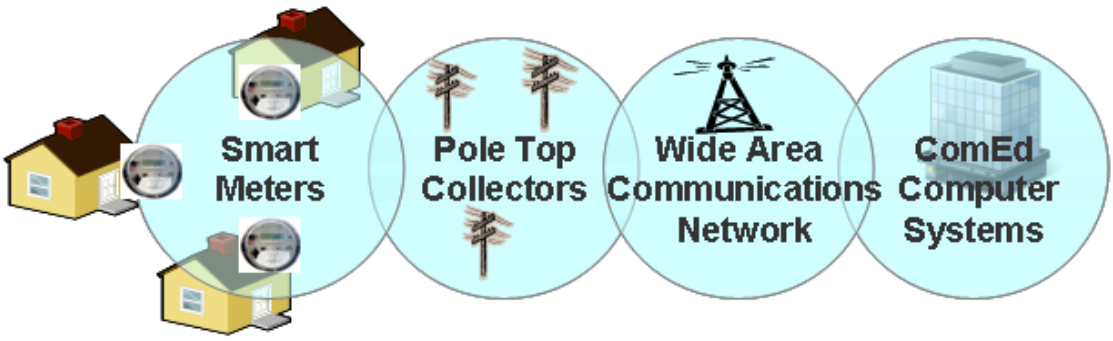

Figure 2 - Meter and Network Deployment Diagram

The high-level solution components are the smart meters and their associated capabilities, the network technology for two-way communication, and various other software and back office applications to effectively deploy the meters, operate the solution and fully leverage the solution to deliver operational benefits to customers. The network to enable the two-way communications between the Smart Meters and ComEd's Computer Systems will consist of multiple technologies. The portion of the network between the Smart Meter and the Pole Top Collectors will be a private network owned by ComEd and provided by SSN (see 'a' below for further discussion). SSN provides a network interface card that is assembled into a solid-state meter provided by a separate meter manufacturer that enables the meter to send usage, events, and diagnostic data and to receive messages, commands, and firmware updates. The portion of the network between the Pole Top Collector and ComEd's Computer Systems may change over time based on cost, geographic location and availability of existing public or private network infrastructure. For the AMI Pilot and the initial deployment covered in this plan, ComEd will utilize publicly available digital cellular networks. As detailed engineering design occurs over the course of the project, ComEd may utilize its own private network (e.g., fiber network).

To ensure that the related sourcing decisions are financially responsible, and in alignment with the functional and operational needs of the business, a procurement strategy was developed for all of the solution components and the services needed to install and integrate them.

a) AMI Network

The AMI Network technology is foundational to the deployment and overall project execution because it represents the key to the enablement of two-way communication between the meter and ComEd. The unique characteristics of the AMI network technology make it the highest priority for thorough analysis and review prior to selection. The process leading to the selection of the mesh technology provided by SSN started before the AMI Pilot. Through a series of interactive workshops in late 2008 and early 2009, ComEd sought and received input from external stakeholders on what criteria should be used in the selection of the AMI technology in order to achieve operational benefits (e.g., financial savings, improved reliability, improved customer experience) and enable other smart grid applications.

That collaborative engagement with external stakeholders resulted in the technical criteria used for evaluation of potential solutions listed and described in the figure below:

Technology Criteria	Description
Security	Security for the grid as well as consumer protections.
Network Performance	Flexibility in terms of networking technology. The solution will have to be able to accommodate a number of potential program designs including innovative pricing programs, home area networking, distribution automation, plug-in electric vehicles, etc. This may be quantified in bandwidth margin and application prioritization capability.
Obsolescence Risk	ComEd will evaluate technologies to ensure a solution with appropriate long-term value.
Flexibility & Scalability	Ability to adapt to smaller deployment increments, deployment to different service areas or types, deployment in more than one operating center (i.e., how easily the proposed solution scales for deployment throughout ComEd's service area).
Interoperability	A preference for non-proprietary solutions over proprietary solutions.
Capability	Ability to meet ComEd's operational goals in meter reading, meter servicing, theft detection, and outage management.
Maturity	The intent is to not use new technology that has not demonstrated capabilities elsewhere.

Figure 3 - AMI Pilot Technology Selection Criteria

As a result of the competitively bid process, SSN was selected as the provider of AMI Network technology for the AMI Pilot and approved by the Commission. Agreement on the selection of SSN was reached with key external stakeholders through an ongoing interactive and collaborative workshop process. Concurrently with the AMI Pilot rollout, the Illinois Statewide Smart Grid Collaborative (ISSGC) provided additional technical requirements against which smart grid technology will be evaluated in the future. The resulting 15 technical requirements

are embodied within the EIMA. With the assistance of two outside firms, West Monroe Partners and Black & Veatch, seventeen network technology providers[32] were analyzed across those 15 technical requirements, as noted below:

1. Flexibility of the smart meter platform to accept remote device upgrades.
2. Use of open standards and internet protocol to the maximum extent possible.
3. Internal Memory Capacity for Additional Storage Capabilities, Functions, and Services without the need for physical access to the meter (with a focus on additional capacity for the Metrology, HAN, and AMI communication software upgrades[33]).
4. Ability to develop, store, send, and receive digital information concerning or enabling grid operations, electricity use, costs, prices, time of use, etc.
5. Ability to develop, store, send, and receive digital information concerning electricity use, costs, prices, time of use, etc. to or from a computer or other control devices.
6. Ability to measure or monitor electricity use as a function of time of day and power quality characteristics, and to store, synthesize, or report that information by digital means.
7. AMI Interoperability (compliance with National Institute of Standards and Technology (NIST) Guidelines).
8. Ability to sense and localize disruptions or changes in power flows on the grid and communicate such information instantaneously, enabling automatic protective responses to sustain reliability and security of grid operations.
9. Ability to detect, prevent, communicate with regard to, respond to, or recover from system security threats, including cyber-security threats and terrorism, using digital information, media, and devices.
10. Ability of any device to respond to signals, measurements, or communications automatically without independent human intervention.
11. Ability to use digital information to operate functionalities on the electric utility grid that were previously electromechanical or manually controlled.

[32] The technology providers assessed included those that use private or public telecommunications networks as part of their system.

[33] The meters also need a limited amount of memory to temporarily store usage and other critical data as a contingency in case the meter needs to be read in person if for some reason the communication to/from the meter fails. Meters will hold approximately 3 to 4 months of interval data.

12. Ability to use digital controls to manage and modify electricity demand, enable congestion management, assist in voltage control, provide operating reserves, and provide frequency regulation.

13. Ability to support future electric plug-in vehicles, distributed generation, and storage in a safe and cost-effective manner on the electric grid.

14. Distribution Automation (DA) Interoperability (Meets NIST Guidelines).

15. Internet Protocol (IP) Interoperability (support End to End IP along with Key Protocols over IP including HTTPS, FTPS, TFTP).

The analysis of the available AMI Network solutions showed that the SSN was the only AMI Network provider that satisfied each and every one of the fifteen technical requirements. The best alternative vendors only met 12 of the requirements and did not have end-to-end secure IP-based communications.

Proceeding with SSN's technology is also supported by the history of the AMI process, the terms of the EIMA, SSN's unique capabilities and the competitive pricing:

- SSN is the only vendor that offers a proven AMI/network technology meeting the specific technical requirements of the EIMA, including being able to support the test bed. SSN uses an IP-based network which will support other 3rd party vendor IP-based products.

- SSN has not lost ground technically since the Commission approved it as the Pilot vendor. Based on the in-depth industry research and analysis completed, SSN continues to outperform other vendors on the same stakeholder-vetted criteria that led ComEd to select, and the Commission to approve, SSN as the pilot vendor.

- SSN has a proven track record of success, both generally and in ComEd's own pilot. Indeed, the successful use of SSN's technology in the pilot was a basis for Black & Veatch's modeling of the long-term benefits of AMI deployment and underlies many of the statutory performance metrics included in the formula rate.

- SSNs advantages lie in critical areas (e.g., security, IP protocol, and interoperability) that were emphasized in the stakeholder process.

- ComEd, with the assistance of Exelon's Supply organization within Exelon Business Services Company ("BSC"), demonstrated thorough pricing prudency throughout the negotiations with SSN. During the initial negotiations for the Pilot technology in 2009, SSN provided a full-deployment cost estimate. ComEd was able to leverage that estimate during final negotiations of the full deployment contract in conjunction with SSN pricing quotations for both PECO Energy Company's ("PECO") and Baltimore Gas and Electric's ("BG&E") AMI technology procurement processes.

b) Other technologies

To optimize the benefits to customers from smart meters, additional new technologies will be required. The figure below identifies the new solutions (outside of SSN) that have already been selected, along with the basis for their selection. The subsequent figure identifies the solutions that still need to be selected, as well as the process that will be followed for selection.

Already Selected Solution	Description	Basis for Selection
Meter Data Management System (MDMS)	Application to process and store meter data	Based upon ComEd Pilot results, ComEd and PECO completed an updated technical evaluation of MDMS suppliers. Based upon this evaluation, ComEd concurred in the selection of Oracle, and Exelon BSC Supply **competitively negotiated** an enterprise-wide agreement.
Handheld Device Interface	Meter work management system for handheld devices used by meter technicians	**Competitively bid** for ComEd's AMI Pilot. The Clevest solution will be extended for full deployment because it still meets ComEd's needs and performed well in the Pilot. The IT integration associated with this solution was completed as part of the Pilot and minimal work will be required for scaling to the full deployment.
Handheld Devices	Devices used by meter installers to support the meter exchange process	ComEd will reuse the hand-held devices purchased for the AMI Pilot and purchase additional devices, as dictated by the volume of meters deployed.
IT Hardware (outside of SSN's hosted solution)	Servers and other IT infrastructure required to run the applications	Routinely **competitively bid** at the Exelon enterprise level.

Figure 4 – IT Solutions Selected

Solution Not Yet Selected	Description	Process for Selection
Meters	The meters to be deployed throughout the service territory	This will be **competitively bid**. The vendors' meters will be required to work with SSN technology.
Theft Detection Solution	Tool and/or service to process and organize meter event data in support of suspected tampered meter services	This will be **competitively bid** once the associated business processes are designed and the business and technical requirements are determined. This could result in either a product purchased for use by ComEd or services performed by a third party
Meter Events Solution	Validate and organize all meter event data	This will be **competitively bid** once the associated business processes are designed and the business and technical requirements are determined. There is a possibility that ComEd may extend the "suite" of products already in house after an in depth technical evaluation.
Web Presentment Solution	Customer-specific energy information application (historical usage presentment, savings tips, neighbor comparison, etc.)	This will be **competitively bid**. The tool used for the pilot worked well and continues to be utilized and may be re-selected as part of the new bidding process.
Opt-in Peak Time Rebate Solution	Rebate calculator and billing interface for Opt-in Peak Time Rebate	Further analysis will be completed to determine whether the peak time rebate tool utilized during the pilot is appropriate for high customer participation rates. If another solution is required, a **competitive bid process** will be utilized based on business and technical requirements.
Data Analytics Solution	Processing and analyzing of meter data for business intelligence	This will be **competitively bid** once the associated business processes are designed and the business and technical requirements are identified. There is a possibility that ComEd may extend the "suite" of products already in house after an in depth technical evaluation.
Business Process and Systems Integrator	Professional services to redesign business processes and design, build, test, and implement IT solutions to support the new processes	This will be done through a **competitive process**. The business process design work may be awarded separately from the systems integration work.

Figure 5 – IT Solutions Not Selected

3. Deployment Approach

ComEd will execute parallel paths of short-term and long-term work streams. Short-term activities will allow ComEd to begin to deploy meters in September of 2013. ComEd's selection of SSN as the AMI Network solution provider is in alignment with this timeline. The short term deployment approach will utilize the existing processes and systems/tools currently in place to operate the AMI Pilot solution with minor enhancements based on the lessons learned from the AMI Pilot.

While the short-term work stream is being executed, other project team members will be focused on long-term solution activities, led by the Business Transformation Team. A sub-set of the long-term solution activities includes evaluation, selection, procurement, and implementation of the additional technologies required for full deployment (noted in the figures above).

4. Deployment Strategy

The ComEd service territory is broken down into 19 regional operating centers that will serve as deployment centers for the smart meter deployment. The following factors were used as the basis for the deployment strategy to prioritize the 19 Operating Centers for meter deployment:

Operational Factors

- Entire operating centers should be automated for cost and operational efficiency purposes and to maximize net benefits to customers.
- AMI mesh network technology is optimal for more dense urban and suburban environments.
- Growing outward from the existing pilot footprint within the Maywood operating center will maximize the performance of the network as well as ensure project efficiencies.
- Simultaneous deployment in non-contiguous multiple operating centers introduces operating inefficiencies for implementation and ongoing operations, including the provision of customer education efforts.
- Achievement of benefits in the business case is best positioned to be preserved by the geographic deployment.

Participation in Customer-side Programs

- Operating centers with customers having a higher propensity to participate in demand side programs should be considered (e.g., peak time rebate). This determination will be made based on historical program participation.

Based upon these factors, and a desire to balance achievement of operational efficiencies, minimize costs to customers, and maximize participation of customers in the peak-time rebate

program, the deployment strategy is to install meters in two to four separate operating centers at any given time after completion of the Maywood operating center for residential customers. With the Maywood operating center as the hub of the AMI mesh network that was deployed during the AMI Pilot, the technology is optimized when growing outward to contiguous operating centers generally north through the Glenbard, Mt. Prospect, Chicago North and Skokie operating centers, and south generally through Chicago South, Crestwood and Bolingbrook operating centers. Participation in residential real time pricing and direct load control programs tends to be highest in the west, northwest and north regions. Therefore, based on the operational factors identified, a multiple-operating center deployment strategy radiating out from the Maywood footprint capitalizes on both prioritization elements, in alignment with the original strategy agreed to by ComEd and stakeholders. After completing the Maywood operating center, the Chicago South and Glenbard operating centers would be the next deployment areas. The figure below presents the deployment order of the 7-year deployment by operating center, maintaining the contiguous deployment sequencing to align with the overall deployment strategy.

Year	Meters Deployed	Operating Center(s)
Pilot	127,857	Maywood, Chicago North
2013	70,882	Maywood
2014	540,744	Maywood, Chicago South, Glenbard, Mount Prospect
2015	1,077,758	Maywood, Chicago South, Glenbard, Mount Prospect, Chicago North, Crestwood, Skokie, Rockford
2016	1,165,742	Chicago South, Mount Prospect, Chicago North, Crestwood, Skokie, Bolingbrook, Aurora, Libertyville, University Park, Elgin, Rockford, Maywood, Glenbard
2017	789,307	Chicago North , Bolingbrook, Aurora, Libertyville, University Park, Elgin, Joliet, Crystal Lake, Dixon, Rockford, Freeport, Streator
2018	330,850	University Park, Joliet, Crystal Lake, Rockford
2019	102,810	Planned clean-up and Rider NAM exchanges, and New Business Exchanges
TOTAL	**4,205,950**	

Figure 6 - Meter Deployment Rollout[34]

This plan represents the current approach to geographic meter deployment over a 7-year period that is within the 10-year timeline specified in the PUA. *See* 220 ILCS 5/16-108.6(c). The timing and prioritization of the deployment may change as the plan progresses. The currently proposed deployment sequence is generally depicted in the figure below, showing that once the Chicago South and Glenbard operating centers are complete, the deployment would progress in a clockwise fashion, concluding with the outlying rural areas.

[34] The overall meter count for the deployment is 4,029,000. The 4,205,950total meter population includes the 128,000 AMI meters that are currently installed in the field via the AMI pilot. These meter counts do not take into account estimated meter growth of 20,000 meters per year, which growth is captured for financial purposes within the Black & Veatch model.

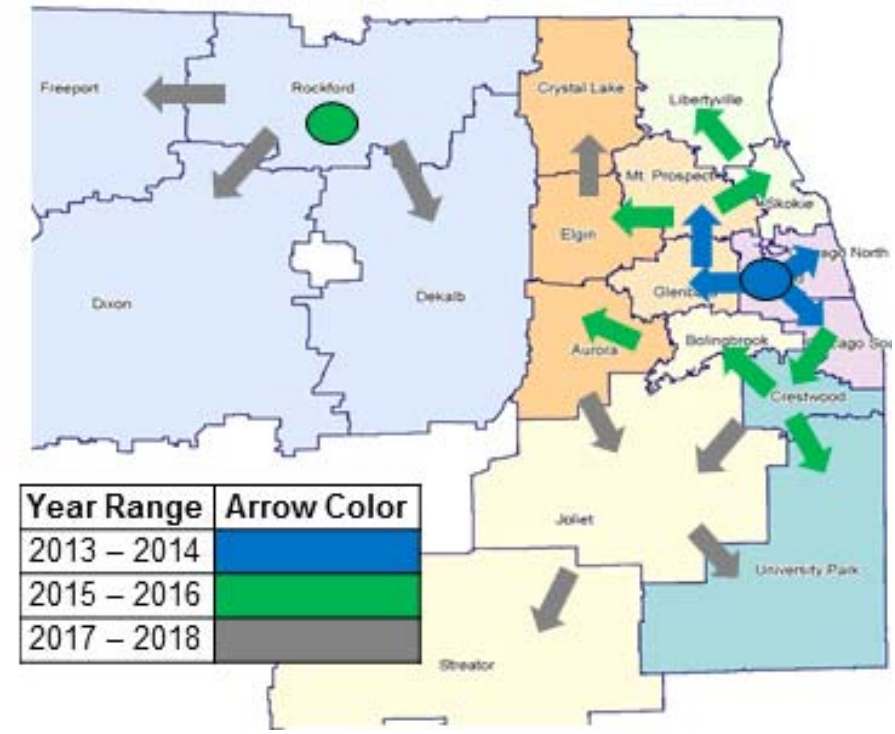

Figure 7 - Geographical Representation of the Meter Deployment Schedule

5. Incorporation of Statutory Operational Requirements

a) Technical Requirements Including Security

Throughout the development of the project, ComEd has maintained a focus on both interoperability and cyber security to ensure that the Smart Grid devices and associated software applications can be supported through the entire lifecycle of each device. ComEd has and will continue to identify all subsystem and application interfaces (physical, human, and application interfaces) and identify the key standards and cyber security policies to secure the data, including customer usage data, going across these interfaces from external and internal attacks. Furthermore, ComEd will ensure that all the security procedures, designs, implementations, and policies are supported throughout the life cycle of the project. The ComEd team will use this information to drive vendor RFP requirements for security and to drive the implementation of the Cyber Security Solution and Acceptance testing.

ComEd endorses and promotes alignment with open and interoperable standards as identified by the National Institute of Standards and Technology (NIST) and more specifically standards that have been adopted by NIST's Smart Grid Interoperability Panel (SGIP). ComEd is engaged and actively participates in the SGIP along with several subcommittees in order to be

current on progress and standards adoption and approval. In an effort to define standards for the Smart Grid, the SGIP has created the Smart Grid Catalog of Standards (CoS). ComEd interprets "consistent with NIST standards" to be adoption of relevant standards contained in the Catalog of Standards for Smart Grid Interoperability as it exists today. ComEd has reviewed those standards that are relevant to AMI and concludes that it has selected technology that complies with them. The selection of other technologies will similarly include compliance with those standards. Furthermore, ComEd will continue to monitor the emergence of new standards out of the SGIP process for future adoption as necessary.

ComEd's strategy is for compliance with the following cyber security and interoperability standards identified within the NIST framework as of the filing date:

NISTIR 7628 Guidelines for Smart Grid Cyber Security

These guidelines present an analytical framework that organizations can use to develop effective cyber security strategies tailored to their particular combinations of Smart Grid-related characteristics, risks, and vulnerabilities. These guidelines were developed as part of a consensus document by the Cyber Security Working Group (CSWG) of the Smart Grid Interoperability Panel (SGIP) with participation by representatives of both ComEd and its AMI vendor, SSN.

SSN has designed its system with security embedded in the architecture, addresses all relevant cyber security requirements analyzed in the publication, and adheres to the specified guidelines for technology, system, and process controls included in the document. Specifically, SSN cryptography technology employs Federal Information Processing Standards (FIPS) 140-2 certified modules.

SGIP 2011-0008-1 (PAP 18 Transition from SEP 1 to SEP 2.0)

This standard is related to the HAN interoperability and functionality. It is important to follow this standard to ensure multi-vendor interoperability between the ComEd smart meters and the various HAN devices and manufacturers that will be supported.

The HAN gateway functionality is contained within SSN's network interface card that will be located inside the solid-state meter. SSN is scheduled to roll out software in the second quarter of 2012 that will meet compliance standards for Smart Energy Profile (SEP) SEP1.1. SSN plans a robust SEP2.0 Energy Services Interface implementation. SSN's approach to HAN communications is to use a generic 2.4 GHz radio so that as standards change, new firmware can be downloaded to the meter over the network without having to exchange the meter. In addition, SSN continues to develop new product features that will support other potential wireless and wireline HAN solutions.

NISTIR 7761: Guidelines for Assessing Wireless Standards for Smart Grid

These guidelines provide a fact-based assessment of emerging wireless standards and representative technology implementations of those standards for their ability to satisfy the

business need for Smart Grid. It provides a comprehensive set of requirements for wireless technologies that are to be used within the Smart Grid.

SSN is compliant with the Field Area Network, Advanced Metering Interface and Home Area Network portions of the standard. ComEd will provide IP backhaul[35] services to the AMI solution in order to provide connectivity between the existing ComEd network and the AMI system. ComEd will ensure that all communications services used will meet the guidelines of this standard. Furthermore, ComEd will ensure that all communication solutions leverage standard IP protocols and cyber security solutions are consistent with the current NISTIR guidelines.

IETF RFC6272: Internet Protocol Standards for Smart Grid

This RFC is an informational document published by the Internet Engineering Task Force (IETF). The goal of the document is to catalog IETF standards that are applicable to Smart Grid, specifically identifying key infrastructure protocols within the Internet Protocol (IP) Suite for use in the Smart Grid. IP is the backbone of many modern communications systems and provides a platform that offers a mature model that highlights interoperability and security.

ComEd's AMI solution is based on IP and implements many of the IETF standards within the IP Suite, including:

- IP Security (IPSec)
- User Datagram Protocol (UDP)
- Transmission Control Protocol (TCP)
- Internet Protocol version 6 (IPv6)
- Domain Name System (DNS)
- Simple Network Management Protocol (SNMP)

These protocols and others are the foundation for the secure transmission of data between disparate systems relating to the AMI Network. The ComEd solution complies with the applicable sections of IETF RFC6272.

AMI field systems, as described above, rely on a backhaul network to transport the information to the head-end systems. ComEd is deploying communications systems and technologies that comply with the above mentioned standards. Interoperability and security are critical requirements that will be incorporated into the ComEd solution to assure customers the benefit of a secure and flexible AMI solution.

[35] The backhaul portion of the network comprises the intermediate links between the core network, or backbone, of the network and the small sub-networks at the edge of the entire hierarchical network.

NEMA SGAMI 1: Requirements for Smart Meter Upgradeability

This standard delivers a key set of requirements for Smart Meter Upgradeability that can be used by suppliers, customers, and regulators. One of the main goals is to assist in the procurement of Smart Meters that will enable upgrades for future technological developments, with respect to the technology deployed within the meters themselves and the communications networks the data will traverse.

The SSN AMI Network enables ComEd to remotely manage (i.e., no field trip required) firmware updates on all meters deployed in the field. As newer meter firmware is available, ComEd will be able to tightly control the upgrade process. This will allow ComEd and its customers the ability to take advantage of advancements in technology/software, as well as providing a mitigation strategy for any security or interoperability issues that are identified after deployment.

ComEd intends to align with NIST guidelines and other industry best practices to develop a foundation for its customer information privacy policy.

ComEd corporate procedures related to data security, access, and transfer will be assessed against the following regulations and policies:

NISTIR 7628: Guidelines for Smart Grid Cyber Security: Vol. 2, Privacy and the Smart Grid

This document contains guidance for conducting a privacy impact assessment for the Smart Grid with a section focused on risk analysis and mitigation.

b) Privacy and Personal Energy Information

The designed and implemented AMI solution will secure the privacy of personal information. ComEd's digital meters do not store or transmit any personal identification information about customers, do not identify electrical devices within a home, do not identify an occupant's specific behavior or activities, and do not determine physical locations of persons within a home. These meters record only information on electricity usage – just as existing electromechanical meters do; they are not surveillance devices. Additional steps that ComEd will take to protect the privacy of personal energy information are discussed in Chapter 3.

C. Deployment Activities

There are a number of key activities that will be completed within each project functional area during the deployment. A PMO will be established to ensure that these activities are completed on-time and on-budget in order to minimize costs and maximize benefits to customers. The following activities for the over-seeing PMO, as well as each key functional area have been identified:

1. Program Management

Program Management consists of the overall management activities required to lead the multi-year smart meter project. Program Management is the responsibility of the PMO function and will serve as the central group responsible for overall project planning, coordination, and delivery of the smart meter project.

2. Network Design and Deployment

Network Deployment is a new activity that was developed for the AMI Pilot and will need to be enhanced for full network deployment. This activity encompasses the planning and execution of all of the work required for the field network design, the field communications network installation and the network optimization to support the full deployment of approximately four million smart meters. Field network devices include SSN's Access Points and Relays and associated telecommunications equipment such as digital cellular radios, fiber optic cable, and mounting equipment. IT, AMI Operations and the AMI network vendor are primarily responsible for this function with support from Supply (procurement and cross dock) and ComEd field construction work forces.

The critical activity is to initially conduct a radio frequency (RF) propagation study for each deployment location within the operating centers in conjunction with SSN, the AMI network vendor. The RF propagation study will provide the estimated counts of field devices and installation location coordinates to optimize the network from both a performance and cost perspective.

Propagation studies will be completed within each operating center based on the established schedule. The propagation studies, in conjunction with the geographic deployment plan and schedule, will then be utilized to develop the detailed AMI network deployment plan. Field installation activities will begin with the procurement of the field devices from SSN. Additionally, network optimization and RF troubleshooting activities will be required during the network deployment to mitigate areas with low RF signal strength or areas of lower reliability on the telecommunication network.

3. Meter Deployment

Meter Deployment is an existing activity that was revised for the AMI Pilot and will need to be enhanced for the full smart meter deployment. This activity encompasses the planning and execution of all of the work required for installing approximately four million additional smart meters over a 7-year period. The Field Deployment project team function is primarily responsible for this activity with support from Supply (procurement and cross dock), IT, AMI Operations, Customer Experience, and ComEd's External Affairs (customer outreach).

4. Cross Dock Operations

Cross Dock Operations is a new activity that was developed for the AMI Pilot and will need to be enhanced for the full smart meter deployment. This activity encompasses managing the supply chain activities required for installing four million smart meters and associated network communications field devices over the 7-year deployment period. A "cross dock" is a location where equipment (*e.g.* AMI meters, network communication devices) is received from the manufacturer, stored for a short period of time, and loaded onto vehicles for the daily field installation activities. Additional activities occur at the cross dock locations such as AMI meter pre-installation testing, support for installer handheld tools, disposition of old electromechanical meters, fleet vehicle management and general field operations support. Supply is primarily responsible for the cross dock activity with support from organizations including Field Deployment, Supply – Procurement, AMI Operations, and potentially an external meter installation vendor to supplement the internal installation workforce. ComEd expects to open 4 separate cross docks across the ComEd service territory during the peak deployment of AMI meters, but this number may increase or decrease based on on-going learning.

5. Meter Activation

Meter Activation is a new activity that was developed for the AMI Pilot and will need to be modified based on lessons learned for the full smart meter deployment. This activity consists of determining when a smart meter is operationally ready and can be activated to use the meter reads via the wireless network for billing (i.e., manual meter reading is no longer required). Major activities include validating smart meter communication performance in the field over a pre-defined time period and transferring eligible smart meters from the manual meter reading process to the AMI-based meter reading process in a systematic manner. The AMI Operations project team function is primarily responsible for these activation activities.

6. Business Transformation

Business transformation activities center on delivering to customers the benefits provided by smart meters and the associated AMI technology while driving value to the customer by enabling smart grid functions. The functionality provided by the AMI solution requires changes to the existing business processes, IT applications, departmental operating models and organizational structures. Additionally, given that the technology is relatively new and evolving rapidly, certain applications will be designed, developed and implemented over several years.

The newly created Business Transformation project team function consists of two primary activities required to lead the business from the "As-Is" to the "To-Be" state. The first set of activities relates to the business process redesign work which includes process redesigns, requirements gathering, technology evaluation and selection, IT testing, change management and employee training. The second set of activities relates to leading the development of new product/service/application roadmaps for items that require longer term planning horizons.

7. Systems Integration

Systems integration refers to the activities and processes of implementing new systems, as well as linking together legacy computing systems and software applications physically or functionally to act as a coordinated whole. System integration brings together discrete systems utilizing a variety of techniques such as computer networking, enterprise application integration, business process management or manual programming. The IT project team function is responsible for the systems integration. This consists of the activities required to analyze, design, develop, integrate to legacy systems, test, and implement the IT applications and tools required for the smart meter program and is responsible for any hardware and software procurement.

8. Automated Meter Reading

Automated Meter Reading is a new activity that was developed for the AMI Pilot. This activity consists of retrieving consumption and meter event data from activated smart meters for billing and other business purposes. The smart meter data is received by the back office utility systems via the AMI network on a scheduled and on-demand basis. The AMI Operations project team function is primarily responsible for this activity with support from organizations including Field Deployment and IT, as well as coordination with ComEd's Billing department.

The Automated Meter Reading activity fundamentally changes the manner in which customer billing data is obtained by utilizing the new AMI systems. The technology benefits customers by enabling the automated retrieval of meter data on all meters every day, including weekends and holidays in place of meter readers that attempt to read each meter once per month. This activity is critical to successfully generating accurate and timely customer bills after a smart meter is installed and activated.

9. Customer Engagement

Customer engagement activities include proactive issue identification and management, customer outreach and education support, and ensuring that the voice of the customer is accurately represented during business process redesign and technology evaluation and selection. This activity primarily involves the AMI Customer Experience project team function and ComEd's Customer Education and Products team with technical support from Field Deployment and IT.

Proactive Issue Identification and Management

The new functionality of smart meters will lead to the identification of new customer-related issues that will need to be addressed over the course of deployment. The team will be actively researching issues experienced by other utilities undergoing similar deployments and applying customer-related lessons learned to ComEd's AMI deployment. Responses and issue management techniques will be developed and communicated throughout the organization to promote a positive and consistent customer experience throughout the deployment.

Customer Outreach and Education Support

Due to the transformational impact that the smart meter deployment will have on customers, ongoing outreach and education will be required to ensure that they are aware of how they will be impacted from a day-to-day process standpoint. To the extent that they are impacted, customers will need to be provided with information accordingly. This activity will be tightly aligned with ComEd's customer outreach and education efforts discussed in Chapter 4.

Voice of the Customer in Business Process Redesign and Technology Evaluation and Selection

The transformation to a smart meter environment will require business process redesign efforts and new technology selection across the organization. Because of the impact these new business processes and the newly selected technologies will have on the customer, it is critical that their voice and impact are adequately represented during the redesign process and throughout technology evaluation and selection. To maintain ComEd's focus on the interest of customers in the business process redesign effort, ComEd personnel with knowledge and experience in direct interactions with customers will be included in the business process redesign effort.

10. Billing

Billing is an existing activity that was modified for the pilot and will be further modified for full deployment. Since smart meter technology enables the automated retrieval of meter data on all meters every day, including weekends and holidays, and allows every meter to be remotely reprogrammed to record usage in various time increments. Project activities include the installation of software tools validate, edit and estimate (VEE) the raw data retrieved by the AMI technology.

11. Remote Connect/Disconnect

The remote connect and disconnect activity is a new activity that consists of switching power on and off remotely when customers move in and move out of premises or do not pay their ComEd bill, in accordance with ICC rules. Each smart meter contains a service switch ("switch") that will be used to disconnect and connect service. The use of the switch for non-payment disconnect will be done in a manner that is compliant with ICC rules. The AMI Operations project team is primarily responsible for this activity.

12. Meter Events

Meter Events is a new activity that was developed for the AMI Pilot. This activity consists of the interpretation of meter data that falls outside of the established parameters (e.g. low voltage, tampering, and loss of power). The meter event data is received by the back office utility systems via the AMI network on a scheduled and real-time basis. The AMI Operations project team function is primarily responsible for this activity with support from the AMI IT project team function.

Given the significant volume of meter event data that will be generated by the smart meters and required for various operational purposes, automated back office processes and systems are required to monitor, analyze and correlate the data, and store this data for data analytics purposes associated with the new business processes.

13. Customer Inquiries

Customer Inquiries is an existing activity within ComEd's current operations. ComEd's Call Center organization is the primary group for direct interaction with customers along with account managers who are responsible for interactions with large commercial and industrial customers. Given the transformation of existing business processes expected with the smart meters, the primary activities involve training and change management for the Call Center personnel and account managers to better serve customers.

14. Electronic communications

a) Customer eServices

The Customer eServices is an existing activity that represents the manner and mechanism by which customers are communicated with via the web, mobile devices, social media, and interactive voice response (IVR). These channels are utilized to communicate directly with customers regarding information related to their account, energy usage, outage status (if applicable), and for Customer Education and Products and other communications announcements. The type and volume of data that will be captured by smart meters will enable new information services directly to the customer. This will provide customers with services such as access to interval energy usage data and dynamic reporting on a next-day basis, updated account information, outage status information, energy usage alerts, and smart meter deployment updates via the web or mobile device.

Additional application integration will be required between the Meter Data Management System, Outage Management System, ComEd's website, and third-party hosting companies to provide proper communication and information flow with other systems. Business process redesign and related training will also be required. A key initial outcome will be an evaluation of the current tools being utilized, and the identification of new tools, integration steps, and business processes required to achieve value to customers through improved functionality to the business over time.

b) Retail Electricity Supplier ("RES") eServices

Currently, the energy usage at accounts with demand greater than 100 kW is measured using interval data recording meters (IDRs) which measure energy and demand across 30-minute intervals. This interval data is used for billing, and provided to Retail Electric Suppliers (RES) via monthly EDI transactions, which is then used to settle the market.

The existing process also allows a RES to request IDR metering for accounts with demand less than 100 kW. While no RES has requested an IDR meter for an account with demand less than 100kW as of March 2012, switching activity for under 100 kW customers (i.e., switching from ComEd supply to RES supply) has become much more active within the industry and is expected to continue to grow in the next couple of years.

To accommodate the provisioning of an IDR meter, ComEd must dispatch a technician to exchange the meter and update the account accordingly. With the onset of AMI metering, ComEd will be able to continue to support these RES requests without the need of dispatching a technician. There are no plans, at this time, to provide billing data to third parties in any additional frequency. Further elaboration on plans to provide all customers and third parties with daily usage information can be found in Chapter 3.

15. Outage Management

Outage Management is an existing activity (though not currently used with smart meters) accountable for detecting and validating unplanned outages as well as coordinating the restoration effort and capturing data used to inform customers. This activity is also accountable for managing planned outages that are required to perform system maintenance on a periodic basis. This activity utilizes an Outage Management System (OMS) to manage all unplanned outage activity and for supplying the data used in calculating system reliability indices (e.g. CAIDI, SAIDI, MAIFI, SAIFI). ComEd's Distribution Systems Operations organization is responsible for this activity.

Smart meters provide near real-time power loss ("last gasp") [36] and power restoration messages to the utility. The implementation of smart meters, associated back-end IT systems and integration with existing legacy systems will improve the effectiveness of Outage Management, and potentially reduce the outage duration for individual customers.

There are six primary outage management dimensions (see below table). Smart meter technology can directly improve performance on all of those dimensions except restoration, and can facilitate the restoration dimension through more timely detection and validation of outages.

[36] 'Last Gasp' is defined as the near real-time final message that is sent from the meter to the ComEd system via the communication network that is coded to indicate loss of power.

Detection	Outage Validation	Customer Notification	Restoration	Restoration Confirmation	Updating Information
Use of AMI to detect outages via meter ping and "last gasp"	Determination of real outages vs. momentary outages / other causes	Proactively communicating with customers regarding an outage	Restoring the customer's power	AMI providing identification of nested outages and checking open outages	Canceling outages and determining the exact start and end times

Figure 8 - Primary Outage Management Dimensions

Based on ComEd's analysis and the evolving and relatively immature state of the industry and supporting technology in this area, eight levels of maturity were identified. The following product road map outlines the characteristics of each outage management dimension in terms of maturity level and the path to future functionality, including short and long-term functionality targets.

	Detection	Outage Validation	Customer Notification	Restoration	Restoration Confirmation	Updating Information
Levels 1-3	- Outage data collection and historical analysis	- Manual meter pinging		**NOT APPLICABLE TO AMI**	- Informational nested outage identification - Email, report, or viewable web page results	- Manual outage restore time updates
Level 4	- Automatic outage reporting in OMS	- Sustained outage validation - Planned outage detection and other system activity filtering				
Level 5					- Automatically re-issue outages that are still out	
Level 6	- Enhanced outage escalation and detection		- Notification to customers of an outage and a restoration			
Level 7	- Additional detection from grid devices					- Ticket cancellation confirmed "on"
Level 8					- Proactive confirmation checks - Restoration signals from grid devices	-Proactive event updates - Auto update restore times

Figure 9 - OMS Functionality Road Map

At this time, it is expected that the eight levels of functionality can be implemented in four phases:

Phase 1: Levels 1 through 3

Phase 2: Levels 4 and 5

Phase 3: Level 6

Phase 4: Levels 7 and 8

Phase 1 scope includes the functionality associated with achieving Level 1 (Meter Deployment and Network Setup), Level 2 (Meter Event Gathering) and Level 3 (Informational Outage Restoration Confirmation and Nested Outage Detection) maturity. This will enable operators to "ping" a meter in real-time to determine if a customer has power or not. This level of maturity was largely achieved during the AMI Pilot, and this functionality and its related benefits will be achieved as the AMI system is deployed throughout ComEd's service area. There is no significant system or IT enhancements required to support these changes.

There are two key benefit drivers associated with Phase 1. The first is a reduction in truck rolls and outbound phone calls associated with improved response to "single light out" complaints. The second, and much more significant driver of benefit realization are the improvements in storm response that impact ComEd overtime labor costs, contractor costs, and mutual aid costs. A reduction in the overall time duration of storm events will result in a decrease in organizational impact and improved efficiencies.

Phase 2 would include the functionality described in Level 4 (Basic Outage Detection with Simple Event Correlation) and Level 5 (Integrated Outage Restoration Confirmation and Nested Outage Detection) of the road map. With this functionality implemented, the OMS would receive real-time "last gasp" and "power on" messages from the smart meters to accelerate the outage detection and restoration activities. The system would be designed in a manner that would prevent data overloads within the OMS and with the dispatcher during periods of large outages. Additionally, the system would have the intelligence to distinguish between data associated with planned and unplanned outages. The activities required to execute Phase 2 scope include significant system and IT enhancements, business process redesign work, and training. The work required and associated costs for achieving the Phase 3 (Level 6) and Phase 4 (Levels 7 and 8) have not been determined at this time. It is anticipated that additional business process and system integration work will be required for Phase 3 and Phase 4. By implementing Phase 1 and Phase 2 and taking advantage of industry advancements and peer experiences, the scope and related costs/benefits for Phase 3 and Phase 4 can be more accurately determined.

16. Opt-in Peak Time Rebate Tariff

ComEd is statutorily required to offer to residential customers with smart meters the opportunity to participate and benefit from a peak-time rebate (PTR) program. ComEd tested a

PTR rate structure in the AMI Pilot's Customer Applications Program (CAP), and that experience will inform the design and implementation of the new program. PTR consists of designing and managing the overall PTR program including the business processes and supporting systems. Major activities required to support this include providing for customer enrollment in the PTR program, calculating and posting the credit amounts for participating customers, altering the physical bill layout to support the display of PTR credits, and interfacing with PJM Interconnection, LLC (PJM) markets. ComEd's Customer Education and Products organization is primarily responsible for this activity with support from organizations that include Billing, IT, AMI Operations project team, and potentially eChannel.

17. Cyber Security

Cyber Security is an existing activity that is required to analyze, design, develop, test and implement the necessary IT security controls for the AMI meter program. It is also required to ensure, for the benefit of customers, a secure and safe IT operating environment and to keep the program in alignment with industry standards and statutory requirements. It also includes establishing a continuing cyber security support model and the governance surrounding that model, including roles and responsibilities. In addition, Cyber Security will support the system vendor procurement process related to cyber security such as security software, tools, and consulting services to ensure that proper controls are in place and that the vendor incorporates the appropriate industry standards in their offerings.

Cyber Security activities include the analysis, design, development, testing and implementation of the cyber security controls for the smart meter program. This activity shall identify, understand and apply the relevant cyber security standards and regulations (e.g., NIST, FERC, etc.) in implementing the cyber security solution and is accountable for providing the technical expertise for cyber security related procurement activity.

The cyber security approach and controls established for the AMI Pilot will remain in place for the short-term portion of the project. This activity will be focused on developing the long-term cyber security solution as described by the detailed activities outlined below.

IT Telecommunications and Network Engineering will assume responsibility for monitoring the security of the smart meter network and systems as well as managing and updating the cyber security controls to maintain a secure smart meter network after the systems are moved into production.

18. Training

Proper training of process owners and new system users is required to realize the full benefits of smart meters and the associated AMI technology for customers. The functionality provided by smart meters will drive changes to the existing business processes, IT applications, departmental operating models, and organizational structures. These system and process changes will impact the roles and tasks performed by ComEd personnel, thereby creating additional training requirements. Given the evolving nature of the technology and the long-term

road maps that are being developed for many functional areas, a long-term training plan will be developed and maintained to ensure that the skills and capabilities of ComEd personnel are properly aligned with the desired functionality.

Training includes those activities required to provide ComEd personnel with the skills, knowledge, and job aids they need to perform the roles and tasks they will be responsible for in the To-Be state, in support of the smart meter deployment. The specific training plans, content, and sequencing will be defined once the business process redesign work is completed by the AMI Business Transformation project function.

19. Procurement

The size and scope of the proposed smart meter deployment requires that a variety of products and services be procured and scheduled over the course of the 7-year smart meter implementation, with the bulk of procurement activities occurring in the first year of the project. Periodic re-assessment of the marketplace relative to the procurement needs will take place over the course of the deployment to ensure that advances in technology and potential pricing benefits are taken advantage of to minimize costs to customers. The procurement plan must align with the detailed deployment schedule and support both the short-term and long-term solution work streams.

Procurement represents the standard activities by which resources (hardware, software, and services) are purchased to support the organization. This centralized support activity is utilized to ensure that departments and work streams have the resources they need to execute projects and operate in the steady-state. This activity also helps the business manage contracts and resolve the related issues that can arise. The BSC Supply organization has responsibility for this activity.

In addition to these standard activities, Procurement will investigate opportunities to leverage spending, with collaborative support from business representatives across ComEd and other Exelon business units, such as PECO and BG&E. This collaboration will be a component of the procurement strategy, and will need to be factored into the overall project schedule.

20. Milestones and Metrics

Pursuant to the Commission's Order in Docket No. 12-0298, ComEd has modified this Plan to include additional milestones and metrics. As part of the metric and measurement tracking process, the program management team will be responsible for ongoing monthly, quarterly, and yearly data reporting, including data provided through the annual reports pursuant to Section 16-108.6(e) of the PUA, 220 ILCS 5/16-108.6(e). As directed by the Commission in its Order in Docket 12-0298, and subject to the protection of consumer privacy, the results of the milestones and metrics tracked pursuant to this Plan will be provided to the Commission and stakeholders.

Milestones and metrics to be tracked pursuant to this Plan include the following:

No.	Issue	Operational Tracking Measure
1	Customers enrolled in Peak Time Rebate, Real Time Pricing, and other dynamic/time variant prices	<u>Residential Customers</u> 1. Number of customers on a time-variant or dynamic pricing tariff offered by ComEd. Expressed also as a percentage of customers in each delivery class. 2. Number of customers served by retail electric suppliers for which the supplier has requested monthly Electronic Data Interchange delivery of interval data. Expressed also as a percentage of customers taking supply from a retail electric supplier in each delivery class. <u>Small Commercial Customers</u> 1. Number of customers on a time-variant or dynamic pricing tariff offered by ComEd. Expressed also as a percentage of customers in the delivery class. 2. Number of customers served by retail electric suppliers for which the supplier has requested monthly Electronic Data Interchange delivery of interval data. Expressed also as a percentage of customers taking supply from a retail electric supplier in the delivery class.
2	Customer-side-of-the-meter devices sending or receiving grid related signals	Number of ComEd AMI meters with consumer devices registered to operate with the Home Area Network (HAN) chip by tariffs under which customer receives delivery.
3	AMI Meter failures	Number of advanced meter malfunctions where customer electric service is disrupted. A “malfunction” is a malfunction that causes the meter to become inoperable but does not include cases of tampering, service panel and service entry equipment, house fires, etc.
4	AMI Meters replaced before the end of their expected useful life	Number of ComEd advanced meters replaced annually before the end of their expected useful life, including reasons for replacement that include ComEd errors. “Replaced” means a replacement due to a malfunction that causes the meter to become inoperable, including tampering.
5	Customers with net metering	Number of customers enrolled on Net Metering tariff and the total aggregate capacity of the group.
6	Customer premises capable of receiving information from	Number of installed AMI Meters as of the last day of the calendar year that communicate back to the head end system. Number of installed AMI Meters as of the last day of the calendar year

No.	Issue	Operational Tracking Measure
	the grid	that communicate back to the head end system, divided by the total number of AMI meters installed. Number of customers who have accessed the web-based portal as of the last day of the calendar year as a percentage of customers with AMI Meters and as a percentage of ComEd customers in that delivery class. Number of customers who can directly access their usage data as of the last of the calendar year as a percentage of customers with AMI Meters and as a percentage of ComEd customers in that delivery class
7	Peak load reductions enabled by demand response programs	Load impact in MW of peak load reduction from the summer peak due to AMI enabled, ComEd administered demand response programs such as the Peak Time Rebate program as a percentage of all demand response in ComEd's portfolio.
8	Customer Complaints	Number of formal ICC complaints, informal ICC complaints, and complaints escalated to ComEd's customer relations department related to AMI Meter deployment, broken down by type of complaint and resolution. AMI Meter deployment includes AMI Meter installation, functioning or accuracy of the AMI meter, and HAN device registration.
9	Reduction in Greenhouse Gas Emissions enabled by smart grid	ComEd will work collaboratively with CUB and EDF to operationalize this measure.
10	Distributed generation projects	Number of locations and total MWs of customer owned distributed generation connected to the transmission or distribution system, broken down by connection to transmission and distribution system. "Distributed generation" locations are those where customers take service under Rider POG or POG-NM or successor tariffs.
11	Load served by distributed resources	Total sales of electricity to the grid from distributed generation (Rider POG or POG-NM customers) divided by zone energy plus distributed generation sales, with all data provided in sortable format.
12	System load factor and load factor by customer class	Total annual consumption for AMI meters (including, separately, small commercial customers) divided by the average demand across all AMI meters over the 4 peak hours multiplied by 8,760 hours by customer class. ComEd will work collaboratively with CUB and EDF to establish a similar measure for all system load.
13	Products with end-to-end	ComEd will conduct an annual survey through a third-party provider to evaluate how products are being introduced in the smart grid enabled

No.	Issue	Operational Tracking Measure
	interoperability certification	marketplace.
14	Network nodes and customer interfaces monitored in "real time"	ComEd will work collaboratively with CUB and EDF to operationalize this measure.
15	Grid connected energy storage interconnected to utility facilities at the transmission or distribution system level	Number of locations and total MWs of utility owned or operated energy storage interconnected to the transmission or distribution system as measured at storage device electricity output terminals. ComEd will conduct an annual survey through a third-party provider to estimate similar measures of non-utility storage units.
16	Time required to connect distributed resources to grid	ComEd's response time to a distributed resource project application, and time from receipt of application until energy flows from project to grid.
17	Voltage and VAR controls	Number and percentage of distribution lines using sensing from an AMI meter as part of ComEd's voltage regulation scheme.
18	Grid assets that are monitored, controlled, or automated	Number and percentage of ComEd substations (Distribution Center Substations (DCs), Substations (SSs) Transmission Substations (TSSs) and Transmission Distribution Centers (TDCs)) monitored or controlled via Supervisory Control and Data Acquisition (SCADA) systems. Number and percentage of ComEd distribution circuits (4kV, 12kV and 34kV) equipped with automation or remote control equipment including monitor or control via Supervisory Control and Data Acquisition (SCADA) systems.
19	Customers connected per automated circuit segment	Average number of customers per automated three phase 12kV line segment. An "automated line segment" is a segment of 12 kV three phase mainline circuit between automated devices which include circuit breakers, reclosers, automated switches, etc. A "customer" is a ComEd account connected on the automated 12kV three phase line segment.
20	Improvement in line loss reductions enabled by smart	ComEd will research the uncertainty in line loss measurement collaboratively with CUB and EDF.

No.	Issue	Operational Tracking Measure
	grid technology	
21	Tracking Actual Costs	The actual cost of the AMI deployment costs that ComEd has incurred, including both one-time costs and on-going operating costs.

D. Operating Considerations by Department

Section C described the activities necessary to deploy and implement the AMI solution. This section describes how ComEd's departments are affected by the AMI solution during the implementation period and after the solution is fully deployed.

1. AMI Operations

AMI Operations was established for the AMI Pilot to operate and maintain the network to support billing operations and other business activities. It will function as both a project team and as an operating department. During the deployment period, the function is responsible for activating smart meters and monitoring the status of the activated meters. At the conclusion of the installation of the final AMI meter, the AMI Operations project team responsibilities will transition to full time responsibility for the day to day operation of the AMI system. The function will need to be scaled-up in both size and capabilities to support the full meter deployment and perform the ongoing operational activities post-deployment.

As the AMI network and smart meters are installed and activated in each operating center across the service territory, the AMI Operations organization will assume an operational role related to the automated meter reading data flow and management, Meter Activation (for smart meter-to-smart meter exchanges), meter events processing and management, and meter/network health monitoring and troubleshooting (in conjunction with the AMI IT Operations organization).

2. AMI IT Operations

The implementation of smart meters and the associated technologies and systems will require IT monitoring, support, and maintenance in order to enable and sustain the desired functionality. The AMI IT Operations organization was formed during the AMI Pilot, and will serve as both a part of the project team and an operating department responsible or supporting the day to day operation of the AMI system. It will expand as necessary to support full deployment.

3. Field and Meter Services

The Field and Meter Services (F&MS) department is responsible for performing various work orders related to meters (e.g., inspections, testing, sampling, connections, disconnections, meter exchanges, theft investigations, and repairs). The advanced functionality provided by the smart meters and AMI network will change both the type and volume of activities performed by the F&MS organization. Over the course of the 7-year deployment, the set of F&MS activities will change as smart meters are deployed. There are three fundamental changes to the work activities.

1. The remote connect/disconnect functionality provided by the AMI system reduces the number of field visits required to perform that function on premises. The use of the remote disconnect capability for non-payment disconnects will be done in a manner that is compliant with ICC rules.

2. Inspections of smart meter installations, performance of manual reads for smart meters when consumption data cannot be accessed remotely, and performance of smart meter safety inspections based on specific account activity criteria.

3. The planned retirement of three legacy remote meter reading solutions eliminates the activities required to maintain those solutions.

4. IT Telecom, Cyber Security

The implementation of smart meters and the associated telecommunications equipment will require ongoing network monitoring and support, and end-to-end cyber security to operate efficiently, sustain the desired functionality, and meet the requirements of the overall program.

IT Telecommunications & Network Engineering Department will be responsible for managing backhaul communications. These activities include:

- Engineering and design of the required specifications, including security
- Ongoing monitoring of performance
- Network enhancements
- Procurement of telecommunications-related resources (products, services)
- Vendor management

During the Pilot, AMI network operations were handled by the AMI Operations project team, and were very manual in nature. These activities included:

- Monitoring the performance of the AMI network

- Identifying issues related to performance of the AMI network
- Coordinating issue resolution through the submission of trouble tickets
- Ongoing assessment of AMI network performance and configuration

Currently, Cyber Security is centralized within the existing IT organizational structure and the specific plans are developed and executed within the context of the applications in use. There are a limited amount of dedicated resources allocated to ensuring Cyber Security is implemented throughout the applications impacted by the smart meter deployment. This will be addressed by the IT group once the specifics of the operating model are finalized.

During the AMI Pilot, the resources dedicated to AMI IT project team were responsible for ensuring thorough and sound Cyber Security for the applications in use. In some cases, this was provided by external contractors through their application implementation and ongoing support, including the AMI Head-End.

The model and structure of the IT Telecommunications & Network Engineering Department that will support the smart meter environment is currently under development. Once finalized, it will address:

- Maintenance, monitoring, and support of the AMI Network via a network management system
- Monitoring of endpoint meter connectivity
- Vendor Management of AMI network systems and services providers
- SaaS management (if applicable)
- Support and resolution of systems issues and trouble calls related to the AMI Network
- Provide centralized RF Engineering support
- Identify and implement network enhancements
- Support ongoing assessment of network systems, vendor performance, and future needs
- Support network procurement needs, including RFP creation and evaluation (as required)
- Firmware download and execution
- Develop and execute comprehensive Cyber Security Strategy and Implementation Plan across Smart Grid and Smart Meter Projects
- Perform ongoing security event testing

- Monitor and report on Cyber Security performance and key metrics
- Identify and implement Cyber Security enhancements

5. Meter Reading

The advanced functionality of smart meters, specifically the automated meter reading capability via the AMI network, will fundamentally change the manner in which customer energy usage data is obtained. The Meter Reading group will no longer be responsible for manually gathering all customer energy usage data on a monthly basis, though a small level of meter reading activities will be performed by the remaining inspectors.

6. Billing

Smart meters and the two-way communications enabled by the AMI system will benefit customers by improving meter reading performance in both the percentage of meters read and the accuracy of the meter reading which will improve the efficiency of the Billing department.

Over the course of the 7-year deployment, the Billing department will migrate from the current billing systems and processes utilized to support manual meter reading to new systems and processes based on the AMI technology that will better serve customers. The primary change to the billing operations is the use of a different editing tool for accounts that require manual intervention.

7. Call Center

The implementation of smart meters impacts the type and volume of calls received by the Call Center organization. During the deployment period, there will be calls related to the program as a whole, or to specific topics such as when the meter will be installed or how the power will be re-connected to the premises. The process for responding to customer inquiries will not fundamentally change in the smart meter environment. However, the Customer Service Representatives will experience a learning curve related to all of the business process redesigns that they will need to understand in order to better serve customers.

8. eChannel

The advanced functionality of smart meters, specifically the type and volume of data captured, will enable new information services directly to the customer. The eChannel group will be responsible for providing customers with access to interval energy usage data and dynamic reporting on a next-day basis, updated account information, outage status information, energy usage alerts, and smart meter deployment updates via the web, mobile device, and social media outlets.

9. Revenue Protection

The Revenue Protection organization is impacted in the areas of Theft and Consumption on Inactive Meters (CIM).

The current practice for identifying and investigating theft is manual in nature. Revenue Protection obtains tamper leads primarily through the field personnel from Meter Reading and Field Operations, or from third party provider specializing in the identification of unaccounted for energy usage.

The current practice for monitoring and eliminating CIM is manual in nature. Minimum usage thresholds are established for inactive premises, and a report is generated for those locations where the threshold is exceeded.

Once the installed smart meter's event detection capability (e.g. tamper flags) is enabled, those events, along with related information, will be correlated to identify potential theft situations.

CIM investigation and reduction will become a much more automated process once the remote disconnect functionality is enabled. When a customer moves out, the power will be disconnected, or a new account may be created in the property owner's name if elected by the owner.

10. Revenue Management

When customers are unwilling or unable to honor their bill payment obligations, an order is generated to disconnect electric service. With the implementation of smart meters and the associated systems integration, the process to disconnect power (in compliance with ICC rules) and the corresponding reconnection of electric service will be effected using the remote service switch and without the associated time lag required for manual reconnection.

The core activities performed by Revenue Management do not fundamentally change in the "To-Be" state. The manual tasks in the process will remain manual; however, the technology utilized to execute the disconnection and connection of power will replace the field visit to disconnect and re-connect service, in compliance with ICC rules.

11. Marketing - Peak Time Rebate Tariff and Program

Current meter technology provides a limited capability to provide innovative rate programs to ComEd consumers without a meter replacement, as has been the case with Residential Real Time Pricing. The implementation of smart meters and the associated data acquisition capabilities benefit customers by enabling the implementation of innovative time varying and dynamic rates and demand response programs, such as PTR. Smart meters will be capable of collecting the data required to settle more complex transactions at a very low incremental cost to customers. As called for in PA 97-0616, the PTR tariff and program will

provide consumers with an opportunity to receive a financial incentive, in the form of a rebate, by lowering their consumption on event days.

Currently, a residential customer that elects a dynamic rate structure (RRTP now and PTR in the future) have to wait up to 3 monthly billing cycles for the meter exchange and rate change to take effect. With AMI, customers can be switched to a dynamic rate much faster.

12. Distribution System Operations

The implementation of smart meters, new applications and/or enhancements to legacy systems such as the Outage Management System (OMS) will benefit customers by improving the effectiveness of the Outage Management function within Distribution System Operations (DSO). As the functionality is implemented over the course of the 7-year deployment, the OMS will be more effective at predicting the sources of outages, automatically opening/closing outage tickets, and more accurately reporting outage durations. The specific timeline and details of the OMS roadmap for implementation will be finalized in conjunction with the work completed by the Business Transformation Office and incorporated into future functionality and IT waves.

Currently, DSO personnel have an outage management process that relies heavily on customers calling to report outages at their premises, field resources assessing the extent of damage, and field crews reporting restoration activities. Customer-provided outage information is utilized by the outage management system to predict the outage type and location as well as to generate outage tickets for manual dispatching. Outage restoration activity reported by field crews allows DSO office personnel to effectively manage the restoration process.

Over the course of the 7-year deployment, DSO will obtain the additional outage management functionality provided by the smart meters, associated backend IT systems and integration with existing legacy systems. As many of the enhancements involve improving the existing OMS automation through the use of real-time smart meter data, DSO personnel will require minimal awareness training to understand the new system functionality. The core accountabilities and activities performed by the DSO personnel remain, in large part, unchanged.

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E. Project Schedule and Cost Estimates

1. Schedule

The following section contains the anticipated schedule for the 7-year deployment period, as summarized in the figures below, and the related key takeaways. The schedule includes a monthly view for 2012-2013, and an overall annual view for the duration of the deployment.

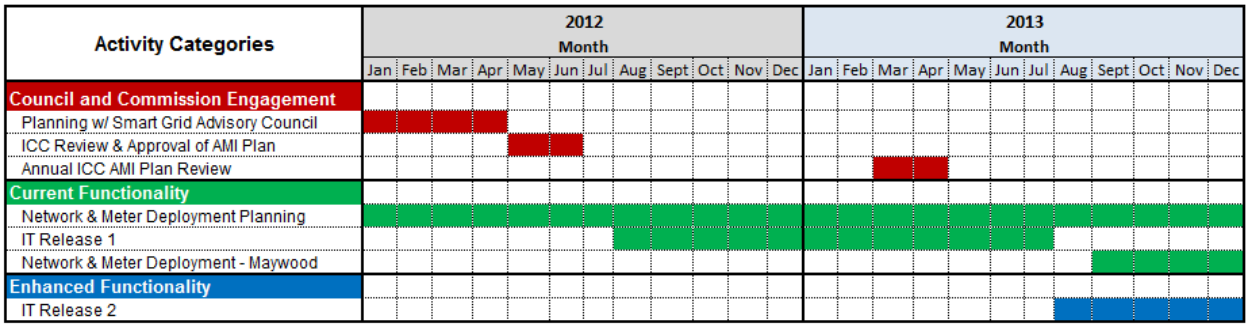


Figure 10 - 2012-2013 Monthly Schedule

Key Observations and Milestones for 2012-2013 include:

- IT Release 1 refers to the initial IT work to be completed to enhance the AMI Pilot solutions to commence the short-term deployment activities.
- IT Release 2 refers to the next set of functionality to be managed by the AMI Business Transformation Project Team.

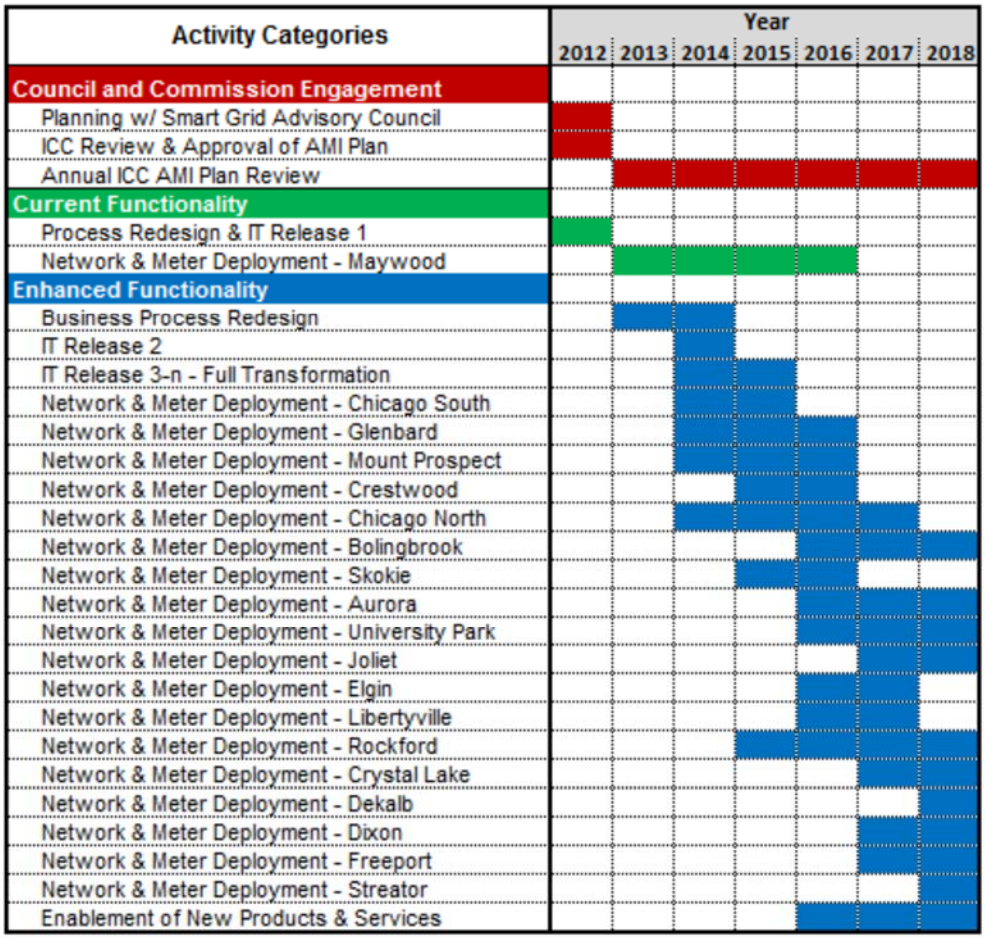


Figure 11 - Overall Deployment Schedule

Key Annual Schedule Observations and Milestones include:

- IT Release 1 refers to the initial IT work to be completed to enhance the AMI Pilot solutions to commence the short term deployment activities.

- IT Release 2 refers to the next set of functionality to be managed by the AMI Business Transformation Project Team.

- IT Release 3-n refers to the subsequent IT work that will be associated with enabling the full smart meter functionality. The specific components and quantity of releases will be managed by the AMI Business Transformation Project Team.

- The full business transformation (business process redesign, change management, functionality realization, etc.) will take place over a period of three years.

- The full deployment plan includes having multiple separate operating centers active for deployment at any given time.

- The smart meters and associated technology represent a platform for future enablement of new products and services that will drive long-term benefits to ComEd and their customers.

2. Estimated Costs

The following section outlines the overall program costs, in terms of anticipated O&M and Capital costs. The annual program costs by Capital and O&M is depicted in the figures below[37]:

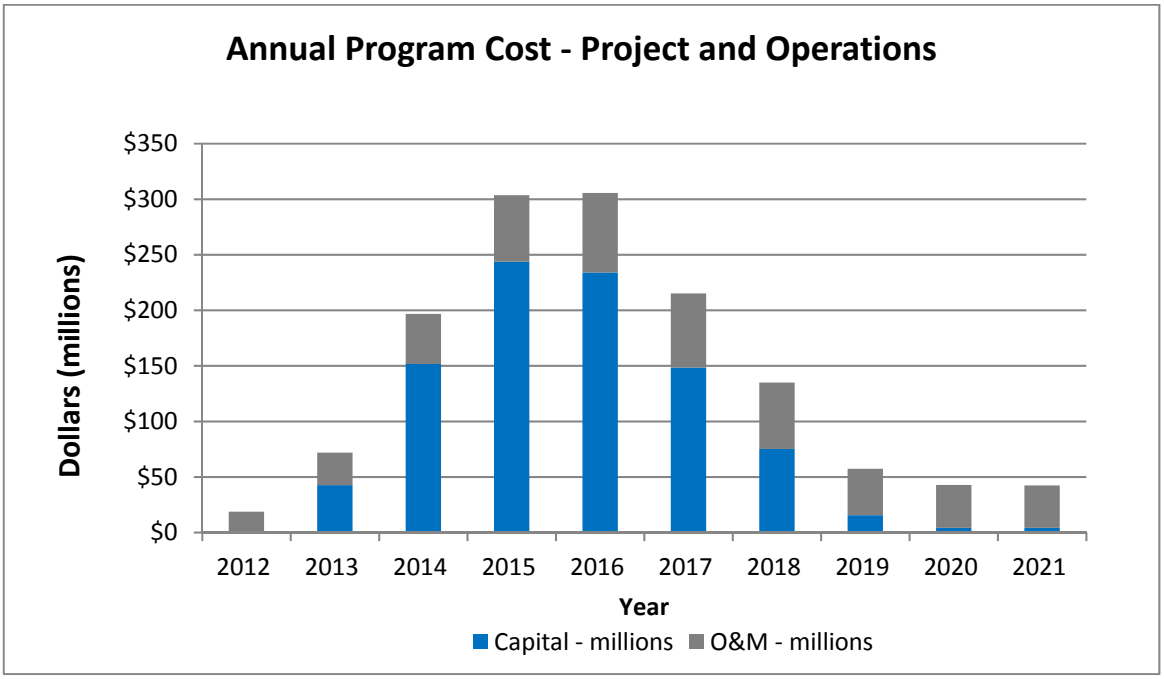


Figure 12 - Annual Program Costs ($ in millions)

Caiptal Cost Category	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Capital - millions	0.3	42.6	151.6	243.6	234	155	91.2	16.5	4.2	4.2	943.2

Figure 13 - Capital Cost Detail ($ in millions)

[37] The amounts in these figures exclude the sunk costs associated with the AMI Pilot (i.e., $54.7 million of Capital and $7.6 million of O&M) as well as the costs associated with a Peak Time Rebate ("PTR") program included in the PTR cost benefit analysis.

O&M Cost Category	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
O&M - millions	18.4	29.3	45.1	59.9	71.5	70.5	62.2	43.5	40.4	40.9	**481.7**

Figure 14 - O&M Cost Detail ($ in millions)

ComEd estimates that the unrecovered cost of the non-AMI meters is approximately $258 million, as of January 1, 2014. Of this amount, ComEd estimates that the accelerated depreciation resulting from the early retirement of the non-AMI meters over the AMI meter deployment period will be approximately $180 million. This amount includes the impact of estimated removal costs.

ComEd plans to record monthly the accelerated depreciation costs resulting from the early non-AMI meter retirement as a regulatory asset, and to amortize each such respective amount over a 10-year period. As a result, the regulatory asset is expected to be established gradually over the period 2012 through 2018, and will be amortized over the period of 2012 through 2028. ComEd would recover the amortized amounts of the retired meters through the revenue requirements established in response to the annual formula rate updates, or in the absence of a formula rate, through its delivery services revenue requirement. The unamortized balance of the regulatory asset will be included in ComEd's delivery service rate base and will earn a return equivalent to the return earned on its other distribution assets. The unrecovered cost of the non-AMI meters is included in the cost-benefit analysis of this AMI Plan.

3. Benefits

There are a number of key benefits for customers that will be realized from the smart meter deployment. These benefits are aligned with the following six plan objectives:

1. Financial payback

Customers will benefit based on operational savings (*i.e.*, the categories of benefits described in the Black & Veatch Report) in the following areas:

- Reduction in manual meter reading
- Reduction in meter field work
- Reduction in manual billing
- Reduction in outage management effort
- Reduction in call center effort
- Reduction in consumption on inactive (CIM) meters
- Reduction in energy theft

- Reduction in bad debt
- Avoided capital investment in equipment

These operational savings will flow back to customers through ComEd's performance-based formula rates.

2. Peak time financial rebates

Customers will receive "rebates" (rate reductions) when their energy usage is reduced during peak time events. ComEd will offer an opt-in peak time rebate tariff (voluntary to customers) that incentivizes customers to reduce their consumption when energy costs are high. These events are likely to occur on hot summer days when demand for electricity is at its highest points of the year.

3. More informed customers

Customers will benefit by having access to energy usage and cost information regarding how much energy is being consumed, and the time of day of usage. Similar to the AMI pilot, ComEd plans to make available a web-based application that provides a variety of charts and graphs of the customer's historical usage based on different time dimensions (i.e., hourly, daily, and monthly). This data will be updated on a daily basis to reflect the prior day's usage. In addition, the application will compare the customer's usage to neighbors for benchmarking purposes.

4. Foundation for more products and services

Customers will benefit by additional product and service offerings from ComEd and other companies to help them manage their electricity costs, keep them informed during power outages, and improve their overall experience with ComEd. As an example, every meter will have a second radio to communicate usage to smart in-home devices for real-time access and/or control.

5. Improved customer experience

Customers will benefit from the implementation of more effective business processes associated with a variety of customer operations transactions, including more effective outage management. As an example, every meter will be read every day by the system, thereby reducing the number of bills created from estimated readings.

6. New professional and skilled trades jobs

Additional local jobs will be created in a variety of fields such as meter assembly, meter installations, data analytics, information technology, operating technology, network engineering, network management, RF engineering, and cyber security.

The benefit details can be found in the Black & Veatch Advanced Metering Infrastructure Evaluation Final Report, and the Black & Veatch Update and Explanation of Changes to the Cost

and Benefit Analysis in Support of the Commonwealth Edison AMI Plan Due to Revised Meter Deployment Schedule.

Chapter 3: Customer Applications

A. Introduction

This section builds on Chapter 2 by explaining how the AMI system ComEd proposes will benefit customers by enabling specific functionalities of the Smart Grid that were previously unavailable. In addition, this section explains the specific customer applications that ComEd plans to offer once the AMI system is in place, as well as the process ComEd will use to identify, evaluate, and implement future customer applications that will utilize the AMI system.

The AMI system that ComEd installs will provide the foundation for enabling many of the Smart Grid functionalities identified by the EIMA. However, AMI is only one component necessary to deliver some of the functionalities. Other future applications and technologies that can benefit customers – such as distributed renewable generation, battery storage, plug-in electric vehicles, and HAN technologies – will help customers unlock the full value of the Smart Grid. As a result, ComEd has developed a two-pronged plan to directly meet certain key functionalities, while also enabling the widest range of future Smart Grid applications that promise to deliver value to customers. First, ComEd has designed its AMI system around leading specifications to meet these functionalities and support as many future Smart Grid applications as possible. Second, ComEd has developed a process for identifying and evaluating future Smart Grid applications in order to enable or implement those applications that prove to be valuable to customers. The remainder of this section provides details around the two parts of ComEd's plan to create customer value through technology selection.

B. Plan to Deliver Smart Grid Functionalities through AMI System Selection

The first and most fundamental way that ComEd is creating value for its customers through the Smart Grid is by selecting technologies for its AMI system that meet industry-leading specifications and standards. These technologies and the criteria used to select them are described in detail in Chapter 2 of this plan. What follows in this section builds upon the previous description by explaining how the specific standards and specifications of ComEd's AMI system will benefit customers by enabling key functionalities of the Smart Grid identified by the EIMA.

1. How ComEd's AMI System Enables Smart Grid Functionalities

a) Data Collection, Analysis, and Communication Capabilities

Language from the EIMA:

- The ability to develop, store, send, and receive digital information concerning or enabling grid operations, electricity use, costs, prices, time of use, nature of use, storage, or other information relevant to device, grid, or utility operations, to or from or by means of the electric utility system through one or a combination of devices and technologies

- The ability to measure or monitor electricity use as a function of time of day, power quality characteristics such as voltage level, current, cycles per second, or source or type of generation and to store, synthesize, or report that information by digital means.

1. Potential to enhance data collection, analysis, and communication capabilities

The Smart Grid holds the potential to benefit customers by improving data analysis pertaining to electricity use and system monitoring/management. While a Smart Grid provides greater data availability at all points in the transmission and distribution system, some of the greatest enhancements in data analysis are made possible by AMI meters capable of digital monitoring and two-way wireless communication.

AMI meters can measure usage at hourly and sub-hourly levels. In addition, these AMI meters are capable of collecting peak demand as well as voltage information. AMI meters can then send this detailed data back to the utility at daily or hourly intervals via the AMI network, so that data can be analyzed and used for a variety of utility and customer applications.

Given the wireless communication capabilities of AMI meters, utilities will also be able to send data to the AMI meter in a way that was previously not possible. For example, utilities can send AMI meters pricing information at an interval level. As a result, hourly rates with prices that change daily can be communicated to the AMI meter. In addition, time of use tiers and peak event periods can also be sent to the Ami meter, along with accompanying text messages. AMI meters are then capable of sending this information to compatible Home Energy Management (HEM) devices so that customers can benefit by understanding and managing their energy use in the home.

2. How ComEd's AMI network enables those functionalities

ComEd's AMI system will enable all of the functionalities discussed above. First, ComEd's AMI meters will capture hourly interval usage data. However, the AMI meters will have enough memory pre-installed to capture sub-hourly intervals, and ComEd will be able to remotely re-program the AMI meters to collect this shorter interval data if required. The meters, however, will send data back to ComEd through the SSN wireless mesh network every four hours, so ComEd has significant flexibility in how much data needs to be stored by the AMI meter. Given that the wireless mesh network makes it unlikely that ComEd will lose contact with the AMI meter for a significant period of time, ComEd can store the data within the AMI meter for a shorter period of time if it begins to run into memory limitations when storing shorter interval usage data or more detailed power quality, voltage, or other system condition data. The AMI meters will also be capable of measuring voltage, current, and power quality at the interval level, giving ComEd better visibility for its planning and grid operations to better serve its customers.

Second, the AMI meters will be fully capable of communicating with each other and the ComEd's centralized AMI IT systems using the SSN wireless mesh AMI network. The AMI

meters will be able to use the AMI network to benefit customers by sending usage data, as well as receive meter re-programming signals, prices, time of use and peak notifications, and text messages.

Third, ComEd is installing a MDMS capable of storing and processing the data it will receive from AMI meters. ComEd's MDMS, as well as the other IT systems it is installing as part of the AMI system, will enable ComEd to operate more effectively for the benefit of customers by managing the amount of data collected by the AMI system for billing and other operational purposes.

b) Energy Monitoring, Management, and Automation Applications

Language from the EIMA:

- The ability to develop, store, send, and receive digital information concerning electricity use, costs, prices, time of use, nature of use, storage, or other information relevant to device, grid, or utility operations to or from a computer or other control device

- The ability of any device or machine to respond to signals, measurements, or communications automatically or in a manner programmed by its owner or operator without independent human intervention

1. Potential of energy monitoring, management, and automation applications

The amount of data collected by the AMI meters (as described in the previous section) will enable a number of new applications designed to benefit customers by helping them control and automate energy use in their homes. Examples of these applications follow in Figure 15, Figure 17, Figure 18, and Figure 19.

One of the most immediate ways customers can benefit from having an AMI meter is to be able to view their interval usage online. By viewing their hourly interval usage online within a day of the actual usage, residential customers are able to better understand how much energy they, or a communicating appliance they enable, use and the associated costs. Hourly data helps customers know how much energy they were consuming during a specific time period, and having this data presented within a day of the actual usage helps customers remember what they were doing during a specific interval that led to changes in their energy consumption. Furthermore, vendors have developed websites that are capable of letting customers set a goal for how much energy they want to consume each month, and a website with daily refreshes of interval data can help the customer understand if they are on track for that goal. To help customers set a goal, some vendors' websites show customers how much energy a similar premises uses each month. Once the goal is set, the website can suggest tips and tricks to reduce energy consumption based on actual interval usage patterns of that customer. These services can be integrated with other functions of utility websites – such as online bill pay and energy audit tools – to help reduce costs and save energy for customers.

Figure 15 - Sample Web Portal Screenshots

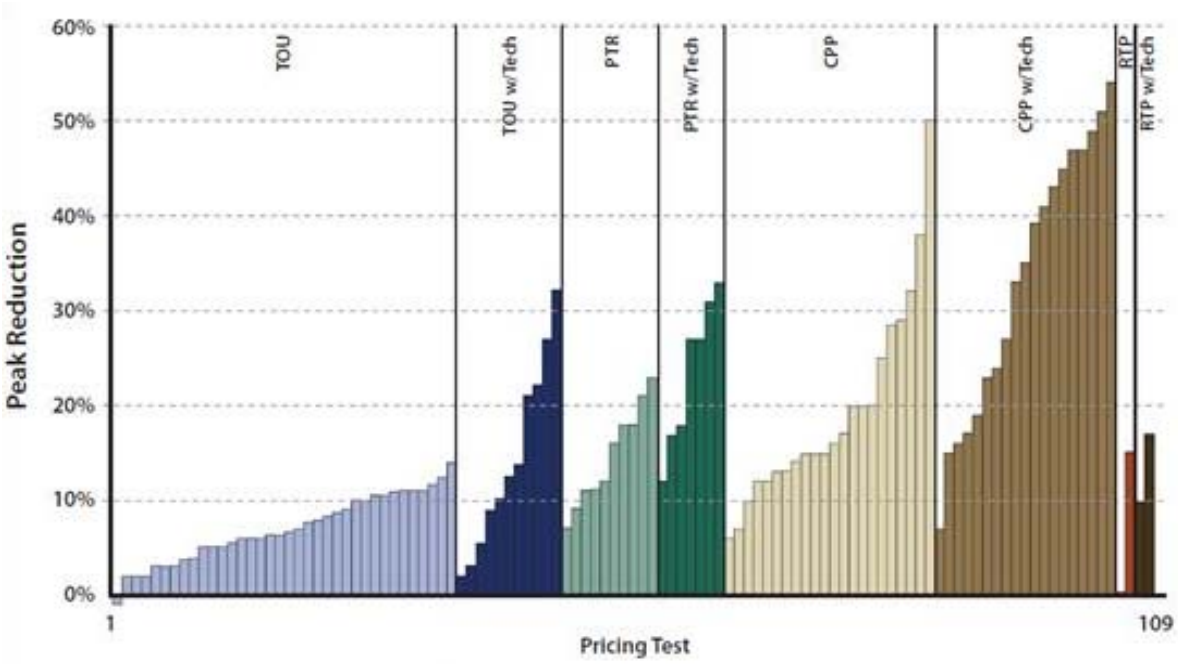
The availability of interval data also enables suppliers to offer customers a much wider range of rate options. Many of these new rates are dynamic, in that they will vary to reflect the fact that energy costs different amounts based on the time period in which it is consumed. There are many different types of dynamic rates that can be offered once a customer has an AMI meter installed (see Figure 16).

First, in certain dynamic rates, the customer's cost of energy during a critical event changes. One example of this rate is a critical peak pricing (CPP) rate, where the customer receives a small discount on energy consumed during normal times, but pays a significant premium for energy consumed during a peak event (which usually lasts a few hours and only occurs a few days a year).

Another example of this type of rate is a peak time rebate (PTR), which ComEd will offer as a demand response program. The PTR program that ComEd will offer will be a voluntary, e.g. opt-in, program funded by revenues from the PJM energy and capacity markets. The program will be open to all residential customers (regardless of their electricity supplier) with an installed and certified AMI meter, and will offer the customer a rebate for reducing their usage during peak events compared to a projected baseline. ComEd will "call" PTR events – during which customers can benefit by receiving a rebate for reducing their usage – for a period of several hours on select days of the year in which reduced demand will help improve system reliability (capacity). There will be no cost to enroll in the program, and there will also be no penalties for customers who do not reduce usage during the peak event – they will only forego the opportunity to receive a rebate during that period.

The next class of dynamic rates includes time of use (TOU) rates, in which energy costs vary by time of day (usually costing less during low demand off-peak hours and costing more during the high demand on-peak hours). TOU rates can have more than two tiers in which prices change, but the price of energy in each tier usually remains the same within a single day.

Hourly or real-time pricing (RTP) rates vary the price of energy in each interval measured, typically as a function of the hourly market prices for that energy. The day-ahead and real-time markets in PJM are used to determine the price of energy in each interval, and as a result, energy prices change daily for each interval. ComEd's Residential Real Time Pricing (RRTP) program is an example of a RTP rate.



Note: TOU=time-of-use pricing; Tech=technology; PTR=peak-time rebate; CPP=critical peak pricing; RTP=real-time pricing.

Source: A. Faruqui, "The Tao of the Smart Grid," presentation to the Michigan Smart Grid Collaborative, Lansing, MI, August 24, 2011, http://www.brattle.com/_documents/UploadLibrary/Upload973.pdf.

Figure 16 - Peak Load Reduction from Dynamic Pricing Pilot Programs by Rate Design and Technology. Source: MIT study "The Future of the Electric Grid"

In addition to dynamic rates, AMI meters will enable a wide range of HEM devices intended to help customers understand and control their energy use in the home. HEM technologies achieve these goals in a number of ways, including providing access to information that encourages customers to reduce or shift energy consumption, by enabling dynamic rates, and by automating appliances to use energy during less expensive time periods.

HEM technology devices fall largely into three broad categories. First, In-Home Displays (IHDs) are the broad class of devices used to monitor near-real time energy use in the home. Most IHDs are built to communicate directly with the AMI meter to show the customer exactly how much energy that customer is currently consuming, and many can store a history of energy use to show consumption on a daily or monthly level. IHDs also frequently have the ability to show on- and off-peak tiers or peak event notification either through a text message or through a device that contain a light that changes color, e.g. an illuminated orb.

Figure 17 - Sample IHDs

Second, Programmable Communicating Thermostats (PCTs) are the class of HEM devices that are able to change a customer's Heating Ventilation and Air Conditioning ("HVAC") usage based on price signals from the utility, but (except, potentially, if the customer has agreed to an automatic rate) pursuant to the customer's direction and programming. PCTs frequently have many of the same capabilities as IHDs – like the ability to display price, usage, and messages sent from the AMI meter – but are also capable of automating the HVAC system to adjust to price signals from the utility. This ability includes turning off or cycling cooling during peak periods in the summer. PCTs enable customers to benefit by taking full advantage of dynamic rate structures that provide incentives for off-peak energy usage, as a customer's HVAC system frequently consumes the most energy in the home.

Figure 18 - Sample PCTs

The third class of HEM devices includes "smart" appliances. These appliances function much like PCTs in that they can receive price signals from the AMI network or Internet and can be automated to run during low-priced time periods. "Smart" washers, dryers, and dishwashers are some of the examples of the appliances being developed to help customers control when they use energy.

Figure 19 - Sample Smart Appliances

In addition to HEM tools that customers can use themselves to monitor and control their energy usage, a number of Direct Load Control (DLC) devices are being developed that enable customers to allow the utility or third-party service provider to control some of their heavy-use appliances. DLC devices will allow the utility or third-party service provider to turn off heavy use appliances like HVAC systems and pool pumps during times of high energy use, in exchange for a rebate or other financial inducement. DLC devices have the capability of reducing peak demand, energy, providing frequency regulation, and other ancillary services to the grid.

Taken together, all of the previous components can be integrated with other media, security, and healthcare applications to create a "Smart Home." In the GSM Association of mobile operators report titled "Vision of Smart Home: The Role of Mobile in the Home of the Future," they lay out a vision for "an integrated smart home that extends beyond the electric utility… with other data from providers of media, security, and healthcare. Through a wireless connection, all of these areas could be integrated into a seamless experience for the consumer."

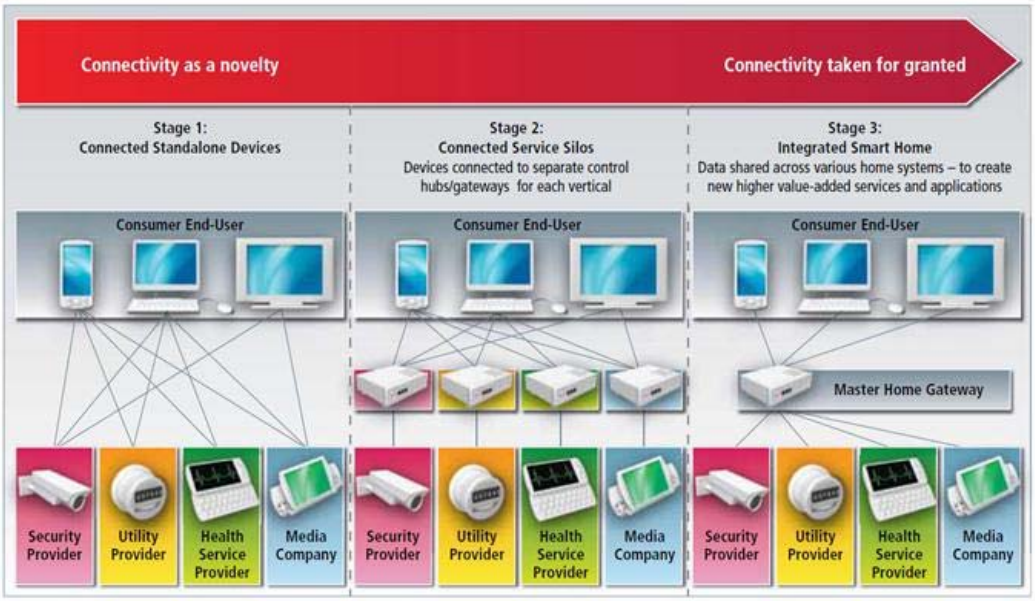


Figure 20 - Smart Home Services Evolution Scenario from GSMA Report "Vision of Smart Home: The Role of Mobile in the Home of the Future"

2. Challenges in implementing Smart Home vision

While the Smart Home offers a myriad potential benefits for the customer and the electric grid as a whole, a number of key developments are necessary before many of these benefits can be realized. First and foremost, standards for communication between devices need to be implemented across the range of technologies that comprise the Smart Home. For example, while the ZigBee® wireless protocol is the most widely accepted standard for HEM technologies, a plethora of other standards still exist for wireless communication (see Figure 21).

Technology	Verticals classification	Key design/ application features	Network Type	Technology classification
Mobile WAN	General purpose	Secure, high-scale wide area connectivity	WAN	3GPP technology standards; Connectivity
Femtocell	General purpose	Extension of mobile connectivity into the home	LAN/HAN	Connectivity
Wi-Fi	General purpose	Local-area connectivity	LAN/HAN	802.11a/b/g/n; Branded standard for wirelessly connecting electronic devices
Bluetooth	Multiple depending on Bluetooth profile	Low power wireless protocol for Personal Area Networking, high levels of security	PAN	Technology standard 2.40 – 2.48 GHz
Bluetooth Low Energy	Healthcare	Subset of Bluetooth v4.0 For very low power applications running off a coin cell	PAN	As Bluetooth
DECT/CAT-iq 2.0	General purpose	Next generation of DECT technology. For smart home and m2m applications	LAN/HAN	Connectivity
ZigBee	Multiple. Dominant in the smart energy verticals: smart metering and home automation	Low power wireless protocol for Personal Area Networking	PAN	Low power communication protocol, wireless network standard; operates in ISM (868MHz/915MHz/2.4GHz)
HomePlug, Multimedia over Coax (MoCA), Home PNA	Home entertainment, smart metering and home appliances	Wired home networking	HAN	IEEE 1901. Powerline communications standard; Connectivity
Wireless M-Bus	Smart metering	Connectivity between smart meters and head-end	NAN	Connectivity
6LoWPAN i.e. IPv6 over Low power WPAN	Smart objects that are IP enabled – extending the Internet of Things	Simplifies IPv6 connectivity, defining very compact header formats and taking nature of wireless network characteristics (e.g. packet loss, congestion etc.) into account.	PAN	Standard

Note: WAN, LAN, NAN, and HAN correspond to wide area, local area, neighbourhood area and home area networks respectively.

Figure 21 - Wide- and Home-Area Networking Standards from GSMA Report "Vision of Smart Home: The Role of Mobile in the Home of the Future"

Furthermore, even once standards have been agreed upon, devices frequently have to be certified on an ad hoc basis by the meter manufacturers to communicate all of the data necessary to deliver the full value of the HEM technologies to customers. The same holds true for many potential stand-alone gateway devices that promise to wirelessly connect all of the technologies in the Smart Home.

3. How ComEd's AMI network enables those potential capabilities

Despite the challenges in connecting the Smart Home, ComEd's AMI network will enable the full range of potential solution options. At the heart of this solution lies ComEd's AMI meters, which are capable of recording interval data needed to enable dynamic rates – and thus provide customers with opportunities for savings on their energy bills. The AMI meters are also capable of communicating price, usage, and messaging information into the home via the

ZigBee® radio installed in each AMI meter. As ZigBee® is the leading communications protocol for HEM technology and the AMI meters will be able to broadcast to any certified device or gateway built to the ZigBee® specification. The ZigBee® connection is encrypted to ensure security of customer data transmitted over ZigBee® network. ZigBee® has established itself as a leading wireless communication standard primarily due to its low cost, low power demand, and ease and reliability of adding devices.

The AMI meters will also be remotely programmable, which will allow firmware updates to the ZigBee® radio to ensure that the AMI meter will be able to communicate with any devices using future iterations of the standard. The AMI network also will enable ComEd to send price and DLC signals to the AMI meter, which then will be capable of broadcasting those signals to other Smart Home technologies.

Once AMI meters are installed, customers will be able to benefit from the latest Smart Home applications. For example, they will be able to participate in any supplier's dynamic rate offerings and/or any curtailment service (demand response) provider's or ComEd's DLC programs, such as the PTR program discussed earlier in this chapter. ComEd is also in the process of enhancing the existing web portal, which was used in the Pilot to enable all of the potential value for customers from this application, including:

- Viewing hourly interval usage data within 24 hours of that consumption
- Setting a goal for reducing energy usage, setting up a plan/budget to meet that goal, viewing progress towards that goal, and receiving optional proactive communications if not meeting the goal.
- Comparing energy use to similar anonymous customers
- Viewing tips for reducing energy consumption
- Encrypted data transfer to ensure security of customer usage data
- The web portal ComEd is developing will also be built with a "Green Button" functionality. Further description of this functionality can be found in the "Data Privacy" section of this chapter.

c) Digitization and Automation of Electric Grid Functionalities

Language from the EIMA:

- The ability to use digital information to operate functionalities on the electric utility grid that were previously electro-mechanical or manual.

1. Potential abilities to automate previously electro-mechanical or manual steps

The Smart Grid holds the promise of automating many functions of grid operations and electricity delivery that were previously not possible with an analog grid. A key function that the AMI system provides is a way for the utility to read the AMI meter remotely. Usage data collection can thus be automated, and conducted at daily or even hourly intervals.

The AMI network also allows utilities to upgrade the AMI meter firmware remotely. Updates to the AMI meter firmware can be sent via the AMI network to ensure that the AMI meter has the most up-to-date software and communications capability. This capability allows the utility to connect diagnostics and fix problems with the AMI meter, as well as keep the AMI meters as up-to-date as possible.

AMI meters also enable the utility to detect theft in a more robust manner that will benefit customers. First, analysis of customers' interval data can reveal patterns typical of theft in ways that monthly data from analog meters would not permit. Second, the new AMI meters are physically more difficult for potential thieves to manipulate in a way that would evade detection by utility systems.

Next, the utility is able to remotely connect and disconnect customers using the AMI system. This ability benefits customers by eliminating the need for a manual visit to a home to turn on or off an AMI meter when the customer moves in or out of a premises, or when a customer stops/starts paying any overdue bills.

Finally, AMI systems are capable of assisting in the automatic detection of outages. The backend IT systems supporting the AMI network can automatically determine which AMI meters have power flowing to them, and which do not. As a result, when AMI meters are fully integrated into an automated Outage Manage System, customers benefit by not having to call ComEd to report an outage, and storm crews can restore service faster by isolating any problems more quickly and targeting their repair work in the most efficient manner possible.

2. How ComEd's AMI network enables those potential capabilities

ComEd's AMI network benefits customers by enabling all of the automation capabilities discussed above. The AMI network will allow two-way communication between ComEd and the AMI meter. This two-way communication enables ComEd to receive usage information from the AMI meter at regular intervals, and to send the AMI meter signals to update its firmware and turn the electricity on or off at a premises. Furthermore, the AMI meter design and the interval data collected will make it more difficult for energy theft, and will enable ComEd to detect outages automatically.

d) Integration of Electric Plug-In Vehicles, Distributed Generation, and Storage

Language from the EIMA:

- The ability to integrate electric plug-in vehicles, distributed generation, and storage in a safe and cost-effective manner on the electric grid.

1. Plug-in Electric Vehicles (PEVs)

Consumer adoption of PEVs

PEVs have a great potential to transform the automotive industry and the way we drive. As PEV technologies continue to improve and come down in cost, and automotive manufacturers continue to provide additional PEV choices, more and more consumers will have the opportunity to adopt PEVs and transition to domestically-produced electricity to fuel their driving at a fraction of the cost of gasoline.

Consumers will have a wide array of PEV types from which to choose. These range from plug-in hybrid electric vehicles (PHEVs) which include both a battery and an internal combustion engine to power the vehicle, to battery electric vehicles (BEVs) in which the sole source of power is the battery. This range of PEV options will enable consumers to choose the PEV type that best fits their lifestyles. For example, the BEV, with a typical driving range of 100 miles or less between charges, may be ideally suited as a true "zero emissions" commuter vehicle, but limited in its capability for longer trips without significant build-out of inter-regional charging infrastructure. PHEVs, on the other hand, generally offer driving range similar to conventional vehicles because of the onboard internal combustion engine. As such, a PHEV can be a consumer's "only car". As intra-regional and inter-regional PEV charging infrastructure continues to be deployed, consumers will have greater flexibility with respect to their PEV choices, and the ability to charge their PEVs at home, at work, while shopping, or in other public places when it best suits their needs and lifestyles. Figure 22, included in a recent publication from the Edison Electric institute (EEI), "The Utility Guide to Plug-In Electric Vehicle Readiness", illustrates the anticipated launches of commercial passenger PEVs in the United States.

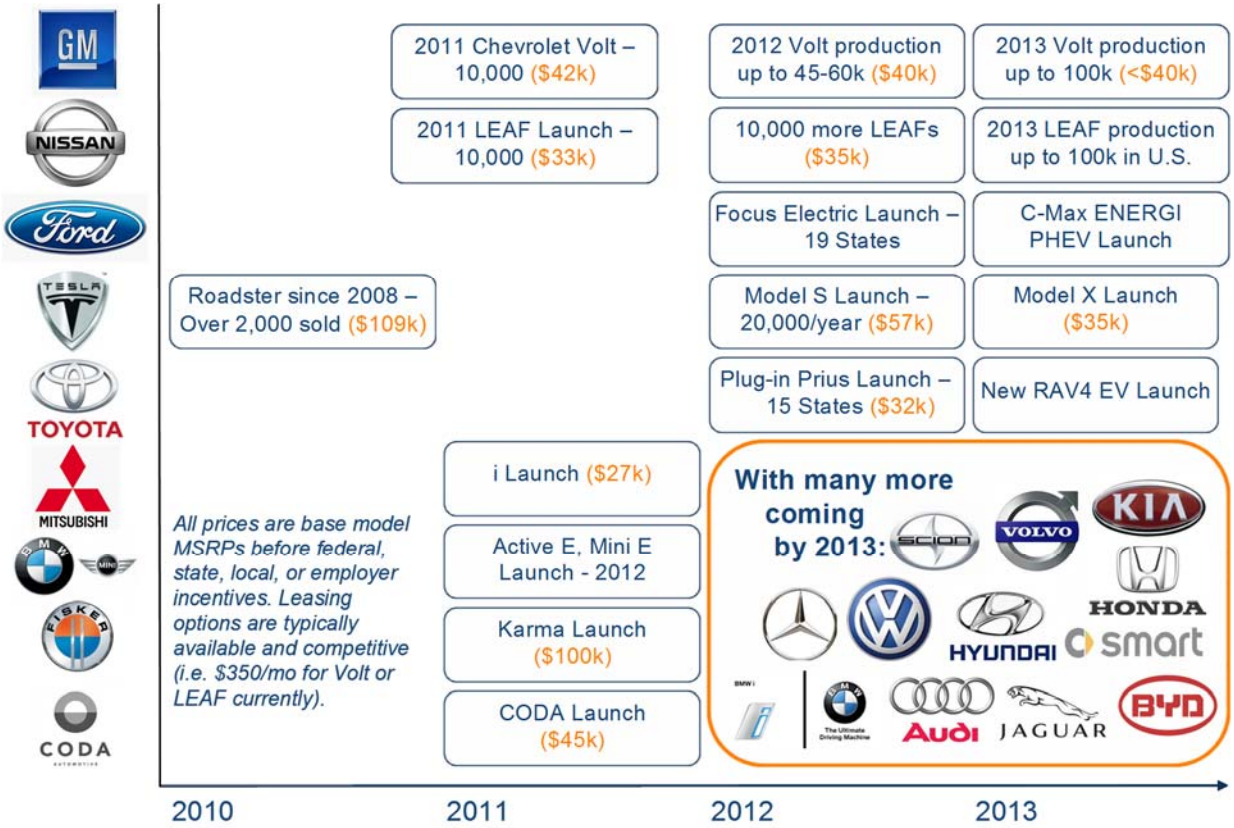


Figure 22 - Anticipated U.S. Commercial Passenger PEV Launches. Source: EEI report titled "The Utility Guide to Plug-In Electric Vehicle Readiness"

The current Presidential Administration has set a goal of having one million PEVs on the road by 2015, and research such as that conducted by the Electric Power Research Institute (EPRI) suggests the potential for 15 million to over 65 million PEVs on the road in the U.S. by 2030, representing about 4% to 18%, respectively, of the total vehicles on the road in the U.S. (see Figure 23 and Figure 24 below)[38].

[38] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, Figure 4-2

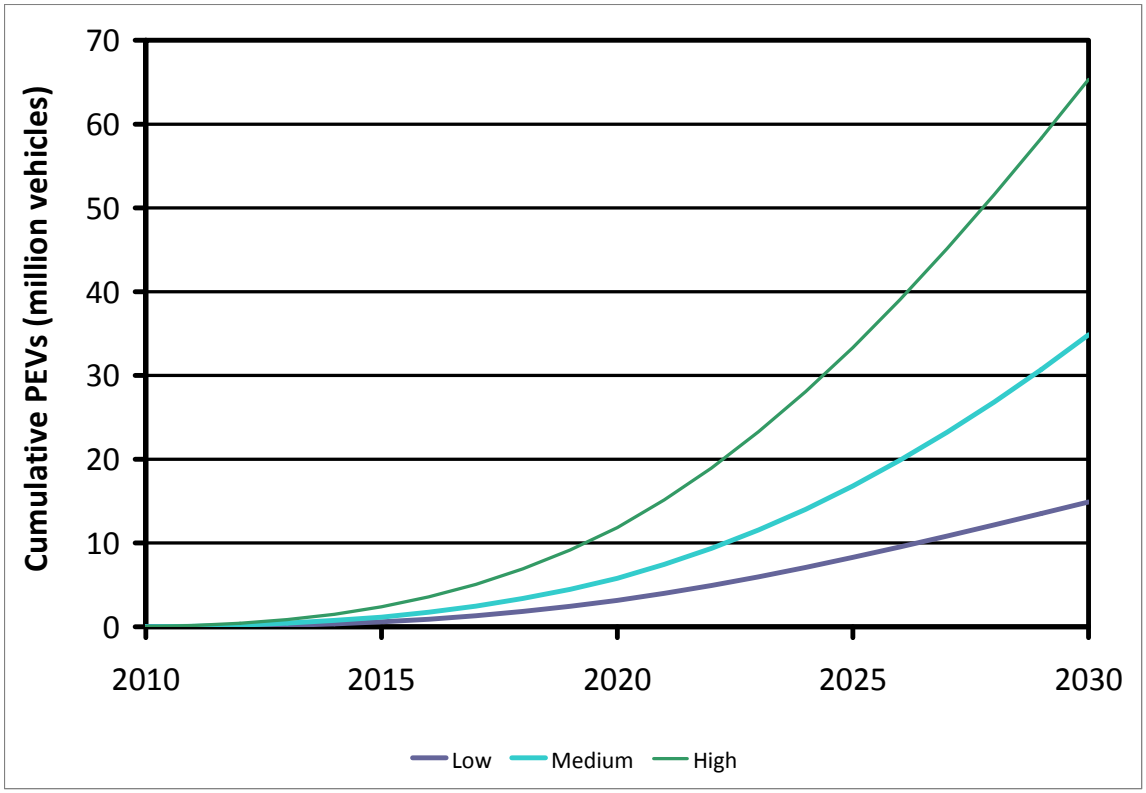


Figure 23 - Projected Electric Vehicles on the Road by 2030. Source: EPRI report titled "Transportation Electrification, A Technology Overview"

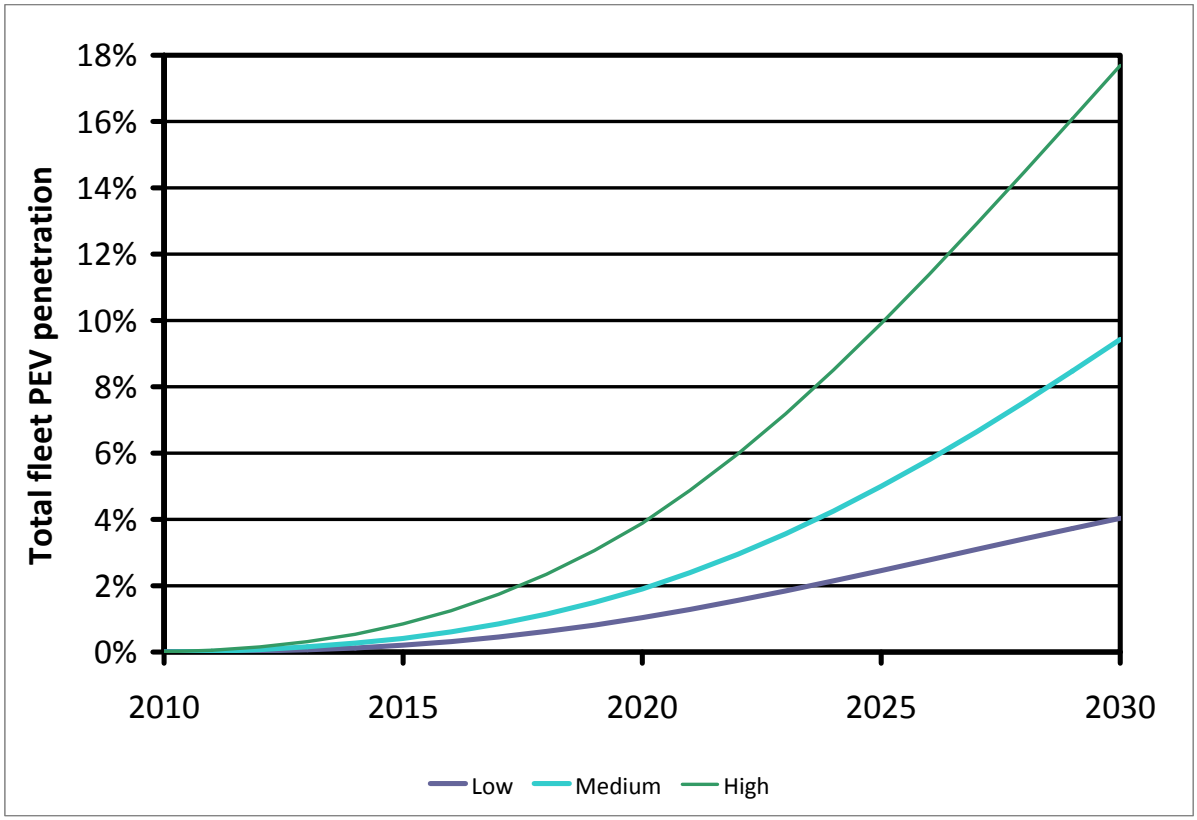


Figure 24 – Penetration of PEVs as a percentage of total U.S. vehicles. Source: EPRI report titled "Transportation Electrification, A Technology Overview"

Projections of PEV adoption are highly uncertain, and actual penetration could be significantly higher or lower than these estimates depending on a number of factors, such as battery costs, gasoline prices, charging infrastructure availability, competition from other vehicles, and government policy. Compared to other advanced vehicles like hybrid electric vehicles (HEVs), PEVs are generally more expensive and more technologically risky for vehicle manufacturers, which reduce the likely rate of introduction. However, more manufacturers are introducing vehicles at the same time, in more vehicle classes, and with a much higher level of government and consumer support.[39]

Potential grid impacts of PEVs

The charging of PEVs has the potential for both positive and negative impacts to the electric grid. Understanding and addressing potential PEV impacts to the electric grid is a critical role for the electric utility and a key enabler of both widespread PEV adoption and maximizing the benefits of transportation electrification. The timing of PEV charging can create either positive or negative impacts on electric generation and transmission systems. A significant

[39] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, p 4-1

amount of PEV charging coincident with the system peak would create a need for additional generation. On the other hand, charging performed consistently during off-peak hours could reduce system costs.[40]

The extent of PEV charging impacts will depend on the degree and density of PEV penetration, charging requirements, and the time of day PEVs are charged. A significant amount of PEV charging coincident with a system peak load could create the need for additional capacity. Large concentrations of PEVs charging in concentrated geographic areas (also known as "clustering") – especially residential areas - could require upgrades to local electric distribution system equipment to ensure continued reliability of service. As Figure 25 below illustrates, PEV charging can represent an electric load greater than a house.

	Tesla Roadster	Nissan Leaf	GM Chevy Volt	Toyota Plug-in Prius
Type	Battery	Battery	Plug-in hybrid	Plug-in hybrid
Electric Range	245 miles	100 miles	35 miles	15 miles
Battery Size	53 kWh	24 kWh	16 kWh	4.4 kWh
Onboard Charger	9.6 kW	3.3 kW	1.44 kW	1.44 kW
Quick Charger	16.8 kW	60 kW	3.3 kW	3.3 kW
Charging Time	6 hours (onboard) 3.5 hours (quick)	6 hours (onboard) 0.5 hours (quick)	10 hours (onboard) 4 hours (quick)	3 hours (onboard) 1.5 hours (quick)
U.S. Launch	March 2008	December 2010	December 2010	Spring 2012
Price (MSRP)	$109,000	$35,200	$40,280	$32,000

Source: Tesla Motors Inc., "Roadster Features and Specifications," http://www.teslamotors.com/roadster/specs; Nissan Motors Company Ltd., "Nissan Electric Leaf Car: 100% Electric. Zero Gas. Zero Tailpipe," http://www.nissanusa.com/leaf-electric-car/; J. Wiesenfelder, "Cars.Com Field Trial: Mobile EV Quick-Charging," *Kicking Tires*, July 26, 2011, http://blogs.cars.com/kickingtires/2011/07/carscom-field-trial-mobile-ev-quick-charging-.html; General Motors Company, "2011 Chevrolet Volt," http://www.gm.com/content/gmcom/home/vehicles/browseByBrand/baseball_cards/chevrolet/volt.html; General Motors Company, "Chevrolet Volt's 240V Home Charging Unit Priced at $490," press release, October 6, 2010, Detroit, MI, http://gm-volt.com/2010/10/06/gm-announces-chevrolet-volt-240v-charger-pricing-and-installation-service-provider; Toyota Motor Sales, USA, Inc., "Toyota Introduces 2012 Prius Plug-in Hybrid," press release, September 16, 2011, Richmond, CA, http://pressroom.toyota.com/releases/toyota+introduces+2012+prius+plug-in+hybrid.htm.

Figure 25 - Comparison of PEVs Commercially Available in US Market. Source: MIT report titled "The Future of the Electric Grid"

Vehicle home arrival times are generally correlated with electric system peak load. If PEV charging is not managed appropriately (i.e., uncontrolled charging), it could add to existing system peaks. In its analysis of grid impacts from PEVs, EPRI studied three patterns of residential EV charging: uncontrolled, set-time controlled, and managed off-peak controlled. Figure 26 illustrates potential U.S. EV charging load in 2030 under the medium adoption

[40] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, p 5-1

scenario shown in Figure 26 for each of the three charging patterns. Note that if all PEVs used set-time control, the charging load would most likely create an additional system peak at the designated set time (in this example, start at 9 PM). Uncontrolled charging would most likely cause an increase in the overall system peak. However, managed off-peak charging would shift PEV charging load into off-peak hours.[41]

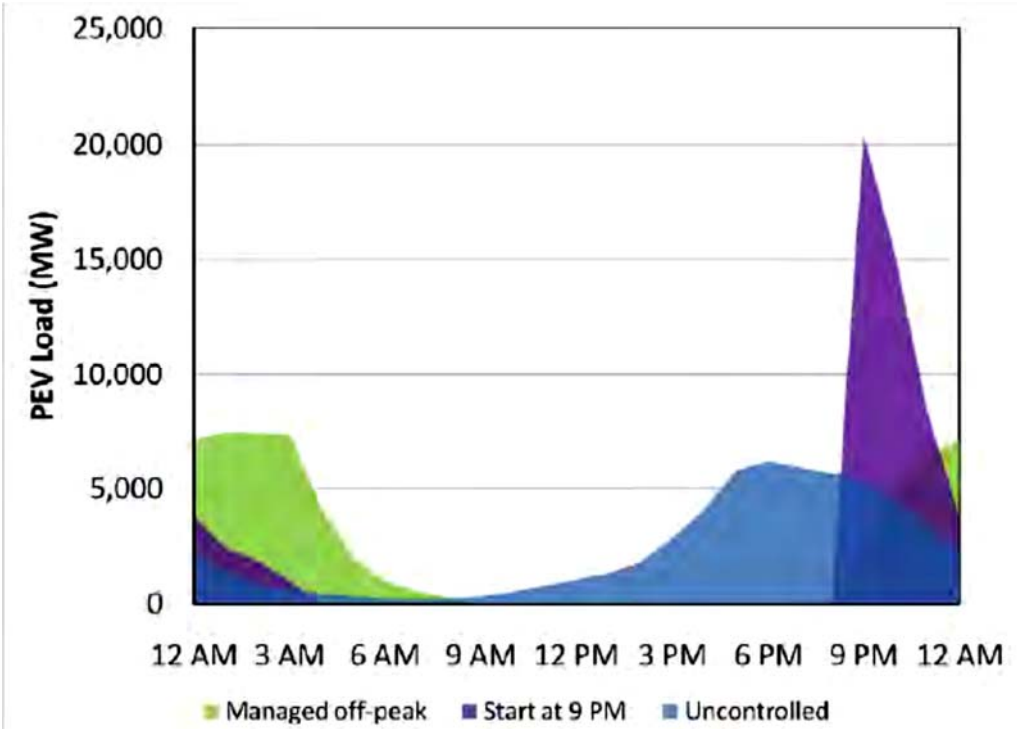


Figure 26 - PEV charging load in 2030, medium adoption scenario. Source: EPRI report titled "Transportation Electrification, A Technology Overview"

To further understand PEV charging impacts, EPRI conducted a System Impacts Assessment, designed to capture potential near term distribution system impacts in response to consumer adoption of PEVs. EPRI used a three-stage methodology, shown in Figure 27, consisting of the following types of analysis:

Asset Deterministic Analysis – Examined the ability of each asset to safely supply the worst-case projected load base. Existing capacity and number of customers serviced is determined using the circuit model and compared with the projected PEV load derived from probabilistic evaluations of PEV projections.

System Level Deterministic Analysis – This provides qualitative sensitivity information on system wide behaviour to worst-case charging conditions at various penetration levels.

[41] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, p 5-5

Additionally, the analysis provides a quick evaluation of the boundaries for potential impacts to the system.

Stochastic Analysis – Evaluated both the system as well as PEV charging across not only the full calendar year but hundreds of different spatial and temporal variations. The results of this analysis provide insights into impact likelihood and severity as well as information concerning the conditions under which these particular impacts occurred.[42]

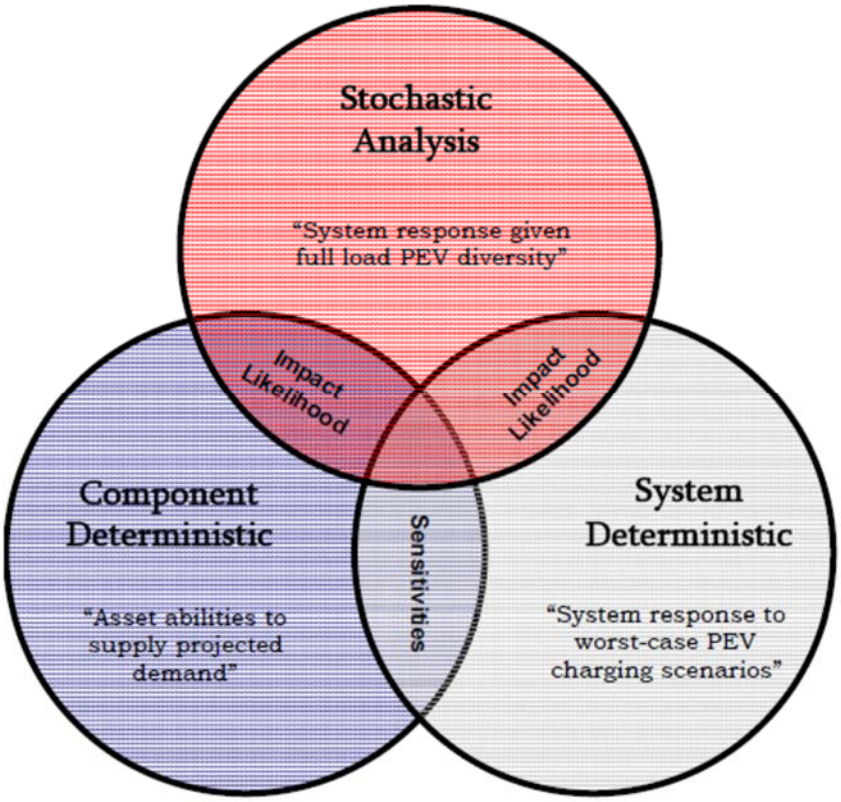


Figure 27 - PEV distribution impact evaluation methodology. Source: EPRI report titled "Transportation Electrification, A Technology Overview"

Deterministic and stochastic analyses of the potential load impacts on an actual distribution circuits are being conducted as part of a multi-utility project. The results to date, however, generally show the following:

- The extent of system impacts depends upon the PEV penetration and charge behaviors of PEV adopters.

[42] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, p 5-15

- Due to diversity, the expected aggregate addition to system peak loads is 700-1000 Watt per PEV in a given utility territory. Based on typically daily driving statistics, the average energy delivered to a vehicle during a charge is 5-8 kWh for a midsize sedan.

- Recognizing that all distribution circuits will not realize the same level of PEV adoption, the extent of system impacts depends upon the PEV penetration and charge behaviors of PEV adopters

- The short-term impacts for most utilities studied should be minimal and localized. There is a possibility, however, of isolated impacts on some distribution transformers and secondary drops, particularly in neighborhoods with older distribution systems including underground systems.

- By system design, per-capita load growth (PEV or otherwise) will first impact devices closest to the customer

- Components closer to the customer are the most likely to be impacted as they do not benefit as greatly from PEV load diversity

- Low capacity per customer ratios combined with low PEV load diversity (assets closer to the customer) are the most likely to be impacted as they do not benefit as greatly from PEV load diversity

- The remaining capacity per customer can be used as a means for evaluating possible risk of impact due to customer adoption of PEVs

- The assets near the load are most susceptible to PEV clusters as the potential benefit of spatial diversity decreases. Older distribution systems (including underground systems), initially designed for much lower per-customer load than its current operation, it is likely that the PEV impacts are more severe and impactful than to a relatively newer infrastructure.

- Based on system configuration and customer adoption, PEV clustering will occur randomly throughout the system. While PEV clustering may indicate an increased risk higher than average loading levels, PEV clustering alone does not signify the likelihood of negative impact occurrence as the other PEV load characteristics must also be taken into account

- Transformers characterized by low capacity per customer ratios are the most likely to be impacted by PEV adoption. Furthermore, transformers lower than 25 kVA nameplates are expected to be the most susceptible to becoming overloaded as these transformers typically have lower amounts of existing capacity which can be quickly consumed by one or more PEV.

- Likelihood of a given system component becoming overloaded is a function of the remaining capacity on the element and the number of customers served from the element that are potential charging locations for PEVs. The increased loading on the substation transformer tends to be tempered by the diversity in charging times for the many PEVs that are served across the entire feeder. Conversely, a single service transformer serving 5-10 customers may become overloaded with 1 or 2 higher charge current PEVs.

- Stochastic results show that the temporal and spatial diversity of PEVs charging on the system mitigates mass overloads of any particular asset class for penetration levels in the 2-8% range.

- Controlled charging can defer projected impacts due to load growth to later years, but care must be taken to ensure that the control strategy does not create secondary system peaks.[43]

Opportunities for managing grid impacts from PEV charging

With a wide range of potential outcomes for PEV development, the possible courses of action a utility could take are also widely varied. Time-variant rates are one example of managed off-peak control that can be offered to customers to encourage PEV charging during the least expensive hours, typically overnight. Since the price of electricity generally follows available capacity, time variable rates can be especially effective for encouraging PEV charging when capacity is typically more than sufficient to meet increases in demand. Overnight PEV charging also supports use of renewable generation sources such as wind, which is typically more available during night time hours.

The Illinois Commerce Commission's "Initiative on Plug-In Electric Vehicles Rates Working Group Report" helps to narrow the possible outcomes by suggesting that key market players focus on "encouraging PEV owners to charge their vehicles primarily during off-peak hours – whether through time-variant supply service offerings, demand response, or other load management programs." The report specifically suggests that:

- Time-variant rates, whether provided by the utility or a RES, can provide PEV owners with the opportunity to save on their energy costs by moving vehicle charging and other electricity usage off peak, when electricity prices on such rates are typically lower.

- Moving the PEV charging load to off-peak hours could help defer the need to increase the capacity of electric distribution system assets, particularly in areas where several PEVs may be clustered on the same local distribution equipment.

[43] "Transportation Electrification, a Technology Overview" EPRI, Palo Alto, CA, July 2011, 1021334, pp 5-32, 5-33

- Moving PEV charging off-peak could lower or mitigate the impact on the marginal cost of electricity for all consumers by achieving more efficient utilization of generating capacity.

- Through battery storage, off-peak PEV charging can help integrate energy from intermittent renewable resources (*e.g.*, nighttime wind) onto the electric grid.

How ComEd's AMI network enables these capabilities

ComEd has designed its AMI network to accommodate this wide range of possible capabilities, impacts, and timelines for PEV development, and to enable the suggested path forward for developing PEVs.

First, ComEd's AMI infrastructure enables the entire range of charging rates offered by suppliers that will facilitate PEV deployment. AMI meters that gather hourly data will allow suppliers to offer time-variant rates that are low during off-peak hours but are higher during on-peak hours. Suppliers will be able to offer such low price, off-peak charging rates to customers as soon as the customer receives and AMI meter.

Second, ComEd's AMI communications network enables the integration of smart EVSE (electric vehicle supply equipment, a.k.a. charging equipment), to perform functions such as the transmittal of pricing signals directly to the EVSE. Functionality such as this allows PEV owners to fully automate the management of their PEV charging based on a desired price point in a "set it and forget it" manner.

Third, the ability to associate AMI meters with distribution system assets, such as transformers, provides the ability to continuously track the loading of such assets by aggregating data from the associated AMI meters. This, in turn, enables real-time alarms and notification when the loading on such assets exceeds a pre-determined threshold, allowing the asset to be addressed proactively, before it fails. This capability will be especially beneficial for monitoring the load on transformers in residential areas with higher rates of PEV adoption, but is equally applicable to any type of load that a customer may add at his or her premises.

2. Distributed Generation (DG)

Potential abilities of DG

The MIT report titled "The Future of the Electric Grid" defines DG as "relatively small-scale generators that produce several kilowatts (kW) to tens of megawatts (MW) of power and are generally connected to the grid at the distribution or substation levels." The report identifies a wide range of DG generation technologies, "including gas turbines, diesel engines, solar photovoltaics (PV), wind turbines, fuel cells, biomass, and small hydroelectric generators. Some DG units that use conventional fuel-burning engines are designed to operate as combined heat and power (CHP) systems that are capable of providing heat for buildings or industrial processes using the "waste" energy from electricity generation."

The potential benefits of DG are myriad, and are explained in detail in the MIT report (summarized in Figure 28).

Reliability and Security Benefits	Economic Benefits	Emission Benefits	Power Quality Benefits
• Increased security for critical loads • Relieved transmission and distribution congestion • Reduced impacts from physical or cyberattacks • Increased generation diversity	• Reduced costs associated with power losses • Deferred investments for generation, transmission, or distribution upgrades • Lower operating costs due to peak shaving • Reduced fuel costs due to increased overall efficiency • Reduced land use for generation	• Reduced line losses • Reduced pollutant emissions	• Voltage profile improvement • Reduced flicker • Reduced harmonic distortion

Source: U.S. Department of Energy, *The Potential Benefits of Distributed Generation and Rate-Related Issues that May Impede Their Expansion: A Study Pursuant to Section 1817 of the Energy Policy Act of 2005* (Washington, DC, 2007); and P. Chiradeja and R. Ramakumar, "An Approach to Quantify the Technical Benefits of Distributed Generation," *IEEE Transactions on Energy Conversion* 19, no. 4 (2004): 764–773.

Figure 28 - Theoretical Benefits of DG. Source: MIT study "The Future of the Electric Grid"

Many of the benefits in the above table will accrue directly to the consumer who owns/operates the DG source. For example, the consumer will get a reduced energy bill for any power supplied by their DG system. The consumer will also get a monetary benefit for any demand response service provided by the DG system or for any energy sold back to the grid.

Potential consequences of DG on the electric distribution system

While DG has the potential to bring a number of benefits to both consumers and the operators of the electric grid, it presents grid operators with a number of challenges. First and foremost, the variability of renewable resources creates a potential problem for voltage and frequency regulation when a large amount of DG is connected to the electric grid. In particular, solar PV resources have varied output, as demonstrated in Figure 29.

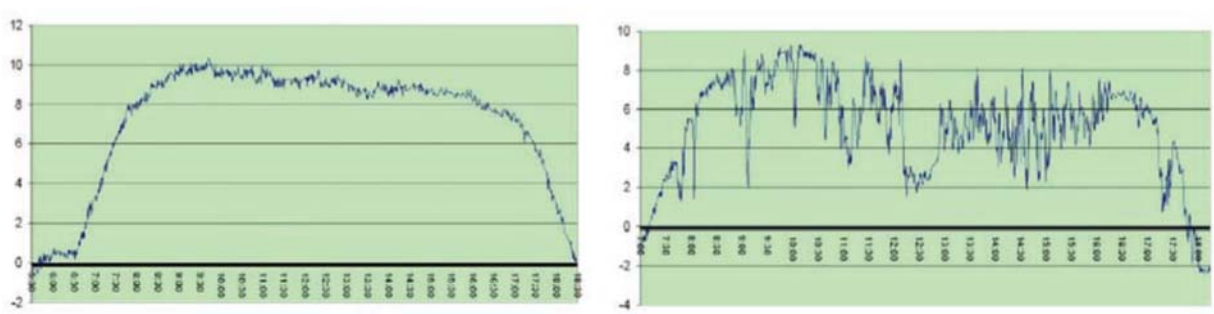


Figure 29 - Nevada Solar Photovoltaic (PV) Plant Output on a Sunny Day (Left) and a Partly Cloudy Day (Right) in 2008. Source: MIT study "The Future of the Electric Grid"

The variability of DG resources can have a particularly adverse effect on grid voltage and frequency stability when significant amounts of DG capacity are added in geographically concentrated areas. When large DG applications are connected to an already at-capacity substation, the variability issue can lead to significant reliability concerns.

Uncertainties surrounding DG development

Furthermore, DG cost-competitiveness – and thus likelihood of its proliferation – faces a number of significant uncertainties. Currently, a number of state and Federal tax incentives help make DG costs affordable to customers. The future of the Federal incentives remains very uncertain, which could contribute to a significant increase in installed costs for DG units. On the other hand, DG manufacturers are improving manufacturing efficiency in a consistent manner, which eventually could lead to DG proving cost-effective when compared to large-scale utility generation (see projection in Figure 30).

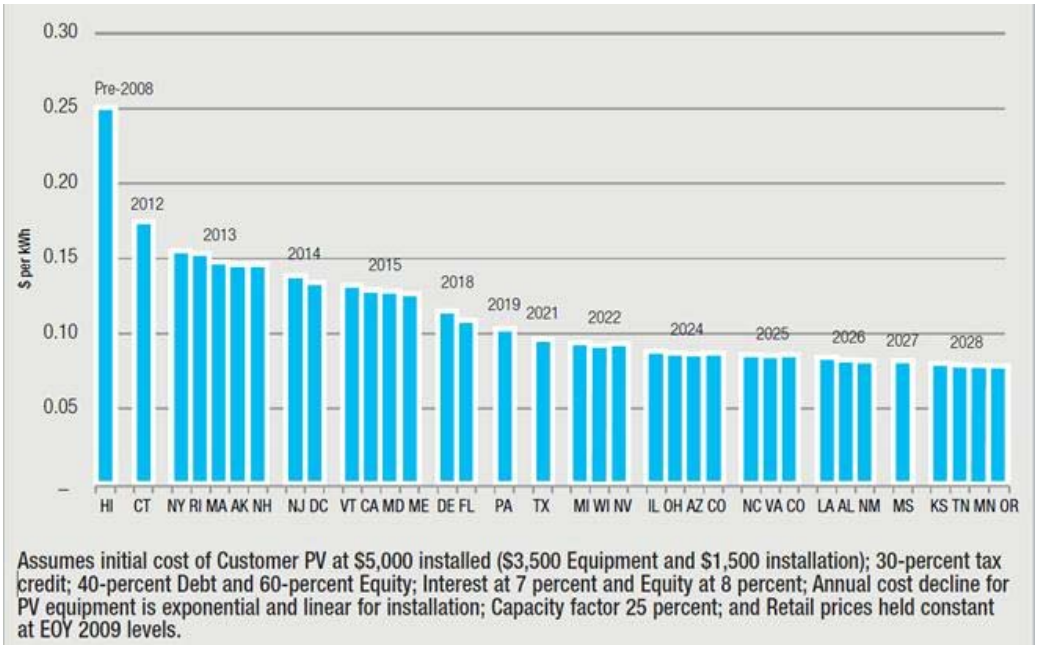


Figure 30 - Grid Parity of Solar PV Forecast by State. Source: Accenture

How ComEd's AMI network enables these capabilities

ComEd's AMI network will enable full integration of DG resources with the electric grid. First, ComEd's AMI meters will all be equipped with net metering capability. As a result, customers will benefit by receiving a bill credit for any energy of a DG system sold back to the grid.

Second, ComEd's AMI meters will enable dynamic rates that take advantage of DG systems by collecting hourly interval usage from the AMI meters to use in billing. As a result, customers with peak-coincident DG systems (such as solar) will be able to benefit significantly from dynamic rates offered by suppliers that charge high prices for usage during peak hours.

Third, ComEd's IT systems will be capable of communicating with DG systems through the AMI network infrastructure. This enables DG systems to provide frequency regulation and other ancillary services to the grid where possible, providing an additional financial benefit to consumers.

Finally, the AMI network can be used to remotely shut off output of DG when system conditions dictate the need to reduce system supply or when sections of the network need to be safely shut down for maintenance of the grid or emergency work.

3. Storage

Potential impacts of storage

Energy storage technologies hold significant promise for making electricity cheaper, more reliable, and more environmentally friendly for customers. That promise spans the electricity value chain, as can be seen in Figure 31. The Smart Grid and AMI networks in particular have the potential to facilitate growth in many of the applications for energy storage identified by EPRI.

Value Chain	Application		Description
Generation & System-Level Applications	1	Wholesale Energy Services	Utility-scale storage systems for bidding into energy, capacity and ancillary services markets[1]
	2	Renewables Integration	Utility-scale storage providing renewables time shifting, load and ancillary services for grid integration
	3	Stationary Storage for T&D Support	Systems for T&D system support, improving T&D system utilization factor, and T&D capital deferral
•	4	Transportable Storage for T&D Support	Transportable storage systems for T&D system support and T&D deferral at multiple sites as needed
	5	Distributed Energy Storage Systems	Centrally managed modular systems providing increased customer reliability, grid T&D support and potentially ancillary services
T&D System Applications	6	ESCO Aggregated Systems	Residential-customer-sited storage aggregated and centrally managed to provide distribution system benefits
	7	C&I Power Quality and Reliability	Systems to provide power quality and reliability to commercial and industrial customers
•	8	C&I Energy Management	Systems to reduce TOU energy charges and demand charges for C&I customers
	9	Home Energy Management	Systems to shift retail load to reduce TOU energy and demand charges
End-User Applications	10	Home Backup	Systems for backup power for home offices with high reliability value
T&D = Transmission and Distribution; C&I = Commercial and Industrial; ESCO = Energy Services Company; TOU = Time of Use			

Figure 31 - Energy Storage Value Chain. Source: EPRI, "Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits"

AMI networks can increase the value of energy storage applications for both utilities and for customers. On the distribution side, storage is capable of providing valuable ancillary services to keep the grid functioning efficiently and reliably. Especially as intermittent renewable resources become more prevalent, applications that can quickly store and discharge energy with minimal energy loss will prove more important for grid operators in keeping load and supply balanced. On the customer side, storage will provide an opportunity for customers to fully monetize the benefits of renewable DG systems by storing energy when the resource is available. And as a simultaneous benefit to the customer and the utility, distributed energy storage applications will provide a key demand response and frequency regulation resource that will improve system reliability and bring a monetary benefit to the consumer.

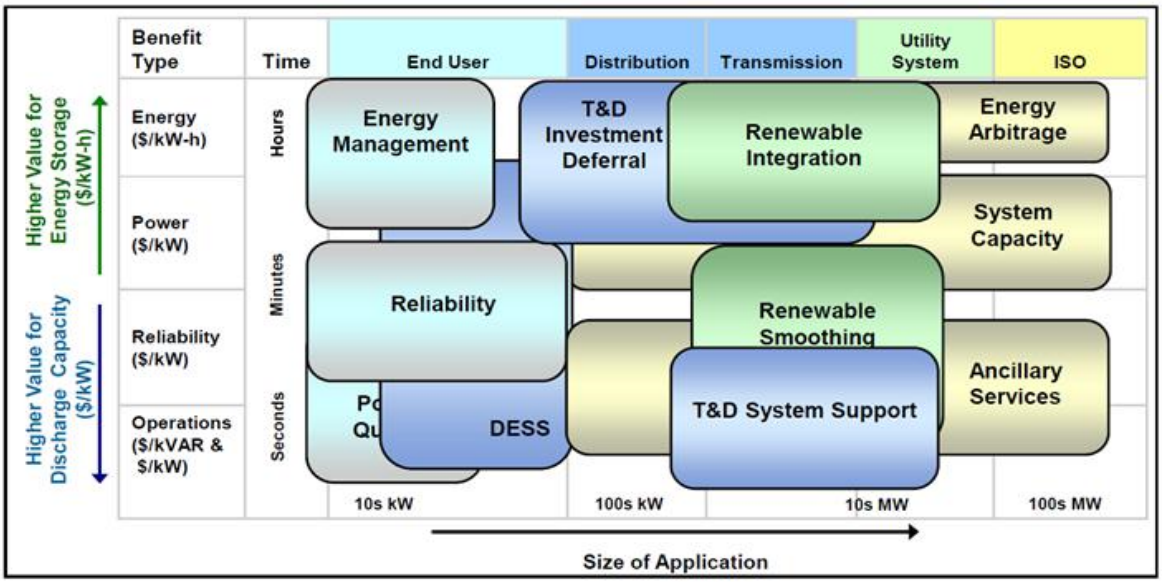


Figure 32 - Energy Storage Benefits Summary. Source: EPRI, "Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits"

The technology options available for energy storage are also very diverse, and have benefits for different applications (as summarized in Figure 32). That said, AMI networks are capable of integrating all types of storage applications.

Technology Option	Maturity	Capacity (kWh)	Power (kW)	Duration (hrs)	% Efficiency (total cycles)	Total Cost ($/kW)	Cost ($/kW-h)
Energy Storage for Distributed (DESS) Applications							
Advanced Lead-Acid	Demo-Commercial	100-250	25-50	2-5	85-90 (4500)	1600- 3725	400- 950
Zn/Br Flow	Demo	100	50	2	60 (>10000)	1450-3900	725-1950
Li-ion	Demo	25-50	25-50	1-4	80-93 (5000)	2800-5600	950-3600
Energy Storage for Residential Energy Management Applications*							
Lead-Acid	Demo-Commercial	10	5	2	85-90 (1500-5000)	4520-5600	2260
		20		4			1400
Zn/Br Flow	Demo	9-30	3-15	2-4	60-64 (>5000)	2000-6300	785- 1575
Li-ion	Demo	7-40	1-10	1-7	75-92 (5000)	1250-11,000	800-2250

1. Refer to the full EPRI report for important key assumptions and explanations behind these estimates. All systems are modular and can be configured in both smaller and larger sized not represented. Figures are estimated ranges for the total capital installed cost estimates of "current" systems based on 2010 inputs from vendors and system integrators. Included are the costs of power electronics if applicable, all costs for installation, step-up transformer, and grid interconnection to utility standards. Smart-grid communication and controls are also assumed to be included. For batteries, values are reported at rated conditions based on reported depth of discharge. Costs include process and project contingency depending on technical maturity. The cost in $/kW-h is calculated by dividing the total cost by the hours of storage duration.
2. For CAES and Pumped Hydro, larger and smaller systems are possible. For belowground CAES the heat rate may range from ~3845-3860 Btu/kWh and the energy ratio is 0.68-0.78; for aboveground CAES the heat rate is ~4000 Btu/kWh and the energy ratio is ~1.0.

Figure 33 - Energy Storage Characteristics by Application (Kilowatt-scale). Source: EPRI, "Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits"

How ComEd's AMI network enables these capabilities:

ComEd's AMI network enables energy storage applications through three key channels: net metering for distributed applications; measuring interval energy usage to enable dynamic rates; and through two-way communication and control of storage devices through the AMI network. All of the AMI meters will be net metering enabled, so in combination with a dynamic rate offered by a supplier, a customer could benefit by storing energy during off-peak periods and discharge energy during the more expensive peak period. The hourly intervals measured by the AMI meters will also be critical to enabling such dynamic rate offerings (as discussed earlier in this chapter). Finally, the two-way communications capabilities of the AMI network will enable DLC and other demand response or ancillary service programs that utilize energy storage applications.

C. Data Privacy

1. ComEd's Plan to Protect Customers' Data Privacy

ComEd is dedicated to maintaining the highest level of communications security to help ensure that customer-related energy data remains confidential and secure at all times.

As noted earlier, the AMI meters do not store or transmit any personal identification information about customers, do not identify electrical devices within a home, do not identify an occupant's specific behavior or activities, and do not determine physical locations of persons within a home. These AMI meters record only information about electricity usage at a premises – just as existing mechanical meters do; they are not surveillance devices.

ComEd will also permit consumers to consent to the disclosure of personal energy information to third parties through electronic, web-based, and other means in accordance with state and federal law and regulations regarding consumer privacy and protection of consumer data. Therefore, any applications discussed previously that will provide individual data to third parties, such as the "Green Button" web initiative, will require direct consent from the customer before any data is transmitted by ComEd to the third party.

In particular, the "Green Button" web initiative mentioned earlier in this chapter provides an example of how ComEd will provide for customer control of data regarding their electricity usage. On March 22, 2012, ComEd joined a number of other utilities across the US to announce their participation in the "Green Button" initiative, a voluntary effort by utilities to provide energy usage data to customers in a standard format to help them make informed decisions about how to reduce energy consumption and save money. "Green Button" is based on a consensus industry standard that was created through a public-private partnership with the Commerce Department's National Institute of Standards and Technology. [44] "Green Button" is expected to foster innovation by third-party apps developers and providers of energy management services. This will enable customers to take advantage of the following:

- customizing thermostats for savings and comfort;
- community and student energy efficiency competitions;
- improved decision-support tools to facilitate energy efficiency retrofits;
- measurement of structural energy efficiency investments; and
- optimizing the size of rooftop solar panels.

Customers can provide energy usage data to energy suppliers and other energy companies to participate in programs that can further reduce their energy costs. While the "Green Button" provides a standardized and easy manner for the customer of provide this data to third parties, these third parties aren't able to access this data without express permission from the customer.

The Illinois Consumer Fraud and Deceptive Business Practices Act requires that an electric service provider maintain customers' personal information "solely for the purpose of generating the bill for such services". This requirement will not change under ComEd's AMI

[44] http://www.whitehouse.gov/blog/2011/11/21/empowering-customers-green-button

plan. Furthermore, in accordance with relevant laws and regulations, ComEd will not disclose or sell any personally identifiable information about a customers' energy use without approval, except as required by regulatory agencies or governmental authorities. If ComEd is able to track vulnerable customers for the purpose of milestones and metrics set forth in this Plan, this data will remain confidential and secure at all times. ComEd will not disclose or sell any personal information about vulnerable customers, or their self-identified vulnerability, except as required by regulatory agencies or governmental authorities.

Additionally, ComEd will fully comply with the Illinois Personal Information Protection Act. This Act states that: "any data collector that owns or licenses personal information concerning an Illinois resident shall notify the resident at no charge that there has been a breach of the security of the system data following discovery or notification of the breach." ComEd will fully comply with this requirement by contacting all customers to inform them if there is a breach of data security

D. Plan to Enable Existing and Future Smart Grid Technologies and Applications that Deliver Value to Customers

ComEd believes it should emphasize the benefits and value customers receive from the AMI deployment. ComEd believes its position is to establish itself as a leader in setting the vision of an AMI-enabled customer and clearly articulate these messages to its customers. While ComEd's AMI system will enable all of the Smart Grid functionalities identified above, there are still many uncertainties about what level of additional action ComEd will need to take in the future to facilitate undeveloped, cost-effective technologies and applications. In order to enable these future applications once they become mature enough to deliver customer value, ComEd has developed a process for researching and tracking future customer-side Smart Grid applications in order to identify those in which ComEd should invest more heavily to provide additional functionalities directly to customers.

1. ComEd's Process for Enabling Future Smart Grid Applications

Specifically, ComEd has developed a three-stage process to identify, evaluate, and implement customer applications that will unlock key functionalities of the Smart Grid.

First, ComEd proposes to track the availability and demand for potential customer applications through customer-centric technology research. ComEd also proposes to conduct a detailed technology market assessment and technology provider analysis for the various customer-side technologies. This type of analysis is designed to help ComEd understand where potential customer applications fall on the maturity curve (see Figure 34). This knowledge will also enable the development of service offerings in a manner that is most beneficial to customers.

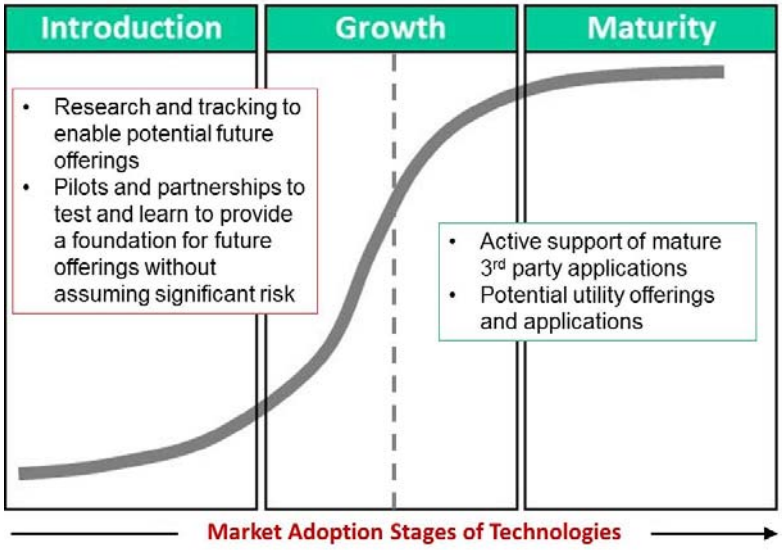


Figure 34 - Maturity Curve for Smart Grid Applications

This market assessment and research identifies technologies that demonstrate potential to unlock Smart Grid functionalities for customers and will allow ComEd to test Smart Grid applications through pilots to learn how to best enable them for the benefit of customers. In addition, ComEd proposes to develop a model to help systematically identify entities interested in testing and deploying AMI-enabled technologies in the introduction and growth phases. Furthermore, ComEd proposes to develop a roadmap to facilitate piloting a broad range of customer-side technologies, including: distributed renewable generation, battery storage technologies, plug-in electric vehicles, and HAN technologies.

Third, ComEd will facilitate future customer applications as they become required or prove to deliver value. The primary way that ComEd will accomplish this goal is working with third parties that want to leverage ComEd's AMI network to enable key Smart Grid functionalities for the benefit of ComEd's customers. ComEd's Test Bed will allow third parties to use ComEd's system to test programs, technologies, business models, and other Smart Grid-related activities, provided those third parties qualify to use the AMI system.

Furthermore, as discussed earlier in this chapter and in the previous chapter, ComEd has already begun to deploy a number of programs designed to deliver immediate value from its AMI system investment. For example, ComEd is enhancing a web portal that allows customers to view and manage their interval electricity usage, as well as view tips and tricks to help them set an energy reduction goal and save energy. In addition, ComEd is designing an opt-in, market-funded, Peak-Time Rebate (PTR) program (as explained in earlier in Chapter 3).

2. ComEd's Planned Activities to Facilitate Future Customer Applications

ComEd believes its role will vary by each product or service and be aligned to one of these five strategies:

- Enable – support third party development of new applications (products/services) that run on ComEd platform. Enable in a variety of ways – e.g. providing data, or technology (test bed)

- Partner – work with 3rd parties to demonstrate their products and services

- Facilitate – make it easy for customers to find and make use of third party products and services that are compatible with the ComEd AMI network. For example, we could adopt the approach used by SDG&E to provide a consumer's guide to in-home devices on the company's web site.

- Promote – actively market programs that are available in the market that can benefit ComEd customers

- Deliver – ComEd designs and deliver projects (i.e. PTS, demand response, energy efficiency)

In addition, ComEd intends to establish a "Co-Creation" process to engage customers and third parties in enablement of new products and services. In 2014 we intend to sponsor one or more design competitions for products and services that can help hard-to-reach customers access the value of the AMI network.

As stated previously, ComEd has committed to delivering a number of products and services in 2013 – 2014 that directly deliver value to customers derived from the AMI Implementation. ComEd is actively looking to expand the number of products and services offered in 2014. ComEd can help bring to the market either through partnerships, promotions, or direct delivery products and services that will have a meaningful impact across the various ComEd customer segments. ComEd is currently reviewing an initial set, developing project charters, identifying partnerships and establishing a 2014 release schedule for these products / services.

ComEd's current plan for enabling future customer applications includes the following:

Peak Time Rebate Program	Opt-in, market funded rebate for customers with AMI meters that reduce usage during peak events
Web Portal	Website that displays interval usage, energy saving tips and tricks, and comparison of energy usage to

	anonymous neighbors.
Smart Grid Test Bed	Platform for third parties to test applications over ComEd's AMI network
Smart Grid Technology Tracking	Track development of technologies capable of enable Smart Grid functionalities for consumers
Customer Research: Smart Grid Technology Value Proposition to Customers	Understand customer demands and value from developing technologies
Contracts with Vendors of Maturing Smart Grid Technology	Executed when technology that will deliver Smart Grid functionalities to customers is identified
Implementing New Programs to Facilitate Future Customer Applications	Executed when application/program that will deliver Smart Grid functionalities to customers is identified

Figure 35 - ComEd Planned Activities to Facilitate Smart Grid Functionalities

ComEd's approach to enabling future customer applications and technologies focuses on shifting the cost for developing these applications to the third-party vendors where possible. The Test Bed, for example, provides third-parties vendors with access to the AMI network, provided those third-party vendors qualify to use the Test Bed. The Test Bed is designed to let outside parties test new technologies and services that leverage the AMI network to deliver value to customers without cost to the customer for that development.

E. Milestones and Metrics

Many of the functionalities unlocked through ComEd's deployment of AMI will be available to the customer as soon as the AMI meter is installed at their premises and activated pursuant to the AMI deployment schedule described in Chapter 2. ComEd's AMI meters will unlock key functionalities as described earlier in this chapter, including:

- Suppliers' ability to offer dynamic rates and PEV charging rates
- Net metering for DG and storage
- Wireless communication from the AMI meter through the ZigBee® standard
- Interval data available for viewing and download on the web portal
- Ability to enroll in the PTR program
- Faster and simpler enrollment for the RRTP program

Therefore, the milestones for enabling these foundational capabilities will be realized immediately as AMI meters are deployed and activated pursuant to the AMI deployment schedule (see Figure 36).

Year	Meters Deployed	Operating Center(s)
Pilot	127,857	Maywood, Chicago North
2013	70,882	Maywood
2014	540,744	Maywood, Chicago South, Glenbard, Mount Prospect
2015	1,077,758	Maywood, Chicago South, Glenbard, Mount Prospect, Chicago North, Crestwood, Skokie, Rockford
2016	1,003,200	Chicago South, Mount Prospect, Chicago North, Crestwood, Skokie, Bolingbrook, Aurora, Libertyville, University Park, Elgin, Rockford
2017	830,000	Chicago North, Bolingbrook, Aurora, Libertyville, University Park, Elgin, Joliet, DeKalb, Crystal Lake, Dixon, Rockford
2018	506,559	Bolingbrook, Aurora, University Park, Joliet, Crystal Lake, Streator, Freeport, DeKalb, Dixon, Rockford
TOTAL	4,157,000	

Figure 36 - Meter Deployment Rollout

Key AMI Meter Deployment Milestones and Metrics (see Chapter 2 for full list)

- IT Release 1 scheduled for completion by the end of July 2012
- First AMI meter installed Q3 2013
- From approximately 71,000 to 930,000 meters installed each full year as per roll out schedule set forth in Figure 36.
- Last non-AMI electro-mechanical meter replaced with AMI meter in 2018
- IT Release 2 to support Full Deployment scheduled to start in August of 2013 and be completed by the end of 2016
- IT releases 3 through "n" to support Full Transformation to be completed by the end of 2016 (see **Error! Reference source not found.** in Chapter 2 for full details)

Key Research Milestones and Metrics

- Quarterly: Provide refresh of technology tracking outlook
- Quarterly: Update customer research to understand how preferences and demand for Smart Grid-related applications are developing

Key PTR Milestones and Metrics

- Key milestone: A proposed tariff will be filed with the ICC within 60 days of the ICC's approval of ComEd's AMI Plan
- Key milestone: Customers with installed and certified AMI meters will be eligible to enroll in PTR consistent with the PTR tariff when approved by the ICC
- Key milestone: The first PTR event is expected take place in the summer of 2015
- After the fourth year of the PTR program, ComEd will submit a report detailing:
    - Number of customers eligible for the PTR program
    - Number of customers enrolled in the PTR program
    - Average peak reduction for enrolled customers
    - Average rebate for enrolled customers
    - Total events called by year
    - Total program energy and bill savings by year

Key Web Portal Milestones and Metrics

- Customers will have access to a monthly usage web portal in 2012 and an interval usage web portal as soon as their AMI meter is installed and certified
- Customers will have access to "Green Button" functionality as soon as they have access to the web portal
- Key milestone: launch the following new web features by Q4 2014:
    - Launch new mobile-friendly version of Weekly Energy Breakdown emails
    - Fully integrate My Energy Tools into customers' ComEd.com accounts
    - Integrate My Energy Tools functionality into the ComEd mobile app and mobile site for smart phone access

- Launch Unusual Usage Alerts via SMS (text)

Metrics Related to "Vulnerable" Customers to Track Impact of Costs, AMI Deployment and Customer Benefits

The Commission's Order in Docket No. 12-0298 directed ComEd to discuss with stakeholders and Staff the methodology to define and identify "vulnerable" customers. ComEd met with numerous stakeholders in the second half of 2012 to exchange views on defining and identifying vulnerable customers. Consistent with the consensus reached with stakeholders in these meetings, vulnerable customers are defined, for purposes of this Plan as customers belonging to the following customer groups:

(1) Low income

(2) Very young (from birth to age 5)

(3) Older individuals (age 65 and older)

(4) Those who have limited English proficiency or literacy

(5) Individuals with a functional disability, such as impaired mobility

(6) Persons who are socially isolated

Also consistent with the consensus reached with stakeholders in these meetings, metrics reported for each of the above-named subgroups will be conducted or presented individually for each of the six subgroups. ComEd will identify customers as belonging to each of the subgroups based on information available to ComEd from customer energy assistance programs. Information is not currently available for all subgroups, but ComEd will report data for the metrics identified herein based on data that is or becomes available and can be verified at the account level.

The Commission's Order in Docket No. 12-0298 also states that "[i]f further information is required to allow ComEd to track vulnerable populations and that information is not easily available (or only at significant cost) then ComEd should provide an explanation of the barriers to tracking vulnerable populations." ComEd interprets this directive to require such information to be included in this Plan. There remain significant barriers to tracking vulnerable populations. ComEd's customer files do not include income, age, disability, or other information placing customers into the subgroups used to define vulnerable customers. Such "vulnerability" indicators would be considered highly personal and private by customers. One method to attempt to compile this personal information would be surveys conducted among customers. Customers would have to identify themselves as "vulnerable" based on their responses to the questions. A census survey of all 3.4 million residential customers would likely be very costly. Further, ComEd assumes that stakeholders and the Commission would intend for responses to the survey to be voluntary, meaning customers would not be obligated to complete the survey. Thus, many customers will elect to not answer questions posed on behalf of ComEd that reveal personal information. Many customers may find certain questions of a personal nature to be

intrusive or offensive. Therefore, such a survey may be impractical as well as costly, and ComEd will continue to explore other more efficient and productive means of obtaining this data. These and other issues will need to be addressed in ongoing discussions with stakeholders and Staff.

For purposes of this Plan, ComEd will track the following metrics for all customers by customer class, by usage level for the residential, watt hour, and small load delivery service classes, and for the six vulnerable customer subgroups that are potentially identifiable through energy assistance programs. For purposes of this Plan, "low income customers" will be defined as those customers participating in the Low Income Home Energy Assistance Program (LIHEAP), the Residential Special Hardship Program, the CHA All Clear program, or the Percentage of Income Payment Program (PIPP). For purposes of this Plan, "customer class" will be defined as ComEd's 15 delivery classes as defined in its General Terms and Conditions (Sheets 135 -138).

- ComEd initially will report the following metrics on an annual basis:
    - Bill impacts associated with the costs for implementation of ComEd's Smart Grid Advanced Metering Infrastructure Deployment Plan for low, average, and higher usage level customers pursuant to approved rates and surcharges. The usage level calculations will be values for a "typical" customer at the 25th, 50th, and 75th percentile of total usage for each applicable delivery service class.
    - Number of customers that have created an account on ComEd.com – by usage levels, customer class, and low income customers. An account on ComEd.com is necessary for viewing the web portal.
    - Number of customers with ComEd.com accounts that have viewed the web portal – by usage levels, customer class, and low income customers.
    - Change in customers' energy consumption for customers that have viewed the web portal. ComEd will work with the web presentment vendor to define the business processes necessary to track an energy usage impact of accessing the web portal.
    - Number of customers enrolled in the Residential Real Time Pricing (RRTP) program (ComEd's hourly pricing program) by usage levels, customer class, and low income customers.
    - Number of customers enrolled in any future Time of Use (TOU) program that ComEd might offer by usage levels, customer class, and low income customers.
    - Number of customers enrolled in ComEd's Peak Time Rebate ("PTR") program by usage levels, customer class, and low income customers.

- Number of deposits required, disconnection notices, and disconnections for nonpayment for all customers and, if applicable, by low income customers. Other "key indicia associated with credit and collection activities targeted to low income customers" may be incorporated in the project plan's business process redesigns for future implementation.

Of course, these metrics are subject to further revision and refinement based on discussions with Staff and stakeholders regarding the tracking of "vulnerable" populations. ComEd plans to ensure that any data used to further identify accounts as belonging to the vulnerable customer groups will be accurate, sufficiently detailed, and maintained as customer confidential information.

Chapter 4: Customer Outreach and Education

A. Overview

ComEd's AMI deployment initiative, enabled by PA 07-0616, will impact the ~3.8 million customers served by ComEd for the next 10 years and beyond. As the AMI Deployment Plan investment begins in 2013, the objective of the education and outreach effort is to help customers capture value from the investment, enhance the customer experience by providing actionable information, easy access to information and simple enrollment in Residential Real Time Pricing (RRTP)[45] or Peak Time Rebate (PTR) programs, and proactively address negative experiences and perceptions.

The customer education and outreach plan has been developed to take customers through a journey that seeks to build awareness, strengthen understanding, promote engagement through participation, and encourage customers to advocate beneficial programs facilitated by the advanced meter technology such as RRTP and PTR. We recognize that not all customers will complete the entire journey, but we are committed to engaging as many customers as possible, and helping them move through the steps of the journey over the next ten years to facilitate the realization of customer benefits.

This education and outreach plan leverages customer research, best practices and lessons learned from previous implementations of advanced meter technology by the Pilot and by other utilities. The key audiences in this plan are residential and small business customers. We will utilize readily available data such as type of building and energy usage at the onset of our education and outreach program. As implementation progresses, audiences will be differentiated by demographics, geography and behavioral data, allowing us to test the effectiveness of both benefit messaging and marketing methods.

The education and outreach plan will use a targeted messaging strategy to deliver the messages that will most easily resonate with residential and small business customers, with initial message themes of control / empowerment, savings, reliability, service, and future preparedness for future technology enabled by smart meters.

Messages will be delivered via a staged messaging approach. Initial customer messages are intended to enhance comprehension of smart meters and explain the benefits of the pricing programs. Messages will also be tailored to audiences based on data and ethnic composition. Targeted messages delivered via strategies by audience with specific methods will support our efforts to move customers along their journey. The outreach and education will communicate to customers the benefits of the smart meters by signing up for pricing plans, such as residential real time pricing (RRTP) and Peak Time Rebate (PTR) or a pricing program developed by a RES, and how they can manage their energy with these programs and save money.

[45] The Residential Real-Time Pricing (RRTP) program is currently under review in Docket No. 11-0546 where the Illinois Commerce Commission is considering the modification or termination of the program

Leveraging other utilities' best practices, methods have been identified to support each of the strategies in this plan. Chapter 2 contains the anticipated smart meter deployment schedule by year and operating center. In addition, an extensive program of primary and secondary research will be employed to support planned initiatives, as well as to measure the overall success of the customer education and outreach initiatives.

This Plan reflects the acceleration of AMI meter deployment approved by the Commission in Docket Nos. 14-0212, 13-0285, 12-0298 (cons.). ComEd will continue, under this accelerated deployment schedule, to perform all planned customer education and outreach activities including providing all customers the staged-messaging AMI deployment materials prior to, during, and after installation of AMI meters. In addition, post-installation efforts and activities under this accelerated deployment schedule will continue to be utilized in the same manner to continue educating customers about tools and programs enabled by AMI meters and engage customers to take action to realize their benefits. ComEd will accelerate AMI customer outreach and education utilizing the same amount of resources to match accelerated deployment levels.

B. Background

As a result of PA 97-0616, AMI deployment is expected to impact virtually all ~3.8 million ComEd customers through meter upgrades, infrastructure upgrades in the community, system improvements and new information and programs. This section summarizes the key learnings from the Pilot and the information about other advanced meter deployments.

1. AMI Pilot Lessons

ComEd deployed "advanced meters" and an AMI Network for approximately 130,000 residential and non-residential customers as part of the Pilot from November 2009 through May 2011.

The meter installation communication protocol for the pilot included four steps: a pre-installation letter sent out three weeks prior to the week of installation, a pre-installation automated outbound call one week prior to installation, a personal notification immediately prior to meter exchange, and a door hanger after the installation of the advanced meter was completed explaining the benefits of advanced meters (or explaining why a new meter couldn't be installed).

Recommendations Based on Key Customer Communication Learnings from the AMI Pilot:

- Recommendation to continue the pre and post meter installation communication methods used, as customer satisfaction with the installation process was high at 90%.

- Reinforcement of the use of the door hanger even if the customer is home at the time of the installation.

- Revision to the treatment of multiple occupancy buildings to include leaving multiple door hangers at the main entrance.

- The web site, www.comed.com\smartmeter, was updated for usability and contained information including: the installation process, a pilot overview, FAQ, and how to read the new meters.

- Community advanced meter awareness and education events should take place prior to and during advanced meter deployment to raise awareness of the meter installations within communities

2. Information from Other U.S. Deployments

Many U.S. utilities have already embarked upon mass deployments of advanced meters in their service territories. A number of the utilities recognize the importance of communicating effectively with their customers about the benefits of AMI deployment. Each utility faces a different political and cultural environment, ComEd will consider the strategies and methods employed by other utilities to identify approaches to better educate and engage its customers.

As a result, interviews were conducted with subject matter experts in education and outreach at some of the larger utilities that deployed advanced meters (and grid modernization) in their service territory including CenterPoint Energy (CPE), Detroit Edison (DTE), Florida Power & Light (FPL), Oncor, Pacific Gas & Electric (PG&E), Portland General Electric (PGE), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E). ComEd obtained information about deployment messaging, general communication methods, meter installation communication methods, issue management methods, meter accuracy and high bill mitigation methods, media efforts and employee communication methods.

Deployment Messaging

- FPL's key messages focused on customer benefits, emphasizing reliability and control

- Oncor's messaging emphasized customer control; secondary messages revolved around environmental savings and energy efficiency

- SCE's messages that focused on cost savings resonated with customers

- SCE, Oncor and CPE provided messaging to target specific regions (e.g., demographic) of their service territory and / or segments

Communication Methods

- SDG&E developed a 90/60/30/7/0 day communications plan to educate each community prior to meter deployment.

  - At 90 days, SDG&E met with community leaders and influencers; at 60 days, they attended community events; at 30 days, direct mail was sent to citizens; at 7 days, outbound calls were made to residents

  - SDG&E also had an "in-field team" (made up of retirees) that went door to door after the meter installation to survey them about their experience and answer questions (e.g., energy efficiency).

- CPE's deployment communication methods included publishing a quarterly customer newsletter, website updates, automated emails to customers before meter installation, pre and post meter installation door hangers, and instructional videos and brochures.

  - CPE's installers took pictures of the final reading on a customer's old meter before exchanging it with a two-way communicating digital meter as part of their installation process.

  - CPE hosted online public chat forums for customers to ask questions regarding their deployment.

- FPL's post-installation communications demonstrated how to get value from its Energy Dashboard.

- SCE's communication material (e.g., notice letters, door hangers) had a 3-layered approach: two-second tagline, elevator pitch, detailed fact sheet. SCE also developed and offered a budget assistant tool to provide customers with energy use data, budget goals and alerts.

- PGE developed and used four separate door hangers during the installation process; "successful installation," "we missed you," "we've caused a problem on your property and will fix it," and "we need to talk to you."

Media Efforts

- SCE issued a press release to the local media shortly before deployment in every community that received the new meters.

- Oncor was able to better address customer concerns when they were more proactive with correcting and educating the media.

- SDG&E and CPE actively monitored traditional and social media sites for issues and addressed them directly as they arose.

- After re-vamping its communications strategy in 2010, PG&E started using several media outlets including broadcast, newspapers, social media and bus station kiosks for its "advanced meter" (and subsequently grid modernization) communications

C. Objective

The **objectives** of the Education and Outreach Plan are to:

- Provide customers with practical instruction, analysis, and information to enable and encourage customers to capture economic benefits as quickly as possible, especially to produce immediate bill savings to customers.

- Provide customers with the information that will help them capture value from the AMI deployment

- Enhance the customer experience by providing actionable information, easy access to information, and simple enrollment in pricing programs such as (PTR and RRTP)

To support these objectives ComEd will increase customers' awareness, acceptance and engagement in the AMI deployment initiative through education and outreach activities employing targeted messages throughout the implementation.

D. Strategy

To support the objectives stated earlier, several strategies will be utilized based on audience and the implementation cycle. Methods will be aligned with audience specific strategies. Strategies will drive the selection of which methods should be utilized, to which audience, and at what time based on the customers' knowledge of advanced meters.

1. Core Strategies

- Build awareness of the value and benefits of advanced meter deployment among customers.

- Inform about benefits of advanced meters and pricing programs (such as PTR and RRTP).

- Educate to ensure that customers understand how to manage energy from advanced meters.

    - Focus customer education on specific actions customers with AMI meters can take to realize economic benefits from AMI meters (e.g., how to use the meter's capabilities) and actions that customers without meters can take to offset their AMI-related charges while awaiting AMI meter installation. Customer education content will include specific information on how customer can use their AMI data to produce immediate bill savings.

- Increase engagement with planned implementation activities.

- Collaborate with community leaders to ensure customers are engaging in PTR and RRTP

2. Guiding Principles

The following guiding principles apply to residential and small business customers, and are based on what we have learned from our benchmarking and discussions with other utilities and independent parties.

- **Build Relationships to Facilitate Engagement** – Establish platforms for ongoing dialogue to ensure that customers are aware of the **AMI deployment.**

- **Gain Customer Acceptance** –Through collaborative work with stakeholders, improve customer utilization and acceptance.

- **Tap into the Power of Community** – Understand the power of human social networks. Personal learning comes through communication with friends, neighbors and coworkers.

- **Commit to Creating Mutually Beneficial Outcomes** – Build "what's in it for me" messages to ensure that we are focusing on customer's needs.

- **Demonstrate Responsiveness** – Be transparent through continual education and information provided to customers and communities.

- **Proactively and Responsibly Engage** –Provide information on potential issues that may arise and suggested responses to external facing teams, employees, community leaders and organizations.

- **Meet People Where They Are** – Don't wait for customers to connect, rather, take AMI deployment information to them to effortlessly take them on the journey leading to engagement and advocacy.

- **Be Open to Feedback and Continued Improvement –** Expect requests for communication and process improvements, and be flexible to accommodate continual change.

3. Customer Journey

	Uninformed	Aware	Informed	Educated	Engaged	Advocate
	IDLE	INQUISITIVE	LISTENING	ACCEPTING	ENJOYING	REVEALING
FEELINGS						
	Indifferent, I don't know what you're talking about	Uninterested, mildly curious, what is this again?	Interested, curious, I want to learn more about this	Accepting, excited, hmm this could really be beneficial	Enthusiastic, this really makes a difference for me	Love it! This is so great, you have to try it
ACTIONS						
	Passive, no action	Saw an ad or bill insert	Attended an event, looked for more info after seeing ad	Logged on to portal	Using PTR, web tools	Telling friends about it

A customer journey is an illustration of the steps customers experience in engaging with a company, whether it is a product, an experience, or a service. Sometimes customer journeys are "cradle to grave" looking at the entire arc of engagement. At other times, customer journeys are used to look at very specific customer-company interactions (for example, the purchase of an iPad™). We have developed a customer journey for ComEd's AMI deployment initiative. As advanced meters are deployed by city and neighborhood, ComEd will take customers through a journey that seeks to build awareness, strengthen understanding, engage through participation and collaborate with community leaders to ensure customers are engaging in mutually beneficial programs facilitated by advanced meters, like RRTP and PTR, or other pricing programs delivered by a RES. Not every customer will complete the entire journey. In some cases simple neutrality or indifference will be as far as some customers are able to move. However, we would like as many customers as possible to move through most steps on the journey through participation in programs facilitated by advanced meters over ten years. The goal of the journey is to demonstrate value and enhance the customer experience. Through the journey, the customer will see the growth of local business and innovative new products and services such as new pricing programs.

4. Customer-Specific Strategies

- Utilize a phased communication approach so that customers receive relevant information when it counts; customers are most often responsive when they receive information that they can immediately act on.

- Incorporate customer behavioral and demographic data points to target messaging; not all customers have the same concerns about advanced meters.

- Foster customer goodwill through community outreach, environmental events, and partnering with trusted community groups.

- Set clear expectations about what customers can expect through a steady feed of relevant news and information.

- Leverage public influencers to deliver messages to constituents.

  - Partner with local community organizations and advocacy groups to communicate the grid modernization messages and to provide trusted third parties as additional voices. Work with the public influencers to educate customers on smart meters, pricing programs and tools to reduce energy use and cost

- Customize education to focus on key customer segments based on available demographic data.

  - Deliver low-income education and support programs to help seniors and economically disadvantaged understand how to manage energy effectively using smart meters and pricing programs (such as RRTP and PTR)

  - Because some customers may not have access to a computer and / or internet access, ComEd is exploring the ability to also facilitate information and data access through personal mobile devices, which may provide less expensive internet access for customers most in need of savings opportunities, by incorporating internet applications that accommodate use of smart phones or other mobile devices.

  - Further, for customers who may not have means to receive information through electronic channels, ComEd will facilitate information and data access through face to face communications. That will be done with the Speakers Bureau, teacher partnerships, small business neighborhood canvases, and outreach through faith-based and environmental non-profits. Each of these programs is described in more detail below in section I(6).

  - Make sure that education regarding cost savings under AMI is reaching all customers including low-income customers participating in PIPP, LIHEAP or a DPA. Include education around PTR, RRTP and web tools. If a TOU rate becomes available in the future, ComEd will also include that tariff in its education efforts. How ComEd will educate customers is detailed below in subsection F under the marketing campaign for low income and senior customers. How ComEd will measure the effectiveness of these education efforts is described in subsection J.

- Utilize traditional (out-of-door, print and online media, public relations), non-traditional (grassroots, community events, social media) and one-to-one channels (direct mail and email) to reach customers throughout the communication cycle.

The communication wheel below illustrates the core strategies and how they will be implemented at each stage of deployment. As this plan is further developed, additional sections will be added to the wheel to illustrate how each component of the plan ties together.

E. <u>Audiences</u>

The objective of the customer education and outreach plan will be realized through strategies tied to specific residential and small business audiences. The audiences will be approached based on their current state of understanding, their interest in further education, and their receptivity to engage and realize the benefits of advanced meters. This section will describe

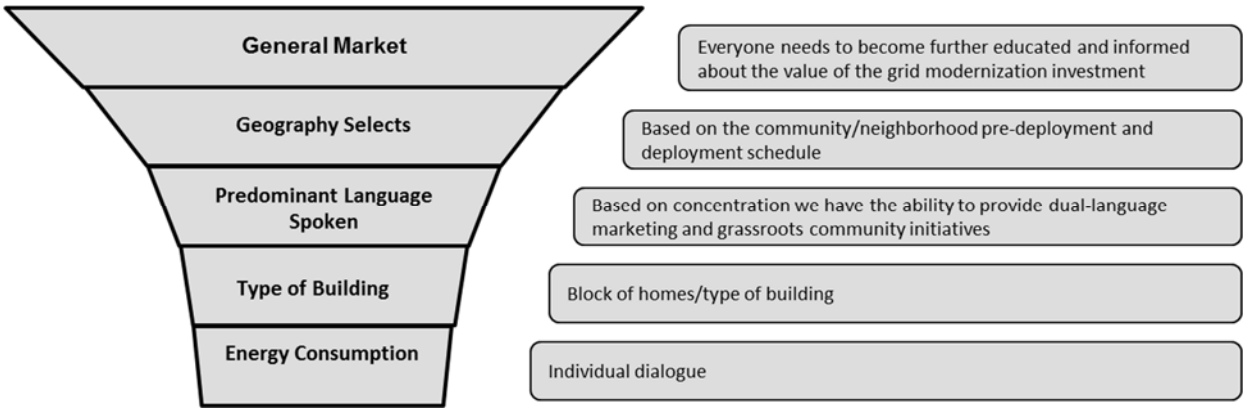
how ComEd plans to utilize the current data available on our customers, and the behavioral data that will be available in the future, to target outreach and education efforts.

Audience Approach

The customer journey overlaps with the operational and implementation activities that customers will experience. Regardless of who the customer is, where they live and how they consume energy, they need to hear the same basic, informational messages at the beginning of the program touching their community.

ComEd will differentiate the audiences based on geographic and demographic data. ComEd will test the effectiveness of utilizing various data or different segments to target communications at each phase of the customer's journey. What works in traditional energy efficiency education and outreach may not be as effective with this plan due to the diversity of the customer base and the complexity of tailoring messaging to different customer segments. In addition, ComEd will consider the fact that all customers will eventually have an advanced digital meter and many will experience a lag time between messaging and meter deployment over a 7-year deployment schedule.

The approach that will be used to define audiences and link the tactical marketing plan can be visualized as a funnel and supported by the readily available internal data. The graphic shown below is for illustrative purposes only, and suggests a way available data will be used to target communications.



Readily Available Data for Initial Audience Segments

The table below provides a partial listing of readily available data that can be captured from internal database systems and then overlaid with geographic information in the advanced meter deployment plan. This data will allow for a deeper understanding of customers' experiences with ComEd, particularly with energy usage, bill payment and power outage experiences. The following information will likely be used for the initial audience segmentation for both residential and business customers.

Data from Internal Systems	
Residential Customers	Business Customers
• **Address** • **Single Family / Multi-Family** • **kWh Usage**	• **Address** • **kWh Usage**

F. Low Income Customer Assistance Programs

The data and programs provided by AMI meters have the potential to change the way we relate with customers who are on the verge of disconnection by helping them reduce their energy consumption. However if customers find themselves experiencing a hardship, there are customer assistance programs for low-income customers for the primary purpose of avoiding imminent disconnection.

ComEd will provide $10M per year for five years pursuant to Section 16-108.5(b-10) to fund low income programs which are listed below. These programs will be designed to assist customers who are either in arrearages or who are about to be disconnected, as well as customers who have been disconnected. The allocation for the $10M for these programs in 2012 is expected to be as follows:

- $8M for Residential Special Hardship: This program will provide relief to the customers who need it most by assisting them to regaining the ability to manage their electricity bills successfully. Eligible[46] residential customers who are experiencing a hardship (senior hardship, job loss, medical issue, etc.) can receive a grant of up to $500 each. ComEd will educate customers about no-cost and low-cost ways they can decrease their future electric bills.

- $1M for Non-Profit Special Hardship: This program will focus on assisting non-profit organizations in need that provide basic life needs (senior centers, homeless shelters, Veteran organizations). A requirement to participate will include participating in energy management education.

- $0.5M for C.H.A.M.P. (ComEd Helps Active Military Personnel): This program serves our nation's active military, and veterans (including disabled veterans) experiencing a hardship. Grants up to $1000 and/or various other benefits (deposit refund, late payment charges waived etc.). We will identify and partner with military organizations, such as the American Legion and Marine Corps League that have existing points of contract and utilize their communication channels to reach eligible customers. We will use a channel mix of marketing and communications to increase program awareness and enrollment. Methods will include: newsletter content, brochures, posters/counter cards, fact sheets,

[46] Customers eligible if income is at or below 250% of poverty level ($57,625 for family of four), and if they are not PIPP participants. LIHEAP customers are eligible for grants *after* LIHEAP funds have been applied.

email templates, talking points and events. These methods will also provide information about no-cost and low-cost ways to decrease future electric bills

- $0.25M for Educational Classes: ComEd will conduct first time homebuyer classes through the Chicago Urban League and LUCHA organizations. In addition, non-profit energy management education will be developed and implemented with CNT.

- $0.25M for Outreach and Marketing: Outreach will entail targeted participation with a variety of communities. This includes the following: participation in Energy Fairs with LIHEAP, participation in local community events, Energy Fairs participation with local community agencies, partnerships or pilots with local housing authorities to target senior population on energy management. Specifically, ComEd will expand the outreach efforts to include the City of Chicago Department of Aging. For marketing, traditional communications methods to include: general and minority market radio, press conferences in key communities & news releases, face book & twitter, ComEd CARE website, a monthly fact sheet and a program fact sheet for community distribution in municipalities and with legislators.

In addition, the statutorily-authorized Percentage of Income Payment Plan ("PIPP") will be available to an estimated 260,000 of ComEd's low income customers.

- The PIPP is administered by the Department of Commerce and Economic Opportunity ("DCEO") who also administers the Low Income Home Energy Assistance Program ("LIHEAP").

- PIPP is designed to attempt to change and reward the good payment behavior of low-income customers with program participants paying no more than 6% of their income for home energy charges. Each customer can receive up to $1,800 in energy assistance benefits per year.

- DCEO subsidizes a participant's remaining service charges year-round with funding from State and Federal Appropriations. The State component is partially funded through the Supplemental Low-Income Energy Assistance Fund, a component of the ComEd customer charge.

- PIPP includes an Arrearage Reduction Program (ARP) component that rewards participants for regular, on-time bill payments – "arrearage forgiveness". This results in a 1/12 credit toward pre-program arrears for each on-time monthly payment up to $1,000 per year for each utility. ARP is limited to maximum funds available per utility. In addition, Section 16-108.5(b-10) funds will be used to assist customers in arrearages.

In order to proactively provide for the foreseeable effects on low-income customers from increased disconnections for nonpayment in an effective and focused manner, the following enhanced communication methods will be available for low income customers:

- **CARE** – ComEd will add reference to the availability of the customer assistance programs in existing outgoing collection activity communication channels. The enhanced communication will direct customers to ComEd.com/CARE or to call ComEd's CARE hotline at 888-806-2273:

- **Proactive Call** – ComEd will change the call message script on the existing proactive calls to state the availability of customer assistance programs, including LIHEAP, PIPP, and Residential Special Hardship.

- **Written Disconnection Notice** – While the current disconnection notice does mention the availability of Customer Assistance Programs, the reference to the programs will be modified to include the website and CARE hotline phone number to use to apply for the programs. Additionally, ComEd will improve the visibility of this language on the disconnection notice.

- **Field Notification Call** – ComEd will change the call message script on the field notification calls to identify the availability of customer assistance programs, including LIHEAP, PIPP, and Residential Special Hardship.

- **Municipal Notification** – ComEd will notify the City of Chicago and other municipalities of impending disconnections on a zip code (or comparable) basis after developing a business process to accomplish same, as permitted by customer information privacy constraints. ComEd is currently exploring its capability to report impending service disconnection information on a zip code by zip code basis. ComEd will solicit input from the City of Chicago and other municipalities on a new process to provide notice of disconnection of customers for nonpayment on a geographic basis for customers who have received an AMI meter, as permitted by customer information privacy constraints.

The company will take the following actions to enhance communication for situations where the customer contacts ComEd:

- **Phone Greeting:** The Call Center and Revenue Management will work together to determine how the IVR and CSR call scripts could be altered to better proactively provide customer assistance information over the phone to customers in credit distress, including communication regarding the availability of LIHEAP, PIPP, and Residential Special Hardship.

- **Web:** Customer Operations will change existing web messaging to better emphasize the availability of customer assistance programs, including PIPP, LIHEAP, and Residential Special Hardship.

ComEd will also coordinate with social service agencies, local governments and other sources of customer assistance via the following:

- ComEd Customer Assistance has engaged and will continue to engage the following organizations to discuss the development of Customer Assistance Program guidelines (i.e., customer eligibility, program design, timing of program rollout, etc.):
    - DCEO
    - Housing Authorities (CHA, Aurora, Rockford, Metropolitan, Kankakee)
    - CNT Energy

Additionally, Customer Assistance has engaged and will continue to engage in the following outreach efforts in connection with the availability of assistance programs:

- ComEd held media awareness events in Chicago, Rockford and Will County

- In partnership with Ameren and DCEO, ComEd participated in the Housing Authority Conference held April 2012 for the purpose of providing Customer Assistance information

- English/Spanish translation of program information has been shared with the Chicago Housing Authority for distribution to their residents

- ComEd will be hosting a senior night in Saratoga Towers (Kendall-Grundy) with participants receiving Customer Assistance Program information, energy efficiency information, and entertainment

- Customer Assistance, Marketing, Corporate and Communications are coordinating efforts to provide Customer Assistance program and energy efficiency information to seniors through the meals on wheels program throughout the territory (Dept. of Aging)

- LAA's will receive energy efficiency packets via a marketing drop shipment. Customers applying for Residential Special Hardship will be provided with a packet for their use.

- External Affairs will work with United Way to distribute information regarding the Non-Profit Special Hardship program.

- Coordinating a conference with St Vincent De Paul, Lake County LAA and Lake County Housing authority to align efforts to get information to customers seeking assistance.

- The Customer Assistance team participated in the Welcome Home Celebration for Military Veterans in May. CHAMP information was distributed along with giveaways for military families

The marketing plan for low income and senior populations will also include energy management to help customers manage and reduce their energy usage.

- As part of the promotion on CARE, ComEd will educate low income customers on energy management providing customers with information to help them lower their

future energy bills. Energy efficiency tips will be included on all CARE collateral, such as brochures and flyers, and at events where CARE is promoted.

- Energy efficiency tips will focus on low-cost and no-cost ideas that can help low income customers save money immediately.

- Build energy efficiency knowledge among existing low-income advocates and organizations (such as LIHEAP and CIDA offices) so they can help communicate energy management information to their constituents.

- Host speakers bureau events for low-income customers via low-income advocates and organizations offering in-person education about energy efficiency.

- Messages will be used as a supplement to primary messaging about CARE assistance in paying electric bills. Messaging will focus on no-cost and low-cost energy-saving tips and will include:

    - In addition to the financial assistance programs ComEd offers, here are some small changes you can make to have a noticeable impact on your energy bill.

        - Adjust your refrigerator settings

        - Keep your refrigerator's coils clean

        - Use a power strip to power off unused electronics

        - Use window shades

        - Turn off lights when you leave a room

        - You've got the power to save.

        - For more no-cost and low-cost energy-saving tips, visit ComEd.com/Tips

The table below outlines some methods and tactics to be used for low income audiences:

Tactic	Strategies	Description	Audience(s)
Enhanced Speakers Bureau	▪ Use CARE channels ▪ Promote directly ▪ Build knowledge among advocates	▪ Partner w/LIHEAP and CEDA offices to host Speakers Bureau presentations to low income customers ▪ Partner w/Housing Authorities to host Speakers Bureau presentations	▪ Supporting orgs ▪ Customers
Brochures	▪ Use CARE channels	▪ Distribute EE brochures (leave behind packets) to all LIHEAP and CEDA offices (quantity-31,700) – complete ▪ Distribute CARE brochure w/EE tips through Meals on Wheels program	▪ Supporting orgs ▪ Customers
Workshop/ webinar	▪ Build knowledge among advocates	▪ Develop workshop/webinar presentation on energy management for Non-profit Assistance program (required attendance for grant recipients) ▪ Attend LIHEAP conference (end of June), partake in panel discussion on energy management	▪ Non-profit orgs ▪ LAAs
Newsletter Templates	▪ Use CARE channels	▪ Short template that can be sent by supporting organizations	▪ Supporting orgs ▪ Housing Authorities
Events	▪ Use CARE channels	▪ Small number of select events to generate general awareness	▪ Customers

The following table provides additional details for Speakers Bureau for low income customers:

Audience	Description	Message(s)
LIHEAP/CEDA offices	▪ Hold energy management sessions for LAAs to educate them and arm them with information to share with customers ▪ Partner w/LIHEAP and CEDA offices to host Speakers Bureau presentations to low income customers ▪ Attend LIHEAP conference (end of June), partake in panel discussion on energy management	▪ Low cost/no cost tips ▪ CARE programs
Housing Authorities	▪ Partner w/Housing Authorities to host Speakers Bureau presentations	▪ Low cost/no cost tips ▪ CARE programs
CNT	▪ Develop workshop/webinar presentation on energy management for Non-profit Assistance program (required attendance for grant recipients)	▪ Low cost/no cost EE tips ▪ Encourage employee participation
Senior Centers	▪ Host Speakers Bureau presentations to senior citizens	▪ Low cost/no cost tips ▪ CARE programs
Faith-based Organizations	▪ Host Speakers Bureau presentations to low income customers	▪ Low cost/no cost tips ▪ CARE programs
Community Centers (i.e., Urban League, LUCHA, etc.)	▪ Host Speakers Bureau presentations to first-time homebuyers	▪ Low cost/no cost tips ▪ CARE programs ▪ Select Smart Ideas incentives

G. Vulnerable Populations

As noted in Chapter 3(E), the Commission's Order in Docket No. 12-0298 directed ComEd to discuss with stakeholders and Staff the methodology to define and identify "vulnerable" customers. As noted in Chapter 3(E), ComEd contacted stakeholders and Staff to

attempt to initiate discussions, but there was insufficient time to resolve the methodology to define and identify "vulnerable" customers by the filing of this modified Plan, and ComEd will work with stakeholders and Staff to include a proposal for the methodology to define and identify "vulnerable" customers in the first annual report to be submitted on April 1, 2013. For purposes of this modified Plan, ComEd will track its education metrics for low income customers as defined above in Chapter 3(E).

Subject to the barriers to tracking vulnerable populations discussed in Chapter 3(E), one approach to measuring the effectiveness of the education and outreach efforts is to conduct a tracking survey among customers (as described in detail in Section J). This survey would include demographic questions that would allow us to evaluate the response by various vulnerable populations such as seniors and low-income customers. ComEd commits to protecting consumer privacy regarding any responses to demographic questions and personnel information provided by the consumer. The survey might also ask about awareness of PTR, the use of web tools and RRTP.

H. Messaging

Messaging will be developed to support the objectives and strategies outlined earlier in this plan. One of the keys to success will be delivering the right message, to the right person, at the right time. Targeted messaging works since it does not overwhelm customers with irrelevant information, but only provides them with what they need to know at the time they need to take action. Messaging for the education and outreach plan will be targeted by audience, but will continue to include general information about advanced meters and their benefits throughout the initiative.

The messaging used for AMI deployment education and outreach initiatives will revolve around the functions and benefits of advanced meters. Themes will focus on how customers can derive value from the advanced meters; controlling costs, giving customers choices and control, and an enhanced customer experience.

There are several distinct ways that targeted, relevant messaging will be used:

- Messaging will be used to communicate the benefits of advanced meters, as a way to educate customers but also as a way to address potential negative perceptions/beliefs, ideally before they occur or become ingrained.

- Messaging will be used to communicate specific, factual information about AMI deployment details – for example, when a specific customer's meter is being installed.

- Messaging will be used to clearly articulate the tangible customer benefits and value derived from advanced meters, RRTP and PTR.

A key purpose of the messaging is to reiterate the benefits of AMI deployment which fall into several themes, developed using secondary research and prior ComEd market research:

- Control/Empowerment
- Savings
- Reliability
- Service
- Future Preparedness

Research is underway to understand which themes, and their associated benefits statements, resonate most with customers. The research will enable us to refine the content and tone of benefit statements. Both qualitative and quantitative customer research will be conducted in three phases.

- Phase I: In December 2011 initial research was conducted via the Customer Roundtable and an e-newsletter survey. This initial research was used to guide early education and awareness communication planning, offer support for rollout of smart meter research activities, and screen out those messages that do not resonate from further, more robust research activities planned in early 2012.

- Phase II: Leveraging the findings from Phase I, a series of focus groups was conducted among customers In March 2012. Initial findings are as follows:

    - Marketing by electricity suppliers, municipality's role in choice, and outages are top-of-mind issues in electric utility space. Grid modernization is not.

    - Customers know little about the smart grid and smart meters and do not envision spending much time to inform themselves, not surprising given electricity's low-involvement category. Customers may not learn much more unless impelled by self-interest or concerns.

    - Customers will not credit claims about grid modernization's prospective benefits. ComEd will have to earn trust by improving performance, as it did prior to launching the Recommitted campaign.

    - Unsure if the smart grid and smart meter would actually benefit them and skeptical of what their actual costs would be, customers want to know "what's in it for me." ComEd will need to improve comprehension by communicating benefits rationally, not emotionally.

    - Customers expect future communications to coordinate with ComEd's physical work of improving reliability. Informational graphics help customers visualize the grid modernization work.

  - Recommendation: Deliver a staged messaging approach. Offer customers messages that are rational and enhance comprehension while offering more aspirational messages to employees, legislators and community officials in the early years.

- A quantitative online study will be fielded that leverages the findings from the Phase II focus groups.

- Phase III: Awareness and education quantitative tracking research will be conducted to monitor customer awareness of AMI deployment work and assess the effectiveness of the information communicated to customers.

Over the 7-year course of the AMI deployment project, ComEd may continue to conduct research to refine messages and proof points, especially as new issues of importance emerge.

Current messages are under development and research review. Preliminary examples of messages that will be validated include:

- We're improving our customers' experience by giving them more information, more power to control their electric bills and more ways to save money.

- At ComEd, we are changing the way we operate in order to provide our customers with better service, more choices and greater control over the size of their electric bill.

- Two-way communication through smart meters will eventually mean customers won't have to call when they're without power, ComEd can restore power more quickly.

Proof points, Q&A and other information are under development and will also be validated by customer research. Preliminary examples of the information that will be used for customer education and outreach efforts are:

- What is a smart meter?

  - A smart meter is a digital electric meter that is equipped with wireless communication capabilities to allow customers to track their electricity consumption more frequently.

- How will this benefit customers?

  - With more timely information on electricity usage, customers can better manage their energy use to save money on their electric bills. Customers can take advantage of pricing plans that will include rebates to reward customers for reducing consumption during peak usage times.

- Are there other benefits?

- Eventually, smart meters will be able to immediately send a signal to ComEd when power in a home or business has been lost, enabling ComEd to respond to outages more quickly and efficiently.
- Smart meters will make it easier to incorporate renewable energy sources, such as wind and solar power.

- When is this happening?
  - The installation of smart meters began in 2015 with four million meters to be installed through 2021.
  - ComEd will provide customers and local municipalities with updates prior to any improvements taking place.
- I won't get a smart meter right away. How will I benefit?
  - All customers will immediately realize savings due to operational efficiencies and reduced cost. As customers receive smart meters, they will have the ability to monitor their electricity usage more frequently and enroll in new incentive programs. This new technology will help customers manage their electricity use better and reduce their monthly electric bills.
- Compared to analog meters, smart meters provide a wider range of benefits:
  - They reduce utility operating costs (e.g., manual meter reading, manual meter disconnections and reconnections, manual bill creation)
  - They help pinpoint outages and verify power restoration to allow faster outage restoration
  - They make move-in/move-out changes in service much faster and more efficient
  - They reduce unbilled electricity usage that occurs between tenants
  - They reduce electricity theft by identifying irregularities
  - They provide customers with hourly energy-usage data that can help them manage electric bills

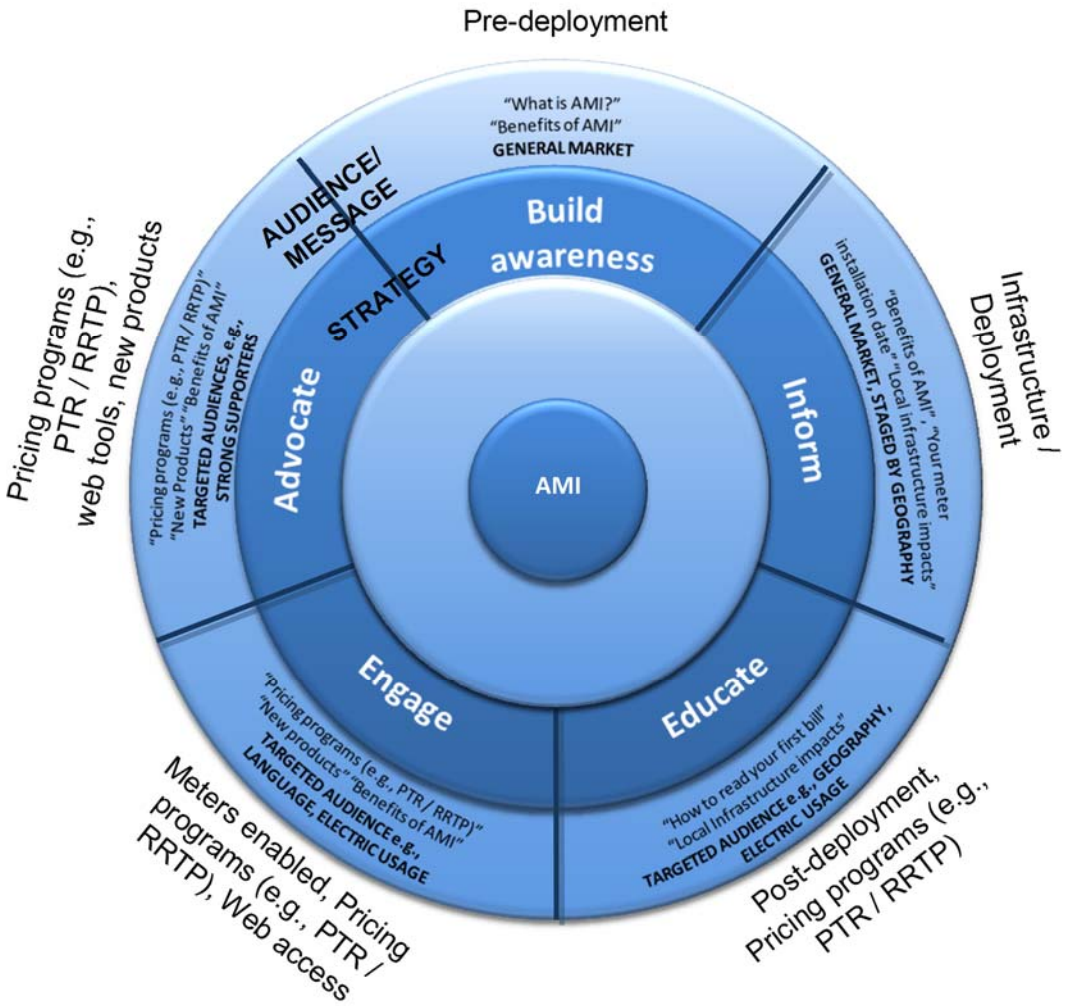
1. <u>Staged Messaging Approach</u>

Studies have shown that utilizing a "staged messaging approach" effectively addresses customer expectations during pre-deployment, deployment and post-deployment implementation phases. When the education and outreach campaigns focus on the "what, when and how" of the deployment and installation, implementation occurs with few issues. Staged messaging should

follow specific timed period outreach initiatives such as 90, 60, 30 and 7 days prior to deployment to educate and inform customers about specific activities they will experience, and reiterate initial or near-term benefits. Post installation, messages will be tailored for AMI customers to focus on pricing programs such as RRTP and PTR; others will receive general energy efficiency messaging.

The initial education and informational messages will lay the foundation for future dialogue about future benefits enabled by the technology. Promising too early or communicating misinformation can lead to lowering of expectations, and even lower future support and participation. For example, one of the first points of communication will include factual information about "what is an advanced meter", and how the systems work.

The communication wheel below has been enhanced to include audience and messages. The messages provide an illustration of "what" will be communicated at each stage.



I. Methods

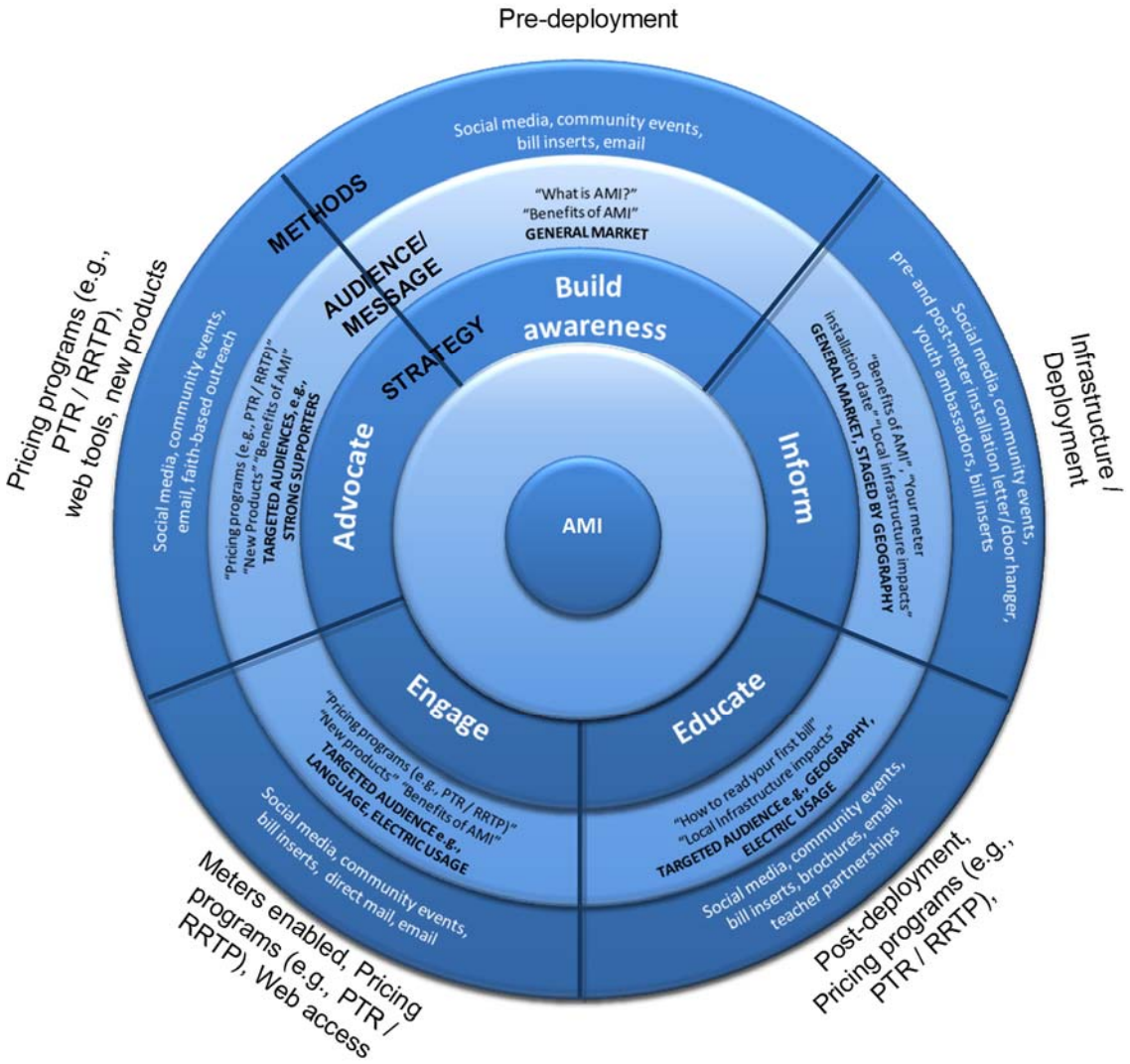
Using key lessons from the Pilot as well as best practices from other utilities, methods have been created to execute each core strategy as shown earlier in the plan. Messaging and audience segmentation will also be incorporated into these customer and small business methods.

ComEd will install advanced meters on homes and businesses throughout its entire service territory on a rolling geographic basis over a 7-year period. ComEd will also offer customers the opportunity to participate in voluntary pricing programs (such as PTR and RRTP) and take advantage of energy management tools and services on a parallel rolling geographic basis.

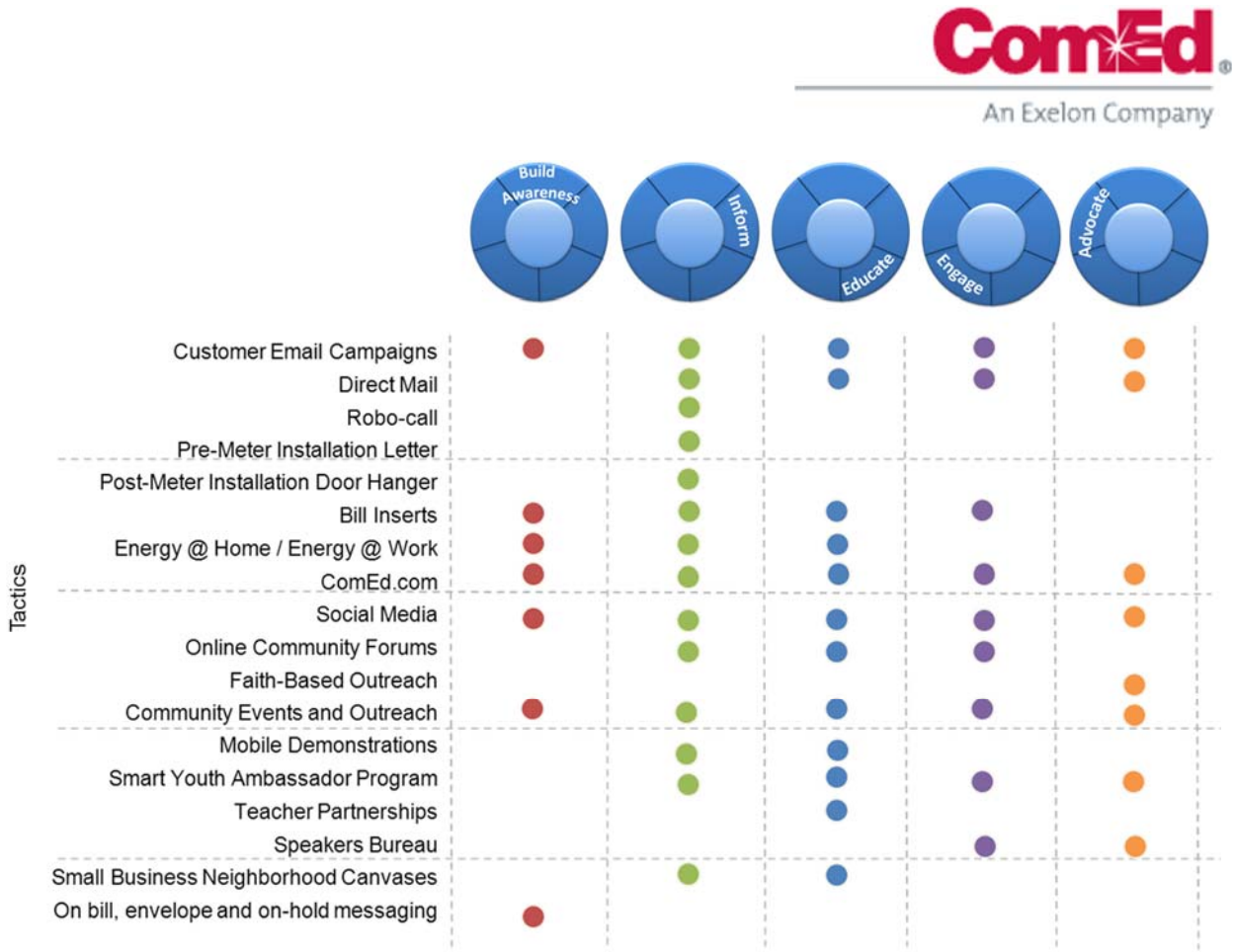
Given this geographic deployment plan, ComEd has the opportunity to tailor its messages about the meter exchange and the benefits of advanced meters, RRTP and PTR program participation to fit the unique characteristics of its customer base within defined geographic boundaries. Because deployment will occur over 7 years, there will be an opportunity to revise the methods and messaging based on experiences and results from the initial deployment. Details regarding timing of methods related to deployment and meter installation by geography is shown in the timeline section of this document.

This plan will be executed in a collaborative fashion with other internal ComEd departments as well as external vendors and partners.

The communication wheel shown earlier in this Chapter has been enhanced to include methods. The methods below provide an illustration of "how" messages will be communicated at each stage of deployment and to support each strategy. Messages shown will be modified based on research results and throughout the stages of deployment to avoid message fatigue. The methods shown in this communication wheel are illustrative (not comprehensive) of the methods that will be used at each stage.



A summary of methods by strategy is shown in the chart below, with details following.



1. <u>Build Awareness</u>

Building awareness is the first step in the education and outreach process. ComEd will promote AMI benefits and progress through paid and earned media.

Communication Topics and Targeting

Building awareness within ComEd's service territory will occur prior to meter deployment and before much infrastructure work has begun, so communication messages will cover general topics such as:

- Value of AMI meters
- What is an advanced meter?
- Benefits of AMI "what's in it for me?"
- How can I manage my energy information differently?
- Access to energy information and budget tools, including information specifically for customers without internet access

- Program progress/timeline
- Low-income customer assistance programs

Methods

Specific methods to support the Build Awareness strategy include:

- Customer email campaigns
- Direct mail
- Bill inserts, brochures, fact sheets
- Energy @ Home / Energy @ Work
- Updates on ComEd.com
- Social media including Facebook, Twitter, YouTube and blogs
- Community events and outreach
- No cost messaging including bill messaging, on-hold messaging and envelope messaging

2. <u>Inform</u>

This strategy involves informing customers about the benefits of AMI, RRTP and PTR. Informing customers will occur prior to and during meter deployment.

Communication Topics and Targeting

Customers within initial meter deployment areas may have already received specific information about grid modernization occurring in their area. Beyond those affected customers, the general market will also be informed about topics including:

- Benefits of AMI "what's in it for me?"
- Customer commitment details
- Program progress/timeline/milestones
- Your meter installation date is approaching – for customers in affected geographies
- Coming soon – the ability to manage electricity use more effectively using PTR and other pricing programs such as RRTP.

Methods

Specific methods to support the Inform strategy include:

- Customer email campaigns
- Pre-meter installation letter
- Post-meter installation door hanger
- Unable to Complete installation (UTC) door hanger
- Bill inserts, brochures, fact sheets
- Energy @ Home / Energy @ Work
- ComEd.com
- Social media
- Online community forums
- Community events and outreach
- Mobile demonstrations
- Smart Youth Ambassador Program
- Small business neighborhood canvasses

3. Educate

As customers become aware and informed about AMI deployment, they are more receptive to education about implementation plan activities and the benefits of advanced meters. At this stage, deployment has occurred and customers have received their new meters. Infrastructure improvements are underway as well, so customers are ready to start the education process.

Communication Topics and Targeting

Several communication topics will be covered to educate customers about AMI deployment and how it will benefit them:

- How to read your first bill – to customers on a rolling basis as their new meters are activated
- Get acquainted with your advanced meter

- Access your usage details online and via personal mobile devices as new meters are activated
- Local infrastructure impacts
- Benefits of AMI "what's in it for me?"
- Call to action: visit web to view data, analyze usage, and sign up for a voluntary pricing program (e.g., PTR or RRTP)

Messages about the bill and accessing usage data online will be targeted to specific geographies as the new meters are activated and as information becomes available. In addition, these messages and methods may be further customized by amount of electric usage or by type of home (single family or multi-family).

Methods

Specific methods to support the Educate strategy include:

- Customer email campaigns
- Direct mail
- Bill inserts, brochures, fact sheets
- Energy @ Home / Energy @ Work
- ComEd.com
- Social media
- Online community forums
- Community events and outreach
- Mobile demonstrations
- Smart Youth Ambassador Program
- Teacher partnerships
- Neighborhood canvases to small businesses

4. Engage

Engaging customers will occur as customers are continually exposed to advanced meter messages and improvements. This strategy focuses on how customers can use the advanced meters and become engaged through the tools facilitated by the advanced meter. At this stage, deployment has occurred and meters have been verified and are now fully functioning. PTR/RRTP and other web tools will be strongly promoted.

Communication Topics and Targeting

ComEd will strive to ensure all customers are informed about the new web tools and pricing programs, however not all customers will be able or willing to actually utilize every tool available. Methods and communications may be customized by language, electric usage, and type of home, and how customers will access the web tools (online or mobile). If additional behavioral data is available, this will also be used to further target customers most likely to be interested and receptive to engage in the new tools. Specific topics that will be communicated include:

- Benefits of PTR and RRTP
- How to view usage
- New innovative products and services
- Benefits of AMI "what's in it for me?"
- Program progress/timeline/milestones

Methods

Specific methods to support the Engage strategy include:

- Customer email campaigns
- Direct mail
- Bill inserts
- ComEd.com
- Social media
- Online community forums
- Community events and outreach

- Smart Youth Ambassador Program
- Speakers bureau

5. Advocate

Personal learning comes from communication with friends, family, neighbors and co-workers. ComEd will encourage customers who realize the value of new tools and programs to talk to others about becoming active users and strong supporters.

Communication Topics and Targeting

Customers will receive messaging promoting ComEd's pricing programs (PTR/RRTP), web tools and new products. Additional behavioral data, if available, will be used to further target customers and small businesses. Specific topics communicated will include:

- ComEd's customer ePortal
- Use of a Home Area Network (HAN)
- Use of energy management tools
- Use of ancillary or supplemental energy management tools via other retailers
- Savings earned through PTR and RRTP
- Benefits of AMI "what's in it for me?"
- Program progress/timeline/milestones

As customers learn more about these tools and benefits, they will become empowered and supportive and naturally advocate concerning the benefits of AMI.

Methods

Specific methods to support the Advocate strategy include:

- Customer email campaigns
- Bill inserts, brochures, fact sheets
- Direct mail
- ComEd.com
- Social media

- Community events and outreach
- Smart Youth Ambassador Program
- Speakers' bureau
- Outreach to faith-based organization and environmental non-profts

6. Additional Information about Methods

Some methods require additional detail and explanation, provided below.

ComEd.com

ComEd's website will be used as a repository of content related to the AMI deployment program as a supplement to the information being disseminated through other channels. This will include general advanced meter details and customer benefits, as well as deployment and infrastructure details. ComEd will provide information from the website, in the form of hyperlinks and documents, to customers and others who wish to have more information about the program. In addition, customers and others will be able to go to a specific page on ComEd's site to obtain information in the form of fact sheets, frequently asked questions ("FAQs"), testimonials, videos and more. Customers will also have access to the energy management tools via ComEd.com and via mobile applications.

Online Community Forums

Online Community Forums will be used as another channel to inform and educate customers about AMI meters. ComEd would seek out or create specific "online communities" of like-minded customers that have a particular interest in smart grid, advanced meters, energy efficiency or new technologies. ComEd could post content in these forums to help customers learn more in an interactive environment.

Influential Moms and Parents Online Forums

Moms today are on the cutting edge of technology and are constantly seeking new tools to help them carry out their duties more efficiently and effectively in the home. A 2010 Forbes study found that 61% of women influence household technology buying decisions, and that nearly half want more green choices. ComEd will develop content appropriate blogs to engage these groups and initiate conversations pertaining to AMI. Blogs may include Mom Central, a national social media and blog network that engages influential moms to become brand ambassadors and evangelists for leading products and services.

Environmental Nonprofit Groups

We will also look to establish a dialog with environmental non-profit groups such as National Resources Defense Council, Environmental Defense Fund and Global Green USA. We will also identify and engage in a conversation with local green community groups such as Illinois Solar Energy Association, and the Sierra Club. By harnessing their credibility and

influence, we will help advance the smart grid in Illinois by reaching consumers through authentic and trusted advocates for environmental issues.

Community Events and Outreach

Education and outreach will be performed at community events throughout the course of AMI deployment. These events include festivals, fairs, and other events. Multi-cultural outreach activities will also be included. We will be mindful of languages spoken in specific geographies where events will be attended, and tailor the event staff and collateral to these and other cultural nuances. Event staff will be equipped with toolkits including FAQs, fact sheets, talking points, etc. in order to effectively communicate with customers regarding the benefits of the new meters. Interactive devices, brochures and fact sheets will be available to facilitate customer engagement. As part of community outreach, faith-based organizations will be engaged to discuss AMI benefits among their congregations through one-on-one conversations, hosted coffee hours, and distribution of educational leave-behind displays. Additional details are in development.

The **Mobile Demonstration Units** and the **ComEd Classroom** will support the ComEd education outreach program by providing customers with a hands-on opportunity to learn more about the advanced meter capabilities and energy efficiency.

Games

By building the games in an iPad application, the units can be used in combination with a kiosk to allow for higher visibility and branding at large events or as standalone assets at small events. This strategy allows for an equally effective experience, whether the event is large or small.

Below is a description of two of the games to be deployed at events and can also be found on ComEd.com and ComEd's Facebook page. The **Smart Home** game will focus on smart meters and Energy Efficiency. With the installation of Smart Meters, customers will be able to see exactly how they are using energy and where there are potential savings opportunities. In the Smart Home demonstration, players will interact in a fun and engaging way. They will learn exactly how the AMI Meter benefits them and how they can reduce energy use to save money.

HOW IT WORKS:

- The game begins in a "house" where the Smart Meter has recently been installed.
- As the months/climates change, players must manage a number of factors to minimize energy use including heating/cooling costs, lighting, television and computer use, while balancing their family's happiness at the same time (i.e., temperature is comfortable, they can watch TV when they want to, etc.).
- In order to maintain the balance of energy efficiency and family happiness, players must constantly check their energy usage while monitoring their family's happiness meter shown within the game.

- By referring to the meter, players will be able to see which electronics draw the most energy and can then make the necessary decisions/adjustments to use less energy, including unplugging the vacuum while the blender is running or turning off lights, etc.

- The more the players reduce their energy consumption in the cold and hot weather months, the larger the rebate they will receive at the end of the game. This rebate will be exchanged for an increase in their point total.

- Players can also determine how much electricity each appliance/electronic item draws by scrolling over the star located at these locations. *Smart Ideas for Your Home* tips and facts will also pop up to guide players through the experience and help them make the best decisions.

- Once time expires, the player's score will be posted on the screen. The top five highest scores at the end of each event day will receive a premium prize. The collection of contact information at the beginning of the game allows for identification of the winner and easy delivery of the prize when applicable.

- To replicate the onsite event experience, customers are able to access the Smart Home game from the ComEd Facebook page

The **Energy Efficiency** game will focus on providing customers with an opportunity to test and add to their energy efficiency knowledge.

HOW IT WORKS:

- Customers will attempt to answer a series of trivia questions relating to energy efficiency. If they don't know the answer, they can click "Hint" to receive an info-morsel to help them answer the question correctly.

- Based on the number of questions answered correctly, customers will receive a "score" in the form of a name identifying their level of energy efficiency knowledge (i.e., "Congratulations! You are an energy expert!").

- To further their commitment, customers will then be encouraged to sign a pledge showing their dedication to becoming more energy efficient by incorporating ComEd's "nudges" into their everyday lives. This pledge, along with their level of energy efficiency knowledge, will be uploaded and shared via their Facebook wall.

- Once posted on Facebook, friends can also sign up to take the pledge agreeing to ComEd's "nudges" for becoming more energy efficient.

Classroom

A portion of the space will be allocated to the ComEd Classroom (for demonstration areas with sufficient space). Here, customers can learn and ask questions about smart meters

from live ComEd experts. Customers will receive a premium (t-shirt, plugs for sockets, screen cleaner, seeds) for participation;

Signage, brochures and collateral (interchangeable given demographic) will supplement the experience and provide additional information

Social Media Integration

To drive traffic to ComEd's Facebook and website page, customers will have access to all mobile demonstration unit content and games online. This provides an added touch point and an opportunity to direct customers to additional online resources where they can learn more about smart meters.

All games will be highly integrated into social media platforms such as Facebook, with the ability to post game results, view leader boards and challenge friends to play.

To drive viral buzz and generate more awareness during the live events and beyond, prizes and sweepstakes will be integrated into each game.

Text-to-Talk

The Text-to-Talk display enables one-on-one communication by providing customers without Internet access a platform to text in their questions, concerns and feedback about Grid Modernization and Smart Meters directly to a ComEd representative. While some customers are currently able to text in power outage reports, the Text-to-Talk program takes it one step further by encouraging two-way dialog.

Smart Youth Ambassador Program

As part of the Customer Education and Outreach Plan, ComEd will utilize a Smart Youth Ambassador Program to help turn ComEd customers into advocates. The ambassador program will consist of primarily high-school students who reside within ComEd's service territory. The goal of the program will be to educate customers on energy efficiency and smart meters and dispel myths and concerns customers may have, ultimately creating advocates for energy management.

This program will be executed in collaboration with Faith in Place, The Chicago Urban League and ComEd. It will support the Smart Meter rollout schedule as determined by ComEd.

- Seventy students ages 15-19 will work from four sites (three Faith in Place partner congregations and The Urban League) located throughout the ComEd service territory.
- Students will participate in predetermined ComEd events scheduled during the summer.
- A core group of 15 students will continue through the school year with Faith in Place, and will provide the core of the summer 2013 Smart Youth Ambassador program.

- The program will also include a career day at ComEd, in which the youth will be invited to consider the different career options open to them in the field of energy and energy conservation. Career Day may include all 70 youth on a single day or be divided into smaller groups on different days, based on the needs of ComEd to coordinate.

- Each summer student will receive a stipend of $800.

- Faith in Place will perform background checks on the students and supervisors.

- A photo authorization and a hold harmless agreement will be signed by each young person or their parent or guardian.

- On completion of the summer project, there will be a culminating celebration for all 70 youth at The Urban League.

Small Business Neighborhood Canvases

In addition to attending local events the local marketing teams will conduct Neighborhood Canvassing by delivering messaging and collateral to customers through local businesses where customers live.. These locations will include libraries, community centers, grocery stores and more. The neighborhood canvassing efforts also include creating partnerships with local restaurants to allow ComEd to include collateral on food packaging (ie. Pizza box). The collateral serves a dual purpose: 1. provides ComEd messaging about Smart Meters, and 2. Invites customers to a ComEd social at a local community center or church. As an added incentive for residents to attend the social and as a marketing opportunity for the local restaurant they will provide food for all to enjoy.

Teacher Partnerships

Through Teacher Partnerships, ComEd will educate students and teachers on advanced meters and PTR and how they address our energy challenges. Using a list of teachers interested in energy efficiency (collected from past energy efficiency work), ComEd will distribute emails to teachers soliciting interest in advanced meters and PTR, offering ways they can get involved. Options for their involvement include classroom involvement, teacher education, environmental student club participation, and events at the school. Packets of information will be provided to interested teachers for them to use when creating curriculum and student activities.

Speakers Bureau

The Speakers Bureau program already in place will be used as a method to engage communities in ComEd AMI deployment. ComEd receives regular requests from external affairs and local communities and organizations to attend an event and provide a speaker. Events are generally well attended and serve as another opportunity to provide information about AMI deployment. In addition, an enhanced Speaker's Bureau will target low-income customers through events hosted at low-income advocate organizations such as LIHEAP, offering them education on energy management tips and tools.

Faith-Based and Environmental Non-Profit Outreach

A key component of advocacy involves leveraging existing, influential non-virtual networks to share information among customers and discuss the benefits of ComEd's AMI and PTR programs. ComEd will provide these organizations with information such as fact sheets, talking points, research and testimonials about energy management and its benefits. Through this work, we hope to develop a network that becomes informed and tells others about the benefits of AMI deployment and its programs, products and services.

J. Metrics

ComEd will include metrics to measure the effectiveness of customer education and outreach. This will measure the use of community organizations, and awareness of AMI and customer engagement and experiences. ComEd's key metrics will measure the following:

- Awareness of AMI technology and benefits (Awareness and Education study).
- Understanding of AMI technology (Customer Experience/Engagement Research and Customer Experience Tracking).
- Number of community outreach events and number of attendees (Event Tracking)
- Number of articles that appear in local media (traditional media tracking)
- Number of articles in internal newsletter
- Number of meter installations complaints/claims (Rapid Response Situational Assessments)
- Number of installation appointments (tracked by AMI deployment team)
- Number of customer organizations contacted
- Number of customer communication methods deployed
- Number of advocates and ambassadors informed
- Number of surveys completed at events

These metrics are outlined in the following chart:

Metric Category	Key Metric	Calculation	Results Year Y	Comment
Awareness and Education	Awareness and understanding of AMI technology and benefits (survey metric)	3rd party survey	x%, verbatims, etc	
Customer Experience and Engagment	Understanding of AMI technology (Customer Experience/Engagement Research and Customer Experience Tracking).	3rd party survey	x%, verbatims, etc	
Community Outreach	# of community events and # of direct interactions	Event Tracking	Conducted XX, Interactions YY	
Local Media	# of articles that appear in local media	Traditional media tracking; articles that appear as a result of press releases	xx	
Internal Media	# of articles in internal newsletter	Count of articles in newsletter	xx	
Customer Experience and Engagment	Meter Installations complaints/claims (Rapid Response Situational Assessments)	Count of installation complaints	xx	
Customer Experience and Engagment	# installation appointments (tracked by AMI deployment team)	Count of installation appointments	xx	
Community Outreach	# of customer organizations contacted	Count of number of organizations	XX	
Community Outreach	# of customer communication methods deployed	Count of number of items	XX	
Awareness and Education	# of advocates and ambassadors informed	Count of number of ambassadors	XX	
Awareness and Education	# of surveys completed at events	Count of number of surveys completed	XX	

The measures listed above will be tracked through the metrics listed in the table below to account for the $27.7 million in customer education planning over the next ten years. The following table gives an example for year 2012.

Tactic	Target	Budget for 2012	Direct Interactions / Impressions^	Clicks	Organizations contacted	Premiums Given away	Articles internal newsletter	Enrollments	Surveys Collected	Emails Collected	Cost/per Interaction (CPI)
Energy management Education & Outreach events + interactive items	General Market (residential)	$337,500	xx	n/a	n/a	xx	n/a	n/a	xx	xx	
Speakers' Bureau	General Market (residential)	$5,000	xx	n/a	xx	n/a	n/a	n/a	xx	n/a	
Youth Ambassador program	Faith based organizations & End customers	$111,000	xx	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Faith Based and Low Income outreach	Faith based organizations & low income populations	$31,500	xx	n/a	xx	n/a	n/a	n/a	n/a	n/a	
Email Marketing	General Market (residential)	$8,500	xx	xx	n/a	n/a	n/a	n/a	xx	n/a	
Energy @ Home & Bill inserts	General Market (residential)	$145,000	xx	n/a	n/a	n/a	xx	n/a	n/a	n/a	
Direct Mail for PTR & web tools	General Market (residential)	$95,000	xx	xx	n/a	n/a	n/a	xx	n/a	n/a	
Videos & Brochures	General Market (residential)	$75,000	xx	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Online and Social Media outreach	General Market (residential)	$17,500	xx	xx	n/a	n/a	n/a	n/a	n/a	n/a	
Teacher Partnership	General Market (residential)	$20,000	xx	n/a	xx	n/a	n/a	n/a	n/a	n/a	
Municipal Toolkit & Experiential marketing materials	Municipalities, Legislators, Community Leaders	$106,500	xx	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Municipal Events Speakers Bureaus Townhalls	Municipalities, Legislators, Community Leaders and constituents	$61,000	xx	n/a	n/a	n/a	n/a	n/a	n/a	na	
Municipal online web	Municipalities, Legislators, Community Leaders and constituents	$0	n/a	xx	n/a	n/a	n/a	n/a	n/a	n/a	
Outreach materials/interactive items	Municipalities, Legislators, Community Leaders and constituents	$25,000	xx	n/a	n/a	xx	n/a	n/a	n/a	na	
Awareness tracking	Market research	$137,500	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Customer Experience + Message testing	Market research	$200,000	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
FTE's (4 people)	Staff	$ 381,358	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
	Summary	$1,757,358									

The Messaging section outlines qualitative and quantitative customer research that launched in December 2011 and follow-on research that is planned to commence in early 2012 to test and refine the content and tone of messages and benefit statements to potentially communicate to customers. This research will be used to develop a preliminary set of benefit statements that resonate most favorably with customers, supporting ComEd's overarching objective stated earlier.

An extensive program of primary and secondary market research will be employed to assist ComEd's AMI deployment initiatives and to measure the success of customer education and outreach efforts. Prior to conducting each primary research project, a research plan will be prepared to include the following elements:

- Explanation of the need for the research
- Description of specific research objectives
- Description of the intended uses of research findings
- Discussion of the research methodology
- Examples of topics and questions to be included in questionnaires and discussion guides
- Project timeline

- Estimated budget requirements

An integrated set of research projects has been identified as necessary to support meter deployment and PTR initiatives (broadly characterized as the installation of advanced digital two-way communicating meters, and the offer of a peak time rebate pricing program). These projects are designed to:

- Measure and track the success of customer education and outreach efforts
- Better understand customers and their evolving needs and service expectations
- Assess customer interest in, and the viability of, the PTR pricing program and other services and tools enabled by the presence of an advanced digital meter

1. Secondary Research

Secondary research is often based on information from studies previously performed by government agencies, industry organizations, trade associations, and other organizations. U.S. Census Bureau information and studies made available by other energy companies are examples of secondary market research. Secondary research data are typically easy to find and either free or available at a relatively low cost. For the purposes of this Plan, past ComEd primary market research and actual ComEd data, such as from public events and sponsorships, will be classified as secondary research.

Several forms of secondary research will be employed to support the objectives of this Plan.

1. Traditional Media Tracking – Monitor traditional media channels to capture reactions and feedback from customers and external stakeholders on matters pertaining to reliability improvement initiatives, advanced digital meters, and the PTR pricing program.

2. Audience Reach and Frequency Tracking – Measure the number of customers exposed to information in the media about the AMI deployment initiative as well as the number of exposures from each major communications channel.

3. Social Media Tracking – Monitor social media channels to capture reactions and feedback from customers and external stakeholders on matters pertaining to reliability improvement initiatives, advanced digital meters, and the PTR pricing program and to engage customers to allay concerns, dispel misconceptions, and foster positive impressions.

4. Benchmarking / Best Practices Assessments – Canvas the education and outreach efforts undertaken by other energy companies to capture lessons learned and best practices.

5. Macro-Environmental Assessments – Track broad, environmental developments to understand impacts on customers and how those impacts could shape or affect our communications messages.

6. Rapid Response Situational Assessments – Monitor the number and intensity of rapid response situations and how and how well they are handled.

7. Events Tracking – Track the number and types of events sponsored by the company, the number of people attending each event, and feedback from attendees.

8. Existing Body of Research – Build upon existing and newly completed research, such as segmentation research and customer satisfaction research, to guide future research efforts and jumpstart message platform development.

2. Primary Research

Primary market research typically refers to custom quantitative and qualitative research methods.

Quantitative research methods involve large numbers of randomly-selected respondents and yield results that are representative of the total population under study. Data collection methods commonly include telephone-administered surveys, mail surveys, web-based surveys or some combination of these methods. By contrast, qualitative research methods involve a small number of respondents and yield results that are viewed as directional, not conclusive. Common methods include focus groups led by a trained moderator and in-depth one-on-one interviews conducted in person or by phone by a highly skilled professional interviewer. ComEd anticipates employing an integrated body of primary research to support the company's AMI deployment initiatives and to assess and measure the success of customer education and outreach efforts.

A number of prospective primary research projects are outlined below. Recognizing this early stage of developing a multi-year research program of work, a partial list of preliminary research objectives and intended uses of research findings are also listed. Importantly, for cost management purposes, it may be possible to group individual projects into a single research project.

1. Message Testing Research – Employ qualitative and quantitative research techniques to define and hone the content and tone of communications messages.

   Research Objectives:

   - To gather customer perceptions and reactions to the company's more recent advertising and marketing messages related to AMI deployment and smart grid

   - To assess the appeal of existing messages and themes, particularly with respect to dimensions of trust, believability and credibility

- To explore customer reactions to message themes pertaining to AMI deployment
- To test alternative benefit statements pertaining to AMI deployment and identify those that have the greatest appeal to customers
- To hone the content and tone of messages and benefit statements to potentially communicate to customers
- To test the appeal of advertisements and marketing communications materials
- To refine the content of advertisements and marketing communications materials

Intended Uses of Research Findings:

- To develop a message platform compatible with a value proposition that appeals to customers
- To help develop the key messages and benefit statements to communicate to customers on AMI deployment benefits of advanced digital meters, and the peak time rebate pricing program
- To help shape the development of advertisements and marketing communications materials

2. Awareness / Education Tracking Research – Employ a tracking survey to monitor customer awareness of the company's main communications messages pertaining to AMI deployment and to assess the effectiveness of those communications in shaping attitudes and behaviors.

Research Objectives:

- To measure customer awareness of the company's general AMI deployment plans, events and initiatives
- To measure customer awareness of the benefits of AMI
- To measure customer understanding and the appeal of AMI benefits
- To measure awareness of other messages and events that are not supported by ComEd
- To measure customers' attitudes and beliefs regarding AMI
- To measure customers' expressed intent to enroll in the PTR pricing program or to engage in other potential services enabled by advanced digital meters
- To measure the perceived value of the investment in AMI

Intended Uses of Research Findings:

- To uncover obstacles to the effectiveness of the company's communications to customers
- To track the effectiveness of the company's communications in breaking through to customers with respect to awareness and resonance
- To establish a basis for making mid-course adjustments in the messages communicated to customers

3. Customer Experience / Engagement Research – Employ qualitative research techniques to identify the optimal customer experience, such as dynamic pricing offer, as defined by customers, to incorporate into education and outreach activities.

   Research Objectives:

   - To identify the requirements for driving customer acceptance of the company's AMI deployment plans, particularly with respect to offering a PTR pricing program option
   - To assess customer receptivity to having a digital meter and taking advantage of the PTR pricing program
   - To understand customers' expectations, preferences and priorities around having a digital meter and participating in the PTR pricing program
   - To capture customers' anticipated and expected touch-points in the experience of having a digital meter and participating in the PTR pricing program

Intended Uses of Research Findings:

- To identify the most critical touch-points in the customer experience
- To define and map the experience most preferred by customers
- To help shape the company's processes and programs to deliver a positive customer experience

4. Customer Experience / Engagement Tracking Research – Employ quantitative research techniques to measure and track customer satisfaction with new customer experiences and to use the findings to help calibrate activities and ensure a positive customer experience.

   Research Objectives:

   - To measure satisfaction with the PTR pricing program, ranging from the initial program offer through program stages of program participation and engagement

Intended Uses of Research Findings:

- To monitor the company's performance in managing the PTR pricing program
- To support any needed course corrections in the administration and implementation of the meter exchange process and the PTR pricing program

5. Motivational Research – Employ qualitative research techniques to identify underlying motivators for customers to engage in the PTR pricing program or any other service enabled by two-way communicating digital meters.

Research Objectives:

- To uncover customers' underlying motivations for enrolling in the PTR pricing program or taking advantage of other services enabled by advanced digital meters
- To understand the benefits of PTR pricing as defined by customers
- To understand customers' decision to enroll in the PTR pricing program relative to other options that could achieve customers' goals

Intended Uses of Research Findings:

- To support the development of a messaging strategy in support of the company's PTR pricing program
- To help develop specific messages to communicate to prospective PTR pricing program customers that align with their needs

3. Data Collection Tool

ComEd will evaluate employing its Customer Roundtable as a vehicle for engaging customers in market research.

Customer Roundtable – Employ the existing Customer Roundtable program to enable a dedicated focus on topics pertaining to advanced digital meters, and the PTR pricing program and related information tools and services. Facilitated by an experienced moderator, the Customer Roundtable offers unique advantages:

- Provides a forum for a free, two-way exchange of information between customers and ComEd
- Enables the exploration of a myriad of topics of mutual interest to the company and participating Roundtable customers

- Provides an opportunity for ComEd executives and managers to hear first-hand customers' thoughts, opinions and reactions to topics pertaining to AMI

- Secures session-to-session progressive feedback from customers

- Allows probing on specific issues and, more importantly, allows ComEd managers to secure immediate, honest feedback on their answers to customers' questions

- Offers an opportunity to request participating customers to do "homework" prior to a session to jumpstart the discussion

- Focuses on solutions to problems and issues, going beyond probing

K. Timeline

The following section contains a timeline to deploy end customer and employee education and outreach methods through Q4 2015 of the AMI deployment program. The tasks within the timelines are segmented into months, with cells of varying colors. The color of each cell indicates the ComEd team responsible for executing each task. If a cell is white, that means the specific task has no activity for that month or that the month can be used as contingency.

Team Responsible
Marketing
Combined Effort

	2012												
Audience/Activity		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
End Customers													
Traditional													
Customer Email Campaigns													
Direct Mail													
Robo-Call													
Pre-Meter Installation Letter													
Post-Meter Installation Door Hanger													
Welcome Letter & PTR Enrollment (pending research outcome and open enrollment date)													
Welcome Letter web tools only (pending research outcome and open enrollment date)													
Direct Mail - PTR Enrollment for Existing Smart Meters													
Robo Call - PTR Enrollment for Existing Smart Meters													
Bill Inserts													
Bill messaging													
Envelope messaging													
Energy @ Home / Energy @ Work													
On-Hold Messaging													
ComEd.com													
Non-Traditional													
Social Media													
Online Community Forums													
Faith-Based Outreach													
Outreach													
Community Events and Outreach													
Smart Youth Ambassador Program													
Teacher Partnerships													
Speakers Bureau													
Small Business Neighborhood Canvasses													
Research													
Value-focused quantitative research													
Exploratory qualitative message testing research													
Exploratory qualitative/quanitative Small Business research													
Awareness tracking													

Figure 37 - 2012 End Customer Methods Timeline

Team Responsible													
Marketing													
Combined Effort													
		2013											
Audience/Activity		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
End Customers													
Traditional													
Customer Email Campaigns													
Direct Mail													
Robo-Call													
Pre-Meter Installation Letter													
Post-Meter Installation Door Hanger													
Welcome Letter & PTR Enrollment (pending research outcome and open enrollment date)													
Welcome Letter web tools only (pending research outcome and open enrollment date)													
Direct Mail - PTR Enrollment for Existing Smart Meters													
Robo Call - PTR Enrollment for Existing Smart Meters													
Bill Inserts													
Bill messaging													
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Speakers Bureau													
Small Business Neighborhood Canvasses													
Research													
Value-focused quantitative research													
Exploratory qualitative message testing research													
Exploratory qualitative/quanitative Small Business research													
Awareness tracking													

ComEd
An Exelon Company

Team Responsible													
Marketing													
Combined Effort													
							2014						
Audience/Activity		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
End Customers													
Traditional													
Customer Email Campaigns													
Direct Mail													
Robo-Call													
Pre-Meter Installation Letter													
Post-Meter Installation Door Hanger													
Welcome Letter & PTR Enrollment (pending research outcome and open enrollment date)													
Welcome Letter web tools only (pending research outcome and open enrollment date)													
Direct Mail - PTR Enrollment for Existing Smart Meters													
Robo Call - PTR Enrollment for Existing Smart Meters													
Bill Inserts													
Bill messaging													
Envelope messaging													
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Smart Youth Ambassador Program													
Teacher Partnerships													
Speakers Bureau													
Small Business Neighborhood Canvasses													
Research													
Value-focused quantitative research													
Exploratory qualitative message testing research													
Exploratory qualitative/quanitative Small Business research													
Awareness tracking													

Team Responsible													
Marketing													
Combined Effort													
		2015											
Audience/Activity		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
End Customers													
Traditional													
Customer Email Campaigns													
Direct Mail													
Robo-Call													
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Post-Meter Installation Door Hanger													
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Robo Call - PTR Enrollment for Existing Smart Meters													
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On-Hold Messaging													
ComEd.com													
Non-Traditional													
Social Media													
Online Community Forums													
Faith-Based Outreach													
Outreach													
Community Events and Outreach													
Smart Youth Ambassador Program													
Teacher Partnerships													
Speakers Bureau													
Small Business Neighborhood Canvasses													
Research													
Value-focused quantitative research													
Exploratory qualitative message testing research													
Exploratory qualitative/quanitative Small Business research													
Awareness tracking													

Figure 38 – 2013- 2015 Customer Methods Timeline

Smart Grid Advanced Metering Annual Implementation Progress Report

ATTACHMENT 1

Metrics and Milestones

Metric: 1B

Metric Description: Residential Customers-Number of customers served by retail electric suppliers for which the supplier has requested monthly Electronic Data Interchange delivery of interval data. Expressed also as a percentage of customers taking supply from a retail electric supplier in each delivery class.

Number of Accounts with AMI Meters by Delivery Class			
Delivery Class	**# of Accounts**	**# of Accounts with supplier–requested EDI delivery of internal data**	**% of accounts with supplier–requested EDI delivery of internal data**
Single Family W/O Elec. Space Heat	2,277,502	225	0.01%
Multi Family W/O Elec. Space Heat	1,142,240	45	0.00%
Single Family With Elec. Space Heat	35,329	2	0.01%
Multi Family With Elec. Space Heat	165,035	13	0.01%
Watt-Hour	86,774	0	0.00%
Small Load	267,628	0	0.00%
Medium Load	16,575	0	0.00%
Large Load	4,051	0	0.00%
Very Large Load	1,820	0	0.00%
Extra Large Load	43	0	0.00%
High Voltage	62	0	0.00%
Railroad	14	0	0.00%
Fixture-Included Lighting	1,913	0	0.00%
Dusk to Dawn Lighting	4,894	0	0.00%
General Lighting	1,768	0	0.00%
Total	4,005,648	285	0.01%

Metric: 1D

Metric Description: Small Commercial Customers. Number of customers served by retail electric suppliers for which the supplier has requested monthly Electronic Data interchange delivery of interval data. Expressed also as a percentage of customers taking supply from a retail electric supplier in the delivery class.

Smart Meter as of 12/31/2017

Revised Category	Total Of Premise Nbr	No	Yes*	Customers taking supply from a RES	%
COM KWH ONLY	86,774	86,647	127	45,761	0.28%
SMALL (0 - 100)	267,628	222,810	44,818	117,032	38.30%
Total	354,402	309,457	44,945	162,793	27.61%

Metric: 6C Continued

Metric Description: Number of customers who have accessed the web-based portal as of the last day of the calendar year as a percentage of customers with AMI Meters and as a percentage of ComEd customers in that delivery class.

Number of Accounts with AMI Meters by Delivery Class			
Delivery Class	# of Accounts with AMI Meters Viewed Web	# of Accounts With AMI Meters	Viewed Web Portal as % of # of Accounts With
Single Family W/O Elec. Space Heat	327,951	2,002,650	16.38%
Multi Family W/O Elec. Space Heat	234,766	1,117,622	21.01%
Single Family With Elec. Space Heat	4,989	28,033	17.80%
Multi Family With Elec. Space Heat	34,003	153,118	22.21%

Number of Accounts by Delivery Class			
Delivery Class	# of Accounts Viewed Web Portal	# of Accounts in Class	Viewed Web Portal as % of # of Accounts in Class
Single Family W/O Elec. Space Heat	372,536	2,277,502	16.36%
Multi Family W/O Elec. Space Heat	239,752	1,142,240	20.99%

Delivery Class	# of Accounts Viewed Web Portal	# of Accounts in Class	Viewed Web Portal as % of # of Accounts in Class
Single Family With Elec. Space Heat	6,245	35,329	17.68%
Multi Family With Elec. Space Heat	36,669	165,035	22.22%

Metric: 6D Continued

Metric Description: Number of customers who can directly access their usage data as of the last day of the calendar year as a percentage of customers with AMI Meters and as a percentage of ComEd customers in that delivery class.

Number of Accounts with AMI Meters by Delivery Class			
Delivery Class	**# of Accounts with AMI Meters and Can Directly Access Usage Data (1)**	**# of Accounts with AMI Meters**	**Accounts Can Directly Access Usage Data as % of # Accounts with AMI Meters**
Single Family W/O Elec. Space Heat	756,406	2,002,650	37.77%
Multi Family W/O Elec. Space Heat	529,763	1,117,622	47.40%
Single Family With Elec. Space Heat	10,341	28,033	36.89%
Multi Family With Elec. Space Heat	68,936	153,118	45.02%
Watt-Hour	13,981	60,565	23.08%
Small Load	70,949	252,227	28.13%
Medium Load	3,895	15,982	24.37%
Large Load	670	3,906	17.15%
Very Large Load	358	1,776	20.16%
Extra Large Load	11	42	26.19%
High Voltage	8	51	15.69%
Railroad	0	13	0.00%
Fixture-Included Lighting	9	38	23.68%
Dusk to Dawn Lighting	111	1,958	5.67%
General Lighting	63	509	12.38%

Number of Accounts by Delivery Class			
Delivery Class	**# of Accounts Can Directly Access Usage Data (1)**	**# of Accounts in Class**	**Accounts Can Directly Access Usage Data as %**
Single Family W/O Elec. Space Heat	862,746	2,277,502	37.88%
Multi Family W/O Elec. Space Heat	541,101	1,142,240	47.37%
Single Family With Elec. Space Heat	13,007	35,329	36.82%
Multi Family With Elec. Space Heat	74,292	165,035	45.02%
Watt-Hour	15,887	86,774	18.31%
Small Load	74,789	267,628	27.95%
Medium Load	4,019	16,575	24.25%
Large Load	691	4,051	17.06%
Very Large Load	366	1,820	20.11%
Extra Large Load	11	43	25.58%
High Voltage	9	62	14.52%
Railroad	0	14	0.00%
Fixture-Included Lighting	111	1,913	5.80%
Dusk to Dawn Lighting	266	4,894	5.44%
General Lighting	116	1,768	6.56%

Notes:
(1) Although only these percentages of accounts created an account in ComEd.Com and have direct access to usage data, all accounts can directly access usage data by creating an account in ComEd.com.

Metrics and Milestones

Metric: 9

Metric Description: Reduction in Greenhouse Gas Emissions enabled by smart grid and the success of AMI deployment in enabling consumer benefits from the smart grid.

ComEd has worked with the Citizen's Utility Board *("CUB")* and Environmental Defense Fund *("EDF")* to develop a practical measure of changes in Greenhouse Gas *("GHG")* emissions attributable to smart grid functions enabled by Advanced Metering Infrastructure *("AMI")* deployment and AMI related investments by exploring the capability of calculating GHG emission changes realized through items such as the following:

A. Enabling Energy Efficiency and conservation
B. Reducing peak load and creating a flatter load profile
C. Creating a more predictable load profile
D. Enabling customer Demand-side management and Demand Response
E. Enabling the integration of clean, renewable generation sources
F. Reducing technical electricity losses

In its 2015 AMI Annual Implementation Progress Report *("AIPR")*, ComEd proposed modifications to Metric 9. The reporting of the revised and updated metric began with the 2016 AIPR. ComEd, CUB and EDF have continued to work together to identify and define certain details of the methodology to implement the revised GHG emission metric, including as reflected in the Stipulation to Dismiss Proceeding as to Commonwealth Edison Company filed on March 14, 2016 in ICC Docket No. 14-0555.

Vehicle GHG Emissions

Meter Reading Vehicles

ComEd refined this calculation in its 2015 AIPR to be the difference between (i) the previous year's GHG emissions associated with meter reading vehicles at each operating center that had AMI meter deployment during that year or in a prior year and (ii) a baseline defined as the three (3) year average GHG vehicle emissions associated with meter reading vehicles at each such operating center. GHG emissions are calculated based on fuel consumption and the emission factors from the Climate Registry used by Exelon Corporation.

The vehicle GHG emissions metric methodology includes all vehicles that are used to read meters because a significant number of non-fleet vehicles are utilized to read electric meters. When a ComEd-owned vehicle is no longer needed in one operating center, it is commonly redeployed to another operating center, offsetting the use of non-fleet vehicles *(which are not in the fleet data)*.

2017 Meter Reading Vehicle GHG Emissions Calculation

Operating Center	2015 (a)	2016 (b)	2017 (c)	Average (d)	2017 Emissions *(MT CO_2)* (f)=(c)*(e)	Avg Emissions *(MT CO_2)* (g)=(d)*(e)	Emissions *(MT $CO_2\Delta$)* (f)-(g)
Chicago North	20,574	15,089	4,314	13,326	39	122	-82
Chicago South	12,177	7,638	5,213	8,343	48	76	-29
Mt Prospect	8,239	5,861	1,106	5,069	10	46	-36
Northbrook	6,216	9,732	6,149	7,366	56	67	-11
Libertyville	18,254	16,430	6,806	13,830	62	126	-64
Maywood	2,611	3,082	1,471	2,388	13	22	-8
Glenbard	6,151	4,016	4,177	4,781	38	44	-6
Joliet	10,659	12,653	16,709	13,340	153	122	31
University Park / Bradley	12,410	12,120	11,602	12,044	106	110	-4
Crestwood	9,004	7,993	2,884	6,627	26	61	-34
Bolingbrook	5,961	6,736	4,529	5,742	41	52	-11
Dekalb	9,774	10,026	8,775	9,525	80	87	-7
Dixon	15,394	14,871	8,703	12,989	80	119	-39
Freeport	5,503	5,368	5,320	5,397	49	49	-1

Rockford	14,489	11,986	11,890	12,788	109	117	-8
Aurora	4,600	4,727	3,925	4,417	36	40	-5
Elgin	5,417	5,570	5,700	5,562	52	51	1
Streator	2,051	1,241	1,141	1,478	10	14	-3
Woodstock	7,557	6,395	5,826	6,592	53	60	-7
						Total	**-323**

Emission Factor[1] ***(MT CO_2/gal)*** **(e)**
0.00913

The overall results show a reduction in GHG emissions for meter reading functions coincident to AMI deployment for seventeen operating centers, while two operating centers show an increase. ComEd notes that certain meters in operating centers where AMI is being deployed are not exchanged to AMI either because they are "Unable to Complete" *("UTC")* or are customers who requested service under Rider NAM – Non AMI Metering *("Rider NAM")*. Reading these meters increases the miles driven on a per-meter basis and increases related fuel consumption due to the inefficient meter reading routes needed to read these meters. Also, deployment of AMI meters in some operating centers (including those showing an increase) began in 2017 so the reduction in meter reading vehicles and resulting emissions may not have been fully realized by the end of last year. These impacts may be why two operating centers show an increase in GHG emissions for 2017.

Outage and Maintenance Vehicles

This calculation for the 2017 AIPR measures reduction in GHG emissions due to dispatching fewer outage and maintenance related vehicles. When a customer calls to report an outage, ComEd utilizes AMI technology by pinging the AMI meter and determines if the outage is taking place on the ComEd system. If the reported outage is the customer's responsibility, a ComEd vehicle can avoid being dispatched. GHG emissions are calculated based on fuel consumption and the emission factors from the Climate Registry used by Exelon Corporation.

[1] CO_2 emission factors from the Climate Registry

2017 Outage and Maintenance Vehicle GHG Emissions Calculation

Operating Center	Fuel Qty *(lbs/gal)* (a)	# of Trips (b)	# of Reduced Truck Rolls (c)	2017 Emissions *(MT CO_2)* (e)=((a)/(b)*(c))*(d)
Chicago North	39,640	9,123	8,583	-340
Chicago South	48,578	13,108	7,833	-265
Mt Prospect	39,490	5,082	3,060	-217
Northbrook / Skokie	29,522	3,808	2,201	-156
Libertyville	37,943	4,801	3,186	-230
Maywood	19,851	4,089	2,392	-106
Glenbard	24,844	4,859	2,468	-115
Joliet / Streator	36,861	6,375	614	-32
University Park	22,005	4,283	2143	-101
Crestwood	26,123	4,865	2,947	-144
Bolingbrook	25,472	3,184	1438	-105
Dekalb	26,565	2,026	111	-13
Dixon / Freeport	37,915	4,609	748	-56
Rockford	37,206	5,225	893	-58
Aurora	20,320	2,352	717	-57
Elgin	19,397	3,057	620	-36
Woodstock	19,317	2,969	87	-5
			Total	**-2,036**

Emission Factor[1] *(MT CO_2/gal)* (d)
0.00913

The overall results show a reduction in GHG emissions for outage and maintenance functions due to AMI deployment for each operating center.

Bottom-Up Approach

For this approach, ComEd calculated the estimated load differences between those customers with AMI and with IDR meters by operating center where deployment has taken place. These load differences will include total load reduction, and to the extent data availability and reliability permits, load shifting and conservation effects. Based on these differences in load by geographic area or customer program, the associated change in GHG emissions was estimated.

Peak Time Savings Program

Load impacts were estimated based on a difference-in-differences calculation between participants and a control group of non-participants with AMI meters that have similar load shapes during peak time savings event hours *(as described in Rider PTR – Peak Time Rebate ("Rider PTR"))*. The results for this calculation did not take into effect pre-event or post-event changes in load *(e.g. pre-cooling, changes due to notification of event, and post-event bounce back)*.

2017 Peak Time Savings Calculations

Delivery Service Classes	Date	Hour Ending	Non-Participant Load *(kW)* (a)	Participant Load *(kW)* (b)	Event Impact *(kW)* (c)=(a)-(b)	MER[2] *(MT CO_2/MWh)* (d)	MER[3] *(MT CO_2/MWh)* (e)	# of Participants[4] (f)	Emissions[5] *(MT $CO_2\Delta$)* (g)=(c)*(d)*(f) / 1000	Emissions[6] *(MT $CO_2\Delta$)* (h)=(c)*(e)*(f) / 1000
Single Family without Electric Space Heat	8/30/2017	15	2.40	2.21	-0.19	0.665	0.691	147,854	-18.693	-19.417
		16	2.40	2.21	-0.19	0.665	0.837	147,854	-18.693	-23.526
		17	2.40	2.21	-0.19	0.665	0.687	147,854	-18.693	-19.297
	9/15/2017	14	2.40	2.21	-0.19	0.687	0.690	147,854	-19.292	-19.380
		15	2.40	2.21	-0.19	0.687	0.645	147,854	-19.292	-18.114
		16	2.40	2.21	-0.19	0.687	0.599	147,854	-19.292	-16.823
	9/22/2017	14	2.40	2.21	-0.19	0.687	0.747	147,854	-19.292	-20.999
		15	2.40	2.21	-0.19	0.687	0.742	147,854	-19.292	-20.855
		16	2.40	2.21	-0.19	0.687	0.756	147,854	-19.292	-21.249
Multi Family without Electric Space Heat	8/30/2017	15	0.98	0.90	-0.08	0.665	0.691	66,444	-3.537	-3.674
		16	0.98	0.90	-0.08	0.665	0.837	66,444	-3.537	-4.451
		17	0.98	0.90	-0.08	0.665	0.687	66,444	-3.537	-3.651
	9/15/2017	14	0.98	0.90	-0.08	0.687	0.690	66,444	-3.650	-3.667
		15	0.98	0.90	-0.08	0.687	0.645	66,444	-3.650	-3.428
		16	0.98	0.90	-0.08	0.687	0.599	66,444	-3.650	-3.183
	9/22/2017	14	0.98	0.90	-0.08	0.687	0.747	66,444	-3.650	-3.973
		15	0.98	0.90	-0.08	0.687	0.742	66,444	-3.650	-3.946
		16	0.98	0.90	-0.08	0.687	0.756	66,444	-3.650	-4.021
Single Family	8/30/2017	15	1.97	1.80	-0.17	0.665	0.691	1,713	-0.194	-0.201

[2]Method 1 Marginal Emission Rates (MER) as described on pages 11-12

[3]Method 2 Marginal Emission Rates (MER) as described on pages 12-13

[4]Based on the number of customers who participated in the Peak Time Savings program in 2017

[5]Final results based on Method 1 of Marginal Emission Rates

[6]Final results based on Method 2 of Marginal Emission Rates

with Electric Space Heat		16	1.97	1.80	-0.17	0.665	0.837	1,713	-0.194	-0.244
		17	1.97	1.80	-0.17	0.665	0.687	1,713	-0.194	-0.200
	9/15/2017	14	1.97	1.80	-0.17	0.687	0.690	1,713	-0.200	-0.201
		15	1.97	1.80	-0.17	0.687	0.645	1,713	-0.200	-0.188
		16	1.97	1.80	-0.17	0.687	0.599	1,713	-0.200	-0.174
	9/22/2017	14	1.97	1.80	-0.17	0.687	0.747	1,713	-0.200	-0.218
		15	1.97	1.80	-0.17	0.687	0.742	1,713	-0.200	-0.216
		16	1.97	1.80	-0.17	0.687	0.756	1,713	-0.200	-0.220
Multi Family with Electric Space Heat	8/30/2017	15	0.99	0.90	-0.09	0.665	0.691	10,452	-0.626	-0.650
		16	0.99	0.90	-0.09	0.665	0.837	10,452	-0.626	-0.788
		17	0.99	0.90	-0.09	0.665	0.687	10,452	-0.626	-0.646
	9/15/2017	14	0.99	0.90	-0.09	0.687	0.690	10,452	-0.646	-0.649
		15	0.99	0.90	-0.09	0.687	0.645	10,452	-0.646	-0.607
		16	0.99	0.90	-0.09	0.687	0.599	10,452	-0.646	-0.563
	9/22/2017	14	0.99	0.90	-0.09	0.687	0.747	10,452	-0.646	-0.703
		15	0.99	0.90	-0.09	0.687	0.742	10,452	-0.646	-0.698
		16	0.99	0.90	-0.09	0.687	0.756	10,452	-0.646	-0.712
								Total	**-212**	**-222**

The overall results show the load for participants were lower than non-participants during each of the hours of the event days.

Residential Hourly Pricing

Load impacts were estimated by hour using existing load impact models and actual 2017 hourly weather, hourly prices and alert hours.

2017 Hourly Pricing Calculations

∑Baseline Load *(kW)* (a)	∑Actual Load *(kW)* (b)	∑Load Δ *(kWh)* (c)=(a)-(b)	2017 Emissions *(MT CO_2)* (d)=(c)*MER[7]	2017 Emissions *(MT CO_2)* (e)=(c)*MER[8]	# of Participants[9] *(f)*	Emissions[10] *(MT $CO_2\Delta$)* (d)*(f)	Emissions[11] *(MT $CO_2\Delta$)* (e)*(f)
11,453	10,654	-799	-0.502	-0.530	11,795	-5,922	-6,246

The overall results show that participants reduced their peak loads for all four seasons.

ComEd will continue to explore and analyze other elements identified as contributors to the GHG emissions for inclusion in future reporting including GHG emissions related to reduction in line losses related to metric 20.

Top-Down Approach

For changes in GHG emissions based on aggregate load, ComEd calculates the load differences between those customers with AMI meters and those without AMI meters and any associated impact on GHG emissions. ComEd started reporting the results of this calculation in the 2016 AIPR.

Approach 1

An average load per customer was developed for customers with AMI meters and compared to an average load per customer for IDR *(Interval Demand Recording Meters e.g. non-AMI)* meters during the same calendar year within an operating center and for each delivery service class. These IDR meters were installed more than three years ago to gather interval level data for customer premises that, at one time, participated in the residential hourly pricing program or that are utilized as load research meters. The usage level of these customers tends to be higher than average-sized customers in annual consumption within each operating

[7]Method 1 Marginal Emission Rates (MER) as described on pages 11-12

[8]Method 2 Marginal Emission Rates (MER) as described on pages 12-13

[9]Based on the number of customers who participated in the Residential Hourly Pricing program in 2017

[10]Final results based on Method 1 of Marginal Emission Rates

[11]Final results based on Method 2 of Marginal Emission Rates

center. In order to reduce this sample bias, the loads for the customers with IDR meters were adjusted by using the actual energy sales per customer by operating center and delivery service class.

As deployment of AMI meters in an operating center increases, the number of customers with IDR meters decreases, which reduces the amount of operating centers that provide meaningful results. This primarily impacts those operating centers that have had AMI meters fully deployed and therefore, have almost no non-AMI IDR meters to compare against. Therefore, operating centers without meaningful results are not included in the tables below.

Operating Center: Joliet								
Delivery Service Class	**∑AMI *(kWh)* (a)**	**Adj ∑Non-AMI *(kWh)* (b)**	**∑Load Δ *(kWh)* (c)=(a)-(b)**	**2017 Emissions *(MT CO_2)* (d)=(c)*MER[12]**	**2017 Emissions *(MT CO_2)* (e)=(c)*MER[13]**	**# of AMI Meters[14] (f)**	**Emissions[15] *(MT CO_2Δ)* (d)*(f)**	**Emissions[16] *(MT CO_2Δ)* (e)*(f)**
Single Family without Electric Space Heat	9,233	9,298	-65	-0.051	-0.063	4,500	-250	-310
Multi Family without Electric Space Heat	6,050	4,454	1,597	1.014	1.114	418	460	500
Single Family with Electric Space Heat	19,849	18,948	900	0.555	0.596	93	60	60

[12] Method 1 Marginal Emission Rates (MER) as described on pages 11-12

[13] Method 2 Marginal Emission Rates (MER) as described on pages 12-13

[14] Based on meters with load for the entire 2017 calendar year

[15] Final results based on Method 1 of Marginal Emission Rates

[16] Final results based on Method 2 of Marginal Emission Rates

Multi Family with Electric Space Heat	9,410	8,137	1,273	0.794	0.851	302	260	280
						Total	**530**	**530**

Operating Center: Dekalb								
Delivery Service Class	**∑AMI *(kWh)* (a)**	**Adj ∑Non-AMI *(kWh)* (b)**	**∑Load Δ *(kWh)* (c)=(a)-(b)**	**2017 Emissions *(MT CO_2)* (d)=(c)*MER[12]**	**2017 Emissions *(MT CO_2)* (e)=(c)*MER[13]**	**# of AMI Meters[14] (f)**	**Emissions[15] *(MT $CO_2\Delta$)* (d)*(f)**	**Emissions[16] *(MT $CO_2\Delta$)* (e)*(f)**
Single Family without Electric Space Heat	11,837	9,524	2,313	1.457	1.558	662	1,040	1,110
Multi Family without Electric Space Heat	4,455	4,383	72	0.042	0.047	30	0	0
Single Family with Electric Space Heat	28,888	21,041	7,847	4.952	5.287	74	390	420
Multi Family with Electric Space Heat	8,546	7,744	802	0.520	0.562	18	10	40
						Total	**1,440**	**1,540**

Operating Center: Woodstock								
Delivery Service Class	**∑AMI *(kWh)* (a)**	**Adj ∑Non-AMI *(kWh)* (b)**	**∑Load Δ *(kWh)* (c)=(a)-(b)**	**2017 Emissions *(MT CO_2)* (d)=(c)*MER[12]**	**2017 Emissions *(MT CO_2)* (e)=(c)*MER[13]**	**# of AMI Meters[14] (f)**	**Emissions[15] *(MT $CO_2\Delta$)* (d)*(f)**	**Emissions[16] *(MT $CO_2\Delta$)* (e)*(f)**
Single Family without Electric Space Heat	8,489	8,845	-356	-0.219	-0.232	1,223	-290	-310
Multi Family without Electric Space Heat	4,641	4,823	-182	-.096	-0.105	75	-10	-10

Single Family with Electric Space Heat	28,898	19,410	9,488	5.921	6.236	32	200	220
Multi Family with Electric Space Heat	8,935	8,469	466	0.299	0.312	18	10	10
						Total	**-90**	**-90**

After making the adjustment to reduce sample bias and excluding the operating centers that did not provide meaningful results, as discussed above, the overall results show an increase in GHG emissions for customers with AMI meters. However, individual delivery service classes for certain operating centers may show either reductions or increases in the emissions.

Approach 2

An average load per customer was developed for customers with AMI meters for the most recent year and compared to the same customers who had IDR meters two years prior. Due to the number of meters that were exchanged from IDR to AMI prior to 2016, there was insufficient data to complete this calculation for the 2017 calendar year.

Marginal Emission Rates

The Marginal Emission Rates are based on publicly available data. Two methods for determining marginal emissions rates and applying them to the bottom up and top down approaches have been identified. Recognizing the limitations of each method, the parties agree that ComEd will apply both, though neither CUB and EDF nor ComEd support both methods. These will continue to be developed amongst the parties in good faith, working together to improve or replace them as better methods and additional public information become available. For any AIPR reporting GHG Metrics that reflect these alternate marginal emission derivation methods, ComEd will also include a detailed explanation of the limitations of each approach.

Method 1: Available Emissions Data Method

Locational Marginal Pricing *("LMP")* is a calculation of the price of electricity based on the marginal energy generating unit *("EGU")* in a particular five-minute interval. While the LMP data are publicly available, the information about the specific EGU is not released by PJM Interconnection, L.L.C. *("PJM")* given the sensitivity and confidentiality of the information.

However, PJM calculates weighted average marginal emissions rates for peak and off-peak hours in each month using five-minute interval data. The most recent report describing these methods and data for 2012-2017 was released on March 15, 2018[17], and PJM has committed to release updated reports on an annual basis. Under this method, ComEd will determine the marginal emissions rates based on these data unless and until more granular marginal emissions rates data from PJM becomes publicly available.

Limitations:
Method 1 uses EGU data to calculate weighted average marginal emission rates for peak and off-peak periods in each month. Therefore, the marginal emission rates are not available for each hour in a calendar year. Also, the marginal emission rates are calculated for the entire PJM footprint, not just ComEd's service territory.

Method 2: Estimated Generation Data Method

While the specific data about EGUs determining LMP for a given interval is not available to the public, they are available to Monitoring Analytics *(MA)*, "the Independent Market Monitor for PJM under a long-term contract."[18] MA has developed a monthly report that summarizes the fuel type of marginal or jointly marginal units in the PJM Real-Time Energy Market for each hour. MA calculates the share of each fuel in each hour based on the number of five minute intervals that a unit burning each fuel type is marginal or jointly marginal.[19] CUB and EDF propose that ComEd use these shares to derive the generation by fuel type per hour in the program year.

[17]PJM, 2012-2017 CO2, SO2 and NOX Emission Rates (March 15, 2018) available at http://www.pjm.com/-/media/library/reports-notices/special-reports/20180315-2017-emissions-report.ashx
[18]Monitoring Analytics, http://www.monitoringanalytics.com/home/index.shtml
[19]Monitoring Analytics – Marginal Fuel Posting,http://www.monitoringanalytics.com/data/marginal_fuel.shtml

This generation by fuel type is multiplied by the Average Heat Rate by Energy Source data published by the U.S. Energy Information Administration *("EIA")*[20], and the Carbon Dioxide Uncontrolled Emissions Factor data *(lbs CO2/million BTU)* published by EIA[21] to derive a weighted average hourly emissions rate for the marginal and jointly marginal units.

Limitations:
Method 2 does not use actual EGU data because this information is not available to the public. Instead, this method uses generation shares for marginal and jointly marginal units and system averages for unit efficiency and carbon emission rates to derive the marginal emission rates by hour. Also, the marginal emission rates are calculated for the entire PJM footprint, not just ComEd's service territory.

[20]http://www.eia.gov/electricity/annual/html/epa_08_02.html
[21]https://www.eia.gov/electricity/annual/html/epa_a_03.html, which compiles data from two sources: 1. Energy Information Administration, Office of Integrated Analysis and Forecasting, Voluntary Reporting of Greenhouse Gases Program, Table of Fuel and Energy Source: Codes and Emission Coefficients; available at: https://www.eia.gov/environment/emissions/co2_vol_mass.php ; and 2. U.S. Environmental Protection Agency, AP 42, Fifth Edition (Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources); available at: https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors

Metric: 13

2018 Update: Survey of Smart Grid-Enabled Marketplace

Overview of Developments in Smart Grid-Enabled Products and Services

As utility service territories with AMI expand around the country, the market for customer applications enabled by the smart grid and smart meters continues to expand. This document reviews the progress in 2017 of the AMI-enabled customer applications industry, and highlights key developments and examples of how products are being introduced into the marketplace.

Smart Thermostats, Connected Devices, IOT Connectivity

A major area of development in customer applications either supplemented or enabled by the smart grid includes "smart home" technologies, including smart thermostats and HAN (Home Area Network) technologies. Collectively, this suite of technologies allows customers to gain insight into and control over appliances throughout their house in order to operate them more efficiently and cost- effectively.

2017 saw increased popularization of digital voice assistant products such as Amazon's Echo and its voice-activated speaker, Alexa, while Google continued to promote its connected home device (Google Home), along with launching a cheaper and smaller connected device (Google Home

Mini).[1] Google has expanded its network of devices supported by Google Home, including tighter integration with Nest thermostats.[2] Amazon has also improved integration with connected home devices including Alexa and ecobee smart thermostats.[3] Most recently, Nest released a lower cost alternative to their primary product, the Nest Thermostat E.[4]

The marketplace of connected devices has been rapidly growing in 2017. Meanwhile, utilities across the country continue exploring ways to offer customers a more personalized, convenient energy experience, all while laying the foundation for innovative utility business models that capitalize on non-traditional revenue streams. As part of that effort, more utilities are starting to offer digital marketplaces that offer their customers energy-related products and services that allow customers to take advantage of utility-based programs and rebates on those products. These e- commerce portals help increase customer satisfaction and empower customers to better understand their energy consumption, as well as helping utilities explore alternate business models. In late 2016, ComEd partnered with Simple Energy, a major vendor in this space, to launch a digital marketplace for customers to purchase energy-saving products and take advantage of instant rebates. Over 700,000 people viewed the marketplace in 2017, and more than $2 million in rebates were awarded to customers from the marketplace throughout the course of the year.

Not only has the marketplace for connected devices grown, but the intelligence and linkage between connected devices has also improved significantly. The linkage between devices has been expanded through an increase in partnerships between manufacturers such as Nest,[5] ADT,[6] Xfinity,[7] etc. as well as through the adoption of tools like IFTTT ("If This Then That", which works with Nest, Google Home, Amazon Alexa, and others) that provide an agnostic platform for devices to communicate and behave harmoniously.

Web Presentment of Interval Usage

One of the most likely areas of growth is providing customers with greater understanding and control of their energy choices and behaviors through web portals and mobile apps. In 2016, Oracle acquired a leading vendor in the utility cloud-services space, Opower.[8] Opower has enabled interval presentment for utility clients across the U.S., including Pacific Gas & Electric, San Diego Gas & Electric, National Grid, Xcel Energy, Exelon Utilities, and others numbering some 100 utilities, analyzing more than 600 billion meter readings from 60 million customers.[9] Opower's core offerings include personalized home energy reports that compare household energy consumption to peers, resulting in more than $1.1 billion savings for customer energy bills.[10] Opower has continued its venture into customer care through Opower 7, its customer

1 http://time.com/4968831/google-home-mini-release-date/

2 https://nest.com/blog/2017/10/04/google-assistant-do-more-with-nest/

3 https://www.ecobee.com/press/ecobee-launches-ecobee4-smart-thermostat-with-built-in-alexa-voice-service/

4 https://nest.com/press/nest-expands-thermostat-line-to-bring-energy-savings-to-more-homes-with-nest-thermostat-e/

5 https://nest.com/blog/2017/10/04/google-assistant-do-more-with-nest/

6 http://news.adt.com/phoenix.zhtml?c=254250&p=irol-newsArticle&ID=2268792

7 http://www.usa.lighting.philips.com/company/newsroom/news/2017/20170517-philips-lighting-and-comcast-partner-to-offer-xfinity-home-customers-simpler-home-security-and-automation-experience

8 https://www.oracle.com/corporate/pressrelease/oracle-buys-opower-050216.html

9 https://www.oracle.com/us/assets/opower-general-presentation-3003202.pdf

10 https://blogs.oracle.com/utilities/opower-energy-savings

engagement platform that includes a call-center analytics program that helps utilities provide better service and insight while reducing overall response time and call center costs.[11]

Bidgely, another leading utility Software-as-a-Service (SaaS) provider of customer engagement and analytics solutions that focus on appliance-level energy disaggregation, continued delivering on several multi-million dollar contracts in 2017 for its HomeBeat mobile app, high-bill alerts system, and its disaggregation-based consumer audit and home assessment tool.[12] Bidgely upgraded to the third version of their platform in 2017.[13] The also expanded upon their offerings by introducing customer engagement channels beyond the mobile app and by providing support to homes that do not have smart meters. As a result of these efforts, Bidgely is working with 25 utilities and reaches over 10 million homes.[14]

Electric Vehicle Public Charging Infrastructure

Among companies in the EV charging station technology space, ChargePoint and EVgo unveiled ambitious plans to improve charging times for electric vehicle owners. In early 2017, ChargePoint launched its Express Plus charger, a new ultra-fast DC charging station that can deliver up to 400 kW. The charging station allows for faster recharging, particularly for long-distance drivers and larger vehicles, adding up to hundreds of miles of driving range in less than 15 minutes. Express Plus expands on ChargePoint's existing products for the residential and multifamily-housing customer segments.[15] EVgo and automakers BMW and Nissan have partnered to expand the DC fast charger network across the US, available to all EV owners. The chargers can add about 80 percent of an EV's battery capacity in less than 30 minutes.[16] EVgo's network of fast-charging systems now includes 1,000 stations in the US.[17]

At the same time, numerous utilities across the country have announced plans to expand EV public charging infrastructure. Southern California Edison, San Diego Gas & Electric, and Pacific Gas & Electric have collectively filed for more than $1 billion to spend on thousands of charging systems for electric delivery trucks and buses.[18] San Diego Gas & Electric has been approved for a utility-owned charging station pilot program. Pacific Gas & Electric will be initiating the largest deployment of EV chargers in the United States, operated under a model in which the utility will own up to 35% of stations and provide infrastructure support to site hosts that own the other stations in the charging network. Pacific Gas & Electric will install 15-20% of the stations in underserved communities.[19]

Blockchain has been growing into a prominent technology for transactions, and eMotorWerks created a way of incorporating this technology into EV charging in 2017. In California, eMotorWerks has created a network in which EV drivers can locate nearby, unused charging stations that belong to other EV owners. Charging station owners set the rate for using their

11 https://www.greentechmedia.com/articles/read/opower-expands-suite-of-services-to-enhance-utilities-role-in-the-evolving#gs.zTx6wk4

12 https://www.utilitydive.com/news/bidgelys-business-blooms-as-residential-demand-management-matures/438651/

13 http://www.bidgely.com/blog/web-portal-modernized-for-todays-consumer/

14 https://www.greentechmedia.com/articles/read/bidgely-raises-27m-to-scale-its-energy-disaggregation-for-utilities#gs.0zYD11Y

15 https://www.chargepoint.com/about/news/chargepoint-enables-future-mobility-express-plus-electric-vehicle-charging-platform/

16 https://cleantechnica.com/2017/01/26/nissan-bmw-evgo-expand-dc-fast-charging-across-u-s/

17 https://cleantechnica.com/2017/12/06/evgo-opens-1000th-dc-fast-charging-station-us/

18 https://www.greentechmedia.com/articles/read/california-utilities-seek-1b-to-build-out-electric-vehicle-infrastructure#gs.zCAot9Q

19 https://www.greentechmedia.com/articles/read/pge-launches-countrys-largest-utility-sponsored-ev-charging-program#gs.O8Lzmog

station, and when EV drivers have located and used a station to charge their cars, blockchain will identify the payment amount owed to the station owner and digitally settle the transaction.[20]

Along with a marked expansion of public charging infrastructure, more initiatives are underway nationally and internationally that are paving the way for smart cities, not just smart grids. This includes the work ComEd has done in this space with smart streetlights, water meters, microgrids and Community of the Future.

Energy Storage: Residential

2017 marked the first year in which deployment of residential batteries tied to the grid exceeds the number of off-grid residential storage systems installed.[21] Arizona Public Service chose to work with Sunverge on launching a residential energy storage pilot. Similarly, Green Mountain Power in Vermont and Lakeland Electric in Florida will also be operating Sunverge pilot programs, demonstrating increasing utility interest in participating in residential distributed energy solutions.[22] Green Mountain Power also offered customers the installation of Tesla Powerwall home batteries, serving as a prime example of a utility actively investing in behind-the- meter assets to produce grid-level benefits. Green Mountain Power is using the Tesla batteries for backup power, grid resilience, sustainability, local power generation, peak demand reduction, and to generate overall cost savings for its entire system.[23]

Tesla is not the only company seeking to prove itself as an emerging and disruptive maker of home batteries. Competitors, including other automakers, have unveiled their own competing products by leveraging and expanding on existing brand name and consumer familiarity and offering solar- plus-storage solutions. For example, Sunrun, a large residential solar company, continued to launch the Sunrun BrightBox, a solar-plus-storage solution for residential customers, in new locations around the U.S. such as Arizona[24] and Long Island.[25] Automakers continued their entry into the residential battery market: Mercedes announced a partnership with Vivint Solar to offer a combined inverter and battery package to residential customers.[26] Audi also prepared for a Smart Energy Network pilot launch in early 2018 to test software that controls solar and batteries.[27]

Energy Storage: Utility-Scale

In 2017, new partnerships formed which are helping drive the increase in utility-scale energy storage. Schneider Electric partnered with NGK to combine inverters with the NAS battery, which can store over a MW of energy.[28] AES and Siemens also decided to collaborate by creating a new company called Fluence. AES will bring its expertise in utility-scale storage deployment to the partnership, while Siemens will offer its Siestorage product.[29]

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20 https://www.greentechmedia.com/articles/read/blockchain-enabled-electric-car-charging-california#gs.YaxUPd0

21 https://www.greentechmedia.com/articles/read/us-residential-grid-tied-energy-storage-is-overtaking-off-grid-storage#gs.nXrw9QE

22 https://www.utilitydive.com/news/arizona-public-service-taps-sunverge-for-residential-energy-storage-pilot/511748/

23 https://www.cnbc.com/2017/05/12/tesla-does-deal-with-vermont-utility-to-reduce-electricity-bills-with-tesla-batteries.html

24 https://www.sunrun.com/home-solar-blog/brightbox-launches-in-arizona

25 https://www.sunrun.com/why-sunrun/about/news/press-releases/sunrun-launches-brightbox%E2%84%A2-solar-and-battery-storage-solution

26 https://www.cnbc.com/2017/05/18/mercedes-benz-and-vivint-solar-partner-to-compete-with-tesla-in-home-energy.html

27 http://www.renewableenergyworld.com/articles/2018/01/auto-home-grid-create-smart-network-in-audi-pilot-project.html

28 https://solar.schneider-electric.com/schneider-electric-ngk-partner-jointly-promote-best-class-large-capacity-energy-storage-system/

29 https://www.greentechmedia.com/articles/read/aes-and-siemens-partner-to-create-a-new-energy-storage-powerhouse#gs.pmRxDIo

Utilities are introducing large-scale storage projects around the United States. ENGIE announced plans to deploy Massachusetts' largest energy storage installation,[30] Consolidated Edison will install new mobile batteries in New York with the help of NRG Energy,[31] and Portland General Electric proposed five storage projects in its 2017 Integrated Resource Plan.[32] As utilities and consumers place greater emphasis on grid reliability and outage prevention, C&I customers are increasingly interested in using battery storage for backup power.

30 http://www.engie-na.com/2017/10/04/engie-north-america-announces-largest-utility-scale-energy-storage-installation-massachusetts/

31 https://www.utilitydive.com/news/coned-nrg-partner-on-4-mwh-mobile-battery-storage-demo-for-rev-docket/437125/

32 https://www.utilitydive.com/news/energy-storage-gets-a-bigger-seat-at-the-utility-planning-table/510216/

Metric: 16 A Continued

Metric Description: ComEd's response time to a distributed resource project application, and time from receipt of application until energy flows from project to grid (distribution.)

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
1466	6/3/2016	1/4/2017	2017	215	Solar	LevelTwo
1628	11/18/2016	1/4/2017	2017	47	Solar	LevelOne
1558	8/24/2016	1/4/2017	2017	133	Solar	LevelTwo
1532	8/11/2016	1/4/2017	2017	146	Solar	LevelTwo
1603	10/27/2016	1/4/2017	2017	69	Solar	LevelOne
1569	9/23/2016	1/5/2017	2017	104	Solar	LevelOne
1623	11/30/2016	1/5/2017	2017	36	Solar	LevelOne
1237	9/9/2015	1/6/2017	2017	485	Solar	LevelOne
1604	9/29/2016	1/13/2017	2017	106	Solar	LevelOne
1607	10/12/2016	1/13/2017	2017	93	Solar	LevelOne
1544	7/29/2016	1/17/2017	2017	172	Solar	LevelOne
1631	12/6/2016	1/17/2017	2017	42	Solar	LevelOne
1633	12/2/2016	1/17/2017	2017	46	Solar	LevelOne
1613	11/9/2016	1/17/2017	2017	69	Solar	LevelOne
1630	12/9/2016	1/17/2017	2017	39	Solar	LevelOne
1156	5/12/2015	1/20/2017	2017	619	Solar	LevelOne
1585	6/2/2016	1/20/2017	2017	232	Solar	LevelTwo
1481	6/14/2016	1/24/2017	2017	224	Diesel	LevelFour
1609	11/29/2016	1/25/2017	2017	57	Solar	LevelTwo
1651	9/1/2016	1/26/2017	2017	147	Solar	LevelTwo
1637	12/9/2016	1/27/2017	2017	49	Solar	LevelTwo
1640	12/9/2016	1/27/2017	2017	49	Solar	LevelTwo
1610	11/3/2016	1/31/2017	2017	89	Solar	LevelOne
1624	12/2/2016	2/3/2017	2017	63	Solar	LevelTwo
1539	8/12/2016	2/8/2017	2017	180	Solar	LevelOne
1636	12/2/2016	2/9/2017	2017	69	Solar	LevelTwo
1206	7/27/2015	2/13/2017	2017	567	Solar	LevelOne
1594	11/2/2016	2/14/2017	2017	104	Solar	LevelOne
1620	11/15/2016	2/15/2017	2017	92	Solar	LevelTwo
1625	10/28/2016	2/15/2017	2017	110	Solar	LevelTwo
1595	10/18/2016	2/15/2017	2017	120	Solar	LevelOne
1660	12/15/2016	2/15/2017	2017	62	Solar	LevelOne
1531	7/20/2016	2/16/2017	2017	211	Solar	LevelTwo

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
1244	9/17/2015	2/17/2017	2017	519	Solar	LevelTwo
1661	1/5/2017	2/17/2017	2017	43	Solar	LevelOne
1556	9/6/2016	2/17/2017	2017	164	Solar	LevelOne
1639	12/2/2016	2/17/2017	2017	77	Solar	LevelTwo
1632	12/2/2016	2/17/2017	2017	77	Solar	LevelOne
1597	11/1/2016	2/28/2017	2017	119	Solar	LevelOne
1618	11/22/2016	2/28/2017	2017	98	Solar	LevelOne
1638	12/9/2016	2/28/2017	2017	81	Solar	LevelTwo
1652	12/17/2016	3/13/2017	2017	86	Solar	LevelOne
1635	11/16/2016	3/14/2017	2017	118	Solar	LevelOne
1616	11/8/2016	3/14/2017	2017	126	Solar	LevelTwo
1475	5/31/2016	3/14/2017	2017	287	Solar	LevelOne
1657	12/28/2016	3/14/2017	2017	76	Solar	LevelTwo
1658	12/28/2016	3/14/2017	2017	76	Solar	LevelOne
1656	12/28/2016	3/14/2017	2017	76	Solar	LevelTwo
1673	1/3/2017	3/14/2017	2017	70	Solar	LevelTwo
1645	12/2/2016	3/15/2017	2017	103	Solar	LevelOne
1659	11/22/2016	3/15/2017	2017	113	Solar	LevelOne
1702	3/15/2017	3/16/2017	2017	1	Solar	LevelOne
1695	2/22/2017	3/16/2017	2017	22	Solar	LevelOne
1599	11/1/2016	3/22/2017	2017	141	Solar	LevelOne
1444	5/17/2016	3/22/2017	2017	309	Solar	LevelTwo
1669	1/6/2017	3/22/2017	2017	75	Solar	LevelOne
1493	6/29/2016	3/24/2017	2017	268	Solar	LevelOne
1617	11/1/2016	3/24/2017	2017	143	Solar	LevelTwo
1538	8/15/2016	3/24/2017	2017	221	Solar	LevelOne
1470	6/8/2016	3/24/2017	2017	289	Solar	LevelOne
1680	1/10/2017	3/28/2017	2017	77	Solar	LevelTwo
1721	3/27/2017	3/29/2017	2017	2	Solar	LevelOne
1626	12/1/2016	3/29/2017	2017	118	Solar	LevelOne
1308	10/26/2015	4/4/2017	2017	526	Solar	LevelOne
1653	12/28/2016	4/4/2017	2017	97	Solar	LevelOne
1703	2/16/2017	4/11/2017	2017	54	Solar	LevelOne
1146	4/29/2015	4/11/2017	2017	713	Solar	LevelOne
1622	11/28/2016	4/12/2017	2017	135	Solar	LevelOne
1681	1/3/2017	4/13/2017	2017	100	Solar	LevelOne
1670	1/3/2017	4/13/2017	2017	100	Solar	LevelOne
1727	3/16/2017	4/13/2017	2017	28	Solar	LevelOne
1614	11/4/2016	4/17/2017	2017	164	Solar	LevelTwo

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
1728	12/13/2016	4/18/2017	2017	126	Solar	LevelOne
1662	12/28/2016	4/19/2017	2017	112	Solar	LevelOne
1479	6/14/2016	4/20/2017	2017	310	Solar	LevelFour
1731	3/23/2017	4/20/2017	2017	28	Solar	LevelOne
1685	12/28/2016	4/20/2017	2017	113	Solar	LevelOne
1679	2/10/2017	4/25/2017	2017	74	Solar	LevelOne
1720	2/22/2017	4/25/2017	2017	62	Solar	LevelOne
1586	4/18/2016	4/27/2017	2017	374	Solar	LevelOne
1672	1/13/2017	4/28/2017	2017	105	Solar	LevelTwo
1582	10/11/2016	4/28/2017	2017	199	Solar	LevelTwo
1510	7/16/2016	4/28/2017	2017	286	Solar	LevelOne
1629	11/14/2016	5/1/2017	2017	168	Solar	LevelOne
1730	3/20/2017	5/1/2017	2017	42	Solar	LevelOne
1424	5/18/2016	5/2/2017	2017	349	Solar	LevelOne
1740	3/31/2017	5/3/2017	2017	33	Solar	LevelTwo
1714	2/8/2017	5/4/2017	2017	85	Solar	LevelOne
1709	3/9/2017	5/5/2017	2017	57	Solar	LevelOne
1739	4/5/2017	5/9/2017	2017	34	Solar	LevelOne
1736	4/11/2017	5/9/2017	2017	28	Solar	LevelOne
1755	4/20/2017	5/9/2017	2017	19	Solar	LevelOne
1665	1/24/2017	5/9/2017	2017	105	Solar	LevelOne
1693	2/27/2017	5/10/2017	2017	72	Solar	LevelOne
1411	4/25/2016	5/16/2017	2017	386	Solar	LevelTwo
1487	6/30/2016	5/16/2017	2017	320	Solar	LevelOne
1600	11/8/2016	5/16/2017	2017	189	Solar	LevelOne
1644	12/30/2016	5/18/2017	2017	139	Solar	LevelOne
1729	3/23/2017	5/18/2017	2017	56	Solar	LevelOne
1771	4/27/2017	5/19/2017	2017	22	Solar	LevelOne
1746	4/20/2017	5/19/2017	2017	29	Solar	LevelOne
1641	12/5/2016	5/19/2017	2017	165	Solar	LevelOne
1738	4/3/2017	5/19/2017	2017	46	Solar	LevelOne
1749	4/20/2017	5/22/2017	2017	32	Solar	LevelOne
1735	4/10/2017	5/24/2017	2017	44	Solar	LevelOne
1598	11/1/2016	5/24/2017	2017	204	Solar	LevelOne
1621	11/2/2016	5/24/2017	2017	203	Solar	LevelTwo
1706	3/8/2017	5/26/2017	2017	79	Solar	LevelOne
1741	4/10/2017	5/26/2017	2017	46	Solar	LevelTwo
1712	3/16/2017	5/30/2017	2017	75	Solar	LevelTwo
1751	4/21/2017	5/30/2017	2017	39	Solar	LevelOne

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
1516	9/28/2016	6/1/2017	2017	246	Solar	LevelFour
1445	6/29/2016	6/1/2017	2017	337	Solar	LevelFour
1732	3/24/2017	6/5/2017	2017	73	Solar	LevelOne
1762	4/20/2017	6/5/2017	2017	46	Solar	LevelOne
1676	11/17/2016	6/5/2017	2017	200	Solar	LevelTwo
1675	11/17/2016	6/5/2017	2017	200	Solar	LevelTwo
1549	8/24/2016	6/5/2017	2017	285	Solar	LevelOne
1507	7/8/2016	6/7/2017	2017	334	Solar	LevelOne
1528	8/8/2016	6/7/2017	2017	303	Solar	LevelOne
1677	1/30/2017	6/7/2017	2017	128	Solar	LevelOne
1678	1/30/2017	6/7/2017	2017	128	Solar	LevelOne
1737	4/6/2017	6/7/2017	2017	62	Wind	LevelOne
1517	7/6/2016	6/8/2017	2017	337	Solar	LevelOne
1726	3/24/2017	6/8/2017	2017	76	Solar	LevelOne
1214	8/5/2015	6/8/2017	2017	673	Solar	LevelOne
1704	3/14/2017	6/8/2017	2017	86	Solar	LevelOne
1494	7/8/2016	6/9/2017	2017	336	Solar	LevelOne
1498	7/8/2016	6/9/2017	2017	336	Solar	LevelOne
1090	3/5/2015	6/9/2017	2017	827	Solar	LevelOne
1572	9/22/2016	6/9/2017	2017	260	Solar	LevelOne
1145	5/5/2015	6/12/2017	2017	769	Solar	LevelOne
1707	3/2/2017	6/13/2017	2017	103	Solar	LevelOne
1744	4/13/2017	6/15/2017	2017	63	Solar	LevelOne
1689	1/24/2017	6/15/2017	2017	142	Solar	LevelOne
1767	4/26/2017	6/15/2017	2017	50	Solar	LevelOne
1710	3/9/2017	6/16/2017	2017	99	Solar	LevelOne
1785	5/12/2017	6/16/2017	2017	35	Solar	LevelOne
1803	5/18/2017	6/16/2017	2017	29	Solar	LevelOne
1799	5/19/2017	6/16/2017	2017	28	Solar	LevelOne
1502	7/6/2016	6/20/2017	2017	349	Solar	LevelTwo
1750	4/17/2017	6/20/2017	2017	64	Solar	LevelOne
1504	7/6/2016	6/21/2017	2017	350	Solar	LevelTwo
1671	1/30/2017	6/21/2017	2017	142	Solar	LevelOne
1615	11/11/2016	6/21/2017	2017	222	Solar	LevelOne
1454	1/14/2016	6/21/2017	2017	524	Solar	LevelOne
1733	3/27/2017	6/21/2017	2017	86	Solar	LevelTwo
1158	5/26/2015	6/23/2017	2017	759	Solar & Wind	LevelTwo
1590	9/21/2016	6/24/2017	2017	276	Solar	LevelOne

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
1752	4/20/2017	6/24/2017	2017	65	Solar	LevelOne
1766	4/24/2017	6/24/2017	2017	61	Solar	LevelOne
1778	5/10/2017	6/26/2017	2017	47	Solar	LevelOne
1747	4/20/2017	6/28/2017	2017	69	Solar	LevelOne
1688	2/9/2017	6/29/2017	2017	140	Solar	LevelOne
1793	5/4/2017	7/1/2017	2017	58	Solar	LevelOne
1664	1/26/2017	7/3/2017	2017	158	Solar	LevelOne
1760	4/19/2017	7/3/2017	2017	75	Solar	LevelOne
1761	4/24/2017	7/3/2017	2017	70	Solar	LevelOne
1705	3/13/2017	7/6/2017	2017	115	Solar	LevelOne
1663	1/18/2017	7/7/2017	2017	170	Solar	LevelOne
1053	1/26/2015	7/7/2017	2017	893	Solar	LevelOne
1589	10/19/2016	7/7/2017	2017	261	Solar	LevelOne
987	12/9/2014	7/7/2017	2017	941	Solar	LevelOne
1095	3/9/2015	7/7/2017	2017	851	Solar	LevelOne
1784	5/12/2017	7/11/2017	2017	60	Solar	LevelTwo
1581	10/4/2016	7/11/2017	2017	280	Solar	LevelOne
1713	1/12/2017	7/12/2017	2017	181	Solar	LevelOne
1086	12/1/2014	7/12/2017	2017	954	Solar	LevelOne
1788	5/15/2017	7/13/2017	2017	59	Solar	LevelOne
1806	5/23/2017	7/13/2017	2017	51	Solar	LevelOne
1769	4/28/2017	7/13/2017	2017	76	Solar	LevelOne
1511	7/12/2016	7/13/2017	2017	366	Solar	LevelOne
1456	12/3/2015	7/14/2017	2017	589	Solar	LevelTwo
1601	11/2/2016	7/17/2017	2017	257	Solar	LevelOne
1711	3/15/2017	7/18/2017	2017	125	Solar	LevelOne
1527	8/2/2016	7/18/2017	2017	350	Solar	LevelTwo
1719	2/13/2017	7/18/2017	2017	155	Solar	LevelOne
1765	4/25/2017	7/18/2017	2017	84	Solar	LevelOne
1696	2/16/2017	7/19/2017	2017	153	Solar	LevelOne
1819	6/12/2017	7/21/2017	2017	39	Solar	LevelOne
1838	6/22/2017	7/21/2017	2017	29	Solar	LevelOne
1822	6/12/2017	7/21/2017	2017	39	Solar	LevelOne
1808	5/31/2017	7/21/2017	2017	51	Solar	LevelOne
1821	6/12/2017	7/21/2017	2017	39	Solar	LevelOne
1820	6/12/2017	7/21/2017	2017	39	Solar	LevelOne
1810	5/31/2017	7/21/2017	2017	51	Solar	LevelOne
1794	5/18/2017	7/21/2017	2017	64	Solar	LevelOne
1792	4/11/2017	7/21/2017	2017	101	Solar	LevelOne

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
1791	5/4/2017	7/21/2017	2017	78	Solar	LevelOne
1768	4/24/2017	7/21/2017	2017	88	Solar	LevelOne
1697	2/16/2017	7/21/2017	2017	155	Solar	LevelOne
1701	4/19/2017	7/24/2017	2017	96	Solar	LevelOne
1642	12/22/2016	7/24/2017	2017	214	Solar	LevelOne
1674	1/24/2017	7/24/2017	2017	181	Solar	LevelOne
1827	6/19/2017	7/24/2017	2017	35	Solar	LevelOne
1809	6/6/2017	7/25/2017	2017	49	Solar	LevelOne
1818	6/9/2017	7/26/2017	2017	47	Solar	LevelOne
1743	11/21/2016	7/26/2017	2017	247	Solar	LevelOne
1840	6/26/2017	7/27/2017	2017	31	Solar	LevelOne
1753	5/17/2017	7/27/2017	2017	71	Solar	LevelOne
1861	6/28/2017	7/27/2017	2017	29	Solar	LevelOne
1863	6/26/2017	7/27/2017	2017	31	Solar	LevelOne
1884	7/11/2017	7/28/2017	2017	17	Solar	LevelOne
1851	5/26/2017	7/31/2017	2017	66	Solar	LevelOne
1654	12/21/2016	7/31/2017	2017	222	Solar	LevelTwo
1807	5/26/2017	7/31/2017	2017	66	Solar	LevelOne
1850	6/21/2017	8/1/2017	2017	41	Solar	LevelOne
1868	5/2/2017	8/1/2017	2017	91	Solar	LevelOne
1734	3/28/2017	8/2/2017	2017	127	Solar	LevelOne
1804	5/24/2017	8/2/2017	2017	70	Solar	LevelOne
1830	6/27/2017	8/3/2017	2017	37	Solar	LevelOne
1690	1/24/2017	8/3/2017	2017	191	Solar	LevelOne
1873	7/12/2017	8/4/2017	2017	23	Solar	LevelOne
1848	6/26/2017	8/7/2017	2017	42	Solar	LevelOne
1826	6/15/2017	8/7/2017	2017	53	Solar	LevelOne
1700	4/17/2017	8/10/2017	2017	115	Solar	LevelOne
1715	5/3/2017	8/10/2017	2017	99	Solar	LevelOne
1857	6/26/2017	8/10/2017	2017	45	Solar	LevelOne
1886	7/18/2017	8/10/2017	2017	23	Solar	LevelOne
1699	8/10/2017	8/10/2017	2017	0	Solar	LevelOne
1887	7/25/2017	8/10/2017	2017	16	Solar	LevelOne
1779	4/25/2017	8/10/2017	2017	107	Solar	LevelOne
1866	6/26/2017	8/10/2017	2017	45	Solar	LevelOne
1847	6/28/2017	8/10/2017	2017	43	Solar	LevelOne
1759	6/21/2017	8/11/2017	2017	51	Solar	LevelTwo
1781	5/11/2017	8/11/2017	2017	92	Solar	LevelOne
1777	4/13/2017	8/15/2017	2017	124	Solar	LevelOne

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
1849	6/28/2017	8/15/2017	2017	48	Solar	LevelOne
1816	6/7/2017	8/16/2017	2017	70	Solar	LevelOne
17-00020	7/28/2017	8/16/2017	2017	19	Solar	LevelOne
1831	6/19/2017	8/16/2017	2017	58	Solar	LevelOne
1883	7/12/2017	8/17/2017	2017	36	Solar	LevelOne
1879	7/13/2017	8/18/2017	2017	36	Solar	LevelOne
1557	9/6/2016	8/22/2017	2017	350	Solar	LevelOne
1815	6/7/2017	8/23/2017	2017	77	Solar	LevelOne
1770	4/13/2017	8/24/2017	2017	133	Solar	LevelOne
1797	6/12/2017	8/25/2017	2017	74	Solar	LevelOne
1812	6/2/2017	8/25/2017	2017	84	Solar	LevelOne
17-00025	6/15/2017	8/28/2017	2017	74	Solar	LevelOne
1845	6/21/2017	8/29/2017	2017	69	Solar	LevelOne
1864	7/3/2017	8/29/2017	2017	57	Solar	LevelOne
17-00018	7/28/2017	8/30/2017	2017	33	Solar	LevelOne
1758	6/21/2017	8/30/2017	2017	70	Solar	LevelTwo
17-00039	8/10/2017	8/30/2017	2017	20	Solar	LevelOne
1754	6/21/2017	8/31/2017	2017	71	Solar	LevelTwo
1756	6/21/2017	8/31/2017	2017	71	Solar	LevelTwo
1757	6/21/2017	8/31/2017	2017	71	Solar	LevelTwo
1862	6/28/2017	8/31/2017	2017	64	Solar	LevelOne
1896	7/21/2017	9/5/2017	2017	46	Solar	LevelOne
17-00082	8/11/2017	9/5/2017	2017	25	Solar	LevelOne
17-00031	7/31/2017	9/5/2017	2017	36	Solar	LevelOne
1798	5/10/2017	9/5/2017	2017	118	Solar	LevelOne
1813	6/2/2017	9/5/2017	2017	95	Solar	LevelOne
1841	6/23/2017	9/6/2017	2017	75	Solar	LevelOne
1832	6/19/2017	9/8/2017	2017	81	Solar	LevelOne
17-00070	8/16/2017	9/8/2017	2017	23	Solar	LevelOne
1790	5/18/2017	9/11/2017	2017	116	Solar	LevelOne
1872	7/6/2017	9/11/2017	2017	67	Solar	LevelOne
1842	6/19/2017	9/11/2017	2017	84	Solar	LevelOne
1313	11/17/2015	9/11/2017	2017	664	Other	LevelTwo
1789	5/18/2017	9/11/2017	2017	116	Solar	LevelOne
17-00024	8/4/2017	9/11/2017	2017	38	Solar	LevelOne
17-00153	6/9/2017	9/12/2017	2017	95	Solar	LevelOne
338	6/9/2017	9/15/2017	2017	98	Solar	LevelOne
17-00112	8/28/2017	9/18/2017	2017	21	Solar	LevelOne
1876	7/10/2017	9/20/2017	2017	72	Solar	LevelOne

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
1825	6/19/2017	9/20/2017	2017	93	Solar	LevelOne
1824	6/21/2017	9/21/2017	2017	92	Solar	LevelOne
17-00037	8/9/2017	9/21/2017	2017	43	Solar	LevelOne
17-00091	8/25/2017	9/21/2017	2017	27	Solar	LevelOne
1856	6/29/2017	9/26/2017	2017	89	Solar	LevelOne
17-00113	8/28/2017	9/26/2017	2017	29	Solar	LevelOne
17-00086	7/26/2017	9/26/2017	2017	62	Solar	LevelOne
1795	5/4/2017	9/26/2017	2017	145	Solar	LevelOne
1834	6/27/2017	9/27/2017	2017	92	Solar	LevelOne
1835	6/27/2017	9/27/2017	2017	92	Solar	LevelOne
1833	6/27/2017	9/27/2017	2017	92	Solar	LevelOne
1894	7/21/2017	9/29/2017	2017	70	Solar	LevelOne
1885	7/20/2017	9/29/2017	2017	71	Solar	LevelTwo
1858	6/30/2017	9/29/2017	2017	91	Solar	LevelOne
17-00109	8/25/2017	9/29/2017	2017	35	Solar	LevelOne
1839	6/22/2017	9/29/2017	2017	99	Solar	LevelOne
17-00083	8/11/2017	10/2/2017	2017	52	Solar	LevelOne
17-00096	8/18/2017	10/2/2017	2017	45	Solar	LevelOne
1774	5/8/2017	10/3/2017	2017	148	Solar	LevelTwo
17-00033	8/8/2017	10/4/2017	2017	57	Solar	LevelOne
1748	4/20/2017	10/4/2017	2017	167	Solar	LevelOne
1776	5/9/2017	10/4/2017	2017	148	Solar	LevelOne
17-00030	8/7/2017	10/4/2017	2017	58	Solar	LevelOne
1846	6/19/2017	10/4/2017	2017	107	Solar	LevelOne
17-00189	9/18/2017	10/5/2017	2017	17	Solar	LevelOne
17-00128	8/31/2017	10/6/2017	2017	36	Solar	LevelOne
17-00075	7/31/2017	10/6/2017	2017	67	Solar	LevelOne
17-00026	8/4/2017	10/9/2017	2017	66	Solar	LevelOne
1811	5/31/2017	10/10/2017	2017	132	Solar	LevelOne
1775	4/25/2017	10/10/2017	2017	168	Solar	LevelOne
17-00126	8/31/2017	10/12/2017	2017	42	Solar	LevelOne
1576	9/29/2014	10/16/2017	2017	1113	Biomass	LevelFour
17-00079	7/31/2017	10/18/2017	2017	79	Solar	LevelOne
17-00078	7/31/2017	10/18/2017	2017	79	Solar	LevelOne
17-00034	8/8/2017	10/18/2017	2017	71	Solar	LevelOne
17-00077	7/31/2017	10/18/2017	2017	79	Solar	LevelOne
17-00046	7/31/2017	10/19/2017	2017	80	Solar	LevelOne
1786	5/18/2017	10/19/2017	2017	154	Solar	LevelOne
1853	6/22/2017	10/19/2017	2017	119	Solar	LevelOne

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
1854	6/22/2017	10/19/2017	2017	119	Solar	LevelOne
1855	6/22/2017	10/19/2017	2017	119	Solar	LevelOne
17-00094	8/23/2017	10/20/2017	2017	58	Solar	LevelOne
17-00213	9/25/2017	10/20/2017	2017	25	Solar	LevelOne
17-00076	7/31/2017	10/20/2017	2017	81	Solar	LevelOne
17-00071	8/14/2017	10/20/2017	2017	67	Solar	LevelOne
17-00182	9/14/2017	10/24/2017	2017	40	Solar	LevelOne
17-00212	9/22/2017	10/24/2017	2017	32	Solar	LevelOne
17-00047	8/11/2017	10/25/2017	2017	75	Solar	LevelOne
17-00121	8/29/2017	10/26/2017	2017	58	Solar	LevelOne
17-00192	9/19/2017	10/26/2017	2017	37	Solar	LevelOne
17-00183	9/15/2017	10/26/2017	2017	41	Solar	LevelOne
17-00088	8/16/2017	10/27/2017	2017	72	Solar	LevelOne
1389	3/25/2016	10/27/2017	2017	581	Solar	LevelOne
17-00110	8/28/2017	10/27/2017	2017	60	Solar	LevelOne
17-00027	8/7/2017	10/27/2017	2017	81	Solar	LevelOne
17-00223	10/2/2017	10/27/2017	2017	25	Solar	LevelOne
17-00140	9/6/2017	10/31/2017	2017	55	Solar	LevelOne
17-00227	10/4/2017	11/1/2017	2017	28	Solar	LevelOne
17-00300	10/19/2017	11/1/2017	2017	13	Solar	LevelOne
17-00234	10/6/2017	11/2/2017	2017	27	Solar	LevelOne
17-00150	9/8/2017	11/2/2017	2017	55	Solar	LevelOne
1529	8/3/2016	11/2/2017	2017	456	Solar	LevelTwo
17-00139	9/6/2017	11/3/2017	2017	58	Solar	LevelOne
17-00214	9/25/2017	11/3/2017	2017	39	Solar	LevelOne
1860	6/23/2017	11/3/2017	2017	133	Solar	LevelTwo
17-00035	7/8/2017	11/3/2017	2017	118	Wind	LevelOne
1869	6/22/2017	11/4/2017	2017	135	Solar	LevelTwo
1870	6/22/2017	11/4/2017	2017	135	Solar	LevelTwo
17-00184	9/15/2017	11/8/2017	2017	54	Solar	LevelOne
17-00152	9/11/2017	11/8/2017	2017	58	Solar	LevelOne
17-00001	8/1/2017	11/8/2017	2017	99	Solar	LevelOne
17-00195	9/19/2017	11/8/2017	2017	50	Solar	LevelOne
1897	7/21/2017	11/8/2017	2017	110	Solar	LevelOne
17-00187	9/18/2017	11/13/2017	2017	56	Solar	LevelOne
17-00259	10/10/2017	11/13/2017	2017	34	Solar	LevelOne
17-00087	8/15/2017	11/13/2017	2017	90	Solar	LevelOne
17-00196	9/19/2017	11/14/2017	2017	56	Solar	LevelOne
17-00216	9/26/2017	11/15/2017	2017	50	Solar	LevelOne

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
17-00190	9/19/2017	11/15/2017	2017	57	Solar	LevelOne
17-00158	9/11/2017	11/15/2017	2017	65	Solar	LevelOne
17-00148	9/8/2017	11/16/2017	2017	69	Solar	LevelOne
17-00045	7/31/2017	11/22/2017	2017	114	Solar	LevelOne
1478	6/22/2016	11/22/2017	2017	518	Solar	LevelOne
17-00296	10/18/2017	11/27/2017	2017	40	Solar	LevelOne
17-00289	10/17/2017	11/27/2017	2017	41	Solar	LevelOne
17-00134	9/5/2017	11/28/2017	2017	84	Solar	LevelOne
17-00336	10/26/2017	11/28/2017	2017	33	Solar	LevelOne
1805	5/26/2017	11/28/2017	2017	186	Solar	LevelOne
17-00092	8/24/2017	11/29/2017	2017	97	Solar	LevelOne
17-00204	9/22/2017	11/29/2017	2017	68	Solar	LevelOne
17-00200	9/20/2017	11/30/2017	2017	71	Solar	LevelOne
17-00270	10/16/2017	11/30/2017	2017	45	Solar	LevelOne
17-00280	10/16/2017	11/30/2017	2017	45	Solar	LevelOne
17-00348	10/31/2017	11/30/2017	2017	30	Solar	LevelOne
17-00357	11/1/2017	11/30/2017	2017	29	Solar	LevelOne
1843	6/19/2017	11/30/2017	2017	164	Solar	LevelOne
17-00278	10/16/2017	12/1/2017	2017	46	Solar	LevelOne
17-00191	9/19/2017	12/1/2017	2017	73	Solar	LevelOne
1646	1/9/2017	12/1/2017	2017	326	Solar	LevelTwo
1666	1/9/2017	12/1/2017	2017	326	Solar	LevelTwo
1619	11/17/2016	12/1/2017	2017	379	Solar	LevelTwo
17-00127	8/31/2017	12/1/2017	2017	92	Solar	LevelOne
17-00345	10/28/2017	12/4/2017	2017	37	Solar	LevelOne
17-00193	9/19/2017	12/4/2017	2017	76	Solar	LevelOne
17-00080	7/31/2017	12/4/2017	2017	126	Solar	LevelOne
17-00264	10/12/2017	12/4/2017	2017	53	Solar	LevelOne
17-00028	8/7/2017	12/4/2017	2017	119	Solar	LevelOne
17-00188	9/18/2017	12/4/2017	2017	77	Solar	LevelOne
17-00487	11/20/2017	12/5/2017	2017	15	Solar	LevelOne
17-00325	10/24/2017	12/6/2017	2017	43	Solar	LevelOne
17-00464	11/17/2017	12/7/2017	2017	20	Solar	LevelOne
17-00340	10/27/2017	12/7/2017	2017	41	Solar	LevelOne
17-00333	10/26/2017	12/7/2017	2017	42	Solar	LevelOne
17-00337	10/26/2017	12/7/2017	2017	42	Solar	LevelOne
17-00263	10/12/2017	12/7/2017	2017	56	Solar	LevelOne
1745	4/3/2017	12/7/2017	2017	248	Solar	LevelOne
1871	7/6/2017	12/7/2017	2017	154	Solar	LevelOne

Issue ID	Date Application Received	Certificate of Completion Date	Year Completed	Duration	Fuel Type	Final Level Assigned
17-00093	8/23/2017	12/8/2017	2017	107	Solar	LevelOne
17-00084	8/11/2017	12/8/2017	2017	119	Solar	LevelOne
1814	6/6/2017	12/8/2017	2017	185	Solar	LevelOne
17-00239	10/9/2017	12/11/2017	2017	63	Solar	LevelOne
17-00058	8/14/2017	12/11/2017	2017	119	Solar	LevelOne
17-00019	7/26/2017	12/11/2017	2017	138	Solar	LevelOne
17-00519	11/29/2017	12/11/2017	2017	12	Solar	LevelOne
1895	7/21/2017	12/12/2017	2017	144	Solar	LevelOne
17-00402	11/8/2017	12/12/2017	2017	34	Solar	LevelOne
17-00089	8/17/2017	12/12/2017	2017	117	Solar	LevelOne
17-00392	11/3/2017	12/13/2017	2017	40	Solar	LevelOne
17-00215	9/26/2017	12/14/2017	2017	79	Solar	LevelOne
17-00293	10/17/2017	12/14/2017	2017	58	Solar	LevelOne
17-00294	10/17/2017	12/14/2017	2017	58	Solar	LevelOne
17-00453	11/16/2017	12/15/2017	2017	29	Solar	LevelOne
17-00097	8/17/2017	12/15/2017	2017	120	Solar	LevelOne
17-00445	11/16/2017	12/18/2017	2017	32	Solar	LevelOne
17-00459	11/17/2017	12/18/2017	2017	31	Solar	LevelOne
17-00452	11/16/2017	12/18/2017	2017	32	Solar	LevelOne
17-00129	9/1/2017	12/19/2017	2017	109	Solar	LevelOne
17-00419	11/13/2017	12/20/2017	2017	37	Solar	LevelOne
17-00511	11/28/2017	12/20/2017	2017	22	Solar	LevelOne
17-00133	9/4/2017	12/20/2017	2017	107	Solar	LevelOne
17-00451	11/16/2017	12/21/2017	2017	35	Solar	LevelOne
17-00491	11/21/2017	12/22/2017	2017	31	Solar	LevelOne
17-00429	11/14/2017	12/22/2017	2017	38	Solar	LevelTwo
17-00358	11/1/2017	12/27/2017	2017	56	Solar	LevelOne
17-00283	10/16/2017	12/28/2017	2017	73	Solar	LevelTwo
17-00506	11/27/2017	12/30/2017	2017	33	Solar	LevelOne

Metric: 22

Metric Description: Bill impacts associated with the costs for implementation of ComEd's AMI Plan for low, average, and higher usage level customers pursuant to approved rates and

surcharges.[54] The usage level calculations will be valued for a "typical" customer at the 25th, 50th, and 75th percentile of total usage for each applicable delivery service class.

Change from January 2017 to January 2018 for Typical Customer			
Customer Class or Type	Monthly	Annual	Percent
Single Family Residential Without Electric Space Heat	$7.30	$87.64	7.82%
Multi-Family Residential Without Electric Space Heat	$3.52	$42.24	7.57%
Single Family Residential With Electric Space Heat	$14.54	$174.43	9.30%
Multi-Family Residential With Electric Space Heat	$6.30	$75.62	7.80%
Non-Residential Watt hour	$6.02	$72.18	11.30%
Non-Residential Small Load (0-100 kW)	$32.75	$393.00	8.63%

Change from January 2017 to January 2018 at Percentile (Low/Median/High Usage)				
Customer Class or Type	Percentile	Monthly	Annual	Percent
Single Family Residential Without Electric Space Heat (low usage)	25%	$4.78	$57.34	7.56%
Single Family Residential Without Electric Space Heat (median usage)	50%	$6.48	$77.72	7.75%
Single Family Residential Without Electric Space Heat (high usage)	75%	$8.72	$104.60	7.91%
Multi-Family Residential Without Electric Space Heat (low usage)	25%	$2.12	$25.47	6.80%

Change from January 2017 to January 2018 at Percentile (Low/Median/High Usage)				
Customer Class or Type	Percentile	Monthly	Annual	Percent
Multi-Family Residential Without Electric Space Heat (median usage)	50%	$3.04	$36.47	7.36%
Multi-Family Residential Without Electric Space Heat (high usage)	75%	$4.30	$51.61	7.80%
Single Family Residential With Electric Space Heat (low usage)	25%	$9.24	$110.86	9.06%
Single Family Residential With Electric Space Heat (median usage)	50%	$13.33	$159.95	9.27%
Single Family Residential With Electric Space Heat (high usage)	75%	$17.76	$213.15	9.39%

[54] The customer rate impacts reflect a comparison of ComEd's total bill year-to-year for the rates in effect for January 2016 to January 2017 (including energy supply and delivery, of which AMI is a component). This is the same manner in which ComEd has been responding to this metric in previous submissions, as agreed upon by stakeholders.

Multi-Family Residential With Electric Space Heat (low usage)	25%	$3.94	$47.33	7.48%
Multi-Family Residential With Electric Space Heat (median usage)	50%	$5.66	$67.89	7.74%
Multi-Family Residential With Electric Space Heat (high usage)	75%	$7.76	$93.10	7.91%
Nonresidential Watthour (low usage)	25%	$4.86	$58.36	15.28%
Nonresidential Watthour (median usage)	50%	$5.70	$68.38	12.08%
Nonresidential Watthour (high usage)	75%	$6.74	$80.89	10.13%
Nonresidential Small Load (0-100 kW) (low usage)	25%	$9.91	$118.93	9.50%
Nonresidential Small Load (0-100 kW) (median usage)	50%	$17.42	$209.03	8.86%
Nonresidential Small Load (0-100 kW) (high usage)	75%	$36.74	$440.92	8.54%

Metric: 23

Metric Description: Number of customers that have created and viewed an account on ComEd.com – by usage levels, customer class, and low income customers. An account on ComEd.com is necessary for viewing the web portal.

Number of Accounts by Delivery Class	
Delivery Class	Total Number of Accounts
Single Family W/O Elec. Space Heat	862,746
Multi Family W/O Elec. Space Heat	541,101
Single Family With Elec. Space Heat	13,007
Multi Family With Elec. Space Heat	74,292
Watt-Hour	15,887
Small Load	74,789
Medium Load	4019
Large Load	691
Very Large Load	366
Extra Large Load	11
High Voltage	9
Railroad	0
Fixture-Included Lighting	111
Dusk to Dawn Lighting	266
General Lighting	116
TOTAL	1,587,411

Number of Accounts by Usage Level for Residential, Watt-hour, and Small Load Delivery						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
SingleFamily w/o Elec. Space Heat	862,746	148,017	179,605	199,643	214,610	120,871
Multi Family w/o Elec. Space Heat	541,101	75,856	85,186	91,680	101,415	186,964
SingleFamily With Elec. Space Heat	13,007	2,480	2,767	2,847	2,821	2,092
Multi Family With Elec. Space Heat	74,292	11,542	12,469	12,916	12,709	24,656
Watt-Hour	15,887	2,639	3,119	3,682	3,692	2,755
Small Load	74,789	15,477	15,791	15,693	16,677	11,151

Number of Low Income Accounts by Usage Level for Residential Delivery Classes(2)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family Without Space Heat	55,674	18,288	13,051	10,445	8,073	5,817
Multi Family Without Space Heat	51,553	14,528	11,413	9,460	8,934	7,218
Single Family With Space Heat	918	234	204	203	141	136
Multi Family With Space Heat	10,769	3,532	2,520	17,69	1,475	1,473

Accounts on Life Support and Medical Condition by Usage Level for Residential Delivery Classes(3)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family Without Space Heat	5,337	613	985	1,361	1,906	472
Multi Family Without Space Heat	2,617	142	328	553	1,196	398
Single Family With Space Heat	132	14	26	41	40	11
Multi Family With Space Heat	506	20	70	103	254	59

Notes for Metric 23:
(1) These accounts did not have bills for all 12 months of 2017 to determine their usage quartile.
(2) Low income accounts are those accounts that participated in the Low Income Home Energy Assistance Program (LIHEAP), and Percentage of Income Payment Program (PIPP).
(3) Customers on Medical Condition or Medical Certificate are based on data for 2017 and customers on Life Support are determined based on accounts on Life Support in January 2018. Some accounts in the Life Support and Medical Condition or Medical Certificate group may also be in the low income group.

Metric: 24

Metric Description: Number of customers with ComEd.com accounts that have viewed the web portal - by usage levels, customer class, and low income customers.

Sort	Revised Category	Total Viewed Portal
1	RESIDENTIAL SINGLE	372,536
2	RESIDENTIAL MULTI	239,752
3	RESIDENTIAL SINGLE (SPACE HEAT)	6,245
4	RESIDENTIAL MULTI (SPACE HEAT)	36,669

Number of Accounts by Usage Level for Residential Delivery Classes						
Number of Accounts by Usage Level						
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
SingleFamily W/O Elec. Space Heat	372,536	62,161	79,373	89,017	96,109	45,876
Multi Family W/O Elec. Space Heat	239,752	30,477	38,768	43,744	49,489	77,274
SingleFamily With Elec. Space Heat	6,245	1,135	1,389	1,503	1,363	855
Multi Family With Elec. Space Heat	36,669	5,566	6,274	6,876	6,803	11,150

Number of Low Income Accounts by Usage Level for Residential Delivery Classes(2)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	8,423	1,912	1,864	1,954	1,831	862
Multi Family W/O Elec. Space Heat	5,761	797	1,022	1,347	1,704	891
Single Family With Elec. Space Heat	172	39	31	43	39	20
Multi Family With Elec. Space Heat	1,195	219	227	257	310	182

Accounts on Life Support and Medical Condition by Usage Level for Residential Delivery Classes(3)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	1,031	87	166	268	433	77
Multi Family W/O Elec. Space Heat	466	21	43	84	256	62
Single Family With Elec. Space Heat	37	5	7	12	11	2
Multi Family With Elec. Space Heat	102	2	11	25	54	10

Notes for Metric 24:
(1) These accounts did not have bills for all 12 months of 2017 to determine their usage quartile.
(2) Low income accounts are those accounts that participated in the Low Income Home Energy Assistance Program (LIHEAP), and Percentage of Income Payment Program (PIPP).
(3) Customers on Medical Condition or Medical Certificate are based on data for 2017 and customers on Life Support are determined based on accounts on Life Support in January 2018. Some accounts in the Life Support and Medical Condition or Medical Certificate group may also be in the low income group.

Metric: 25

Metric Description: ComEd has continued to work with its web presentment vendor to develop and vet a methodology for measuring energy savings by customers that have viewed the web portal (ComEd.com/MyAccount). The 2017 methodology remains the same as the prior year. The methodology is explained below.

Methodology description:

I. PROPENSITY SCORE MATCHING

Logging in to the web is a self-selected, opt-in action and therefore not easily subject to random assignment as in an experimental evaluation approach (i.e., randomized controlled trial). Therefore, this analysis employs a quasi-experimental evaluation method

which seeks to match customers who log in to the web ("treatment customers") to very similar customers who did not log in to the web ("matched control customers"). Matched controls are drawn from a larger set of candidate control customers. Because customers log in to the web on a rolling basis, the matching procedure repeats for each "cohort" of treatment customers defined by month of login.

The matching algorithm follows Imbens and Rubin (2015) and begins by selecting customer characteristics for estimation of a propensity score. The propensity score is the predicted probability of receiving the treatment - logging in to the web. Matching customers based on nearly identical propensity scores serves to balance the distribution of the included customer characteristics among the treatment and matched control populations. This approach effectively attempts to mimic the balancing that occurs via a randomized controlled trial.

An important limitation of this method is that treatment customers may still differ from matched control customers along unobserved dimensions (e.g., attitudes toward energy efficiency). Such unobserved differences can bias results if they remain imbalanced. Despite this limitation, propensity score matching is an accepted method in the DOE SEE Action guidelines and widely used in other disciplines.

The algorithm considered inclusion of each of the previous 12 months of energy usage data prior to the login month, customer tenure, and recipient status in each particular Home Energy Report (HER) wave. All first and second order terms are considered for inclusion by the algorithm. Customers who were missing data for these characteristics were excluded from the analysis.

Once the propensity score is estimated across customers, each treatment customer is matched to the control customer with the closest propensity score (their "nearest neighbor") on a 1:1 basis. Not all customers who log in are successfully matched largely due to not having 12 months of pre-login usage data. These customers are not matched due to the concern that they cannot be matched well. As a result, the analysis measures the average treatment effect on the treated for those customers who visited the web and who could be matched well; it is not a measurement of the effect of web on all customers who visited the web. The final result of this process is a treatment and a control group that are statistically equivalent across characteristics strongly related to both the outcome variable, energy usage, and the likelihood of web login.

II. ESTIMATION OF THE TREATMENT EFFECT

Following matching, savings estimation is conducted using the same model that Opower uses for the savings measurement of Home Energy Report (HER) programs. Robustness checks are conducted using a customer fixed effect model. These models incorporate pre-treatment energy usage data and serve as another opportunity to correct for differences between treatment and matched control customers. Please see Imbens and Rubin (2015) for the benefits of pairing matching with regression estimation to achieve "double robustness".

III. 2017 RESULTS

The tables below displays calendar year 2017 energy efficiency savings from web among ComEd customers who logged-in for the first time in calendar year 2017 and had sufficient data to be included in the analysis.

Electric Savings Results

- Percent savings (%): 0.24% +/- 0.22%
- Savings per customer per day (kWh): 0.057 +/- 0.51
- Total customers: 67,449
- Total savings (MWh): 743 +/- 659

Note: Savings estimates are statistically significant at the > 90% level. Margin of error represents 90% confidence interval.

IV. REFERENCES

Crump, Richard, et al. "Moving the goalposts: Addressing limited overlap in the estimation of average treatment effects by changing the estimand." (2006).

Imbens, Guido W., and Donald B. Rubin. Causal Inference in Statistics, Social, and Biomedical Sciences. Cambridge University Press, 2015.

State and Local Energy Efficiency Action Network. 2012. *Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations.*

Prepared by A. Todd, E. Stuart, S. Schiller, and C. Goldman, Lawrence Berkeley National Laboratory. http://behavioranalytics.lbl.gov.

Metric: 26

Metric Description: Number of customers enrolled in the RRTP program (ComEd's hourly pricing program) by usage levels, customer class, and low income customers.

Number of Accounts by Usage Level for Residential Delivery Classes						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	14,619	2,089	3,187	3,894	5,113	336
Multi Family W/O Elec. Space Heat	2,161	149	261	559	1,000	192
Single Family With Elec. Space Heat	396	52	105	116	113	10
Multi Family With Elec. Space Heat	697	88	161	171	226	51

Number of Low Income Accounts by Usage Level for Residential Delivery Classes(2)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	207	61	57	53	32	4
Multi Family W/O Elec. Space Heat	83	2	12	36	30	3
Single Family With Elec. Space Heat	5	1	3	0	1	0
Multi Family With Elec. Space Heat	29	5	7	11	6	0

Accounts on Life Support and Medical Condition by Usage Level for Residential Delivery Classes(3)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(2)
Single Family W/O Elec. Space Heat	26	2	4	12	6	2
Multi Family W/O Elec. Space Heat	3	0	0	0	3	0
Single Family With Elec. Space Heat	1	0	0	0	1	0
Multi Family With Elec. Space Heat	0	0	0	0	0	0

Notes for Metric 26:
(1) These accounts did not have bills for all 12 months of 2017 to determine their usage quartile.
(2) Low income accounts are those accounts that participated in the Low Income Home Energy Assistance Program (LIHEAP), and Percentage of Income Payment Program (PIPP).
(3) Customers on Medical Condition or Medical Certificate are based on data for 2017 and customers on Life Support are determined based on accounts on Life Support in January 2018. Some accounts in the Life Support and Medical Condition or Medical Certificate group may also be in the low income group.

Metric: 28

Metric Description: Number of customers enrolled in ComEd's PTR program by usage levels, customer class, and low income customers.

Total Number of Accounts for Residential Delivery Classes	
Delivery Class	Total
Single Family W/O Elec. Space Heat	157,790
Multi Family W/O Elec. Space Heat	65,145
Single Family With Elec. Space Heat	2,172
Multi Family With Elec. Space Heat	10,753

Number of Accounts by Usage Level for Residential Delivery Classes						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA
Single Family W/O Elec. Space	157,790	43,772	40,994	37,824	33,700	1,500
Multi Family W/O Elec. Space	65,145	16,040	17,298	16,273	14,267	1,267
Single Family With Elec. Space	2,172	514	581	576	466	35
Multi Family With Elec. Space	10,753	2,708	2,564	2,532	2,661	288

Number of Low Income Accounts by Usage Level for Residential Delivery Classes(2)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA
Single Family W/O Elec. Space Heat	5,330	2,232	1,349	979	723	47
Multi Family W/O Elec. Space Heat	4,801	1,558	1,313	1,042	864	24
Single Family With Elec. Space Heat	81	26	18	22	14	1
Multi Family With Elec. Space Heat	957	343	249	188	161	16

Accounts on Life Support and Medical Condition by Usage Level for Residential Delivery Classes(3)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA
Single Family W/O Elec. Space Heat	316	47	55	90	120	4
Multi Family W/O Elec. Space Heat	154	14	26	31	83	0
Single Family With Elec. Space Heat	12	0	3	4	4	1
Multi Family With Elec. Space Heat	36	2	4	11	19	0

Notes for Metric 28:

(1) These accounts did not have bills for all 12 months of 2017 to determine their usage quartile.

(2) Low income accounts are those accounts that participated in the Low Income Home Energy Assistance Program (LIHEAP), and Percentage of Income Payment Program (PIPP).

(3) Customers on Medical Condition or Medical Certificate are based on data for 2017 and customers on Life Support are determined based on accounts on Life Support in January 2018.

Some accounts in the Life Support and Medical Condition or Medical Certificate group may also be in the low income group.

Metric: 29

Metric Description: Number of deposits required, disconnection notices, and disconnections for nonpayment for all customers and, if applicable, by low income customers. Other "key indicia associated with credit and collection activities targeted to low income customers" may be incorporated in the project plan's business process redesigns for future implementation.

Part 1: Number of Deposits Required in 2017 - by usage levels, customer class, and low income customers.	
Number of Accounts by Delivery Class	
Delivery Class	Total Number of Accounts
Single Family W/O Elec. Space Heat	15,616
Multi Family W/O Elec. Space Heat	27,928
Single Family With Elec. Space Heat	392
Multi Family With Elec. Space Heat	4,479
Watt-Hour	1,616
Small Load	9,634
Medium Load	183
Large Load	38
Very Large Load	18
Fixture-Included Lighting	5
Dusk to Dawn Lighting	2
Other Lights	4

Notes for Deposits: Total accounts and low income accounts presented were active as of December 31, 2017. Inactive accounts are not presented. In total, including inactive, there were 76,938 new distinct accounts with deposits quoted.

Number of Accounts by Usage Level for Residential, Watt-hour, and Small Load Delivery Classes						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	15,616	32	12	18	11	15,543
Multi Family W/O Elec. Space Heat	27,928	45	24	21	20	27,818
Single Family With Elec. Space Heat	392	0	0	0	0	392
Multi Family With Elec. Space Heat	4,479	7	2	6	4	4,460
Watt-Hour	1,616	0	8	6	6	1,596
Small Load	9,634	58	64	38	28	9,446

Number of Low Income Accounts by Usage Level for Residential Delivery Classes (2)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	499	2	1	5	2	489
Multi Family W/O Elec. Space Heat	625	4	0	2	1	618
Single Family With Elec. Space Heat	11	0	0	0	0	11
Multi Family With Elec. Space Heat	144	0	1	1	1	141

Accounts on Life Support and Medical Condition by Usage Level for Residential Delivery Classes (3)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	79	0	0	1	1	77
Multi Family W/O Elec. Space Heat	51	0	0	0	0	51
Single Family With Elec. Space Heat	3	0	0	0	0	3
Multi Family With Elec. Space Heat	8	0	0	0	0	8

Part 2: Number of Disconnection Notices in 2017 - by usage levels, customer class, and low income customers.	
Number of Accounts by Delivery Class	
Delivery Class	Total Number of Accounts
Single Family W/O Elec. Space Heat	254,974
Multi Family W/O Elec. Space Heat	131,207
Single Family With Elec. Space Heat	4,360
Multi Family With Elec. Space Heat	19,341
Watt-Hour	2,155
Small Load	21,559
Medium Load	1,026
Large Load	205
Very Large Load	88
Extra Large Load	1
High Voltage	3
Fixture-Included Lighting	265
Dusk to Dawn Lighting	238
General Lighting	121

Notes for Disconnection Notices: Total accounts and low income accounts presented were active as of December 31, 2017. Inactive accounts are not presented. In total, including inactive, there were 550,808 distinct accounts receiving disconnect notices.

Number of Accounts by Usage Level for Residential, Watt-hour, and Small Load Delivery Classes						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	254,974	38,055	50,875	63,662	76,249	26,133
Multi Family W/O Elec. Space Heat	131,207	14,911	22,687	29,632	40,449	23,528
Single Family With Elec. Space Heat	4,360	702	931	1,107	1,090	530
Multi Family With Elec. Space Heat	19,341	1,726	3,265	4,975	5,916	3,459
Watt-Hour	2,155	238	395	456	734	332
Small Load	21,559	2,699	4,383	5,759	5,942	2,776

Number of Low Income Accounts by Usage Level for Residential Delivery Classes(2)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	13,336	2,284	2,841	3,090	3,089	2,032
Multi Family W/O Elec. Space Heat	8,864	652	1,343	1,937	3,161	1,771
Single Family With Elec. Space Heat	195	25	41	44	37	48
Multi Family With Elec. Space Heat	1,210	115	207	269	357	262

Accounts on Life Support and Medical Condition by Usage Level for Residential Delivery Classes(3)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	3451	382	619	827	1,197	426
Multi Family W/O Elec. Space Heat	2081	113	260	439	915	354
Single Family With Elec. Space Heat	69	6	12	23	18	10
Multi Family With Elec. Space Heat	383	17	53	75	195	43

Part 3: Number of Disconnections in 2017 - by usage levels, customer class, and low income customers.	
Number of Accounts by Delivery Class	
Delivery Class	Total Number of Accounts
RESIDENTIAL SINGLE	44,565
RESIDENTIAL MULTI	29,785
RESIDENTIAL SINGLE (SPACE HEAT)	712
RESIDENTIAL MULTI (SPACE HEAT)	4,212
COM KWH ONLY	871
SMALL (0 - 100)	5,066
MED (100 - 400)	2
DUSK TO DAWN	1

Notes for Disconnection: Total accounts and low income accounts presented were active as of December 31, 2017. Inactive accounts are not presented. In total, including inactive, there were 135,994 distinct accounts suspended in 2017.

Part 3: Number of Disconnections in 2017 - by usage levels, customer class, and low income customers.						
Number of Accounts by Usage Level for Residential, Watt-hour, and Small Load Delivery Classes						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	44,565	7,817	9,405	11,359	12,804	3,180
Multi Family W/O Elec. Space Heat	29,785	3,253	5,517	7,376	10,396	3,243
Single Family With Elec. Space Heat	712	129	157	184	150	92
Multi Family With Elec. Space Heat	4,212	371	762	1,132	1,380	567
Watt-Hour	871	82	188	180	334	87
Small Load	5,066	1,070	1,503	1,247	585	661

Number of Low Income Accounts by Usage Level for Residential Delivery Classes (2)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	2916	589	630	697	700	300
Multi Family W/O Elec. Space Heat	2197	167	365	514	869	282
Single Family With Elec. Space Heat	40	9	9	6	7	9
Multi Family With Elec. Space Heat	263	21	40	63	97	42

Accounts on Life Support and Medical Condition by Usage Level for Residential Delivery Classes(3)						
		Number of Accounts by Usage Level				
Delivery Class	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4	NA(1)
Single Family W/O Elec. Space Heat	1,351	198	256	323	407	167
Multi Family W/O Elec. Space Heat	964	64	139	204	409	148
Single Family With Elec. Space Heat	27	2	4	12	5	4
Multi Family With Elec. Space Heat	165	8	24	33	84	16

Supporting Documentation EIMA Bill Comparison Vulnerable Customers

ATTACHMENT 2

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b) SFSPHT 50%	Single Family Residential With Electric Space Heat	50%	of Customers in this class with less annual usage	20
b) SFSPHT 75%	Single Family Residential With Electric Space Heat	75%	of Customers in this class with less annual usage	21
b) MFSPHT 25%	Multi Family Residential With Electric Space Heat	25%	of Customers in this class with less annual usage	22
b) MFSPHT 50%	Multi Family Residential With Electric Space Heat	50%	of Customers in this class with less annual usage	23
b) MFSPHT 75%	Multi Family Residential With Electric Space Heat	75%	of Customers in this class with less annual usage	24
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b) Small 75%	Nonresidential Small Load (0-100 kW)	75%	of Customers in this class with less annual load	30

BILL COMPARISONS - EIMA

Purchased Electricity Charges (PEC)
$/kWh

(comparison change here:)

	Applicable JAN 2017		Applicable JAN 2018	
	Summer	Nonsummer	Summer	Nonsummer
Residential Non-Electric Space Heating Customer	0.04846	0.05055	0.05544	0.05844
Residential Electric Space Heating Customer	0.04846	0.05055	0.05544	0.05844
Watt-Hour Non-Electric Space Heating Customer	0.04960	0.05124	0.05572	0.05884
Demand Non-Electric Space Heating Customer	0.04933	0.05116	0.05629	0.05935
Nonresidential Electric Space Heating Customer	0.04496	0.04958	0.05162	0.05694
Dusk to Dawn	0.01877	0.02241	0.02136	0.02549
General Lighting	0.04453	0.04885	0.05065	0.05558

Rate Key:
Jan 2017:
Rates in effect 1/1/2017*
* Includes ICC Dkt. 16-0259 Final Order dated 12/06/2016 & Jan '17 effective rates

Jan 2018:
Rates in effect 1/1/2018 *
* Includes ICC Dkt. 17-0196 Final Order dated 12/06/2017 & Jan '18 effective rates

January 2017

	PJM Services Charges ($/kWh)	Misc Procurement Components Charge ($/kWh)	Monthly Capacity Charge ($/kW-Month)	Retail Customer Assessments (Rider RCA) ($/Month)	Customer Charge ($/Month)	Standard Metering Charge ($/Month) - Lighting ($/kWh)	Distribution Facilities Charge (Secondary) ($/kWh) or ($/kW)	Environmental Cost Recovery Adj (Rider ECR) ($/kWh)	Energy Efficiency Programs Rider EDA through May 2017 Rider EEPP eff. Oct 2017 ($/kWh)	Illinois Electricity Distribution Tax (IEDT) ($/kWh)	Franchise Cost Addition (Rider FCA) 5.440%	IDUF Customer, Metering, DFC, IEDT	Primary Voltage Distribution Facilities Charge* ($/kW)	Primary Voltage Transformer Charge* ($/kW)	Renewable Portfolio Standard (Rider REA) Rider eff June 2017 ($/kW)	Zero Emission Standard (Rider ZEA) Rider eff June 2017 ($/kW)
	kWh	kWh	kW	Mo	Mo	Mo / kWh	kWh / kW	kWh	kWh	kWh			kW	kW	kWh	kWh
Residential																
Single Family Without Electric Space Heat	0.01263	na	na	0.57	10.64	4.70	0.03505	0.00033	0.00333	0.00117	5.440%	1.0118	na	na	-	-
Mult Family Without Electric Space Heat	0.01263	na	na	0.57	7.56	4.70	0.02798	0.00033	0.00333	0.00117	5.440%	1.0118	na	na	-	-
Single Family With Electric Space Heat	0.01263	na	na	0.57	12.29	4.70	0.01762	0.00033	0.00333	0.00117	5.440%	1.0118	na	na	-	-
Mult Family With Electric Space Heat	0.01263	na	na	0.57	8.13	4.70	0.01768	0.00033	0.00333	0.00117	5.440%	1.0118	na	na	-	-
Nonresidential																
Watthour Without Electric Space Heat	0.01244	na	na	5.30	11.07	4.75	0.01993	0.00033	0.00658	0.00116	5.440%	1.0029	na	na	-	-
Watthour With Electric Space Heat	0.01244	na	na	5.30	11.07	4.75	0.01993	0.00033	0.00658	0.00116	5.440%	1.0029	na	na	-	-
Small Load (0-100 kW) Without Electric Space Heat	0.01244	na	na	5.30	12.77	13.25	6.65	0.00033	0.00658	0.00116	5.440%	1.0029	2.53	0.64	-	-
Small Load (0-100 kW) With Electric Space Heat	0.01244	na	na	5.30	12.77	13.25	6.65	0.00033	0.00658	0.00116	5.440%	1.0029	2.53	0.64	-	-
Hourly Medium Load (100-400 kW)	0.00838	0.00198	3.10925	5.30	19.57	29.38	6.85	0.00033	0.00255	0.00116	5.440%	1.0029	3.85	0.18	-	-
Hourly Large Load (400-1,000 kW)	0.00838	0.00198	3.10925	5.30	93.18	30.45	7.12	0.00033	0.00255	0.00116	5.440%	1.0029	5.25	0.26	-	-
Hourly Very Large Load (1,000-10,000 kW)	0.00838	0.00198	3.10925	5.30	496.99	31.07	7.06	0.00033	0.00140	0.00116	5.440%	1.0003	5.24	0.26	-	-
Hourly Extra Large Load (over 10,000 kW)	0.00838	0.00198	3.10925	397.50	1,205.52	67.83	5.01	0.00033	0.00140	0.00116	5.440%	1.0003	5.53	0.30	-	-
Hourly Railroad	0.00838	0.00198	3.10925	397.50	5,025.04	136.75	na	0.00033	0.00140	0.00116	5.440%	1.0003	3.50	na	-	-
High Voltage All	0.00838	0.00198	3.10925	na	493.36	40.01	4.16	0.00033	0.00140	0.00116	5.440%	1.0003	3.69	0.35	-	-
High Voltage up to 10MW (HV DFC & TC)				5.30						High Voltage DFC and TC up to 10 MW -->			0.24	2.89		
High Voltage over (HV DFC & TC)				397.50						High Voltage DFC and TC over 10 MW -->			0.16	0.90		
Dusk to Dawn: Non Alley Lighting	0.01221	na	na	5.30	na	0.00110	0.00576	0.00033	0.00658	0.00116	5.440%	1.0003	na	na	-	-
General Lighting	0.01221	na	na	5.30	na	0.00075	0.01302	0.00033	0.00658	0.00116	5.440%	1.0003	na	na	-	-

January 2018

	PJM Services Charges ($/kWh)	Misc Procurement Components Charge ($/kWh)	Monthly Capacity Charge ($/kW-Month)	Retail Customer Assessments (Rider RCA) ($/Month)	Customer Charge ($/Month)	Standard Metering Charge ($/Month) - Lighting ($/kWh)	Distribution Facilities Charge (Secondary) ($/kWh) or ($/kW)	Environmental Cost Recovery Adj (Rider ECR) ($/kWh)	Energy Efficiency Programs Rider EDA through May 2017 Rider EEPP eff. Oct 2017 ($/kWh)	Illinois Electricity Distribution Tax (IEDT) ($/kWh) 0.00119	Franchise Cost Addition (Rider FCA) 5.080%	IDUF Customer, Metering, DFC, IEDT	Primary Voltage Distribution Facilities Charge* ($/kW)	Primary Voltage Transformer Charge* ($/kW)	Renewable Portfolio Standard (Rider REA) ($/kWh)	Zero Emission Standard (Rider ZEA) ($/kWh)
	kWh	kWh	kW	Mo	Mo	Mo / kWh	kWh / kW	kWh	kWh	kWh			kW	kW	kWh	kWh
Residential																
Single Family Without Electric Space Heat	0.01351	na	na	0.57	11.20	5.04	0.03466	0.00048	0.00015	0.00121	5.080%	1.0150	na	na	0.00189	0.00195
Mult Family Without Electric Space Heat	0.01351	na	na	0.57	7.74	5.04	0.02768	0.00048	0.00015	0.00121	5.080%	1.0150	na	na	0.00189	0.00195
Single Family With Electric Space Heat	0.01351	na	na	0.57	13.12	5.04	0.01667	0.00048	0.00015	0.00121	5.080%	1.0150	na	na	0.00189	0.00195
Mult Family With Electric Space Heat	0.01351	na	na	0.57	8.51	5.04	0.01566	0.00048	0.00015	0.00121	5.080%	1.0150	na	na	0.00189	0.00195
Nonresidential																
Watthour Without Electric Space Heat	0.01340	na	na	5.30	13.50	6.50	0.01929	0.00048	0.00019	0.00119	5.080%	1.0029	na	na	0.00189	0.00195
Watthour With Electric Space Heat	0.01340	na	na	5.30	13.50	6.50	0.01929	0.00048	0.00019	0.00119	5.080%	1.0029	na	na	0.00189	0.00195
Small Load (0-100 kW) Without Electric Space Heat	0.01340	na	na	5.30	15.06	15.13	7.07	0.00048	0.00019	0.00119	5.080%	1.0029	3.14	0.24	0.00189	0.00195
Small Load (0-100 kW) With Electric Space Heat	0.01340	na	na	5.30	15.06	15.13	7.07	0.00048	0.00019	0.00119	5.080%	1.0029	3.14	0.24	0.00189	0.00195
Hourly Medium Load (100-400 kW)	0.00851	0.00109	4.69048	5.30	23.62	28.43	7.01	0.00048	0.00019	0.00119	5.080%	1.0029	3.90	0.23	0.00094	0.00195
Hourly Large Load (400-1,000 kW)	0.00851	0.00109	4.69048	5.30	106.70	29.90	7.12	0.00048	0.00019	0.00119	5.080%	1.0029	5.56	0.29	0.00094	0.00195
Hourly Very Large Load (1,000-10,000 kW)	0.00851	0.00109	4.69048	5.30	580.24	28.27	7.01	0.00048	0.00010	0.00119	5.080%	1.0009	5.67	0.30	0.00094	0.00195
Hourly Extra Large Load (over 10,000 kW)	0.00851	0.00109	4.69048	397.50	1,235.22	52.19	7.45	0.00048	0.00010	0.00119	5.080%	1.0009	7.01	0.37	0.00094	0.00195
Hourly Railroad	0.00851	0.00109	4.69048	397.50	5,151.68	120.03	na	0.00048	0.00010	0.00119	5.080%	1.0009	2.79	na	0.00094	0.00195
High Voltage All	0.00851	0.00109	4.69048	na	467.45	42.79	8.44	0.00048	0.00010	0.00119	5.080%	1.0009	4.71	0.44	0.00094	0.00195
High Voltage up to 10MW (HV DFC & TC)				5.30						High Voltage DFC and TC up to 10 MW -->			0.34	1.96		
High Voltage over 10MW (HV DFC & TC)				397.50						High Voltage DFC and TC over 10 MW -->			0.19	1.08		
Dusk to Dawn: Alley/Non Alley Lighting Weighted	0.01303	na	na	5.30	na	0.00094	0.00579	0.00048	0.00019	0.00119	5.080%	1.0009	na	na	0.00094	0.00195
General Lighting	0.01303	na	na	5.30	na	0.00085	0.01441	0.00048	0.00019	0.00119	5.080%	1.0009	na	na	0.00094	0.00195

NOTES

Residential

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Nonresidential

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a nonresidential customer per Rider RCA Sheets Nos. 256 through No. 257.4.
(4) Billed at a per kWh distribution facilities charge.
(5) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(6) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(7) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(8) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(9) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(10) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(11) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(12) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(13) Bill calculations do not include tax additions specified in the Company's Rider TAX.

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a) Change from January 2017 to January 2018 for Typical Customer

Customer Class or Type		Monthly		Annual	Percent
Single Family Residential Without Electric Space Heat	$	7.30	$	87.64	7.82%
Multi Family Residential Without Electric Space Heat	$	3.52	$	42.24	7.57%
Single Family Residential With Electric Space Heat	$	14.54	$	174.43	9.30%
Multi Family Residential With Electric Space Heat	$	6.30	$	75.62	7.80%
Nonresidential Watthour	$	6.02	$	72.18	11.30%
Nonresidential Small Load (0-100 kW)	$	32.75	$	393.00	8.63%

b) Change from January 2017 to January 2018 at Percentile *(low/median/high usage)*

Customer Class or Type	Percentile		Monthly		Annual	Percent
Single Family Residential Without Electric Space Heat ***(low usage)***	25%	$	4.78	$	57.34	7.56%
Single Family Residential Without Electric Space Heat ***(median usage)***	50%	$	6.48	$	77.72	7.75%
Single Family Residential Without Electric Space Heat ***(high usage)***	75%	$	8.72	$	104.60	7.91%
Multi Family Residential Without Electric Space Heat ***(low usage)***	25%	$	2.12	$	25.47	6.80%
Multi Family Residential Without Electric Space Heat ***(median usage)***	50%	$	3.04	$	36.47	7.36%
Multi Family Residential Without Electric Space Heat ***(high usage)***	75%	$	4.30	$	51.61	7.80%
Single Family Residential With Electric Space Heat ***(low usage)***	25%	$	9.24	$	110.86	9.06%
Single Family Residential With Electric Space Heat ***(median usage)***	50%	$	13.33	$	159.95	9.27%
Single Family Residential With Electric Space Heat ***(high usage)***	75%	$	17.76	$	213.15	9.39%
Multi Family Residential With Electric Space Heat ***(low usage)***	25%	$	3.94	$	47.33	7.48%
Multi Family Residential With Electric Space Heat ***(median usage)***	50%	$	5.66	$	67.89	7.74%
Multi Family Residential With Electric Space Heat ***(high usage)***	75%	$	7.76	$	93.10	7.91%
Nonresidential Watthour ***(low usage)***	25%	$	4.86	$	58.36	15.28%
Nonresidential Watthour ***(median usage)***	50%	$	5.70	$	68.38	12.08%
Nonresidential Watthour ***(high usage)***	75%	$	6.74	$	80.89	10.13%
Nonresidential Small Load (0-100 kW) ***(low usage)***	25%	$	9.91	$	118.93	9.50%
Nonresidential Small Load (0-100 kW) ***(median usage)***	50%	$	17.42	$	209.03	8.86%
Nonresidential Small Load (0-100 kW) ***(high usage)***	75%	$	36.74	$	440.92	8.54%

a)Percent Change from January 2017 to January 2018 for Typical Customer

Tab Name	*Customer Class or Type*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
a) TYP BES sf nospht	Single Family Residential Without Electric Space Heat	8.13%	8.00%	7.96%	7.88%	7.89%	7.47%	7.58%	7.59%	7.47%	8.06%	7.94%	8.05%	7.82%
a) TYP BES mf nospht	Multi Family Residential Without Electric Space Heat	7.92%	7.77%	7.60%	7.47%	7.44%	7.27%	7.47%	7.48%	7.26%	7.89%	7.52%	7.72%	7.57%
a) TYP BES wspht	Single Family Residential With Electric Space Heat	9.65%	9.60%	9.54%	9.45%	9.32%	8.58%	8.59%	8.59%	8.50%	9.21%	9.40%	9.57%	9.30%
a) TYP BES mf wspht	Multi Family Residential With Electric Space Heat	8.25%	8.18%	8.06%	7.97%	7.72%	6.99%	7.06%	7.06%	6.97%	7.66%	7.80%	8.10%	7.80%
a) TYP Watthr	Nonresidential Watthour	10.78%	11.22%	11.61%	11.74%	12.03%	11.00%	10.70%	10.73%	11.08%	11.79%	11.86%	11.28%	11.30%
a) TYP Small	Nonresidential Small Load (0-100 kW)	9.06%	9.04%	9.03%	9.02%	8.98%	7.91%	7.90%	7.90%	7.92%	8.93%	8.99%	9.06%	8.63%

b) Percent Change from January 2017 to January 2018 at Percentile

Tab Name	*Customer Class or Type*	*Percentile*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
b) SFnoSPHT 25%	Single Family Residential Without Electric Space Heat	25%	7.87%	7.71%	7.64%	7.61%	7.55%	7.24%	7.37%	7.39%	7.20%	7.80%	7.60%	7.76%	7.56%
b) SFnoSPHT 50%	Single Family Residential Without Electric Space Heat	50%	8.05%	7.95%	7.86%	7.81%	7.79%	7.39%	7.53%	7.54%	7.41%	8.02%	7.87%	7.95%	7.75%
b) SFnoSPHT 75%	Single Family Residential Without Electric Space Heat	75%	8.21%	8.10%	8.07%	8.01%	7.99%	7.55%	7.65%	7.63%	7.55%	8.16%	8.04%	8.15%	7.91%
b) MFnoSPHT 25%	Multi Family Residential Without Electric Space Heat	25%	7.12%	6.93%	6.76%	6.64%	6.61%	6.55%	6.70%	6.79%	6.60%	7.01%	6.80%	6.99%	6.80%
b) MFnoSPHT 50%	Multi Family Residential Without Electric Space Heat	50%	7.71%	7.46%	7.32%	7.30%	7.18%	6.99%	7.31%	7.38%	7.17%	7.68%	7.31%	7.46%	7.36%
b) MFnoSPHT 75%	Multi Family Residential Without Electric Space Heat	75%	8.13%	7.93%	7.83%	7.70%	7.68%	7.43%	7.73%	7.74%	7.54%	8.17%	7.72%	7.93%	7.80%
b) SFSPHT 25%	Single Family Residential With Electric Space Heat	25%	9.53%	9.42%	9.29%	9.19%	9.02%	8.42%	8.47%	8.44%	8.33%	9.00%	9.10%	9.35%	9.06%
b) SFSPHT 50%	Single Family Residential With Electric Space Heat	50%	9.65%	9.57%	9.51%	9.43%	9.25%	8.50%	8.54%	8.54%	8.46%	9.12%	9.32%	9.55%	9.27%
b) SFSPHT 75%	Single Family Residential With Electric Space Heat	75%	9.71%	9.66%	9.60%	9.54%	9.41%	8.63%	8.63%	8.63%	8.56%	9.26%	9.46%	9.63%	9.39%
b) MFSPHT 25%	Multi Family Residential With Electric Space Heat	25%	8.04%	7.94%	7.70%	7.58%	7.28%	6.73%	6.83%	6.87%	6.74%	7.30%	7.43%	7.80%	7.48%
b) MFSPHT 50%	Multi Family Residential With Electric Space Heat	50%	8.21%	8.12%	7.99%	7.90%	7.64%	6.97%	7.00%	7.04%	6.98%	7.59%	7.73%	8.04%	7.74%
b) MFSPHT 75%	Multi Family Residential With Electric Space Heat	75%	8.31%	8.25%	8.16%	8.08%	7.89%	7.12%	7.15%	7.13%	7.05%	7.76%	7.95%	8.20%	7.91%
b) Watthr 25%	Nonresidential Watthour	25%	14.26%	14.87%	15.27%	15.50%	15.89%	15.45%	15.43%	15.39%	15.44%	15.71%	15.57%	14.83%	15.28%
b) Watthr 50%	Nonresidential Watthour	50%	11.30%	11.83%	12.21%	12.46%	12.74%	11.89%	11.66%	11.74%	12.09%	12.70%	12.64%	11.95%	12.08%
b) Watthr 75%	Nonresidential Watthour	75%	9.55%	10.02%	10.34%	10.60%	10.89%	9.78%	9.53%	9.58%	9.86%	10.75%	10.73%	10.19%	10.13%
b) Small 25%	Nonresidential Small Load (0-100 kW)	25%	9.70%	9.74%	9.80%	9.84%	9.79%	9.05%	8.95%	8.93%	9.05%	9.61%	9.80%	9.79%	9.50%
b) Small 50%	Nonresidential Small Load (0-100 kW)	50%	9.18%	9.20%	9.20%	9.20%	9.16%	8.25%	8.21%	8.23%	8.28%	9.09%	9.18%	9.23%	8.86%
b) Small 75%	Nonresidential Small Load (0-100 kW)	75%	8.97%	8.95%	8.93%	8.91%	8.87%	7.83%	7.81%	7.82%	7.83%	8.84%	8.89%	8.97%	8.54%

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a) Dollar Increase/(Decrease) from January 2017 to January 2018 for Typical Customer

Tab Name	*Customer Class or Type*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
a) TYP BES sf nospht	Single Family Residential Without Electric Space Heat	$ 8.81	$ 7.13	$ 6.38	$ 5.99	$ 5.80	$ 7.04	$ 9.03	$ 8.94	$ 7.06	$ 7.80	$ 6.21	$ 7.44	$ 87.64
a) TYP BES mf nospht	Multi Family Residential Without Electric Space Heat	$ 4.10	$ 3.53	$ 3.14	$ 2.99	$ 2.86	$ 3.28	$ 4.17	$ 4.25	$ 3.50	$ 3.89	$ 3.03	$ 3.49	$ 42.24
a) TYP BES wspht	Single Family Residential With Electric Space Heat	$ 29.06	$ 22.44	$ 18.12	$ 14.59	$ 10.88	$ 9.10	$ 9.56	$ 9.29	$ 8.00	$ 9.14	$ 13.31	$ 20.94	$ 174.43
a) TYP BES mf wspht	Multi Family Residential With Electric Space Heat	$ 12.96	$ 10.27	$ 7.77	$ 6.71	$ 4.62	$ 3.84	$ 4.08	$ 4.09	$ 3.57	$ 4.09	$ 5.06	$ 8.56	$ 75.62
a) TYP Watthr	Nonresidential Watthour	$ 6.71	$ 6.38	$ 6.19	$ 6.06	$ 5.95	$ 5.60	$ 5.67	$ 5.67	$ 5.57	$ 6.03	$ 6.01	$ 6.34	$ 72.18
a) TYP Small	Nonresidential Small Load (0-100 kW)	$ 38.03	$ 34.58	$ 32.47	$ 31.69	$ 31.11	$ 30.19	$ 32.49	$ 32.34	$ 30.03	$ 34.68	$ 31.38	$ 34.01	$ 393.00

b) Dollar Increase/(Decrease) from January 2017 to January 2018 at Percentile

Tab Name	*Customer Class or Type*	*Percentile*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
b) SFnoSPHT 25%	Single Family Residential Without Electric Space Heat	25%	$ 5.73	$ 4.71	$ 4.25	$ 4.02	$ 3.82	$ 4.53	$ 5.85	$ 5.83	$ 4.49	$ 5.10	$ 4.09	$ 4.91	$ 57.34
b) SFnoSPHT 50%	Single Family Residential Without Electric Space Heat	50%	$ 7.66	$ 6.22	$ 5.58	$ 5.28	$ 5.10	$ 6.23	$ 8.20	$ 8.17	$ 6.31	$ 7.04	$ 5.46	$ 6.48	$ 77.72
b) SFnoSPHT 75%	Single Family Residential Without Electric Space Heat	75%	$ 10.42	$ 8.35	$ 7.49	$ 7.06	$ 6.84	$ 8.50	$ 11.06	$ 10.91	$ 8.56	$ 9.43	$ 7.27	$ 8.72	$ 104.60
b) MFnoSPHT 25%	Multi Family Residential Without Electric Space Heat	25%	$ 2.40	$ 2.12	$ 1.95	$ 1.88	$ 1.84	$ 2.00	$ 2.36	$ 2.42	$ 2.08	$ 2.30	$ 1.96	$ 2.19	$ 25.47
b) MFnoSPHT 50%	Multi Family Residential Without Electric Space Heat	50%	$ 3.45	$ 2.95	$ 2.67	$ 2.59	$ 2.48	$ 2.83	$ 3.65	$ 3.74	$ 3.07	$ 3.39	$ 2.66	$ 2.99	$ 36.47
b) MFnoSPHT 75%	Multi Family Residential Without Electric Space Heat	75%	$ 4.89	$ 4.16	$ 3.70	$ 3.52	$ 3.39	$ 4.01	$ 5.36	$ 5.48	$ 4.44	$ 4.89	$ 3.60	$ 4.16	$ 51.61
b) SFSPHT 25%	Single Family Residential With Electric Space Heat	25%	$ 17.56	$ 13.40	$ 10.57	$ 8.82	$ 6.91	$ 6.59	$ 7.43	$ 7.04	$ 6.00	$ 6.65	$ 7.81	$ 12.09	$ 110.86
b) SFSPHT 50%	Single Family Residential With Electric Space Heat	50%	$ 27.72	$ 21.19	$ 17.09	$ 13.67	$ 9.90	$ 8.14	$ 8.57	$ 8.29	$ 7.15	$ 7.99	$ 11.31	$ 18.92	$ 159.95
b) SFSPHT 75%	Single Family Residential With Electric Space Heat	75%	$ 38.51	$ 29.30	$ 22.88	$ 18.55	$ 12.91	$ 10.37	$ 10.45	$ 10.31	$ 8.89	$ 9.95	$ 15.11	$ 25.92	$ 213.15
b) MFSPHT 25%	Multi Family Residential With Electric Space Heat	25%	$ 7.70	$ 5.98	$ 4.49	$ 3.86	$ 2.85	$ 2.64	$ 2.95	$ 2.97	$ 2.60	$ 2.92	$ 3.25	$ 5.10	$ 47.33
b) MFSPHT 50%	Multi Family Residential With Electric Space Heat	50%	$ 11.42	$ 8.94	$ 6.83	$ 5.77	$ 4.10	$ 3.57	$ 3.88	$ 3.89	$ 3.39	$ 3.84	$ 4.61	$ 7.66	$ 67.89
b) MFSPHT 75%	Multi Family Residential With Electric Space Heat	75%	$ 16.13	$ 12.77	$ 9.74	$ 8.26	$ 5.68	$ 4.58	$ 4.91	$ 4.88	$ 4.21	$ 4.87	$ 6.25	$ 10.81	$ 93.10
b) Watthr 25%	Nonresidential Watthour	25%	$ 5.17	$ 5.02	$ 4.92	$ 4.88	$ 4.83	$ 4.69	$ 4.73	$ 4.68	$ 4.68	$ 4.86	$ 4.89	$ 5.01	$ 58.36
b) Watthr 50%	Nonresidential Watthour	50%	$ 6.30	$ 6.04	$ 5.86	$ 5.76	$ 5.63	$ 5.35	$ 5.37	$ 5.36	$ 5.32	$ 5.68	$ 5.71	$ 6.00	$ 68.38
b) Watthr 75%	Nonresidential Watthour	75%	$ 7.91	$ 7.40	$ 7.03	$ 6.81	$ 6.57	$ 6.09	$ 6.20	$ 6.21	$ 6.04	$ 6.71	$ 6.73	$ 7.19	$ 80.89
b) Small 25%	Nonresidential Small Load (0-100 kW)	25%	$ 11.44	$ 10.61	$ 9.98	$ 9.61	$ 9.29	$ 9.22	$ 9.79	$ 9.82	$ 9.21	$ 10.09	$ 9.58	$ 10.29	$ 118.93
b) Small 50%	Nonresidential Small Load (0-100 kW)	50%	$ 20.75	$ 18.96	$ 17.58	$ 16.99	$ 16.31	$ 15.88	$ 17.14	$ 17.16	$ 15.90	$ 17.71	$ 16.46	$ 18.19	$ 209.03
b) Small 75%	Nonresidential Small Load (0-100 kW)	75%	$ 43.20	$ 39.23	$ 36.59	$ 35.47	$ 34.45	$ 33.51	$ 36.28	$ 36.17	$ 33.37	$ 38.65	$ 35.18	$ 38.82	$ 440.92

Rate BES - Basic Electric Service
Residential Monthly Bil
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Single Family Without Electric Space Heat

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January 2017			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	873	689	604	564	541	752	994	982	755	761	586	720	8,823
		Charges													
Customer Charge (1)		10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1		0.03505	$ 30.61	$ 24.14	$ 21.18	$ 19.78	$ 18.96	$ 26.37	$ 34.84	$ 34.42	$ 26.48	$ 26.69	$ 20.54	$ 25.25	
PJM Services Charge (4)		0.01263	$ 11.03	$ 8.70	$ 7.63	$ 7.13	$ 6.83	$ 9.50	$ 12.55	$ 12.40	$ 9.54	$ 9.62	$ 7.40	$ 9.10	
Purchased Electricity Charge (5)	Summer	0.04846						$ 36.46	$ 48.16	$ 47.59	$ 36.61				
	Nonsummer	0.05055	$ 44.14	$ 34.81	$ 30.55	$ 28.53	$ 27.34					$ 38.49	$ 29.62	$ 36.42	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 0.29	$ 0.23	$ 0.20	$ 0.19	$ 0.18	$ 0.25	$ 0.33	$ 0.32	$ 0.25	$ 0.25	$ 0.19	$ 0.24	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 2.91	$ 2.29	$ 2.01	$ 1.88	$ 1.80	$ 2.51	$ 3.31	$ 3.27	$ 2.52	$ 2.54	$ 1.95	$ 2.40	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10		0.00117	$ 1.02	$ 0.81	$ 0.71	$ 0.66	$ 0.63	$ 0.88	$ 1.16	$ 1.15	$ 0.88	$ 0.89	$ 0.69	$ 0.84	
Franchise Cost Addition (11)		5.440%	$ 2.56	$ 2.19	$ 2.03	$ 1.95	$ 1.90	$ 2.32	$ 2.79	$ 2.77	$ 2.32	$ 2.33	$ 1.99	$ 2.25	
Total Annual Charges (12)			$ 108.47	$ 89.08	$ 80.22	$ 76.03	$ 73.55	$ 94.20	$ 119.05	$ 117.83	$ 94.51	$ 96.72	$ 78.29	$ 92.41	$1,120.36
														$/kWh	$0.1270

January 2018			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	873	689	604	564	541	752	994	982	755	761	586	720	8,823
		Charges													
Customer Charge (2)		11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2		0.03466	$ 30.27	$ 23.87	$ 20.95	$ 19.56	$ 18.75	$ 26.08	$ 34.45	$ 34.04	$ 26.19	$ 26.39	$ 20.31	$ 24.97	
PJM Services Charge (4)		0.01351	$ 11.80	$ 9.30	$ 8.16	$ 7.62	$ 7.31	$ 10.17	$ 13.43	$ 13.27	$ 10.21	$ 10.29	$ 7.92	$ 9.73	
Purchased Electricity Charge (5)	Summer	0.05544						$ 41.71	$ 55.10	$ 54.45	$ 41.88				
	Nonsummer	0.05844	$ 51.03	$ 40.24	$ 35.32	$ 32.98	$ 31.61					$ 44.50	$ 34.24	$ 42.11	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 0.42	$ 0.33	$ 0.29	$ 0.27	$ 0.26	$ 0.36	$ 0.48	$ 0.47	$ 0.36	$ 0.37	$ 0.28	$ 0.35	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.13	$ 0.10	$ 0.09	$ 0.08	$ 0.08	$ 0.11	$ 0.15	$ 0.15	$ 0.11	$ 0.11	$ 0.09	$ 0.11	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 1.65	$ 1.30	$ 1.14	$ 1.07	$ 1.02	$ 1.42	$ 1.88	$ 1.86	$ 1.43	$ 1.44	$ 1.11	$ 1.36	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 1.70	$ 1.34	$ 1.18	$ 1.10	$ 1.05	$ 1.47	$ 1.94	$ 1.92	$ 1.47	$ 1.48	$ 1.14	$ 1.40	
Illinois Electricity Distribution Tax (IEDT) (10		0.00121	$ 1.06	$ 0.83	$ 0.73	$ 0.68	$ 0.65	$ 0.91	$ 1.20	$ 1.19	$ 0.91	$ 0.92	$ 0.71	$ 0.87	
Franchise Cost Addition (11)		5.080%	$ 2.42	$ 2.08	$ 1.93	$ 1.85	$ 1.81	$ 2.20	$ 2.64	$ 2.61	$ 2.20	$ 2.21	$ 1.89	$ 2.14	
Total Annual Charges (12)			$ 117.29	$ 96.20	$ 86.60	$ 82.02	$ 79.35	$ 101.24	$ 128.08	$ 126.77	$ 101.57	$ 104.52	$ 84.50	$ 99.85	$1,208.01
														$/kWh	$0.1369
		Percent Change	8.1%	8.0%	8.0%	7.9%	7.9%	7.5%	7.6%	7.6%	7.5%	8.1%	7.9%	8.0%	7.8%
		Dollar Change	$ 8.81	$ 7.13	$ 6.38	$ 5.99	$ 5.80	$ 7.04	$ 9.03	$ 8.94	$ 7.06	$ 7.80	$ 6.21	$ 7.44	$ 87.64

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Multi Family Without Electric Space Heat

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January 2017

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	**392**	**328**	**285**	**272**	**256**	**331**	**443**	**453**	**364**	**367**	**275**	**325**	4,092
		Charges													
Customer Charge (1)		7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)		0.02798	$ 10.96	$ 9.17	$ 7.98	$ 7.60	$ 7.16	$ 9.27	$ 12.40	$ 12.68	$ 10.20	$ 10.28	$ 7.69	$ 9.10	
PJM Services Charge (4)		0.01263	$ 4.95	$ 4.14	$ 3.60	$ 3.43	$ 3.23	$ 4.19	$ 5.60	$ 5.72	$ 4.60	$ 4.64	$ 3.47	$ 4.11	
Purchased Electricity Charge (5)	Summer	0.04846						$ 16.06	$ 21.48	$ 21.96	$ 17.66				
	Nonsummer	0.05055	$ 19.79	$ 16.57	$ 14.42	$ 13.74	$ 12.94					$ 18.57	$ 13.89	$ 16.44	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 0.13	$ 0.11	$ 0.09	$ 0.09	$ 0.08	$ 0.11	$ 0.15	$ 0.15	$ 0.12	$ 0.12	$ 0.09	$ 0.11	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 1.30	$ 1.09	$ 0.95	$ 0.91	$ 0.85	$ 1.10	$ 1.48	$ 1.51	$ 1.21	$ 1.22	$ 0.92	$ 1.08	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)		0.00117	$ 0.46	$ 0.38	$ 0.33	$ 0.32	$ 0.30	$ 0.39	$ 0.52	$ 0.53	$ 0.43	$ 0.43	$ 0.32	$ 0.38	
Franchise Cost Addition (11)		5.440%	$ 1.29	$ 1.19	$ 1.12	$ 1.10	$ 1.07	$ 1.19	$ 1.37	$ 1.39	$ 1.25	$ 1.25	$ 1.10	$ 1.18	
Total Annual Charges (12)			$ 51.71	$ 45.48	$ 41.32	$ 40.02	$ 38.46	$ 45.14	$ 55.83	$ 56.77	$ 48.30	$ 49.34	$ 40.31	$ 45.23	$557.91
														$/kWh	$0.1363

January 2018

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	**392**	**328**	**285**	**272**	**256**	**331**	**443**	**453**	**364**	**367**	**275**	**325**	4,092
		Charges													
Customer Charge (2)		7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)		0.02768	$ 10.84	$ 9.08	$ 7.90	$ 7.52	$ 7.08	$ 9.18	$ 12.27	$ 12.54	$ 10.09	$ 10.17	$ 7.61	$ 9.00	
PJM Services Charge (4)		0.01351	$ 5.29	$ 4.43	$ 3.85	$ 3.67	$ 3.46	$ 4.48	$ 5.99	$ 6.12	$ 4.92	$ 4.96	$ 3.71	$ 4.39	
Purchased Electricity Charge (5)	Summer	0.05544						$ 18.38	$ 24.57	$ 25.12	$ 20.20				
	Nonsummer	0.05844	$ 22.88	$ 19.16	$ 16.67	$ 15.88	$ 14.96					$ 21.47	$ 16.06	$ 19.01	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 0.19	$ 0.16	$ 0.14	$ 0.13	$ 0.12	$ 0.16	$ 0.21	$ 0.22	$ 0.17	$ 0.18	$ 0.13	$ 0.16	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.06	$ 0.05	$ 0.04	$ 0.04	$ 0.04	$ 0.05	$ 0.07	$ 0.07	$ 0.05	$ 0.06	$ 0.04	$ 0.05	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 0.74	$ 0.62	$ 0.54	$ 0.51	$ 0.48	$ 0.63	$ 0.84	$ 0.86	$ 0.69	$ 0.69	$ 0.52	$ 0.61	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 0.76	$ 0.64	$ 0.56	$ 0.53	$ 0.50	$ 0.65	$ 0.86	$ 0.88	$ 0.71	$ 0.72	$ 0.54	$ 0.63	
Illinois Electricity Distribution Tax (IEDT) (10)		0.00121	$ 0.47	$ 0.40	$ 0.35	$ 0.33	$ 0.31	$ 0.40	$ 0.54	$ 0.55	$ 0.44	$ 0.44	$ 0.33	$ 0.39	
Franchise Cost Addition (11)		5.080%	$ 1.22	$ 1.13	$ 1.07	$ 1.05	$ 1.02	$ 1.14	$ 1.30	$ 1.31	$ 1.18	$ 1.19	$ 1.05	$ 1.13	
Total Annual Charges (12)			$ 55.80	$ 49.02	$ 44.47	$ 43.01	$ 41.32	$ 48.42	$ 60.00	$ 61.02	$ 51.80	$ 53.23	$ 43.34	$ 48.72	$600.15
														$/kWh	$0.1467
	Percent Change		7.9%	7.8%	7.6%	7.5%	7.4%	7.3%	7.5%	7.5%	7.3%	7.9%	7.5%	7.7%	7.6%
	Dollar Change		$ 4.10	$ 3.53	$ 3.14	$ 2.99	$ 2.86	$ 3.28	$ 4.17	$ 4.25	$ 3.50	$ 3.89	$ 3.03	$ 3.49	$ 42.24

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Single Family With Electric Space Heat

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January 2017

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	**3,261**	**2,485**	**1,980**	**1,569**	**1,134**	**1,036**	**1,099**	**1,061**	**894**	**931**	**1,420**	**2,311**	19,181
		Charges													
Customer Charge (1)		12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)		0.01762	$ 57.45	$ 43.79	$ 34.88	$ 27.65	$ 19.98	$ 18.26	$ 19.36	$ 18.69	$ 15.74	$ 16.40	$ 25.03	$ 40.72	
PJM Services Charge (4)		0.01263	$ 41.18	$ 31.39	$ 25.00	$ 19.82	$ 14.32	$ 13.09	$ 13.88	$ 13.40	$ 11.29	$ 11.76	$ 17.94	$ 29.19	
Purchased Electricity Charge (5)	Summer	0.04846						$ 50.23	$ 53.24	$ 51.42	$ 43.30				
	Nonsummer	0.05055	$ 164.83	$ 125.64	$ 100.07	$ 79.32	$ 57.33					$ 47.06	$ 71.80	$ 116.83	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 1.08	$ 0.82	$ 0.65	$ 0.52	$ 0.37	$ 0.34	$ 0.36	$ 0.35	$ 0.29	$ 0.31	$ 0.47	$ 0.76	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 10.86	$ 8.28	$ 6.59	$ 5.23	$ 3.78	$ 3.45	$ 3.66	$ 3.53	$ 2.98	$ 3.10	$ 4.73	$ 7.70	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)		0.00117	$ 3.81	$ 2.91	$ 2.32	$ 1.84	$ 1.33	$ 1.21	$ 1.29	$ 1.24	$ 1.05	$ 1.09	$ 1.66	$ 2.70	
Franchise Cost Addition (11)		5.440%	$ 4.26	$ 3.46	$ 2.95	$ 2.53	$ 2.08	$ 1.98	$ 2.05	$ 2.01	$ 1.84	$ 1.88	$ 2.38	$ 3.29	
Total Annual Charges (12)			$ 301.03	$ 233.85	$ 190.02	$ 154.47	$ 116.75	$ 106.12	$ 111.40	$ 108.20	$ 94.05	$ 99.16	$ 141.57	$ 218.75	$1,875.36
														$/kWh	$0.0978

January 2018

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	**3,261**	**2,485**	**1,980**	**1,569**	**1,134**	**1,036**	**1,099**	**1,061**	**894**	**931**	**1,420**	**2,311**	19,181
		Charges													
Customer Charge (2)		13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)		0.01667	$ 54.36	$ 41.43	$ 33.00	$ 26.16	$ 18.91	$ 17.28	$ 18.32	$ 17.69	$ 14.90	$ 15.52	$ 23.68	$ 38.53	
PJM Services Charge (4)		0.01351	$ 44.05	$ 33.58	$ 26.75	$ 21.20	$ 15.32	$ 14.00	$ 14.84	$ 14.33	$ 12.07	$ 12.58	$ 19.19	$ 31.22	
Purchased Electricity Charge (5)	Summer	0.05544						$ 57.46	$ 60.91	$ 58.82	$ 49.54				
	Nonsummer	0.05844	$ 190.55	$ 145.25	$ 115.69	$ 91.70	$ 66.28					$ 54.40	$ 83.01	$ 135.06	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 1.57	$ 1.19	$ 0.95	$ 0.75	$ 0.54	$ 0.50	$ 0.53	$ 0.51	$ 0.43	$ 0.45	$ 0.68	$ 1.11	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.49	$ 0.37	$ 0.30	$ 0.24	$ 0.17	$ 0.16	$ 0.16	$ 0.16	$ 0.13	$ 0.14	$ 0.21	$ 0.35	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 6.16	$ 4.70	$ 3.74	$ 2.97	$ 2.14	$ 1.96	$ 2.08	$ 2.01	$ 1.69	$ 1.76	$ 2.68	$ 4.37	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 6.36	$ 4.85	$ 3.86	$ 3.06	$ 2.21	$ 2.02	$ 2.14	$ 2.07	$ 1.74	$ 1.82	$ 2.77	$ 4.51	
Illinois Electricity Distribution Tax (IEDT) (10)		0.00121	$ 3.95	$ 3.01	$ 2.40	$ 1.90	$ 1.37	$ 1.25	$ 1.33	$ 1.28	$ 1.08	$ 1.13	$ 1.72	$ 2.80	
Franchise Cost Addition (11)		5.080%	$ 3.88	$ 3.18	$ 2.72	$ 2.35	$ 1.95	$ 1.86	$ 1.92	$ 1.89	$ 1.73	$ 1.77	$ 2.21	$ 3.02	
Total Annual Charges (12)			$ 330.10	$ 256.29	$ 208.14	$ 169.06	$ 127.62	$ 115.22	$ 120.96	$ 117.49	$ 102.04	$ 108.30	$ 154.88	$ 239.70	$2,049.79
														$/kWh	$0.1069
	Percent Change		9.7%	9.6%	9.5%	9.4%	9.3%	8.6%	8.6%	8.6%	8.5%	9.2%	9.4%	9.6%	9.3%
	Dollar Change		$ 29.06	$ 22.44	$ 18.12	$ 14.59	$ 10.88	$ 9.10	$ 9.56	$ 9.29	$ 8.00	$ 9.14	$ 13.31	$ 20.94	$ 174.43

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Multi Family With Electric Space Heat

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January 2017			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	1,648	1,285	949	809	528	483	516	518	438	453	586	1,057	9,270
		Charges													
Customer Charge (1)		8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)		0.01768	$ 29.14	$ 22.71	$ 16.79	$ 14.30	$ 9.34	$ 8.53	$ 9.12	$ 9.16	$ 7.75	$ 8.00	$ 10.35	$ 18.69	
PJM Services Charge (4)		0.01263	$ 20.82	$ 16.23	$ 11.99	$ 10.21	$ 6.67	$ 6.10	$ 6.52	$ 6.55	$ 5.53	$ 5.72	$ 7.40	$ 13.35	
Purchased Electricity Charge (5)	Summer	0.04846						$ 23.39	$ 25.00	$ 25.11	$ 21.23				
	Nonsummer	0.05055	$ 83.33	$ 64.94	$ 48.00	$ 40.88	$ 26.70					$ 22.89	$ 29.61	$ 53.43	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 0.54	$ 0.42	$ 0.31	$ 0.27	$ 0.17	$ 0.16	$ 0.17	$ 0.17	$ 0.14	$ 0.15	$ 0.19	$ 0.35	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 5.49	$ 4.28	$ 3.16	$ 2.69	$ 1.76	$ 1.61	$ 1.72	$ 1.73	$ 1.46	$ 1.51	$ 1.95	$ 3.52	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)		0.00117	$ 1.93	$ 1.50	$ 1.11	$ 0.95	$ 0.62	$ 0.56	$ 0.60	$ 0.61	$ 0.51	$ 0.53	$ 0.69	$ 1.24	
Franchise Cost Addition (11)		5.440%	$ 2.39	$ 2.02	$ 1.67	$ 1.53	$ 1.24	$ 1.19	$ 1.23	$ 1.23	$ 1.15	$ 1.16	$ 1.30	$ 1.78	
Total Annual Charges (12)			$ 157.04	$ 125.50	$ 96.43	$ 84.23	$ 59.90	$ 54.94	$ 57.76	$ 57.96	$ 51.17	$ 53.36	$ 64.89	$ 105.76	$968.94
														$/kWh	$0.1045

January 2018			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	1,648	1,285	949	809	528	483	516	518	438	453	586	1,057	9,270
		Charges													
Customer Charge (2)		8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)		0.01566	$ 25.81	$ 20.12	$ 14.87	$ 12.66	$ 8.27	$ 7.56	$ 8.08	$ 8.12	$ 6.86	$ 7.09	$ 9.17	$ 16.55	
PJM Services Charge (4)		0.01351	$ 22.27	$ 17.36	$ 12.83	$ 10.92	$ 7.13	$ 6.52	$ 6.97	$ 7.00	$ 5.92	$ 6.12	$ 7.91	$ 14.28	
Purchased Electricity Charge (5)	Summer	0.05544						$ 26.75	$ 28.60	$ 28.73	$ 24.29				
	Nonsummer	0.05844	$ 96.33	$ 75.08	$ 55.49	$ 47.26	$ 30.86					$ 26.46	$ 34.23	$ 61.77	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 0.79	$ 0.62	$ 0.46	$ 0.39	$ 0.25	$ 0.23	$ 0.25	$ 0.25	$ 0.21	$ 0.22	$ 0.28	$ 0.51	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.25	$ 0.19	$ 0.14	$ 0.12	$ 0.08	$ 0.07	$ 0.08	$ 0.08	$ 0.07	$ 0.07	$ 0.09	$ 0.16	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 3.12	$ 2.43	$ 1.79	$ 1.53	$ 1.00	$ 0.91	$ 0.98	$ 0.98	$ 0.83	$ 0.86	$ 1.11	$ 2.00	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 3.21	$ 2.51	$ 1.85	$ 1.58	$ 1.03	$ 0.94	$ 1.01	$ 1.01	$ 0.85	$ 0.88	$ 1.14	$ 2.06	
Illinois Electricity Distribution Tax (IEDT) (10)		0.00121	$ 1.99	$ 1.55	$ 1.15	$ 0.98	$ 0.64	$ 0.58	$ 0.62	$ 0.63	$ 0.53	$ 0.55	$ 0.71	$ 1.28	
Franchise Cost Addition (11)		5.080%	$ 2.10	$ 1.79	$ 1.50	$ 1.38	$ 1.14	$ 1.10	$ 1.13	$ 1.13	$ 1.06	$ 1.08	$ 1.19	$ 1.59	
Total Annual Charges (12)			$ 169.99	$ 135.77	$ 104.20	$ 90.94	$ 64.52	$ 58.78	$ 61.84	$ 62.05	$ 54.74	$ 57.45	$ 69.95	$ 114.32	$1,044.56
														$/kWh	$0.1127
	Percent Change		8.3%	8.2%	8.1%	8.0%	7.7%	7.0%	7.1%	7.1%	7.0%	7.7%	7.8%	8.1%	7.8%
	Dollar Change		$ 12.96	$ 10.27	$ 7.77	$ 6.71	$ 4.62	$ 3.84	$ 4.08	$ 4.09	$ 3.57	$ 4.09	$ 5.06	$ 8.56	$ 75.62

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Nonresidential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY

BILL COMPARISONS - EIMA

Watthour Delivery Class Without Electric Space Heat

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			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW (3)	*	*	*	*	*	*	*	*	*	*	*	*	
January 2017		kWh	434	376	338	320	296	317	340	339	310	314	309	369	4,062
		Charges													
Customer Charge (1)		11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (1)		4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	
Distribution Facilities Charge (4)		0.01993	$ 8.65	$ 7.49	$ 6.73	$ 6.37	$ 5.90	$ 6.32	$ 6.78	$ 6.75	$ 6.18	$ 6.27	$ 6.16	$ 7.35	
PJM Services Charge (5)		0.01244	$ 5.40	$ 4.68	$ 4.20	$ 3.97	$ 3.68	$ 3.95	$ 4.23	$ 4.21	$ 3.86	$ 3.91	$ 3.84	$ 4.59	
Purchased Electricity Charge (6)	Summer	0.04960						$ 15.73	$ 16.88	$ 16.80	$ 15.38				
	Nonsummer	0.05124	$ 22.23	$ 19.26	$ 17.31	$ 16.37	$ 15.18					$ 16.11	$ 15.84	$ 18.90	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00033	$ 0.14	$ 0.12	$ 0.11	$ 0.11	$ 0.10	$ 0.10	$ 0.11	$ 0.11	$ 0.10	$ 0.10	$ 0.10	$ 0.12	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00658	$ 2.85	$ 2.47	$ 2.22	$ 2.10	$ 1.95	$ 2.09	$ 2.24	$ 2.23	$ 2.04	$ 2.07	$ 2.03	$ 2.43	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00116	$ 0.50	$ 0.44	$ 0.39	$ 0.37	$ 0.34	$ 0.37	$ 0.39	$ 0.39	$ 0.36	$ 0.36	$ 0.36	$ 0.43	
Franchise Cost Addition (12)		5.440%	$ 1.36	$ 1.29	$ 1.25	$ 1.23	$ 1.20	$ 1.22	$ 1.25	$ 1.25	$ 1.22	$ 1.22	$ 1.22	$ 1.28	
Total Annual Charges (13)			$ 62.25	$ 56.87	$ 53.33	$ 51.64	$ 49.47	$ 50.90	$ 53.00	$ 52.86	$ 50.26	$ 51.16	$ 50.67	$ 56.22	$ 639
														$/kWh	0.1572

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
January 2018		kW (3)	*	*	*	*	*	*	*	*	*	*	*	*	
		kWh	434	376	338	320	296	317	340	339	310	314	309	369	4,062
		Charges													
Customer Charge (2)		13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (2)		6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	
Distribution Facilities Charge (4)		0.01929	$ 8.37	$ 7.25	$ 6.52	$ 6.16	$ 5.71	$ 6.12	$ 6.56	$ 6.53	$ 5.98	$ 6.06	$ 5.96	$ 7.11	
PJM Services Charge (5)		0.01340	$ 5.81	$ 5.04	$ 4.53	$ 4.28	$ 3.97	$ 4.25	$ 4.56	$ 4.54	$ 4.16	$ 4.21	$ 4.14	$ 4.94	
Purchased Electricity Charge (6)	Summer	0.05572						$ 17.67	$ 18.96	$ 18.87	$ 17.28				
	Nonsummer	0.05884	$ 25.53	$ 22.11	$ 19.88	$ 18.80	$ 17.43					$ 18.50	$ 18.18	$ 21.70	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00048	$ 0.21	$ 0.18	$ 0.16	$ 0.15	$ 0.14	$ 0.15	$ 0.16	$ 0.16	$ 0.15	$ 0.15	$ 0.15	$ 0.18	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00019	$ 0.08	$ 0.07	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.07	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00189	$ 0.82	$ 0.71	$ 0.64	$ 0.60	$ 0.56	$ 0.60	$ 0.64	$ 0.64	$ 0.59	$ 0.59	$ 0.58	$ 0.70	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00195	$ 0.85	$ 0.73	$ 0.66	$ 0.62	$ 0.58	$ 0.62	$ 0.66	$ 0.66	$ 0.60	$ 0.61	$ 0.60	$ 0.72	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00119	$ 0.52	$ 0.45	$ 0.40	$ 0.38	$ 0.35	$ 0.38	$ 0.40	$ 0.40	$ 0.37	$ 0.37	$ 0.37	$ 0.44	
Franchise Cost Addition (12)		5.080%	$ 1.47	$ 1.41	$ 1.37	$ 1.35	$ 1.32	$ 1.35	$ 1.37	$ 1.37	$ 1.34	$ 1.34	$ 1.34	$ 1.40	
Total Annual Charges (13)			$ 68.96	$ 63.25	$ 59.52	$ 57.70	$ 55.42	$ 56.50	$ 58.67	$ 58.53	$ 55.83	$ 57.19	$ 56.68	$ 62.56	$ 711
														$/kWh	0.1750
		Percent Change	10.8%	11.2%	11.6%	11.7%	12.0%	11.0%	10.7%	10.7%	11.1%	11.8%	11.9%	11.3%	11.3%
		Dollar Change	$ 6.71	$ 6.38	$ 6.19	$ 6.06	$ 5.95	$ 5.60	$ 5.67	$ 5.67	$ 5.57	$ 6.03	$ 6.01	$ 6.34	$ 72.18

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a nonresidential customer per Rider RCA Sheets Nos. 256 through No. 257.4.
(4) Billed at a per kWh distribution facilities charge.
(5) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(6) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(7) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(8) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(9) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(10) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(11) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(12) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(13) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Nonresidential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY

BILL COMPARISONS - EIMA

Small Load Delivery Class Without Electric Space Heat

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			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW - Secondary	12	11	11	11	11	13	13	13	12	13	11	11	
		kW - Primary	0	0	0	0	0	0	0	0	0	0	0	0	
		kW - Primary w/ Tr	0	0	0	0	0	0	0	0	0	0	0	0	
January 2017		**kWh**	4,265	3,780	3,475	3,364	3,256	3,714	4,085	4,075	3,704	3,687	3,304	3,726	44,436
		Charges													
Customer Charge (1)		12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (1)		13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	
Secondary Voltage Distribution Facilities Charge (1		6.65	$ 76.92	$ 74.67	$ 73.48	$ 73.44	$ 75.84	$ 84.61	$ 88.07	$ 86.89	$ 82.85	$ 86.20	$ 75.19	$ 71.43	
Primary Voltage Distribution Facilities Charge (1		2.53	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Primary Voltage Transformer Charge (1		0.64	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
PJM Services Charge (5)		0.01244	$ 53.06	$ 47.03	$ 43.23	$ 41.84	$ 40.50	$ 46.21	$ 50.81	$ 50.70	$ 46.08	$ 45.87	$ 41.10	$ 46.35	
Purchased Electricity Charge (6)	Summer	0.04933						$ 183.23	$ 201.50	$ 201.04	$ 182.72				
	Nonsummer	0.05116	$ 218.20	$ 193.40	$ 177.80	$ 172.09	$ 166.57					$ 188.65	$ 169.03	$ 190.60	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00033	$ 1.41	$ 1.25	$ 1.15	$ 1.11	$ 1.07	$ 1.23	$ 1.35	$ 1.34	$ 1.22	$ 1.22	$ 1.09	$ 1.23	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00658	$ 28.06	$ 24.87	$ 22.87	$ 22.13	$ 21.42	$ 24.44	$ 26.88	$ 26.82	$ 24.37	$ 24.26	$ 21.74	$ 24.51	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00116	$ 4.95	$ 4.39	$ 4.03	$ 3.90	$ 3.78	$ 4.31	$ 4.74	$ 4.73	$ 4.30	$ 4.28	$ 3.83	$ 4.32	
Franchise Cost Addition (12)		5.440%	$ 5.87	$ 5.72	$ 5.63	$ 5.62	$ 5.75	$ 6.25	$ 6.46	$ 6.40	$ 6.16	$ 6.34	$ 5.71	$ 5.54	
Total Charges (13)			$ 419.79	$ 382.65	$ 359.51	$ 351.45	$ 346.25	$ 381.60	$ 411.13	$ 409.24	$ 379.02	$ 388.14	$ 349.01	$ 375.30	$ 4,553
														$/kWh	0.1025

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
January 2018		**kW - Secondary**	12	11	11	11	11	13	13	13	12	13	11	11	
		kW - Primary	0	0	0	0	0	0	0	0	0	0	0	0	
		kW - Primary w/ Tr	0	0	0	0	0	0	0	0	0	0	0	0	
		kWh	4,265	3,780	3,475	3,364	3,256	3,714	4,085	4,075	3,704	3,687	3,304	3,726	44,436
		Charges													
Customer Charge (1)		15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (1)		15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	
Secondary Voltage Distribution Facilities Charge (1		7.07	$ 81.78	$ 79.38	$ 78.12	$ 78.08	$ 80.63	$ 89.95	$ 93.63	$ 92.38	$ 88.09	$ 91.64	$ 79.93	$ 75.94	
Primary Voltage Distribution Facilities Charge (1		3.14	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Primary Voltage Transformer Charge (1)		0.24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
PJM Services Charge (5)		0.01340	$ 57.15	$ 50.66	$ 46.57	$ 45.07	$ 43.63	$ 49.77	$ 54.74	$ 54.61	$ 49.63	$ 49.41	$ 44.27	$ 49.92	
Purchased Electricity Charge (6)	Summer	0.05629						$ 209.08	$ 229.93	$ 229.40	$ 208.50				
	Nonsummer	0.05935	$ 253.13	$ 224.37	$ 206.27	$ 199.63	$ 193.23					$ 218.85	$ 196.08	$ 221.11	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00048	$ 2.05	$ 1.81	$ 1.67	$ 1.61	$ 1.56	$ 1.78	$ 1.96	$ 1.96	$ 1.78	$ 1.77	$ 1.59	$ 1.79	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00019	$ 0.81	$ 0.72	$ 0.66	$ 0.64	$ 0.62	$ 0.71	$ 0.78	$ 0.77	$ 0.70	$ 0.70	$ 0.63	$ 0.71	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00189	$ 8.06	$ 7.14	$ 6.57	$ 6.36	$ 6.15	$ 7.02	$ 7.72	$ 7.70	$ 7.00	$ 6.97	$ 6.24	$ 7.04	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00195	$ 8.32	$ 7.37	$ 6.78	$ 6.56	$ 6.35	$ 7.24	$ 7.97	$ 7.95	$ 7.22	$ 7.19	$ 6.44	$ 7.26	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00119	$ 5.08	$ 4.50	$ 4.14	$ 4.00	$ 3.87	$ 4.42	$ 4.86	$ 4.85	$ 4.41	$ 4.39	$ 3.93	$ 4.43	
Franchise Cost Addition (12)		5.080%	$ 5.95	$ 5.79	$ 5.71	$ 5.70	$ 5.83	$ 6.33	$ 6.54	$ 6.47	$ 6.23	$ 6.41	$ 5.79	$ 5.62	
Total Charges (13)			$ 457.82	$ 417.23	$ 391.98	$ 383.14	$ 377.36	$ 411.79	$ 443.62	$ 441.58	$ 409.05	$ 422.82	$ 380.39	$ 409.31	$ 4,946
														$/kWh	0.1113
		Percent Change	9.1%	9.0%	9.0%	9.0%	9.0%	7.9%	7.9%	7.9%	7.9%	8.9%	9.0%	9.1%	8.6%
		Dollar Change	$ 38.03	$ 34.58	$ 32.47	$ 31.69	$ 31.11	$ 30.19	$ 32.49	$ 32.34	$ 30.03	$ 34.68	$ 31.38	$ 34.01	$ 393.00

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a nonresidential customer per Rider RCA Sheets Nos. 256 through No. 257.4.
(4) Billed at a per kWh distribution facilities charge.
(5) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(6) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(7) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(8) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(9) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(10) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(11) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(12) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(13) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bil
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
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January 2017			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	534	422	371	344	323	445	609	604	443	463	354	442	5,354
		Charges													
Customer Charge (1)		10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1		0.03505	$ 18.72	$ 14.79	$ 13.00	$ 12.06	$ 11.31	$ 15.59	$ 21.36	$ 21.19	$ 15.53	$ 16.23	$ 12.39	$ 15.51	
PJM Services Charge (4)		0.01263	$ 6.75	$ 5.33	$ 4.68	$ 4.35	$ 4.08	$ 5.62	$ 7.70	$ 7.63	$ 5.59	$ 5.85	$ 4.47	$ 5.59	
Purchased Electricity Charge (5)	Summer	0.04846						$ 21.56	$ 29.53	$ 29.29	$ 21.47				
	Nonsummer	0.05055	$ 27.00	$ 21.34	$ 18.75	$ 17.39	$ 16.31					$ 23.41	$ 17.87	$ 22.37	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 0.18	$ 0.14	$ 0.12	$ 0.11	$ 0.11	$ 0.15	$ 0.20	$ 0.20	$ 0.15	$ 0.15	$ 0.12	$ 0.15	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 1.78	$ 1.41	$ 1.23	$ 1.15	$ 1.07	$ 1.48	$ 2.03	$ 2.01	$ 1.48	$ 1.54	$ 1.18	$ 1.47	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10		0.00117	$ 0.62	$ 0.49	$ 0.43	$ 0.40	$ 0.38	$ 0.52	$ 0.71	$ 0.71	$ 0.52	$ 0.54	$ 0.41	$ 0.52	
Franchise Cost Addition (11)		5.440%	$ 1.89	$ 1.67	$ 1.57	$ 1.51	$ 1.47	$ 1.71	$ 2.04	$ 2.03	$ 1.71	$ 1.75	$ 1.53	$ 1.71	
Total Annual Charges (12)			$ 72.85	$ 61.08	$ 55.69	$ 52.88	$ 50.64	$ 62.54	$ 79.48	$ 78.97	$ 62.36	$ 65.38	$ 53.88	$ 63.23	$758.99
														$/kWh	$0.1417

January 2018			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	534	422	371	344	323	445	609	604	443	463	354	442	5,354
		Charges													
Customer Charge (2)		11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2		0.03466	$ 18.51	$ 14.63	$ 12.85	$ 11.93	$ 11.19	$ 15.42	$ 21.12	$ 20.95	$ 15.35	$ 16.05	$ 12.25	$ 15.34	
PJM Services Charge (4)		0.01351	$ 7.22	$ 5.70	$ 5.01	$ 4.65	$ 4.36	$ 6.01	$ 8.23	$ 8.17	$ 5.98	$ 6.26	$ 4.78	$ 5.98	
Purchased Electricity Charge (5)	Summer	0.05544						$ 24.66	$ 33.78	$ 33.51	$ 24.56				
	Nonsummer	0.05844	$ 31.21	$ 24.67	$ 21.67	$ 20.11	$ 18.86					$ 27.06	$ 20.66	$ 25.86	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 0.26	$ 0.20	$ 0.18	$ 0.17	$ 0.15	$ 0.21	$ 0.29	$ 0.29	$ 0.21	$ 0.22	$ 0.17	$ 0.21	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.08	$ 0.06	$ 0.06	$ 0.05	$ 0.05	$ 0.07	$ 0.09	$ 0.09	$ 0.07	$ 0.07	$ 0.05	$ 0.07	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 1.01	$ 0.80	$ 0.70	$ 0.65	$ 0.61	$ 0.84	$ 1.15	$ 1.14	$ 0.84	$ 0.88	$ 0.67	$ 0.84	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 1.04	$ 0.82	$ 0.72	$ 0.67	$ 0.63	$ 0.87	$ 1.19	$ 1.18	$ 0.86	$ 0.90	$ 0.69	$ 0.86	
Illinois Electricity Distribution Tax (IEDT) (10		0.00121	$ 0.65	$ 0.51	$ 0.45	$ 0.42	$ 0.39	$ 0.54	$ 0.74	$ 0.73	$ 0.54	$ 0.56	$ 0.43	$ 0.54	
Franchise Cost Addition (11)		5.080%	$ 1.80	$ 1.59	$ 1.50	$ 1.45	$ 1.41	$ 1.64	$ 1.94	$ 1.93	$ 1.63	$ 1.67	$ 1.47	$ 1.63	
Total Annual Charges (12)			$ 78.59	$ 65.79	$ 59.95	$ 56.91	$ 54.46	$ 67.07	$ 85.34	$ 84.80	$ 66.85	$ 70.48	$ 57.98	$ 68.14	$816.34
														$/kWh	$0.1525
		Percent Change	7.9%	7.7%	7.6%	7.6%	7.5%	7.2%	7.4%	7.4%	7.2%	7.8%	7.6%	7.8%	7.6%
		Dollar Change	$ 5.73	$ 4.71	$ 4.25	$ 4.02	$ 3.82	$ 4.53	$ 5.85	$ 5.83	$ 4.49	$ 5.10	$ 4.09	$ 4.91	$ 57.34

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
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January 2017		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	kWh	746	586	516	484	463	655	895	890	664	676	501	617	7,695
	Charges													
Customer Charge (1)	10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	
Retail Customer Assessments (Rider RCA) (3)	0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)	4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)	0.03505	$ 26.16	$ 20.54	$ 18.10	$ 16.97	$ 16.25	$ 22.97	$ 31.37	$ 31.19	$ 23.27	$ 23.71	$ 17.55	$ 21.64	
PJM Services Charge (4)	0.01263	$ 9.43	$ 7.40	$ 6.52	$ 6.11	$ 5.85	$ 8.28	$ 11.30	$ 11.24	$ 8.39	$ 8.54	$ 6.32	$ 7.80	
Purchased Electricity Charge (5) Summer	0.04846						$ 31.76	$ 43.37	$ 43.12	$ 32.17				
Nonsummer	0.05055	$ 37.72	$ 29.62	$ 26.10	$ 24.47	$ 23.43					$ 34.19	$ 25.31	$ 31.20	
Environmental Cost Recovery Adjustment (Rider ECR) (6)	0.00033	$ 0.25	$ 0.19	$ 0.17	$ 0.16	$ 0.15	$ 0.22	$ 0.30	$ 0.29	$ 0.22	$ 0.22	$ 0.17	$ 0.20	
Energy Efficiency Programs (Rider EDA/EEPP) (7)	0.00333	$ 2.49	$ 1.95	$ 1.72	$ 1.61	$ 1.54	$ 2.18	$ 2.98	$ 2.96	$ 2.21	$ 2.25	$ 1.67	$ 2.06	
Renewable Portfolio Standard Adj (Rider REA) (8)	0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)	0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)	0.00117	$ 0.87	$ 0.69	$ 0.60	$ 0.57	$ 0.54	$ 0.77	$ 1.05	$ 1.04	$ 0.78	$ 0.79	$ 0.59	$ 0.72	
Franchise Cost Addition (11)	5.440%	$ 2.31	$ 1.99	$ 1.85	$ 1.79	$ 1.75	$ 2.13	$ 2.60	$ 2.59	$ 2.14	$ 2.17	$ 1.82	$ 2.05	
Total Annual Charges (12)		$ 95.14	$ 78.29	$ 70.97	$ 67.59	$ 65.42	$ 84.22	$ 108.88	$ 108.34	$ 85.09	$ 87.78	$ 69.34	$ 81.58	$1,002.63
													$/kWh	$0.1303

January 2018		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	kWh	746	586	516	484	463	655	895	890	664	676	501	617	7,695
	Charges													
Customer Charge (2)	11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	
Retail Customer Assessments (Rider RCA) (3)	0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)	5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)	0.03466	$ 25.87	$ 20.31	$ 17.89	$ 16.78	$ 16.06	$ 22.71	$ 31.02	$ 30.84	$ 23.01	$ 23.44	$ 17.36	$ 21.39	
PJM Services Charge (4)	0.01351	$ 10.08	$ 7.92	$ 6.97	$ 6.54	$ 6.26	$ 8.85	$ 12.09	$ 12.02	$ 8.97	$ 9.14	$ 6.77	$ 8.34	
Purchased Electricity Charge (5) Summer	0.05544						$ 36.33	$ 49.61	$ 49.33	$ 36.81				
Nonsummer	0.05844	$ 43.61	$ 34.25	$ 30.17	$ 28.29	$ 27.09					$ 39.53	$ 29.26	$ 36.07	
Environmental Cost Recovery Adjustment (6)	0.00048	$ 0.36	$ 0.28	$ 0.25	$ 0.23	$ 0.22	$ 0.31	$ 0.43	$ 0.43	$ 0.32	$ 0.32	$ 0.24	$ 0.30	
Energy Efficiency Programs (Rider EDA/EEPP) (7)	0.00015	$ 0.11	$ 0.09	$ 0.08	$ 0.07	$ 0.07	$ 0.10	$ 0.13	$ 0.13	$ 0.10	$ 0.10	$ 0.08	$ 0.09	
Renewable Portfolio Standard Adj (REA) (8)	0.00189	$ 1.41	$ 1.11	$ 0.98	$ 0.91	$ 0.88	$ 1.24	$ 1.69	$ 1.68	$ 1.25	$ 1.28	$ 0.95	$ 1.17	
Zero Emission Standard Adj (ZEA) (9)	0.00195	$ 1.46	$ 1.14	$ 1.01	$ 0.94	$ 0.90	$ 1.28	$ 1.75	$ 1.74	$ 1.29	$ 1.32	$ 0.98	$ 1.20	
Illinois Electricity Distribution Tax (IEDT) (10)	0.00121	$ 0.90	$ 0.71	$ 0.62	$ 0.59	$ 0.56	$ 0.79	$ 1.08	$ 1.08	$ 0.80	$ 0.82	$ 0.61	$ 0.75	
Franchise Cost Addition (11)	5.080%	$ 2.19	$ 1.89	$ 1.77	$ 1.71	$ 1.67	$ 2.02	$ 2.46	$ 2.45	$ 2.03	$ 2.06	$ 1.74	$ 1.95	
Total Annual Charges (12)		$ 102.80	$ 84.51	$ 76.55	$ 72.87	$ 70.52	$ 90.44	$ 117.07	$ 116.51	$ 91.39	$ 94.82	$ 74.80	$ 88.07	$1,080.35
													$/kWh	$0.1404
	Percent Change	8.1%	7.9%	7.9%	7.8%	7.8%	7.4%	7.5%	7.5%	7.4%	8.0%	7.9%	7.9%	7.8%
	Dollar Change	$ 7.66	$ 6.22	$ 5.58	$ 5.28	$ 5.10	$ 6.23	$ 8.20	$ 8.17	$ 6.31	$ 7.04	$ 5.46	$ 6.48	$ 77.72

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
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January 2017		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	kWh	1,049	822	725	679	655	931	1,242	1,227	938	940	701	860	10,769
	Charges													
Customer Charge (1)	10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	$ 10.64	
Retail Customer Assessments (Rider RCA) (3)	0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)	4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)	0.03505	$ 36.77	$ 28.82	$ 25.40	$ 23.81	$ 22.96	$ 32.61	$ 43.52	$ 43.01	$ 32.89	$ 32.95	$ 24.57	$ 30.14	
PJM Services Charge (4)	0.01263	$ 13.25	$ 10.38	$ 9.15	$ 8.58	$ 8.27	$ 11.75	$ 15.68	$ 15.50	$ 11.85	$ 11.87	$ 8.85	$ 10.86	
Purchased Electricity Charge (5) Summer	0.04846						$ 45.09	$ 60.17	$ 59.47	$ 45.47				
Nonsummer	0.05055	$ 53.03	$ 41.56	$ 36.63	$ 34.34	$ 33.11					$ 47.52	$ 35.44	$ 43.47	
Environmental Cost Recovery Adjustment (Rider ECR) (6)	0.00033	$ 0.35	$ 0.27	$ 0.24	$ 0.22	$ 0.22	$ 0.31	$ 0.41	$ 0.40	$ 0.31	$ 0.31	$ 0.23	$ 0.28	
Energy Efficiency Programs (Rider EDA/EEPP) (7)	0.00333	$ 3.49	$ 2.74	$ 2.41	$ 2.26	$ 2.18	$ 3.10	$ 4.13	$ 4.09	$ 3.12	$ 3.13	$ 2.33	$ 2.86	
Renewable Portfolio Standard Adj (Rider REA) (8)	0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)	0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)	0.00117	$ 1.23	$ 0.96	$ 0.85	$ 0.79	$ 0.77	$ 1.09	$ 1.45	$ 1.44	$ 1.10	$ 1.10	$ 0.82	$ 1.01	
Franchise Cost Addition (11)	5.440%	$ 2.90	$ 2.45	$ 2.26	$ 2.17	$ 2.13	$ 2.67	$ 3.28	$ 3.25	$ 2.68	$ 2.69	$ 2.22	$ 2.53	
Total Annual Charges (12)		$ 126.93	$ 103.09	$ 92.85	$ 88.08	$ 85.55	$ 112.53	$ 144.55	$ 143.07	$ 113.33	$ 115.48	$ 90.37	$ 107.06	$1,322.88
													$/kWh	$0.1228

January 2018		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	kWh	1,049	822	725	679	655	931	1,242	1,227	938	940	701	860	10,769
	Charges													
Customer Charge (2)	11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	$ 11.20	
Retail Customer Assessments (Rider RCA) (3)	0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)	5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)	0.03466	$ 36.36	$ 28.50	$ 25.12	$ 23.54	$ 22.70	$ 32.25	$ 43.04	$ 42.53	$ 32.52	$ 32.58	$ 24.30	$ 29.81	
PJM Services Charge (4)	0.01351	$ 14.17	$ 11.11	$ 9.79	$ 9.18	$ 8.85	$ 12.57	$ 16.77	$ 16.58	$ 12.68	$ 12.70	$ 9.47	$ 11.62	
Purchased Electricity Charge (5) Summer	0.05544						$ 51.59	$ 68.84	$ 68.03	$ 52.02				
Nonsummer	0.05844	$ 61.31	$ 48.05	$ 42.35	$ 39.70	$ 38.28					$ 54.94	$ 40.97	$ 50.26	
Environmental Cost Recovery Adjustment (6)	0.00048	$ 0.50	$ 0.39	$ 0.35	$ 0.33	$ 0.31	$ 0.45	$ 0.60	$ 0.59	$ 0.45	$ 0.45	$ 0.34	$ 0.41	
Energy Efficiency Programs (Rider EDA/EEPP) (7)	0.00015	$ 0.16	$ 0.12	$ 0.11	$ 0.10	$ 0.10	$ 0.14	$ 0.19	$ 0.18	$ 0.14	$ 0.14	$ 0.11	$ 0.13	
Renewable Portfolio Standard Adj (REA) (8)	0.00189	$ 1.98	$ 1.55	$ 1.37	$ 1.28	$ 1.24	$ 1.76	$ 2.35	$ 2.32	$ 1.77	$ 1.78	$ 1.32	$ 1.63	
Zero Emission Standard Adj (ZEA) (9)	0.00195	$ 2.05	$ 1.60	$ 1.41	$ 1.32	$ 1.28	$ 1.81	$ 2.42	$ 2.39	$ 1.83	$ 1.83	$ 1.37	$ 1.68	
Illinois Electricity Distribution Tax (IEDT) (10)	0.00121	$ 1.27	$ 0.99	$ 0.88	$ 0.82	$ 0.79	$ 1.13	$ 1.50	$ 1.48	$ 1.14	$ 1.14	$ 0.85	$ 1.04	
Franchise Cost Addition (11)	5.080%	$ 2.74	$ 2.32	$ 2.15	$ 2.06	$ 2.02	$ 2.52	$ 3.09	$ 3.06	$ 2.53	$ 2.54	$ 2.10	$ 2.39	
Total Annual Charges (12)		$ 137.35	$ 111.44	$ 100.34	$ 95.14	$ 92.38	$ 121.03	$ 155.61	$ 153.97	$ 121.89	$ 124.91	$ 97.64	$ 115.78	$1,427.48
													$/kWh	$0.1326
	Percent Change	8.2%	8.1%	8.1%	8.0%	8.0%	7.6%	7.7%	7.6%	7.6%	8.2%	8.0%	8.1%	7.9%
	Dollar Change	$ 10.42	$ 8.35	$ 7.49	$ 7.06	$ 6.84	$ 8.50	$ 11.06	$ 10.91	$ 8.56	$ 9.43	$ 7.27	$ 8.72	$ 104.60

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Multi Family Without Electric Space Heat

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January 2017

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	kWh	207	175	157	151	146	178	228	232	188	197	157	182	2,197
	Charges													
Customer Charge (1)	7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	
Retail Customer Assessments (Rider RCA) (3)	0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)	4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)	0.02798	$ 5.78	$ 4.89	$ 4.38	$ 4.23	$ 4.09	$ 4.98	$ 6.37	$ 6.49	$ 5.26	$ 5.52	$ 4.38	$ 5.10	
PJM Services Charge (4)	0.01263	$ 2.61	$ 2.21	$ 1.98	$ 1.91	$ 1.85	$ 2.25	$ 2.87	$ 2.93	$ 2.38	$ 2.49	$ 1.98	$ 2.30	
Purchased Electricity Charge (5) Summer	0.04846						$ 8.62	$ 11.03	$ 11.23	$ 9.11				
Nonsummer	0.05055	$ 10.45	$ 8.83	$ 7.92	$ 7.64	$ 7.39					$ 9.98	$ 7.92	$ 9.22	
Environmental Cost Recovery Adjustment (Rider ECR) (6)	0.00033	$ 0.07	$ 0.06	$ 0.05	$ 0.05	$ 0.05	$ 0.06	$ 0.08	$ 0.08	$ 0.06	$ 0.07	$ 0.05	$ 0.06	
Energy Efficiency Programs (Rider EDA/EEPP) (7)	0.00333	$ 0.69	$ 0.58	$ 0.52	$ 0.50	$ 0.49	$ 0.59	$ 0.76	$ 0.77	$ 0.63	$ 0.66	$ 0.52	$ 0.61	
Renewable Portfolio Standard Adj (Rider REA) (8)	0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)	0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)	0.00117	$ 0.24	$ 0.20	$ 0.18	$ 0.18	$ 0.17	$ 0.21	$ 0.27	$ 0.27	$ 0.22	$ 0.23	$ 0.18	$ 0.21	
Franchise Cost Addition (11)	5.440%	$ 0.99	$ 0.94	$ 0.92	$ 0.91	$ 0.90	$ 0.95	$ 1.03	$ 1.03	$ 0.97	$ 0.98	$ 0.92	$ 0.96	
Total Annual Charges (12)		$ 33.66	$ 30.54	$ 28.78	$ 28.25	$ 27.77	$ 30.49	$ 35.24	$ 35.63	$ 31.46	$ 32.76	$ 28.78	$ 31.29	$374.66
													$/kWh	$0.1705

January 2018

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	kWh	207	175	157	151	146	178	228	232	188	197	157	182	2,197
	Charges													
Customer Charge (2)	7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	
Retail Customer Assessments (Rider RCA) (3)	0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)	5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)	0.02768	$ 5.72	$ 4.84	$ 4.33	$ 4.18	$ 4.05	$ 4.93	$ 6.30	$ 6.42	$ 5.21	$ 5.46	$ 4.34	$ 5.05	
PJM Services Charge (4)	0.01351	$ 2.79	$ 2.36	$ 2.12	$ 2.04	$ 1.97	$ 2.40	$ 3.07	$ 3.13	$ 2.54	$ 2.67	$ 2.12	$ 2.46	
Purchased Electricity Charge (5) Summer	0.05544						$ 9.87	$ 12.61	$ 12.85	$ 10.43				
Nonsummer	0.05844	$ 12.08	$ 10.21	$ 9.15	$ 8.83	$ 8.54					$ 11.53	$ 9.15	$ 10.66	
Environmental Cost Recovery Adjustment (6)	0.00048	$ 0.10	$ 0.08	$ 0.08	$ 0.07	$ 0.07	$ 0.09	$ 0.11	$ 0.11	$ 0.09	$ 0.09	$ 0.08	$ 0.09	
Energy Efficiency Programs (Rider EDA/EEPP) (7)	0.00015	$ 0.03	$ 0.03	$ 0.02	$ 0.02	$ 0.02	$ 0.03	$ 0.03	$ 0.03	$ 0.03	$ 0.03	$ 0.02	$ 0.03	
Renewable Portfolio Standard Adj (REA) (8)	0.00189	$ 0.39	$ 0.33	$ 0.30	$ 0.29	$ 0.28	$ 0.34	$ 0.43	$ 0.44	$ 0.36	$ 0.37	$ 0.30	$ 0.34	
Zero Emission Standard Adj (ZEA) (9)	0.00195	$ 0.40	$ 0.34	$ 0.31	$ 0.29	$ 0.29	$ 0.35	$ 0.44	$ 0.45	$ 0.37	$ 0.38	$ 0.31	$ 0.36	
Illinois Electricity Distribution Tax (IEDT) (10)	0.00121	$ 0.25	$ 0.21	$ 0.19	$ 0.18	$ 0.18	$ 0.22	$ 0.28	$ 0.28	$ 0.23	$ 0.24	$ 0.19	$ 0.22	
Franchise Cost Addition (11)	5.080%	$ 0.95	$ 0.91	$ 0.88	$ 0.87	$ 0.86	$ 0.91	$ 0.98	$ 0.99	$ 0.93	$ 0.94	$ 0.88	$ 0.92	
Total Annual Charges (12)		$ 36.06	$ 32.66	$ 30.73	$ 30.12	$ 29.61	$ 32.49	$ 37.60	$ 38.05	$ 33.54	$ 35.06	$ 30.74	$ 33.48	$400.13
													$/kWh	$0.1821
	Percent Change	7.1%	6.9%	6.8%	6.6%	6.6%	6.6%	6.7%	6.8%	6.6%	7.0%	6.8%	7.0%	6.8%
	Dollar Change	$ 2.40	$ 2.12	$ 1.95	$ 1.88	$ 1.84	$ 2.00	$ 2.36	$ 2.42	$ 2.08	$ 2.30	$ 1.96	$ 2.19	$ 25.47

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Multi Family Without Electric Space Heat

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January 2017

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	kWh	320	267	235	225	215	283	381	389	307	314	234	272	3,444
	Charges													
Customer Charge (1)	7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	
Retail Customer Assessments (Rider RCA) (3)	0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)	4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)	0.02798	$ 8.96	$ 7.47	$ 6.58	$ 6.30	$ 6.03	$ 7.91	$ 10.66	$ 10.88	$ 8.60	$ 8.79	$ 6.56	$ 7.62	
PJM Services Charge (4)	0.01263	$ 4.05	$ 3.37	$ 2.97	$ 2.84	$ 2.72	$ 3.57	$ 4.81	$ 4.91	$ 3.88	$ 3.97	$ 2.96	$ 3.44	
Purchased Electricity Charge (5) Summer	0.04846						$ 13.70	$ 18.46	$ 18.85	$ 14.89				
Nonsummer	0.05055	$ 16.19	$ 13.50	$ 11.89	$ 11.38	$ 10.89					$ 15.88	$ 11.85	$ 13.77	
Environmental Cost Recovery Adjustment (Rider ECR) (6)	0.00033	$ 0.11	$ 0.09	$ 0.08	$ 0.07	$ 0.07	$ 0.09	$ 0.13	$ 0.13	$ 0.10	$ 0.10	$ 0.08	$ 0.09	
Energy Efficiency Programs (Rider EDA/EEPP) (7)	0.00333	$ 1.07	$ 0.89	$ 0.78	$ 0.75	$ 0.72	$ 0.94	$ 1.27	$ 1.30	$ 1.02	$ 1.05	$ 0.78	$ 0.91	
Renewable Portfolio Standard Adj (Rider REA) (8)	0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)	0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)	0.00117	$ 0.37	$ 0.31	$ 0.28	$ 0.26	$ 0.25	$ 0.33	$ 0.45	$ 0.46	$ 0.36	$ 0.37	$ 0.27	$ 0.32	
Franchise Cost Addition (11)	5.440%	$ 1.17	$ 1.09	$ 1.04	$ 1.02	$ 1.01	$ 1.12	$ 1.27	$ 1.28	$ 1.15	$ 1.17	$ 1.04	$ 1.10	
Total Annual Charges (12)		$ 44.75	$ 39.55	$ 36.45	$ 35.45	$ 34.52	$ 40.49	$ 49.88	$ 50.64	$ 42.83	$ 44.16	$ 36.37	$ 40.08	$495.17
													$/kWh	$0.1438

January 2018

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
	kWh	320	267	235	225	215	283	381	389	307	314	234	272	3,444
	Charges													
Customer Charge (2)	7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	
Retail Customer Assessments (Rider RCA) (3)	0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)	5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)	0.02768	$ 8.87	$ 7.39	$ 6.51	$ 6.23	$ 5.96	$ 7.82	$ 10.54	$ 10.77	$ 8.51	$ 8.70	$ 6.49	$ 7.54	
PJM Services Charge (4)	0.01351	$ 4.33	$ 3.61	$ 3.18	$ 3.04	$ 2.91	$ 3.82	$ 5.15	$ 5.25	$ 4.15	$ 4.25	$ 3.17	$ 3.68	
Purchased Electricity Charge (5) Summer	0.05544						$ 15.67	$ 21.11	$ 21.56	$ 17.04				
Nonsummer	0.05844	$ 18.72	$ 15.60	$ 13.75	$ 13.16	$ 12.59					$ 18.36	$ 13.70	$ 15.91	
Environmental Cost Recovery Adjustment (6)	0.00048	$ 0.15	$ 0.13	$ 0.11	$ 0.11	$ 0.10	$ 0.14	$ 0.18	$ 0.19	$ 0.15	$ 0.15	$ 0.11	$ 0.13	
Energy Efficiency Programs (Rider EDA/EEPP) (7)	0.00015	$ 0.05	$ 0.04	$ 0.04	$ 0.03	$ 0.03	$ 0.04	$ 0.06	$ 0.06	$ 0.05	$ 0.05	$ 0.04	$ 0.04	
Renewable Portfolio Standard Adj (REA) (8)	0.00189	$ 0.61	$ 0.50	$ 0.44	$ 0.43	$ 0.41	$ 0.53	$ 0.72	$ 0.74	$ 0.58	$ 0.59	$ 0.44	$ 0.51	
Zero Emission Standard Adj (ZEA) (9)	0.00195	$ 0.62	$ 0.52	$ 0.46	$ 0.44	$ 0.42	$ 0.55	$ 0.74	$ 0.76	$ 0.60	$ 0.61	$ 0.46	$ 0.53	
Illinois Electricity Distribution Tax (IEDT) (10)	0.00121	$ 0.39	$ 0.32	$ 0.28	$ 0.27	$ 0.26	$ 0.34	$ 0.46	$ 0.47	$ 0.37	$ 0.38	$ 0.28	$ 0.33	
Franchise Cost Addition (11)	5.080%	$ 1.12	$ 1.04	$ 0.99	$ 0.98	$ 0.97	$ 1.06	$ 1.21	$ 1.22	$ 1.10	$ 1.11	$ 0.99	$ 1.05	
Total Annual Charges (12)		$ 48.21	$ 42.50	$ 39.11	$ 38.04	$ 37.00	$ 43.32	$ 53.52	$ 54.37	$ 45.90	$ 47.55	$ 39.03	$ 43.07	$531.64
													$/kWh	$0.1544
	Percent Change	7.7%	7.5%	7.3%	7.3%	7.2%	7.0%	7.3%	7.4%	7.2%	7.7%	7.3%	7.5%	7.4%
	Dollar Change	$ 3.45	$ 2.95	$ 2.67	$ 2.59	$ 2.48	$ 2.83	$ 3.65	$ 3.74	$ 3.07	$ 3.39	$ 2.66	$ 2.99	$ 36.47

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Multi Family Without Electric Space Heat

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January 2017

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	478	399	346	330	315	423	585	601	475	475	340	398	5,166
		Charges													
Customer Charge (1)		7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	$ 7.56	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)		0.02798	$ 13.38	$ 11.15	$ 9.69	$ 9.25	$ 8.80	$ 11.85	$ 16.37	$ 16.80	$ 13.30	$ 13.29	$ 9.52	$ 11.15	
PJM Services Charge (4)		0.01263	$ 6.04	$ 5.03	$ 4.37	$ 4.17	$ 3.97	$ 5.35	$ 7.39	$ 7.59	$ 6.00	$ 6.00	$ 4.30	$ 5.03	
Purchased Electricity Charge (5)	Summer	0.04846						$ 20.52	$ 28.35	$ 29.10	$ 23.03				
	Nonsummer	0.05055	$ 24.18	$ 20.15	$ 17.51	$ 16.71	$ 15.91					$ 24.01	$ 17.19	$ 20.14	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 0.16	$ 0.13	$ 0.11	$ 0.11	$ 0.10	$ 0.14	$ 0.19	$ 0.20	$ 0.16	$ 0.16	$ 0.11	$ 0.13	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 1.59	$ 1.33	$ 1.15	$ 1.10	$ 1.05	$ 1.41	$ 1.95	$ 2.00	$ 1.58	$ 1.58	$ 1.13	$ 1.33	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)		0.00117	$ 0.56	$ 0.47	$ 0.41	$ 0.39	$ 0.37	$ 0.50	$ 0.68	$ 0.70	$ 0.56	$ 0.56	$ 0.40	$ 0.47	
Franchise Cost Addition (11)		5.440%	$ 1.43	$ 1.30	$ 1.22	$ 1.19	$ 1.17	$ 1.34	$ 1.59	$ 1.62	$ 1.42	$ 1.42	$ 1.21	$ 1.30	
Total Annual Charges (12)			$ 60.17	$ 52.39	$ 47.29	$ 45.75	$ 44.20	$ 53.94	$ 69.35	$ 70.84	$ 58.88	$ 59.85	$ 46.69	$ 52.38	$661.70
														$/kWh	$0.1281

January 2018

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	478	399	346	330	315	423	585	601	475	475	340	398	5,166
		Charges													
Customer Charge (2)		7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	$ 7.74	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)		0.02768	$ 13.24	$ 11.03	$ 9.59	$ 9.15	$ 8.71	$ 11.72	$ 16.19	$ 16.62	$ 13.15	$ 13.15	$ 9.41	$ 11.03	
PJM Services Charge (4)		0.01351	$ 6.46	$ 5.38	$ 4.68	$ 4.46	$ 4.25	$ 5.72	$ 7.90	$ 8.11	$ 6.42	$ 6.42	$ 4.59	$ 5.38	
Purchased Electricity Charge (5)	Summer	0.05544						$ 23.48	$ 32.44	$ 33.30	$ 26.34				
	Nonsummer	0.05844	$ 27.95	$ 23.29	$ 20.24	$ 19.31	$ 18.39					$ 27.76	$ 19.87	$ 23.28	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 0.23	$ 0.19	$ 0.17	$ 0.16	$ 0.15	$ 0.20	$ 0.28	$ 0.29	$ 0.23	$ 0.23	$ 0.16	$ 0.19	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.07	$ 0.06	$ 0.05	$ 0.05	$ 0.05	$ 0.06	$ 0.09	$ 0.09	$ 0.07	$ 0.07	$ 0.05	$ 0.06	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 0.90	$ 0.75	$ 0.65	$ 0.62	$ 0.59	$ 0.80	$ 1.11	$ 1.14	$ 0.90	$ 0.90	$ 0.64	$ 0.75	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 0.93	$ 0.78	$ 0.68	$ 0.64	$ 0.61	$ 0.83	$ 1.14	$ 1.17	$ 0.93	$ 0.93	$ 0.66	$ 0.78	
Illinois Electricity Distribution Tax (IEDT) (10)		0.00121	$ 0.58	$ 0.48	$ 0.42	$ 0.40	$ 0.38	$ 0.51	$ 0.71	$ 0.73	$ 0.57	$ 0.57	$ 0.41	$ 0.48	
Franchise Cost Addition (11)		5.080%	$ 1.35	$ 1.23	$ 1.16	$ 1.13	$ 1.11	$ 1.27	$ 1.51	$ 1.53	$ 1.35	$ 1.35	$ 1.15	$ 1.23	
Total Annual Charges (12)			$ 65.06	$ 56.54	$ 50.99	$ 49.27	$ 47.59	$ 57.94	$ 74.72	$ 76.33	$ 63.31	$ 64.73	$ 50.29	$ 56.53	$713.31
														$/kWh	$0.1381
		Percent Change	8.1%	7.9%	7.8%	7.7%	7.7%	7.4%	7.7%	7.7%	7.5%	8.2%	7.7%	7.9%	7.8%
		Dollar Change	$ 4.89	$ 4.16	$ 3.70	$ 3.52	$ 3.39	$ 4.01	$ 5.36	$ 5.48	$ 4.44	$ 4.89	$ 3.60	$ 4.16	$ 51.61

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
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(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Single Family With Electric Space Heat

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January 2017

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	**1,914**	**1,428**	**1,100**	**893**	**670**	**707**	**819**	**768**	**632**	**639**	**777**	**1,279**	11,626
		Charges													
Customer Charge (1)		12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)		0.01762	$ 33.72	$ 25.15	$ 19.38	$ 15.74	$ 11.80	$ 12.46	$ 14.43	$ 13.53	$ 11.14	$ 11.26	$ 13.70	$ 22.53	
PJM Services Charge (4)		0.01263	$ 24.17	$ 18.03	$ 13.89	$ 11.28	$ 8.46	$ 8.93	$ 10.35	$ 9.70	$ 7.99	$ 8.07	$ 9.82	$ 16.15	
Purchased Electricity Charge (5)	Summer	0.04846						$ 34.27	$ 39.69	$ 37.21	$ 30.64				
	Nonsummer	0.05055	$ 96.75	$ 72.17	$ 55.59	$ 45.16	$ 33.87					$ 32.30	$ 39.29	$ 64.64	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 0.63	$ 0.47	$ 0.36	$ 0.29	$ 0.22	$ 0.23	$ 0.27	$ 0.25	$ 0.21	$ 0.21	$ 0.26	$ 0.42	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 6.37	$ 4.75	$ 3.66	$ 2.97	$ 2.23	$ 2.35	$ 2.73	$ 2.56	$ 2.11	$ 2.13	$ 2.59	$ 4.26	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)		0.00117	$ 2.24	$ 1.67	$ 1.29	$ 1.05	$ 0.78	$ 0.83	$ 0.96	$ 0.90	$ 0.74	$ 0.75	$ 0.91	$ 1.50	
Franchise Cost Addition (11)		5.440%	$ 2.88	$ 2.38	$ 2.05	$ 1.84	$ 1.61	$ 1.65	$ 1.76	$ 1.71	$ 1.57	$ 1.58	$ 1.72	$ 2.23	
Total Annual Charges (12)			$ 184.32	$ 142.18	$ 113.78	$ 95.89	$ 76.53	$ 78.28	$ 87.75	$ 83.42	$ 71.96	$ 73.86	$ 85.85	$ 129.29	$1,223.09
														$/kWh	$0.1052

January 2018

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	**1,914**	**1,428**	**1,100**	**893**	**670**	**707**	**819**	**768**	**632**	**639**	**777**	**1,279**	11,626
		Charges													
Customer Charge (2)		13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)		0.01667	$ 31.90	$ 23.80	$ 18.33	$ 14.89	$ 11.17	$ 11.79	$ 13.65	$ 12.80	$ 10.54	$ 10.65	$ 12.96	$ 21.32	
PJM Services Charge (4)		0.01351	$ 25.86	$ 19.29	$ 14.86	$ 12.07	$ 9.05	$ 9.55	$ 11.07	$ 10.37	$ 8.54	$ 8.63	$ 10.50	$ 17.27	
Purchased Electricity Charge (5)	Summer	0.05544						$ 39.21	$ 45.41	$ 42.57	$ 35.06				
	Nonsummer	0.05844	$ 111.85	$ 83.43	$ 64.27	$ 52.21	$ 39.15					$ 37.35	$ 45.42	$ 74.72	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 0.92	$ 0.69	$ 0.53	$ 0.43	$ 0.32	$ 0.34	$ 0.39	$ 0.37	$ 0.30	$ 0.31	$ 0.37	$ 0.61	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.29	$ 0.21	$ 0.16	$ 0.13	$ 0.10	$ 0.11	$ 0.12	$ 0.12	$ 0.09	$ 0.10	$ 0.12	$ 0.19	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 3.62	$ 2.70	$ 2.08	$ 1.69	$ 1.27	$ 1.34	$ 1.55	$ 1.45	$ 1.20	$ 1.21	$ 1.47	$ 2.42	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 3.73	$ 2.78	$ 2.14	$ 1.74	$ 1.31	$ 1.38	$ 1.60	$ 1.50	$ 1.23	$ 1.25	$ 1.52	$ 2.49	
Illinois Electricity Distribution Tax (IEDT) (10)		0.00121	$ 2.32	$ 1.73	$ 1.33	$ 1.08	$ 0.81	$ 0.86	$ 0.99	$ 0.93	$ 0.77	$ 0.77	$ 0.94	$ 1.55	
Franchise Cost Addition (11)		5.080%	$ 2.66	$ 2.22	$ 1.92	$ 1.73	$ 1.53	$ 1.56	$ 1.67	$ 1.62	$ 1.50	$ 1.50	$ 1.63	$ 2.08	
Total Annual Charges (12)			$ 201.88	$ 155.58	$ 124.35	$ 104.70	$ 83.44	$ 84.87	$ 95.18	$ 90.46	$ 77.96	$ 80.50	$ 93.66	$ 141.38	$1,333.95
														$/kWh	$0.1147
		Percent Change	9.5%	9.4%	9.3%	9.2%	9.0%	8.4%	8.5%	8.4%	8.3%	9.0%	9.1%	9.4%	9.1%
		Dollar Change	$ 17.56	$ 13.40	$ 10.57	$ 8.82	$ 6.91	$ 6.59	$ 7.43	$ 7.04	$ 6.00	$ 6.65	$ 7.81	$ 12.09	$ 110.86

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Single Family With Electric Space Heat

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January 2017

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	3,104	2,342	1,861	1,459	1,022	913	968	929	781	797	1,186	2,072	17,434
		Charges													
Customer Charge (1)		12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)		0.01762	$ 54.69	$ 41.26	$ 32.78	$ 25.72	$ 18.01	$ 16.08	$ 17.05	$ 16.37	$ 13.77	$ 14.05	$ 20.91	$ 36.51	
PJM Services Charge (4)		0.01263	$ 39.20	$ 29.57	$ 23.50	$ 18.43	$ 12.91	$ 11.53	$ 12.22	$ 11.73	$ 9.87	$ 10.07	$ 14.99	$ 26.17	
Purchased Electricity Charge (5)	Summer	0.04846						$ 44.23	$ 46.89	$ 45.01	$ 37.86				
	Nonsummer	0.05055	$ 156.89	$ 118.37	$ 94.05	$ 73.77	$ 51.68					$ 40.31	$ 59.98	$ 104.76	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 1.02	$ 0.77	$ 0.61	$ 0.48	$ 0.34	$ 0.30	$ 0.32	$ 0.31	$ 0.26	$ 0.26	$ 0.39	$ 0.68	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 10.34	$ 7.80	$ 6.20	$ 4.86	$ 3.40	$ 3.04	$ 3.22	$ 3.09	$ 2.60	$ 2.66	$ 3.95	$ 6.90	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)		0.00117	$ 3.63	$ 2.74	$ 2.18	$ 1.71	$ 1.20	$ 1.07	$ 1.13	$ 1.09	$ 0.91	$ 0.93	$ 1.39	$ 2.42	
Franchise Cost Addition (11)		5.440%	$ 4.10	$ 3.32	$ 2.83	$ 2.42	$ 1.97	$ 1.86	$ 1.91	$ 1.87	$ 1.72	$ 1.74	$ 2.14	$ 3.04	
Total Annual Charges (12)			$ 287.43	$ 221.39	$ 179.71	$ 144.95	$ 107.07	$ 95.67	$ 100.30	$ 97.03	$ 84.55	$ 87.58	$ 121.31	$ 198.04	$1,725.03
														$/kWh	$0.0989

January 2018

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	3,104	2,342	1,861	1,459	1,022	913	968	929	781	797	1,186	2,072	17,434
		Charges													
Customer Charge (2)		13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)		0.01667	$ 51.74	$ 39.03	$ 31.02	$ 24.33	$ 17.04	$ 15.21	$ 16.13	$ 15.48	$ 13.02	$ 13.29	$ 19.78	$ 34.55	
PJM Services Charge (4)		0.01351	$ 41.93	$ 31.63	$ 25.14	$ 19.72	$ 13.81	$ 12.33	$ 13.07	$ 12.55	$ 10.56	$ 10.77	$ 16.03	$ 28.00	
Purchased Electricity Charge (5)	Summer	0.05544						$ 50.60	$ 53.64	$ 51.50	$ 43.32				
	Nonsummer	0.05844	$ 181.38	$ 136.84	$ 108.73	$ 85.29	$ 59.74					$ 46.60	$ 69.34	$ 121.11	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 1.49	$ 1.12	$ 0.89	$ 0.70	$ 0.49	$ 0.44	$ 0.46	$ 0.45	$ 0.38	$ 0.38	$ 0.57	$ 0.99	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.47	$ 0.35	$ 0.28	$ 0.22	$ 0.15	$ 0.14	$ 0.15	$ 0.14	$ 0.12	$ 0.12	$ 0.18	$ 0.31	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 5.87	$ 4.43	$ 3.52	$ 2.76	$ 1.93	$ 1.72	$ 1.83	$ 1.76	$ 1.48	$ 1.51	$ 2.24	$ 3.92	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 6.05	$ 4.57	$ 3.63	$ 2.85	$ 1.99	$ 1.78	$ 1.89	$ 1.81	$ 1.52	$ 1.56	$ 2.31	$ 4.04	
Illinois Electricity Distribution Tax (IEDT) (10)		0.00121	$ 3.76	$ 2.83	$ 2.25	$ 1.77	$ 1.24	$ 1.10	$ 1.17	$ 1.12	$ 0.95	$ 0.96	$ 1.44	$ 2.51	
Franchise Cost Addition (11)		5.080%	$ 3.74	$ 3.05	$ 2.61	$ 2.25	$ 1.85	$ 1.75	$ 1.80	$ 1.77	$ 1.63	$ 1.65	$ 2.00	$ 2.81	
Total Annual Charges (12)			$ 315.16	$ 242.58	$ 196.80	$ 158.62	$ 116.97	$ 103.80	$ 108.87	$ 105.31	$ 91.71	$ 95.57	$ 132.62	$ 216.97	$1,884.98
														$/kWh	$0.1081
	Percent Change		9.6%	9.6%	9.5%	9.4%	9.2%	8.5%	8.5%	8.5%	8.5%	9.1%	9.3%	9.6%	9.3%
	Dollar Change		$ 27.72	$ 21.19	$ 17.09	$ 13.67	$ 9.90	$ 8.14	$ 8.57	$ 8.29	$ 7.15	$ 7.99	$ 11.31	$ 18.92	$ 159.95

NOTES:

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(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Single Family With Electric Space Heat

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January 2017

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	**4,365**	**3,288**	**2,537**	**2,031**	**1,370**	**1,203**	**1,214**	**1,193**	**1,010**	**1,027**	**1,629**	**2,894**	23,760
		Charges													
Customer Charge (1)		12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	$ 12.29	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)		0.01762	$ 76.91	$ 57.93	$ 44.71	$ 35.79	$ 24.14	$ 21.19	$ 21.38	$ 21.03	$ 17.80	$ 18.09	$ 28.70	$ 50.99	
PJM Services Charge (4)		0.01263	$ 55.13	$ 41.52	$ 32.05	$ 25.65	$ 17.30	$ 15.19	$ 15.33	$ 15.07	$ 12.76	$ 12.97	$ 20.57	$ 36.55	
Purchased Electricity Charge (5)	Summer	0.04846						$ 58.28	$ 58.81	$ 57.83	$ 48.96				
	Nonsummer	0.05055	$ 220.66	$ 166.19	$ 128.26	$ 102.67	$ 69.25					$ 51.90	$ 82.34	$ 146.28	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 1.44	$ 1.08	$ 0.84	$ 0.67	$ 0.45	$ 0.40	$ 0.40	$ 0.39	$ 0.33	$ 0.34	$ 0.54	$ 0.95	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 14.54	$ 10.95	$ 8.45	$ 6.76	$ 4.56	$ 4.01	$ 4.04	$ 3.97	$ 3.36	$ 3.42	$ 5.42	$ 9.64	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)		0.00117	$ 5.11	$ 3.85	$ 2.97	$ 2.38	$ 1.60	$ 1.41	$ 1.42	$ 1.40	$ 1.18	$ 1.20	$ 1.91	$ 3.39	
Franchise Cost Addition (11)		5.440%	$ 5.39	$ 4.28	$ 3.52	$ 3.00	$ 2.32	$ 2.15	$ 2.16	$ 2.14	$ 1.96	$ 1.97	$ 2.59	$ 3.88	
Total Annual Charges (12)			$ 396.74	$ 303.36	$ 238.36	$ 194.48	$ 137.18	$ 120.19	$ 121.10	$ 119.39	$ 103.91	$ 107.45	$ 159.63	$ 269.24	$2,271.01
														$/kWh	$0.0956

January 2018

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	**4,365**	**3,288**	**2,537**	**2,031**	**1,370**	**1,203**	**1,214**	**1,193**	**1,010**	**1,027**	**1,629**	**2,894**	23,760
		Charges													
Customer Charge (2)		13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	$ 13.12	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)		0.01667	$ 72.77	$ 54.80	$ 42.30	$ 33.86	$ 22.84	$ 20.05	$ 20.23	$ 19.89	$ 16.84	$ 17.12	$ 27.15	$ 48.24	
PJM Services Charge (4)		0.01351	$ 58.97	$ 44.42	$ 34.28	$ 27.44	$ 18.51	$ 16.25	$ 16.40	$ 16.12	$ 13.65	$ 13.87	$ 22.01	$ 39.09	
Purchased Electricity Charge (5)	Summer	0.05544						$ 66.68	$ 67.28	$ 66.16	$ 56.01				
	Nonsummer	0.05844	$ 255.10	$ 192.13	$ 148.28	$ 118.70	$ 80.06					$ 60.00	$ 95.19	$ 169.11	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 2.10	$ 1.58	$ 1.22	$ 0.97	$ 0.66	$ 0.58	$ 0.58	$ 0.57	$ 0.48	$ 0.49	$ 0.78	$ 1.39	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.65	$ 0.49	$ 0.38	$ 0.30	$ 0.21	$ 0.18	$ 0.18	$ 0.18	$ 0.15	$ 0.15	$ 0.24	$ 0.43	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 8.25	$ 6.21	$ 4.80	$ 3.84	$ 2.59	$ 2.27	$ 2.29	$ 2.26	$ 1.91	$ 1.94	$ 3.08	$ 5.47	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 8.51	$ 6.41	$ 4.95	$ 3.96	$ 2.67	$ 2.35	$ 2.37	$ 2.33	$ 1.97	$ 2.00	$ 3.18	$ 5.64	
Illinois Electricity Distribution Tax (IEDT) (10)		0.00121	$ 5.28	$ 3.98	$ 3.07	$ 2.46	$ 1.66	$ 1.46	$ 1.47	$ 1.44	$ 1.22	$ 1.24	$ 1.97	$ 3.50	
Franchise Cost Addition (11)		5.080%	$ 4.89	$ 3.91	$ 3.23	$ 2.77	$ 2.17	$ 2.01	$ 2.02	$ 2.01	$ 1.84	$ 1.86	$ 2.40	$ 3.55	
Total Annual Charges (12)			$ 435.25	$ 332.66	$ 261.24	$ 213.03	$ 150.10	$ 130.56	$ 131.55	$ 129.69	$ 112.80	$ 117.40	$ 174.73	$ 295.15	$2,484.16
														$/kWh	$0.1046
	Percent Change		9.7%	9.7%	9.6%	9.5%	9.4%	8.6%	8.6%	8.6%	8.6%	9.3%	9.5%	9.6%	9.4%
	Dollar Change		$ 38.51	$ 29.30	$ 22.88	$ 18.55	$ 12.91	$ 10.37	$ 10.45	$ 10.31	$ 8.89	$ 9.95	$ 15.11	$ 25.92	$ 213.15

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
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Multi Family With Electric Space Heat

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			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	941	706	510	424	289	297	345	345	290	299	342	591	5,381
		Charges													
Customer Charge (1)		8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)		0.01768	$ 16.64	$ 12.48	$ 9.02	$ 7.50	$ 5.11	$ 5.26	$ 6.10	$ 6.11	$ 5.12	$ 5.29	$ 6.05	$ 10.46	
PJM Services Charge (4)		0.01263	$ 11.89	$ 8.92	$ 6.44	$ 5.36	$ 3.65	$ 3.76	$ 4.35	$ 4.36	$ 3.66	$ 3.78	$ 4.33	$ 7.47	
Purchased Electricity Charge (5)	Summer	0.04846						$ 14.41	$ 16.71	$ 16.73	$ 14.04				
	Nonsummer	0.05055	$ 47.58	$ 35.69	$ 25.78	$ 21.44	$ 14.61					$ 15.13	$ 17.31	$ 29.90	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 0.31	$ 0.23	$ 0.17	$ 0.14	$ 0.10	$ 0.10	$ 0.11	$ 0.11	$ 0.10	$ 0.10	$ 0.11	$ 0.20	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 3.13	$ 2.35	$ 1.70	$ 1.41	$ 0.96	$ 0.99	$ 1.15	$ 1.15	$ 0.96	$ 1.00	$ 1.14	$ 1.97	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)		0.00117	$ 1.10	$ 0.83	$ 0.60	$ 0.50	$ 0.34	$ 0.35	$ 0.40	$ 0.40	$ 0.34	$ 0.35	$ 0.40	$ 0.69	
Franchise Cost Addition (11)		5.440%	$ 1.66	$ 1.42	$ 1.22	$ 1.13	$ 0.99	$ 1.00	$ 1.05	$ 1.05	$ 0.99	$ 1.00	$ 1.05	$ 1.30	
Total Annual Charges (12)			$ 95.71	$ 75.32	$ 58.33	$ 50.88	$ 39.16	$ 39.27	$ 43.27	$ 43.31	$ 38.61	$ 40.05	$ 43.79	$ 65.39	$633.09
														$/kWh	$0.1177

January 2018

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	941	706	510	424	289	297	345	345	290	299	342	591	5,381
		Charges													
Customer Charge (2)		8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)		0.01566	$ 14.74	$ 11.06	$ 7.99	$ 6.64	$ 4.52	$ 4.66	$ 5.40	$ 5.41	$ 4.54	$ 4.69	$ 5.36	$ 9.26	
PJM Services Charge (4)		0.01351	$ 12.71	$ 9.54	$ 6.89	$ 5.73	$ 3.90	$ 4.02	$ 4.66	$ 4.67	$ 3.91	$ 4.04	$ 4.63	$ 7.99	
Purchased Electricity Charge (5)	Summer	0.05544						$ 16.49	$ 19.11	$ 19.15	$ 16.06				
	Nonsummer	0.05844	$ 55.00	$ 41.27	$ 29.80	$ 24.79	$ 16.89					$ 17.49	$ 20.01	$ 34.57	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 0.45	$ 0.34	$ 0.24	$ 0.20	$ 0.14	$ 0.14	$ 0.17	$ 0.17	$ 0.14	$ 0.14	$ 0.16	$ 0.28	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.14	$ 0.11	$ 0.08	$ 0.06	$ 0.04	$ 0.04	$ 0.05	$ 0.05	$ 0.04	$ 0.04	$ 0.05	$ 0.09	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 1.78	$ 1.33	$ 0.96	$ 0.80	$ 0.55	$ 0.56	$ 0.65	$ 0.65	$ 0.55	$ 0.57	$ 0.65	$ 1.12	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 1.84	$ 1.38	$ 0.99	$ 0.83	$ 0.56	$ 0.58	$ 0.67	$ 0.67	$ 0.56	$ 0.58	$ 0.67	$ 1.15	
Illinois Electricity Distribution Tax (IEDT) (10)		0.00121	$ 1.14	$ 0.85	$ 0.62	$ 0.51	$ 0.35	$ 0.36	$ 0.42	$ 0.42	$ 0.35	$ 0.36	$ 0.41	$ 0.72	
Franchise Cost Addition (11)		5.080%	$ 1.49	$ 1.29	$ 1.13	$ 1.05	$ 0.94	$ 0.94	$ 0.98	$ 0.98	$ 0.94	$ 0.94	$ 0.98	$ 1.20	
Total Annual Charges (12)			$ 103.41	$ 81.29	$ 62.82	$ 54.73	$ 42.01	$ 41.91	$ 46.23	$ 46.29	$ 41.21	$ 42.97	$ 47.04	$ 70.50	$680.41
														$/kWh	$0.1265
		Percent Change	8.0%	7.9%	7.7%	7.6%	7.3%	6.7%	6.8%	6.9%	6.7%	7.3%	7.4%	7.8%	7.5%
		Dollar Change	$ 7.70	$ 5.98	$ 4.49	$ 3.86	$ 2.85	$ 2.64	$ 2.95	$ 2.97	$ 2.60	$ 2.92	$ 3.25	$ 5.10	$ 47.33

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
BILL COMPARISONS - EIMA

Multi Family With Electric Space Heat

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January 2017

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	1,442	1,107	824	679	456	438	488	486	407	421	525	935	8,209
		Charges													
Customer Charge (1)		8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)		0.01768	$ 25.49	$ 19.58	$ 14.57	$ 12.01	$ 8.06	$ 7.75	$ 8.64	$ 8.60	$ 7.19	$ 7.44	$ 9.29	$ 16.53	
PJM Services Charge (4)		0.01263	$ 18.21	$ 13.98	$ 10.41	$ 8.58	$ 5.76	$ 5.53	$ 6.17	$ 6.14	$ 5.14	$ 5.31	$ 6.64	$ 11.81	
Purchased Electricity Charge (5)	Summer	0.04846						$ 21.23	$ 23.67	$ 23.57	$ 19.71				
	Nonsummer	0.05055	$ 72.89	$ 55.97	$ 41.65	$ 34.33	$ 23.04					$ 21.27	$ 26.56	$ 47.27	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 0.48	$ 0.37	$ 0.27	$ 0.22	$ 0.15	$ 0.14	$ 0.16	$ 0.16	$ 0.13	$ 0.14	$ 0.17	$ 0.31	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 4.80	$ 3.69	$ 2.74	$ 2.26	$ 1.52	$ 1.46	$ 1.63	$ 1.62	$ 1.35	$ 1.40	$ 1.75	$ 3.11	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)		0.00117	$ 1.69	$ 1.30	$ 0.96	$ 0.79	$ 0.53	$ 0.51	$ 0.57	$ 0.57	$ 0.48	$ 0.49	$ 0.61	$ 1.09	
Franchise Cost Addition (11)		5.440%	$ 2.18	$ 1.83	$ 1.54	$ 1.39	$ 1.17	$ 1.15	$ 1.20	$ 1.20	$ 1.11	$ 1.13	$ 1.24	$ 1.66	
Total Annual Charges (12)			$ 139.14	$ 110.12	$ 85.54	$ 72.98	$ 53.63	$ 51.17	$ 55.44	$ 55.26	$ 48.51	$ 50.58	$ 59.66	$ 95.18	$877.22
														$/kWh	$0.1069

January 2018

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	1,442	1,107	824	679	456	438	488	486	407	421	525	935	8,209
		Charges													
Customer Charge (2)		8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)		0.01566	$ 22.58	$ 17.34	$ 12.90	$ 10.64	$ 7.14	$ 6.86	$ 7.65	$ 7.62	$ 6.37	$ 6.59	$ 8.23	$ 14.64	
PJM Services Charge (4)		0.01351	$ 19.48	$ 14.96	$ 11.13	$ 9.18	$ 6.16	$ 5.92	$ 6.60	$ 6.57	$ 5.50	$ 5.68	$ 7.10	$ 12.63	
Purchased Electricity Charge (5)	Summer	0.05544						$ 24.29	$ 27.08	$ 26.97	$ 22.55				
	Nonsummer	0.05844	$ 84.26	$ 64.71	$ 48.15	$ 39.69	$ 26.64					$ 24.59	$ 30.71	$ 54.65	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 0.69	$ 0.53	$ 0.40	$ 0.33	$ 0.22	$ 0.21	$ 0.23	$ 0.23	$ 0.20	$ 0.20	$ 0.25	$ 0.45	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.22	$ 0.17	$ 0.12	$ 0.10	$ 0.07	$ 0.07	$ 0.07	$ 0.07	$ 0.06	$ 0.06	$ 0.08	$ 0.14	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 2.73	$ 2.09	$ 1.56	$ 1.28	$ 0.86	$ 0.83	$ 0.92	$ 0.92	$ 0.77	$ 0.80	$ 0.99	$ 1.77	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 2.81	$ 2.16	$ 1.61	$ 1.32	$ 0.89	$ 0.85	$ 0.95	$ 0.95	$ 0.79	$ 0.82	$ 1.02	$ 1.82	
Illinois Electricity Distribution Tax (IEDT) (10)		0.00121	$ 1.74	$ 1.34	$ 1.00	$ 0.82	$ 0.55	$ 0.53	$ 0.59	$ 0.59	$ 0.49	$ 0.51	$ 0.64	$ 1.13	
Franchise Cost Addition (11)		5.080%	$ 1.92	$ 1.64	$ 1.39	$ 1.27	$ 1.08	$ 1.06	$ 1.11	$ 1.11	$ 1.04	$ 1.05	$ 1.14	$ 1.49	
Total Annual Charges (12)			$ 150.55	$ 119.06	$ 92.38	$ 78.75	$ 57.73	$ 54.74	$ 59.32	$ 59.15	$ 51.89	$ 54.42	$ 64.28	$ 102.84	$945.11
														$/kWh	$0.1151
		Percent Change	8.2%	8.1%	8.0%	7.9%	7.6%	7.0%	7.0%	7.0%	7.0%	7.6%	7.7%	8.0%	7.7%
		Dollar Change	$ 11.42	$ 8.94	$ 6.83	$ 5.77	$ 4.10	$ 3.57	$ 3.88	$ 3.89	$ 3.39	$ 3.84	$ 4.61	$ 7.66	$ 67.89

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Residential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY
SECTION 285.5135 b) 1) D)
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Multi Family With Electric Space Heat

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January 2017

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	2,077	1,623	1,214	1,016	667	594	644	641	539	561	744	1,359	11,680
		Charges													
Customer Charge (1)		8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	$ 8.13	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (1)		4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	$ 4.70	
Distribution Facilities Charge (1)		0.01768	$ 36.73	$ 28.70	$ 21.46	$ 17.97	$ 11.79	$ 10.51	$ 11.39	$ 11.34	$ 9.53	$ 9.92	$ 13.15	$ 24.02	
PJM Services Charge (4)		0.01263	$ 26.24	$ 20.50	$ 15.33	$ 12.83	$ 8.42	$ 7.51	$ 8.14	$ 8.10	$ 6.81	$ 7.09	$ 9.39	$ 17.16	
Purchased Electricity Charge (5)	Summer	0.04846						$ 28.80	$ 31.22	$ 31.08	$ 26.12				
	Nonsummer	0.05055	$ 105.01	$ 82.05	$ 61.37	$ 51.37	$ 33.71					$ 28.36	$ 37.59	$ 68.68	
Environmental Cost Recovery Adjustment (Rider ECR) (6)		0.00033	$ 0.69	$ 0.54	$ 0.40	$ 0.34	$ 0.22	$ 0.20	$ 0.21	$ 0.21	$ 0.18	$ 0.19	$ 0.25	$ 0.45	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00333	$ 6.92	$ 5.41	$ 4.04	$ 3.38	$ 2.22	$ 1.98	$ 2.15	$ 2.14	$ 1.80	$ 1.87	$ 2.48	$ 4.52	
Renewable Portfolio Standard Adj (Rider REA) (8)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 10)		0.00117	$ 2.43	$ 1.90	$ 1.42	$ 1.19	$ 0.78	$ 0.70	$ 0.75	$ 0.75	$ 0.63	$ 0.66	$ 0.87	$ 1.59	
Franchise Cost Addition (11)		5.440%	$ 2.83	$ 2.36	$ 1.94	$ 1.74	$ 1.38	$ 1.31	$ 1.36	$ 1.36	$ 1.25	$ 1.27	$ 1.46	$ 2.09	
Total Annual Charges (12)			$ 194.25	$ 154.86	$ 119.36	$ 102.22	$ 71.92	$ 64.41	$ 68.62	$ 68.38	$ 59.72	$ 62.76	$ 78.59	$ 131.91	$1,177.00
														$/kWh	$0.1008

January 2018

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kWh	2,077	1,623	1,214	1,016	667	594	644	641	539	561	744	1,359	11,680
		Charges													
Customer Charge (2)		8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	$ 8.51	
Retail Customer Assessments (Rider RCA) (3)		0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	$ 0.57	
Standard Metering Charge (2)		5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	$ 5.04	
Distribution Facilities Charge (2)		0.01566	$ 32.53	$ 25.42	$ 19.01	$ 15.91	$ 10.44	$ 9.31	$ 10.09	$ 10.04	$ 8.44	$ 8.79	$ 11.65	$ 21.28	
PJM Services Charge (4)		0.01351	$ 28.06	$ 21.93	$ 16.40	$ 13.73	$ 9.01	$ 8.03	$ 8.70	$ 8.66	$ 7.28	$ 7.58	$ 10.05	$ 18.36	
Purchased Electricity Charge (5)	Summer	0.05544						$ 32.95	$ 35.71	$ 35.55	$ 29.88				
	Nonsummer	0.05844	$ 121.40	$ 94.86	$ 70.95	$ 59.39	$ 38.98					$ 32.79	$ 43.46	$ 79.40	
Environmental Cost Recovery Adjustment (6)		0.00048	$ 1.00	$ 0.78	$ 0.58	$ 0.49	$ 0.32	$ 0.29	$ 0.31	$ 0.31	$ 0.26	$ 0.27	$ 0.36	$ 0.65	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00015	$ 0.31	$ 0.24	$ 0.18	$ 0.15	$ 0.10	$ 0.09	$ 0.10	$ 0.10	$ 0.08	$ 0.08	$ 0.11	$ 0.20	
Renewable Portfolio Standard Adj (REA) (8)		0.00189	$ 3.93	$ 3.07	$ 2.29	$ 1.92	$ 1.26	$ 1.12	$ 1.22	$ 1.21	$ 1.02	$ 1.06	$ 1.41	$ 2.57	
Zero Emission Standard Adj (ZEA) (9)		0.00195	$ 4.05	$ 3.17	$ 2.37	$ 1.98	$ 1.30	$ 1.16	$ 1.26	$ 1.25	$ 1.05	$ 1.09	$ 1.45	$ 2.65	
Illinois Electricity Distribution Tax (IEDT) (10)		0.00121	$ 2.51	$ 1.96	$ 1.47	$ 1.23	$ 0.81	$ 0.72	$ 0.78	$ 0.78	$ 0.65	$ 0.68	$ 0.90	$ 1.64	
Franchise Cost Addition (11)		5.080%	$ 2.47	$ 2.08	$ 1.73	$ 1.56	$ 1.26	$ 1.20	$ 1.24	$ 1.24	$ 1.15	$ 1.17	$ 1.33	$ 1.85	
Total Annual Charges (12)			$ 210.38	$ 167.63	$ 129.10	$ 110.48	$ 77.60	$ 68.99	$ 73.53	$ 73.26	$ 63.93	$ 67.63	$ 84.84	$ 142.72	$1,270.09
														$/kWh	$0.1087
		Percent Change	8.3%	8.2%	8.2%	8.1%	7.9%	7.1%	7.1%	7.1%	7.1%	7.8%	8.0%	8.2%	7.9%
		Dollar Change	$ 16.13	$ 12.77	$ 9.74	$ 8.26	$ 5.68	$ 4.58	$ 4.91	$ 4.88	$ 4.21	$ 4.87	$ 6.25	$ 10.81	$ 93.10

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a residential customer per Rider RCA, Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Nonresidential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY

BILL COMPARISONS - EIMA

Watthour Delivery Class Without Electric Space Heat

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			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW (3)	*	*	*	*	*	*	*	*	*	*	*	*	
January 2017		**kWh**	**154**	**127**	**110**	**102**	**91**	**92**	**95**	**92**	**91**	**97**	**101**	**127**	1,279
		Charges													
Customer Charge (1)		11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (1)		4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	
Distribution Facilities Charge (4)		0.01993	$ 3.06	$ 2.53	$ 2.20	$ 2.04	$ 1.80	$ 1.83	$ 1.90	$ 1.84	$ 1.82	$ 1.92	$ 2.02	$ 2.53	
PJM Services Charge (5)		0.01244	$ 1.91	$ 1.58	$ 1.37	$ 1.27	$ 1.13	$ 1.14	$ 1.18	$ 1.15	$ 1.14	$ 1.20	$ 1.26	$ 1.58	
Purchased Electricity Charge (6)	Summer	0.04960						$ 4.55	$ 4.72	$ 4.58	$ 4.53				
	Nonsummer	0.05124	$ 7.88	$ 6.50	$ 5.65	$ 5.25	$ 4.64					$ 4.95	$ 5.20	$ 6.51	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00033	$ 0.05	$ 0.04	$ 0.04	$ 0.03	$ 0.03	$ 0.03	$ 0.03	$ 0.03	$ 0.03	$ 0.03	$ 0.03	$ 0.04	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00658	$ 1.01	$ 0.83	$ 0.73	$ 0.67	$ 0.60	$ 0.60	$ 0.63	$ 0.61	$ 0.60	$ 0.64	$ 0.67	$ 0.84	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00116	$ 0.18	$ 0.15	$ 0.13	$ 0.12	$ 0.11	$ 0.11	$ 0.11	$ 0.11	$ 0.11	$ 0.11	$ 0.12	$ 0.15	
Franchise Cost Addition (12)		5.440%	$ 1.04	$ 1.01	$ 0.99	$ 0.98	$ 0.96	$ 0.97	$ 0.97	$ 0.97	$ 0.97	$ 0.97	$ 0.98	$ 1.01	
Total Annual Charges (13)			$ 36.25	$ 33.76	$ 32.23	$ 31.48	$ 30.39	$ 30.35	$ 30.66	$ 30.41	$ 30.32	$ 30.94	$ 31.40	$ 33.78	$ 382
														$/kWh	0.2986

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW (3)	*	*	*	*	*	*	*	*	*	*	*	*	
January 2018		**kWh**	**154**	**127**	**110**	**102**	**91**	**92**	**95**	**92**	**91**	**97**	**101**	**127**	1,279
		Charges													
Customer Charge (2)		13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (2)		6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	
Distribution Facilities Charge (4)		0.01929	$ 2.97	$ 2.45	$ 2.13	$ 1.97	$ 1.75	$ 1.77	$ 1.84	$ 1.78	$ 1.76	$ 1.86	$ 1.96	$ 2.45	
PJM Services Charge (5)		0.01340	$ 2.06	$ 1.70	$ 1.48	$ 1.37	$ 1.21	$ 1.23	$ 1.28	$ 1.24	$ 1.22	$ 1.29	$ 1.36	$ 1.70	
Purchased Electricity Charge (6)	Summer	0.05572						$ 5.11	$ 5.30	$ 5.14	$ 5.09				
	Nonsummer	0.05884	$ 9.04	$ 7.46	$ 6.49	$ 6.02	$ 5.33					$ 5.68	$ 5.97	$ 7.47	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00048	$ 0.07	$ 0.06	$ 0.05	$ 0.05	$ 0.04	$ 0.04	$ 0.05	$ 0.04	$ 0.04	$ 0.05	$ 0.05	$ 0.06	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00019	$ 0.03	$ 0.02	$ 0.02	$ 0.02	$ 0.02	$ 0.02	$ 0.02	$ 0.02	$ 0.02	$ 0.02	$ 0.02	$ 0.02	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00189	$ 0.29	$ 0.24	$ 0.21	$ 0.19	$ 0.17	$ 0.17	$ 0.18	$ 0.17	$ 0.17	$ 0.18	$ 0.19	$ 0.24	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00195	$ 0.30	$ 0.25	$ 0.21	$ 0.20	$ 0.18	$ 0.18	$ 0.19	$ 0.18	$ 0.18	$ 0.19	$ 0.20	$ 0.25	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00119	$ 0.18	$ 0.15	$ 0.13	$ 0.12	$ 0.11	$ 0.11	$ 0.11	$ 0.11	$ 0.11	$ 0.11	$ 0.12	$ 0.15	
Franchise Cost Addition (12)		5.080%	$ 1.18	$ 1.15	$ 1.13	$ 1.12	$ 1.11	$ 1.11	$ 1.12	$ 1.11	$ 1.11	$ 1.12	$ 1.12	$ 1.15	
Total Annual Charges (13)			$ 41.42	$ 38.78	$ 37.15	$ 36.36	$ 35.22	$ 35.04	$ 35.39	$ 35.09	$ 35.00	$ 35.80	$ 36.29	$ 38.79	$ 440
														$/kWh	0.3442
	Percent Change		14.3%	14.9%	15.3%	15.5%	15.9%	15.5%	15.4%	15.4%	15.4%	15.7%	15.6%	14.8%	15.3%
	Dollar Change		$ 5.17	$ 5.02	$ 4.92	$ 4.88	$ 4.83	$ 4.69	$ 4.73	$ 4.68	$ 4.68	$ 4.86	$ 4.89	$ 5.01	$ 58.36

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a nonresidential customer per Rider RCA Sheets Nos. 256 through No. 257.4.
(4) Billed at a per kWh distribution facilities charge.
(5) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(6) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(7) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(8) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(9) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(10) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(11) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(12) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(13) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Nonresidential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY

BILL COMPARISONS - EIMA

Watthour Delivery Class Without Electric Space Heat

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			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW (3)	*	*	*	*	*	*	*	*	*	*	*	*	
January 2017		**kWh**	**364**	**313**	**280**	**261**	**239**	**253**	**264**	**260**	**242**	**245**	**250**	**304**	3,274
		Charges													
Customer Charge (1)		11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (1)		4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	
Distribution Facilities Charge (4)		0.01993	$ 7.25	$ 6.24	$ 5.58	$ 5.20	$ 4.77	$ 5.04	$ 5.26	$ 5.18	$ 4.81	$ 4.88	$ 4.98	$ 6.06	
PJM Services Charge (5)		0.01244	$ 4.52	$ 3.90	$ 3.49	$ 3.25	$ 2.98	$ 3.14	$ 3.28	$ 3.23	$ 3.00	$ 3.05	$ 3.11	$ 3.79	
Purchased Electricity Charge (6)	Summer	0.04960						$ 12.53	$ 13.09	$ 12.88	$ 11.98				
	Nonsummer	0.05124	$ 18.63	$ 16.05	$ 14.36	$ 13.37	$ 12.26					$ 12.55	$ 12.81	$ 15.59	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00033	$ 0.12	$ 0.10	$ 0.09	$ 0.09	$ 0.08	$ 0.08	$ 0.09	$ 0.09	$ 0.08	$ 0.08	$ 0.08	$ 0.10	
Energy Efficiency Programs (Rider EDA/EEPP) (7)		0.00658	$ 2.39	$ 2.06	$ 1.84	$ 1.72	$ 1.57	$ 1.66	$ 1.74	$ 1.71	$ 1.59	$ 1.61	$ 1.64	$ 2.00	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00116	$ 0.42	$ 0.36	$ 0.33	$ 0.30	$ 0.28	$ 0.29	$ 0.31	$ 0.30	$ 0.28	$ 0.28	$ 0.29	$ 0.35	
Franchise Cost Addition (12)		5.440%	$ 1.28	$ 1.22	$ 1.18	$ 1.16	$ 1.14	$ 1.15	$ 1.16	$ 1.16	$ 1.14	$ 1.14	$ 1.15	$ 1.21	
Total Annual Charges (13)			$ 55.73	$ 51.05	$ 47.99	$ 46.21	$ 44.20	$ 45.01	$ 46.05	$ 45.67	$ 44.00	$ 44.71	$ 45.18	$ 50.22	$ 566
														$/kWh	0.1729

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW (3)	*	*	*	*	*	*	*	*	*	*	*	*	
January 2018		**kWh**	**364**	**313**	**280**	**261**	**239**	**253**	**264**	**260**	**242**	**245**	**250**	**304**	3,274
		Charges													
Customer Charge (2)		13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (2)		6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	
Distribution Facilities Charge (4)		0.01929	$ 7.01	$ 6.04	$ 5.41	$ 5.03	$ 4.62	$ 4.87	$ 5.09	$ 5.01	$ 4.66	$ 4.73	$ 4.82	$ 5.87	
PJM Services Charge (5)		0.01340	$ 4.87	$ 4.20	$ 3.75	$ 3.50	$ 3.21	$ 3.39	$ 3.54	$ 3.48	$ 3.24	$ 3.28	$ 3.35	$ 4.08	
Purchased Electricity Charge (6)	Summer	0.05572						$ 14.08	$ 14.70	$ 14.47	$ 13.46				
	Nonsummer	0.05884	$ 21.39	$ 18.43	$ 16.49	$ 15.36	$ 14.08					$ 14.41	$ 14.71	$ 17.90	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00048	$ 0.17	$ 0.15	$ 0.13	$ 0.13	$ 0.11	$ 0.12	$ 0.13	$ 0.12	$ 0.12	$ 0.12	$ 0.12	$ 0.15	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00019	$ 0.07	$ 0.06	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.06	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00189	$ 0.69	$ 0.59	$ 0.53	$ 0.49	$ 0.45	$ 0.48	$ 0.50	$ 0.49	$ 0.46	$ 0.46	$ 0.47	$ 0.58	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00195	$ 0.71	$ 0.61	$ 0.55	$ 0.51	$ 0.47	$ 0.49	$ 0.51	$ 0.51	$ 0.47	$ 0.48	$ 0.49	$ 0.59	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00119	$ 0.43	$ 0.37	$ 0.33	$ 0.31	$ 0.28	$ 0.30	$ 0.31	$ 0.31	$ 0.29	$ 0.29	$ 0.30	$ 0.36	
Franchise Cost Addition (12)		5.080%	$ 1.39	$ 1.34	$ 1.31	$ 1.29	$ 1.26	$ 1.28	$ 1.29	$ 1.29	$ 1.27	$ 1.27	$ 1.28	$ 1.33	
Total Annual Charges (13)			$ 62.03	$ 57.09	$ 53.85	$ 51.97	$ 49.83	$ 50.36	$ 51.42	$ 51.03	$ 49.32	$ 50.39	$ 50.89	$ 56.22	$ 634
														$/kWh	0.1937
	Percent Change		11.3%	11.8%	12.2%	12.5%	12.7%	11.9%	11.7%	11.7%	12.1%	12.7%	12.6%	11.9%	12.1%
	Dollar Change		$ 6.30	$ 6.04	$ 5.86	$ 5.76	$ 5.63	$ 5.35	$ 5.37	$ 5.36	$ 5.32	$ 5.68	$ 5.71	$ 6.00	$ 68.38

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a nonresidential customer per Rider RCA Sheets Nos. 256 through No. 257.4.
(4) Billed at a per kWh distribution facilities charge.
(5) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(6) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(7) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(8) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(9) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(10) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(11) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(12) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(13) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Nonresidential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY

BILL COMPARISONS - EIMA

Watthour Delivery Class Without Electric Space Heat

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			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW (3)	*	*	*	*	*	*	*	*	*	*	*	*	
January 2017		**kWh**	**655**	**559**	**496**	**455**	**413**	**442**	**473**	**470**	**431**	**435**	**439**	**524**	5,790
		Charges													
Customer Charge (1)		11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	$ 11.07	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (1)		4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	$ 4.75	
Distribution Facilities Charge (4)		0.01993	$ 13.06	$ 11.14	$ 9.88	$ 9.08	$ 8.23	$ 8.80	$ 9.42	$ 9.36	$ 8.58	$ 8.68	$ 8.74	$ 10.43	
PJM Services Charge (5)		0.01244	$ 8.15	$ 6.95	$ 6.17	$ 5.67	$ 5.14	$ 5.49	$ 5.88	$ 5.84	$ 5.36	$ 5.42	$ 5.46	$ 6.51	
Purchased Electricity Charge (6)	Summer	0.04960						$ 21.90	$ 23.44	$ 23.29	$ 21.36				
	Nonsummer	0.05124	$ 33.58	$ 28.65	$ 25.40	$ 23.34	$ 21.15					$ 22.31	$ 22.48	$ 26.83	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00033	$ 0.22	$ 0.18	$ 0.16	$ 0.15	$ 0.14	$ 0.15	$ 0.16	$ 0.15	$ 0.14	$ 0.14	$ 0.14	$ 0.17	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00658	$ 4.31	$ 3.68	$ 3.26	$ 3.00	$ 2.72	$ 2.91	$ 3.11	$ 3.09	$ 2.83	$ 2.86	$ 2.89	$ 3.44	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00116	$ 0.76	$ 0.65	$ 0.58	$ 0.53	$ 0.48	$ 0.51	$ 0.55	$ 0.54	$ 0.50	$ 0.50	$ 0.51	$ 0.61	
Franchise Cost Addition (12)		5.440%	$ 1.61	$ 1.50	$ 1.43	$ 1.38	$ 1.33	$ 1.37	$ 1.40	$ 1.40	$ 1.35	$ 1.36	$ 1.36	$ 1.46	
Total Annual Charges (13)			$ 82.81	$ 73.87	$ 68.00	$ 64.27	$ 60.31	$ 62.25	$ 65.08	$ 64.79	$ 61.24	$ 62.39	$ 62.70	$ 70.57	$ 798
														$/kWh	0.1379

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW (3)	*	*	*	*	*	*	*	*	*	*	*	*	
January 2018		**kWh**	**655**	**559**	**496**	**455**	**413**	**442**	**473**	**470**	**431**	**435**	**439**	**524**	5,790
		Charges													
Customer Charge (2)		13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	$ 13.50	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (2)		6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	$ 6.50	
Distribution Facilities Charge (4)		0.01929	$ 12.64	$ 10.78	$ 9.56	$ 8.79	$ 7.96	$ 8.52	$ 9.12	$ 9.06	$ 8.31	$ 8.40	$ 8.46	$ 10.10	
PJM Services Charge (5)		0.01340	$ 8.78	$ 7.49	$ 6.64	$ 6.10	$ 5.53	$ 5.92	$ 6.33	$ 6.29	$ 5.77	$ 5.83	$ 5.88	$ 7.02	
Purchased Electricity Charge (6)	Summer	0.05572						$ 24.61	$ 26.33	$ 26.16	$ 23.99				
	Nonsummer	0.05884	$ 38.57	$ 32.90	$ 29.17	$ 26.80	$ 24.29					$ 25.62	$ 25.82	$ 30.80	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00048	$ 0.31	$ 0.27	$ 0.24	$ 0.22	$ 0.20	$ 0.21	$ 0.23	$ 0.23	$ 0.21	$ 0.21	$ 0.21	$ 0.25	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00019	$ 0.12	$ 0.11	$ 0.09	$ 0.09	$ 0.08	$ 0.08	$ 0.09	$ 0.09	$ 0.08	$ 0.08	$ 0.08	$ 0.10	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00189	$ 1.24	$ 1.06	$ 0.94	$ 0.86	$ 0.78	$ 0.83	$ 0.89	$ 0.89	$ 0.81	$ 0.82	$ 0.83	$ 0.99	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00195	$ 1.28	$ 1.09	$ 0.97	$ 0.89	$ 0.80	$ 0.86	$ 0.92	$ 0.92	$ 0.84	$ 0.85	$ 0.86	$ 1.02	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00119	$ 0.78	$ 0.67	$ 0.59	$ 0.54	$ 0.49	$ 0.53	$ 0.56	$ 0.56	$ 0.51	$ 0.52	$ 0.52	$ 0.62	
Franchise Cost Addition (12)		5.080%	$ 1.70	$ 1.60	$ 1.53	$ 1.49	$ 1.45	$ 1.48	$ 1.51	$ 1.50	$ 1.46	$ 1.47	$ 1.47	$ 1.56	
Total Annual Charges (13)			$ 90.72	$ 81.27	$ 75.03	$ 71.08	$ 66.88	$ 68.34	$ 71.28	$ 71.00	$ 67.28	$ 69.10	$ 69.43	$ 77.76	$ 879
														$/kWh	0.1518
	Percent Change		9.6%	10.0%	10.3%	10.6%	10.9%	9.8%	9.5%	9.6%	9.9%	10.8%	10.7%	10.2%	10.1%
	Dollar Change		$ 7.91	$ 7.40	$ 7.03	$ 6.81	$ 6.57	$ 6.09	$ 6.20	$ 6.21	$ 6.04	$ 6.71	$ 6.73	$ 7.19	$ 80.89

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a nonresidential customer per Rider RCA Sheets Nos. 256 through No. 257.4.
(4) Billed at a per kWh distribution facilities charge.
(5) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(6) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(7) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(8) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(9) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(10) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(11) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(12) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(13) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Nonresidential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY

BILL COMPARISONS - EIMA

Small Load Delivery Class Without Electric Space Heat

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			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW - Secondary	4	4	3	3	3	4	4	4	4	4	4	3	
		kW - Primary	0	0	0	0	0	0	0	0	0	0	0	0	
		kW - Primary w/ Tr	0	0	0	0	0	0	0	0	0	0	0	0	
January 2017		**kWh**	824	714	629	575	526	588	665	678	592	598	555	675	7,619
		Charges													
Customer Charge (1)		12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (1)		13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	
Secondary Voltage Distribution Facilities Charge (1)		6.65	$ 24.72	$ 23.68	$ 22.74	$ 22.44	$ 23.19	$ 26.66	$ 28.58	$ 28.32	$ 26.24	$ 27.86	$ 23.97	$ 22.70	
Primary Voltage Distribution Facilities Charge (1)		2.53	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Primary Voltage Transformer Charge (1)		0.64	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
PJM Services Charge (5)		0.01244	$ 10.25	$ 8.89	$ 7.82	$ 7.15	$ 6.54	$ 7.31	$ 8.27	$ 8.43	$ 7.36	$ 7.44	$ 6.90	$ 8.40	
Purchased Electricity Charge (6)	Summer	0.04933						$ 28.99	$ 32.80	$ 33.44	$ 29.19				
	Nonsummer	0.05116	$ 42.16	$ 36.55	$ 32.18	$ 29.42	$ 26.89					$ 30.62	$ 28.39	$ 34.53	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00033	$ 0.27	$ 0.24	$ 0.21	$ 0.19	$ 0.17	$ 0.19	$ 0.22	$ 0.22	$ 0.20	$ 0.20	$ 0.18	$ 0.22	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00658	$ 5.42	$ 4.70	$ 4.14	$ 3.78	$ 3.46	$ 3.87	$ 4.37	$ 4.46	$ 3.89	$ 3.94	$ 3.65	$ 4.44	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00116	$ 0.96	$ 0.83	$ 0.73	$ 0.67	$ 0.61	$ 0.68	$ 0.77	$ 0.79	$ 0.69	$ 0.69	$ 0.64	$ 0.78	
Franchise Cost Addition (12)		5.440%	$ 2.81	$ 2.75	$ 2.69	$ 2.67	$ 2.71	$ 2.90	$ 3.01	$ 3.00	$ 2.88	$ 2.97	$ 2.75	$ 2.69	
Total Charges (13)			$ 117.91	$ 108.96	$ 101.83	$ 97.64	$ 94.89	$ 101.92	$ 109.34	$ 109.98	$ 101.77	$ 105.04	$ 97.80	$ 105.08	$ 1,252
														$/kWh	0.1644

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
January 2018		**kW - Secondary**	4	4	3	3	3	4	4	4	4	4	4	3	
		kW - Primary	0	0	0	0	0	0	0	0	0	0	0	0	
		kW - Primary w/ Tr	0	0	0	0	0	0	0	0	0	0	0	0	
		kWh	824	714	629	575	526	588	665	678	592	598	555	675	7,619
		Charges													
Customer Charge (2)		15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (2)		15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	
Secondary Voltage Distribution Facilities Charge (2)		7.07	$ 26.28	$ 25.18	$ 24.17	$ 23.86	$ 24.65	$ 28.34	$ 30.39	$ 30.10	$ 27.90	$ 29.62	$ 25.48	$ 24.13	
Primary Voltage Distribution Facilities Charge (2)		3.14	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Primary Voltage Transformer Charge (2)		0.24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
PJM Services Charge (5)		0.01340	$ 11.04	$ 9.57	$ 8.43	$ 7.71	$ 7.04	$ 7.87	$ 8.91	$ 9.08	$ 7.93	$ 8.02	$ 7.44	$ 9.04	
Purchased Electricity Charge (6)	Summer	0.05629						$ 33.08	$ 37.42	$ 38.16	$ 33.31				
	Nonsummer	0.05935	$ 48.91	$ 42.40	$ 37.33	$ 34.13	$ 31.19					$ 35.52	$ 32.94	$ 40.06	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00048	$ 0.40	$ 0.34	$ 0.30	$ 0.28	$ 0.25	$ 0.28	$ 0.32	$ 0.33	$ 0.28	$ 0.29	$ 0.27	$ 0.32	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00019	$ 0.16	$ 0.14	$ 0.12	$ 0.11	$ 0.10	$ 0.11	$ 0.13	$ 0.13	$ 0.11	$ 0.11	$ 0.11	$ 0.13	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00189	$ 1.56	$ 1.35	$ 1.19	$ 1.09	$ 0.99	$ 1.11	$ 1.26	$ 1.28	$ 1.12	$ 1.13	$ 1.05	$ 1.28	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00195	$ 1.61	$ 1.39	$ 1.23	$ 1.12	$ 1.02	$ 1.15	$ 1.30	$ 1.32	$ 1.15	$ 1.17	$ 1.08	$ 1.32	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00119	$ 0.98	$ 0.85	$ 0.75	$ 0.68	$ 0.63	$ 0.70	$ 0.79	$ 0.81	$ 0.70	$ 0.71	$ 0.66	$ 0.80	
Franchise Cost Addition (12)		5.080%	$ 2.92	$ 2.86	$ 2.80	$ 2.78	$ 2.82	$ 3.01	$ 3.12	$ 3.10	$ 2.99	$ 3.07	$ 2.86	$ 2.80	
Total Charges (13)			$ 129.35	$ 119.57	$ 111.81	$ 107.25	$ 104.18	$ 111.14	$ 119.13	$ 119.80	$ 110.98	$ 115.13	$ 107.38	$ 115.37	$ 1,371
														$/kWh	0.1800
		Percent Change	9.7%	9.7%	9.8%	9.8%	9.8%	9.0%	9.0%	8.9%	9.0%	9.6%	9.8%	9.8%	9.5%
		Dollar Change	$ 11.44	$ 10.61	$ 9.98	$ 9.61	$ 9.29	$ 9.22	$ 9.79	$ 9.82	$ 9.21	$ 10.09	$ 9.58	$ 10.29	$ 118.93

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a nonresidential customer per Rider RCA Sheets Nos. 256 through No. 257.4.
(4) Billed at a per kWh distribution facilities charge.
(5) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(6) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(7) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(8) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(9) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(10) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(11) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(12) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(13) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Nonresidential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY

BILL COMPARISONS - EIMA

Small Load Delivery Class Without Electric Space Heat

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			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW - Secondary	**7**	**7**	**7**	**7**	**7**	**8**	**8**	**8**	**7**	**8**	**7**	**7**	
		kW - Primary	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
		kW - Primary w/ Tr	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
January 2017		**kWh**	**1,980**	**1,735**	**1,546**	**1,456**	**1,343**	**1,514**	**1,714**	**1,722**	**1,527**	**1,505**	**1,372**	**1,644**	19,059
		Charges													
Customer Charge (1)		12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (1)		13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	
Secondary Voltage Distribution Facilities Charge (1)		6.65	$ 48.49	$ 46.42	$ 45.04	$ 45.11	$ 46.45	$ 51.03	$ 53.26	$ 52.54	$ 49.82	$ 51.30	$ 45.60	$ 43.93	
Primary Voltage Distribution Facilities Charge (1)		2.53	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Primary Voltage Transformer Charge (1)		0.64	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
PJM Services Charge (5)		0.01244	$ 24.64	$ 21.58	$ 19.23	$ 18.11	$ 16.71	$ 18.84	$ 21.32	$ 21.43	$ 18.99	$ 18.72	$ 17.07	$ 20.45	
Purchased Electricity Charge (6)	Summer	0.04933						$ 74.70	$ 84.55	$ 84.97	$ 75.32				
	Nonsummer	0.05116	$ 101.32	$ 88.74	$ 79.08	$ 74.49	$ 68.71					$ 77.00	$ 70.20	$ 84.11	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00033	$ 0.65	$ 0.57	$ 0.51	$ 0.48	$ 0.44	$ 0.50	$ 0.57	$ 0.57	$ 0.50	$ 0.50	$ 0.45	$ 0.54	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00658	$ 13.03	$ 11.41	$ 10.17	$ 9.58	$ 8.84	$ 9.96	$ 11.28	$ 11.33	$ 10.05	$ 9.90	$ 9.03	$ 10.82	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00116	$ 2.30	$ 2.01	$ 1.79	$ 1.69	$ 1.56	$ 1.76	$ 1.99	$ 2.00	$ 1.77	$ 1.75	$ 1.59	$ 1.91	
Franchise Cost Addition (12)		5.440%	$ 4.18	$ 4.05	$ 3.96	$ 3.96	$ 4.03	$ 4.29	$ 4.42	$ 4.38	$ 4.22	$ 4.30	$ 3.98	$ 3.91	
Total Charges (13)			$ 225.93	$ 206.10	$ 191.10	$ 184.74	$ 178.06	$ 192.40	$ 208.71	$ 208.54	$ 191.99	$ 194.79	$ 179.24	$ 196.99	$ 2,359
														$/kWh	0.1238

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
January 2018		**kW - Secondary**	**7**	**7**	**7**	**7**	**7**	**8**	**8**	**8**	**7**	**8**	**7**	**7**	
		kW - Primary	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
		kW - Primary w/ Tr	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
		kWh	**1,980**	**1,735**	**1,546**	**1,456**	**1,343**	**1,514**	**1,714**	**1,722**	**1,527**	**1,505**	**1,372**	**1,644**	19,059
		Charges													
Customer Charge (2)		15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (2)		15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	
Secondary Voltage Distribution Facilities Charge (2)		7.07	$ 51.55	$ 49.35	$ 47.88	$ 47.95	$ 49.39	$ 54.25	$ 56.63	$ 55.86	$ 52.96	$ 54.54	$ 48.48	$ 46.70	
Primary Voltage Distribution Facilities Charge (2)		3.14	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Primary Voltage Transformer Charge (2)		0.24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
PJM Services Charge (5)		0.01340	$ 26.54	$ 23.24	$ 20.71	$ 19.51	$ 18.00	$ 20.29	$ 22.97	$ 23.08	$ 20.46	$ 20.17	$ 18.39	$ 22.03	
Purchased Electricity Charge (6)	Summer	0.05629						$ 85.24	$ 96.48	$ 96.96	$ 85.95				
	Nonsummer	0.05935	$ 117.54	$ 102.95	$ 91.74	$ 86.42	$ 79.71					$ 89.33	$ 81.44	$ 97.57	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00048	$ 0.95	$ 0.83	$ 0.74	$ 0.70	$ 0.64	$ 0.73	$ 0.82	$ 0.83	$ 0.73	$ 0.72	$ 0.66	$ 0.79	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00019	$ 0.38	$ 0.33	$ 0.29	$ 0.28	$ 0.26	$ 0.29	$ 0.33	$ 0.33	$ 0.29	$ 0.29	$ 0.26	$ 0.31	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00189	$ 3.74	$ 3.28	$ 2.92	$ 2.75	$ 2.54	$ 2.86	$ 3.24	$ 3.26	$ 2.89	$ 2.84	$ 2.59	$ 3.11	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00195	$ 3.86	$ 3.38	$ 3.01	$ 2.84	$ 2.62	$ 2.95	$ 3.34	$ 3.36	$ 2.98	$ 2.93	$ 2.68	$ 3.21	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00119	$ 2.36	$ 2.06	$ 1.84	$ 1.73	$ 1.60	$ 1.80	$ 2.04	$ 2.05	$ 1.82	$ 1.79	$ 1.63	$ 1.96	
Franchise Cost Addition (12)		5.080%	$ 4.27	$ 4.15	$ 4.06	$ 4.06	$ 4.12	$ 4.38	$ 4.51	$ 4.48	$ 4.32	$ 4.40	$ 4.08	$ 4.01	
Total Charges (13)			$ 246.68	$ 225.06	$ 208.68	$ 201.73	$ 194.37	$ 208.28	$ 225.85	$ 225.70	$ 207.89	$ 212.50	$ 195.70	$ 215.18	$ 2,568
														$/kWh	0.1347
		Percent Change	9.2%	9.2%	9.2%	9.2%	9.2%	8.3%	8.2%	8.2%	8.3%	9.1%	9.2%	9.2%	8.9%
		Dollar Change	$ 20.75	$ 18.96	$ 17.58	$ 16.99	$ 16.31	$ 15.88	$ 17.14	$ 17.16	$ 15.90	$ 17.71	$ 16.46	$ 18.19	$ 209.03

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a nonresidential customer per Rider RCA Sheets Nos. 256 through No. 257.4.
(4) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(5) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(6) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(7) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(8) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(9) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(10) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(11) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(12) Bill calculations do not include tax additions specified in the Company's Rider TAX.

Rate BES - Basic Electric Service
Nonresidential Monthly Bill
Actual 2017 Monthly Usage, Unadjusted

COMMONWEALTH EDISON COMPANY

BILL COMPARISONS - EIMA

Small Load Delivery Class Without Electric Space Heat

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			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
		kW - Secondary	**14**	**14**	**14**	**14**	**14**	**16**	**16**	**16**	**15**	**16**	**14**	**13**	
		kW - Primary	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
		kW - Primary w/ Tr	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
January 2017		**kWh**	**4,862**	**4,304**	**3,929**	**3,764**	**3,593**	**4,095**	**4,545**	**4,538**	**4,107**	**4,097**	**3,704**	**4,278**	49,817
		Charges													
Customer Charge (1)		12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	$ 12.77	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (1)		13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	$ 13.25	
Secondary Voltage Distribution Facilities Charge (1)		6.65	$ 94.82	$ 92.07	$ 90.40	$ 90.34	$ 92.78	$ 103.58	$ 108.08	$ 106.90	$ 100.57	$ 104.80	$ 92.14	$ 88.41	
Primary Voltage Distribution Facilities Charge (1)		2.53	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Primary Voltage Transformer Charge (1)		0.64	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
PJM Services Charge (5)		0.01244	$ 60.48	$ 53.54	$ 48.88	$ 46.82	$ 44.70	$ 50.94	$ 56.54	$ 56.46	$ 51.10	$ 50.96	$ 46.08	$ 53.21	
Purchased Electricity Charge (6)	Summer	0.04933						$ 202.00	$ 224.20	$ 223.87	$ 202.62				
	Nonsummer	0.05116	$ 248.72	$ 220.20	$ 201.03	$ 192.56	$ 183.84					$ 209.59	$ 189.52	$ 218.85	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00033	$ 1.60	$ 1.42	$ 1.30	$ 1.24	$ 1.19	$ 1.35	$ 1.50	$ 1.50	$ 1.36	$ 1.35	$ 1.22	$ 1.41	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00658	$ 31.99	$ 28.32	$ 25.86	$ 24.77	$ 23.65	$ 26.94	$ 29.91	$ 29.86	$ 27.03	$ 26.96	$ 24.37	$ 28.15	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00116	$ 5.64	$ 4.99	$ 4.56	$ 4.37	$ 4.17	$ 4.75	$ 5.27	$ 5.26	$ 4.76	$ 4.75	$ 4.30	$ 4.96	
Franchise Cost Addition (12)		5.440%	$ 6.88	$ 6.70	$ 6.58	$ 6.57	$ 6.69	$ 7.31	$ 7.58	$ 7.52	$ 7.15	$ 7.38	$ 6.66	$ 6.49	
Total Charges (13)			$ 481.45	$ 438.56	$ 409.93	$ 397.99	$ 388.34	$ 428.19	$ 464.40	$ 462.69	$ 425.91	$ 437.11	$ 395.61	$ 432.80	$ 5,163
														$/kWh	0.1036

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
January 2018		**kW - Secondary**	**14**	**14**	**14**	**14**	**14**	**16**	**16**	**16**	**15**	**16**	**14**	**13**	
		kW - Primary	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
		kW - Primary w/ Tr	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
		kWh	**4,862**	**4,304**	**3,929**	**3,764**	**3,593**	**4,095**	**4,545**	**4,538**	**4,107**	**4,097**	**3,704**	**4,278**	49,817
		Charges													
Customer Charge (2)		15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	$ 15.06	
Retail Customer Assessments (Rider RCA) (3)		5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	$ 5.30	
Standard Metering Charge (2)		15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	$ 15.13	
Secondary Voltage Distribution Facilities Charge (2)		7.07	$ 100.81	$ 97.88	$ 96.11	$ 96.04	$ 98.64	$ 110.12	$ 114.91	$ 113.65	$ 106.92	$ 111.42	$ 97.96	$ 93.99	
Primary Voltage Distribution Facilities Charge (2)		3.14	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Primary Voltage Transformer Charge (2)		0.24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
PJM Services Charge (5)		0.01340	$ 65.15	$ 57.67	$ 52.65	$ 50.44	$ 48.15	$ 54.87	$ 60.90	$ 60.81	$ 55.04	$ 54.90	$ 49.64	$ 57.32	
Purchased Electricity Charge (6)	Summer	0.05629						$ 230.50	$ 255.83	$ 255.46	$ 231.21				
	Nonsummer	0.05935	$ 288.54	$ 255.45	$ 233.21	$ 223.39	$ 213.27					$ 243.15	$ 219.86	$ 253.88	
Environmental Cost Recovery Adjustment (Rider ECR) (7)		0.00048	$ 2.33	$ 2.07	$ 1.89	$ 1.81	$ 1.72	$ 1.97	$ 2.18	$ 2.18	$ 1.97	$ 1.97	$ 1.78	$ 2.05	
Energy Efficiency Programs (Rider EDA/EEPP) (8)		0.00019	$ 0.92	$ 0.82	$ 0.75	$ 0.72	$ 0.68	$ 0.78	$ 0.86	$ 0.86	$ 0.78	$ 0.78	$ 0.70	$ 0.81	
Renewable Portfolio Standard Adj (Rider REA) (9)		0.00189	$ 9.19	$ 8.13	$ 7.43	$ 7.11	$ 6.79	$ 7.74	$ 8.59	$ 8.58	$ 7.76	$ 7.74	$ 7.00	$ 8.08	
Zero Emission Standard Adj (Rider ZEA) (10)		0.00195	$ 9.48	$ 8.39	$ 7.66	$ 7.34	$ 7.01	$ 7.98	$ 8.86	$ 8.85	$ 8.01	$ 7.99	$ 7.22	$ 8.34	
Illinois Electricity Distribution Tax (IEDT) 11)		0.00119	$ 5.79	$ 5.12	$ 4.68	$ 4.48	$ 4.28	$ 4.87	$ 5.41	$ 5.40	$ 4.89	$ 4.88	$ 4.41	$ 5.09	
Franchise Cost Addition (12)		5.080%	$ 6.95	$ 6.77	$ 6.65	$ 6.64	$ 6.76	$ 7.38	$ 7.65	$ 7.58	$ 7.21	$ 7.44	$ 6.73	$ 6.57	
Total Charges (13)			$ 524.65	$ 477.79	$ 446.52	$ 433.46	$ 422.79	$ 461.70	$ 500.68	$ 498.86	$ 459.28	$ 475.76	$ 430.79	$ 471.62	$ 5,604
														$/kWh	0.1125
		Percent Change	9.0%	8.9%	8.9%	8.9%	8.9%	7.8%	7.8%	7.8%	7.8%	8.8%	8.9%	9.0%	8.5%
		Dollar Change	$ 43.20	$ 39.23	$ 36.59	$ 35.47	$ 34.45	$ 33.51	$ 36.28	$ 36.17	$ 33.37	$ 38.65	$ 35.18	$ 38.82	$ 440.92

NOTES:

(1) January 2017 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 16-0259.
(2) January 2018 charges are based on ICC-jurisdictional delivery service rates and riders filed in Compliance in Dkt. 17-0196.
(3) Total Rider RCA charge for a nonresidential customer per Rider RCA Sheets Nos. 256 through No. 257.4.
(4) Billed at a per kWh distribution facilities charge.
(5) PJM Services Charge per Rate BES, Rider PE and Sheet No. 2.
(6) Retail PE Charges per Rate BES, Rider PE and Informational Sheet No. 1.
(7) Environmental Cost Recovery Adjustment per Rider ECR and Informational Sheet No. 8.
(8) Energy Efficiency Adjustments per Rider EDA and Informational Sheet No. 9 through May 2017 and Rider EEPP and Informational Sheet No. 38 effective June 2017.
(9) Renewable Energy Adjustments per Rider REA and Informational Sheet No. 36.
(10) Zero Emission Adjustments per Rider ZES and Informational Sheet No. 37.
(11) January 2017 IEDT charges - See Note (1), January 2018 IEDT charges - See Note (2).
(12) Franchise Cost Addition is based on an estimated system average percentage of net charges.
(13) Bill calculations do not include tax additions specified in the Company's Rider TAX.

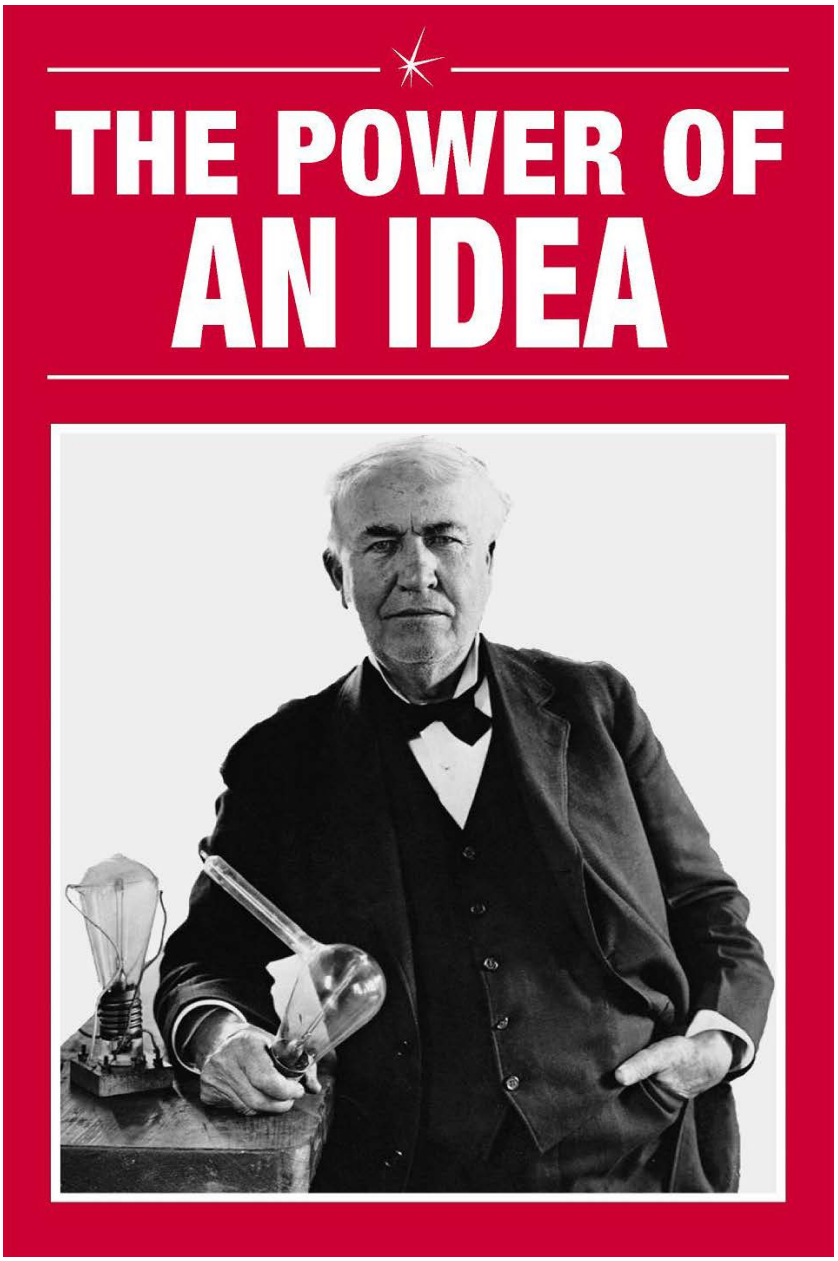
Smart Grid Advanced Metering Annual Implementation Progress Report

Test Bed/Technology Demonstrations

ATTACHMENT 3

ComEd
An Exelon Company

Commonwealth Edison Company's Quarterly Smart Grid Test Bed Report



February 14, 2018

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I.Introduction

ComEd's Smart Grid Test Bed ("Test Bed") mission is to facilitate and provide open and unbiased live-grid opportunities for testing, demonstration, and promotion of innovative smart grid programs, technologies, business models, services, products, and other smart grid-related activities that may benefit ComEd's customers. ComEd created its Test Bed and associated objectives pursuant to subsection 16-108.8 of the Public Utilities Act ("Act"). ComEd protects the safety and security of its distribution grid and grid operations through the Test Bed Idea ("Idea") selection process and through management of Test Bed Demonstration ("Demonstration") projects.

ComEd's Test Bed vision is focused on providing innovative ways to demonstrate, in an open and unbiased manner, how working technology actually operates in a live utility scale environment. The Test Bed is not intended to provide a lab where investigational ideas are tested out; those facilities exist and such tests are not appropriate for a live environment. The Test Bed allows approved Submitters ("Submitters"), subject to appropriate protections, to connect technology to the utility grid for the purpose of demonstrating that the technology functions as designed. The Test Bed is designed to help validate business models or services by permitting demonstration of specific functional aspects of the technology and/or verification that services/business models provide the intended results.

The Test Bed is open to all qualified Submitters. ComEd envisions a diverse group of qualified Submitters that may consist of scientific, technical, entrepreneurial, innovative, and non-technical Idea stakeholders. Ideas may come from a variety of sources including, but not limited to: the Illinois Science and Energy Innovation Foundation

("Energy Foundry"), ComEd's own employees, professional organizations, universities, entrepreneurs, technology partners, and other ComEd stakeholders. By opening the Test Bed to a diverse group of stakeholders, ComEd will provide live-grid opportunities to as many Test Bed Demonstrations as reasonably feasible.

Accordingly, this report summarizes the Test Bed activities, discoveries, and other information deemed mutually relevant from October 1, 2017 through December 31, 2017 ("Reporting Period") as described in subsection (i) of Section 16-108.8 of the Act.

II. Test Bed Ideas

ComEd has led existing and new Test Bed Idea coordination activities during the current Reporting Period. Test Bed Idea status updates are provided in the following three categories: Potential Test Bed Idea Submissions, Recently Submitted Test Bed Ideas, and Previously Submitted Test Bed Ideas.

Stage of Development Symbols

New Idea Stage: Ideas are received and an initial review is conducted to seek clarification on the Idea and to determine applicability of the technology for the Test Bed and for the ComEd system.

Analysis/Planning Stage: Internal subject matter experts work closely with the Submitter 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"), associated costs, and success metrics.

Demonstration Stage: The technology is installed/constructed, and demonstrated on ComEd's grid in accordance with the Demonstration Plan and/or Test Bed Agreement.

Potential Test Bed Idea Submissions

Southwire

Southwire has been working with Electric Power Research Institute ("EPRI") to develop a suite of substation sensors. The proposed technologies pose an integrated solution using a base station, i.e., a Southwire Gateway, to collect weather data and data from multiple sensors and to communicate that data to the local utility. The communication uses a process control network ("PCN") to transmit via a cellular network or direct wire to SCADA. The family of sensing technologies Southwire is proposing to include a Line Monitor, a Connector Monitor, and an Insulator Monitor. The innovative Insulator Monitor (porcelain, glass and polymer) senses contaminate deposit and build-up, and records temperature, humidity, rain, and wind speed and direction data. The sensor will send an alarm/notification (via 2.4 GHz RF) when the equipment requires maintenance before a flashover due to leakage current caused by moisture or contamination. Southwire has expressed interest in the Test Bed and has initiated discussions for a potential Test Bed Demonstration. Southwire is also considering several different applications to determine which would be the best fit for the Test Bed, and hopes to have a prototype available in 2018.

Previously Submitted Test Bed Ideas

Akron/Exacter

The University of Akron (Department of Electrical and Computer Engineering) and Exacter propose to demonstrate their Transmission Tower Sensor. The demonstration system is a platform for various sensors and algorithms that are being evaluated and improved at the University of Akron. They are currently on-track with their internal testing and plan to demonstrate in 2018.

Semtive

Semtive submitted an Idea for a renewable energy technology, the Nemoi, a Vertical Axis Wind Turbine. The turbines can be installed on street light structures or upon rooftops. Semtive currently has three 3-phase models: XS (12V; 100W nominal power; average 200KWh/year); S (24/48V; 200W; 350KWh/yr); and M (24/48V; 1KW; 2,5MWh/yr). Semtive is proposing a Test Bed Demonstration for its S-model and M-model along with the electronics, in order to monitor and manage energy usage. The systems and the electronics are awaiting the Underwriters Laboratory Certification. The turbines will be best used in decentralizing energy and target Q2 2018 for US manufacturing of existing models.

RIOK

RIOK has submitted an Idea for their Aluminum Guide Wire Adjustment Assembly ("GWAA"), which is designed to help minimize damages to lines caused by harsh environmental conditions, typically related to storms. The GWAA is a mechanical fitting that addresses both hardening and modernization of the grid in efforts to make the

infrastructure more resilient. It is comprised of an elongated electrically conductive device that has two points of attachment, a built-in safety turnbuckle mechanism to help with lateral moves within the line to address sagging or taut distribution lines, and a spring to aid in the deflection of debris and to provide flexibility in the service lines due to high winds. The Aluminum Guide Wire Adjustment Assembly has been designed to work with the electrical overhead service conductor or cable that is brought from a utility pole or other main source of electricity, to a point of attachment on or near the structure to bring electrical power. RIOK was awarded a patent from the United States Patent and Trademark Office (USPTO) on November 29, 2017, for their Aluminum Guide Wire Assembly. They are pursuing funding options to support their demonstration plan.

DNV GL

DNV GL has submitted an Idea for their Smart Cable Guard system, which is designed to continuously monitor underground medium voltage cables and detect and locate full and intermittent faults and partial discharges (“PDs”). DNV GL’s submitted Idea is being reviewed. As discussions continue, ComEd will work with DNV GL to determine how the proposed technology can be demonstrated in the Test Bed. DNV GL has committed to delivering the hardware for two complete systems, providing expert supervision of the installation, and training of ComEd personnel on the operation of the systems. ComEd completed review of the proposed equipment from a safety and standards perspective, and a cyber security review of the proposed demonstration project is currently underway.

Carbon Cash

Carbon Cash submitted a customer energy usage tracking mobile application that engages residential customers in energy saving behaviors through personalized messaging, gamification and rewards. This application allows consumers to track their electricity usage and emissions footprint from their iOS device. As users meet consumption benchmarks they earn points, “Carbon Cash” that they can redeem for discounts, gift cards and merchandise on their smart phone. Carbon Cash has been demonstrating their application’s potential for achieving behavioral demand response through an emissions-centric call-to-action. This demonstration also includes the collection and analysis of psychometric data, which will be used to tailor engagement strategies for individual users. Carbon Cash has completed its registration in the Green Button Program, which allows them to securely access customer AMI data. The App is now active on a limited, volunteer customer basis.

Micatu Inc.

Micatu’s Pole Tilt Sensor Technology is an Idea for a smart sensing technology that monitors pole tilt with battery-powered and wireless communications; monitors optical vibrations, vectors and displacement for transformer and circuit breakers; and monitors optical voltage and current. The application for this technology was originally submitted under the name Qualitrol Corp, who has asked if Micatu could lead this demonstration project going forward. As further discussions continue, ComEd will work with Micatu to determine how the proposed technology can be demonstrated in the Test Bed.

eluminocity US Inc.

In collaboration with the Illinois Institute of Technology ("IIT") and Silver Spring Networks ("SSN"), eluminocity will be piloting their Light & Charge system, a combined smart LED streetlight and electric vehicle charging unit, which eluminocity developed in cooperation with automaker BMW. A smart wireless connectivity platform is integrated to allow for sensor-based applications such as lighting control based on occupancy or real-time parking space monitoring. A prototype system was installed in August 2016 at the Illinois Institute of Technology, and displayed at a Department of Energy event shortly thereafter. The unit was a new installation in a parking lot at IIT. However, further applications can ideally be retrofitted to existing streetlights, thereby significantly lowering the costs of installation when compared to conventional EV charging stations. The luminaires are compatible with existing infrastructure and can be sized accordingly, with up to four LED modules per luminaire, further reducing energy consumption. In Q1 2017, all required testing for the UL Certification was completed for the Light & Charge luminaire and electric vehicle charging station. The next step toward receiving the certification is to have a factory audit completed.

QinetiQ

QinetiQ proposed an Idea for its "bird on a wire" voltage and current sensor technology. The bird on a wire is a grid sensing and monitoring technology that measures line current and voltage up to 36kV. Some of the applications for which it can be used include theft detection, grid automation, voltage and power measurements, fault detection and outage management, asset management, and green energy/renewable integration. ComEd has

identified a potentially new application for QinetiQ's line sensing technology. The technology is being evaluated for a potential Community Energy Storage pilot.

G&W Electric Company

G&W has recently submitted an idea to assess the insulation condition on field installed Viper-ST reclosers, utilizing G&W partial discharge sensors. The demonstration plan is to secure the partial discharge sensors around the body of the Viper solid dielectric modules installed in the field, take measurements, and acquire data for analysis. The goal of this demonstration is for G&W to provide best in class product quality, performance, and to ultimately integrate this sensor technology into future G&W products. Currently, there are no reliable methods to check solid dielectric insulation on switchgear in the field. ComEd is determining an appropriate site location for this demonstration.

III. Test Bed Demonstration Projects

Below is a summary of current technology Demonstration projects underway at ComEd. Previously completed Demonstration projects are not included within this report. Demonstration projects can come from a variety of sources, spanning multiple technology areas.

G&W Electric Company

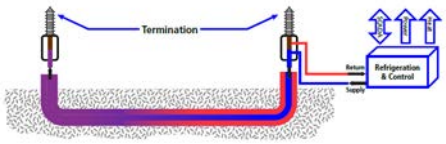
ComEd contractors installed G&W's AccuSense 1 voltage sensing solution in January 2016. AccuSense voltage sensors enable users to collect critical voltage data for optimizing grid power delivery and reliability. They serve as a smaller, light-weight alternative to traditional voltage transformers and can be integrated throughout the grid as metering points. Metering grade, 0.3 class voltage transformers are being used as a reference when monitoring the AccuSense voltage sensors. The AccuSense voltage sensors and voltage transformers were integrated with a control for monitoring purposes. The control serves as the data collection point and is accessed in intervals to evaluate the performance of the devices. A full report was issued by G&W at the close of the AccuSense 1 evaluation in July 2016. Six months was deemed sufficient to obtain all weather variation. In May 2017, an improved second generation of the prototype, AccuSense 2, has been evaluated and replaced AccuSense 1 by ComEd contractors in the same location. The objective of this project is to evaluate performance of the AccuSense 2 voltage sensors in a field installation and initial results indicate the average AccuSense sensor accuracy is better than 0.5% in temperatures ranging from 14°F through 94°F.

IV. Other Innovative Projects

ComEd's commitment to innovation is not limited to the Test Bed program. ComEd and its employees continue to develop new ideas, new products and customer offerings. ComEd has several partnerships with cutting edge companies and organizations. This section focuses on smart grid-related pilots and new technologies spurred by innovation.

Superconductor Development

ComEd and American Superconductor ("AMSC") 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 three 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 cable.

In addition to providing reliable power and increased security, this installation of nearly one and one-half miles of superconductor cable would create the most extensive superconductor technology infrastructure in the world. ComEd's transformation of its 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 completing a feasibility study to determine operation and deployment viability. The preliminary engineering phase has been extended to align the design with the original approved cost estimate. The new target completion of the feasibility study is Q1 2018.

Fuel Cell Demonstration

ComEd worked with Toshiba to develop a showcase for the first implementation of a 700 Watt Toshiba fuel cell in the United States. The initial Toshiba Ene-Farm unit, originally designed for residential applications in Japan, had been planned for installation at Brookfield Zoo, to provide supplemental power to the Zoo's grid and hot water to a new hand-washing station complementing the nearby food court.

The demonstration would have helped ComEd and Toshiba to better understand the operation and applicability of the technology in the U.S., and the exhibit would have served to educate the public on fuel cell technology and energy efficiency. While Toshiba was able to obtain UL approval for the electrical components of the Ene Farm fuel cell unit, a second heat exchanger would be needed in order for UL to approve of use of this unit from a plumbing perspective (for use as a hot water heater). Since the design of the unit would need to be modified substantially to accommodate this change, the project team reviewed the status of this demonstration and decided that the strategic value of continuing this project was limited, and have discontinued the project.

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 develop and test a commercial grade master controller that could drive the operations of clusters of two or more microgrids. ComEd's project was the only utility-led effort to receive DOE funding. ComEd has assembled a group of leading science and technology partners, 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.

Since then, ComEd has completed six sub-task reports for the DOE as part of the grant deliverables. The reports have concentrated on evaluating the Bronzeville neighborhood in terms of loading and potential for generation installation for purposes of a microgrid. Additionally, ComEd submitted a comprehensive test plan report to the DOE and conducted a briefing in 2016 for the DOE Technical Advisory Group ("TAG"), which has responsibility for reviewing the technical aspects of the project.

After the review process ComEd was given the go ahead to start the testing phase of the

project. The first phase of the testing required the control algorithms to be tested in a real-time simulation environment which simulates various scenarios of microgrid operation. Equipment including protective relays were received and installed in the laboratory at the end of 2016. ComEd is currently finalizing the testing for the controller – and expects to finalize the project by Q3 2018.

ComEd is also working to deploy a Grid of the Future Lab, where further Hardware-In-the-Loop (HIL) testing of the microgrid controller will be performed. As part of the controller R&D effort, ComEd is evaluating Chicago's Bronzeville neighborhood, adjacent to IIT's existing microgrid, potentially for its first microgrid installation. The microgrid would also demonstrate all the capabilities of the clustered microgrid controller and is currently under development by ComEd. ComEd's proposed microgrid at

Bronzeville includes a diverse mix of facilities and critical loads, including police headquarters, major transportation infrastructure, healthcare facilities, educational facilities, and private residences.

In January 2016, the DOE announced that ComEd received an additional grant under the sustainable and holistic integration of energy storage and solar PV ("SHINES") funding. This $4M grant allows ComEd the opportunity to research, develop, and test microgrid integrated solar and storage technology ("MISST") within the footprint of the proposed Bronzeville Community Microgrid. In early 2017 the SHINES project was kicked-off with a meeting involving the project partners as well as DOE. As of Q4 2017, the team achieved significant progress on this project in all tasks required by DOE. The steady state and dynamic state studies have been performed to obtain results for MISST solutions. The smart inverter control technologies have been further developed. A vendor has been secured to implement the technologies and test. This inverter will also be tested in the RTDS lab for hardware in the loop test. The team also established initial requirements for enhancing microgrid controller and prepared initial data collection plan. RFP for PV and BESS have been drafted for the field deployment. The team submitted continuation application and held Annual Phase Review (Go/No-go).

Smart FAA Warning Lights

Three new poles equipped with new LED FAA warning lights were installed in downtown Dixon, due to the close proximity of a nearby hospital heliport. The new lights are equipped with a communication panel that leverages the capability of 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 the 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. The hardware and monitoring systems have completed testing in one of ComEd's labs. If the pilot proves successful, and the solution is found to be cost effective, integration with the monitoring software will be the next step in demonstrating the end-to-end FAA warning light monitoring solution.

Smart Meter Connected Devices

The ComEd Smart Meter Connected Devices ("SMCD") service is offered to ComEd residential customers who have smart meters installed at their homes. This service enables customers to receive electricity usage and estimated electricity cost information from ComEd through a customer owned smart device that is wirelessly connected to the

ComEd smart meter. With access to more information, customers can make educated decisions that help them better control their electricity use and save on electric bills.

Presently, the Smart Meter Connected Devices service (SMCD) has 800 smart devices that have been enrolled in the service by ComEd customers. Since early in the inception of the SMCD service ComEd has partnered with the Illinois Science and Energy Innovation Foundation ("ISEIF") to study the usage patterns of ComEd customers in behavioral studies that show the effectiveness of using a smart device. ComEd also keeps in close contact with the manufacturers of the smart devices to provide feedback and ensure ComEd customer who contact the manufacturer have their needs met or exceeded. The manufactures currently include Ambient, AzTech, EnerGate, CEIVA and Rainforest Automation.

A ComEd customer can enroll in the service by purchasing a compatible smart device directly from the manufacturer and registering the smart device on the ComEd.com website. The list of devices tested for compatibility can be found at comed.com/smcd. Once the registration is complete, ComEd will connect their smart device wirelessly over the Silver Spring Networks. There are a variety of smart devices available to customers with varying capabilities. They general fall into the following categories:

- **In-Home Displays ("IHDs"):** IHDs are user-friendly tabletop, smart devices that provide customers with the ability to monitor their costs and energy usage patterns that are streamed to the IHD from the ComEd smart meter. IHDs display estimated electricity costs (Price * Usage) based on the fixed-price electricity supply rate from ComEd or other electric suppliers.

- **Energy Gateway:** The Energy Gateway is a smart device that connects the ComEd smart meter to the Internet (Ethernet LAN), communicating wirelessly using an Ethernet cable or Wi-Fi. Depending on the smart device, you can view your real-time and historical energy usage from wherever you are through a website associated with the smart device, or stream your usage to any supported third-party cloud service.
- **Smart Thermostat – (Zigbee Enabled):** More than just a thermostat, these smart devices feature Wi-Fi connectivity to the Internet. Features for these smart devices may include programmability to adjust temperature, display of energy usage, interactive mobile apps, web portal and live weather updates. This controllable thermostat communicates wirelessly with a ComEd smart meter and the Internet.

Bidgely HomeBeat™ Pilot

ComEd is conducting 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 one of the first utilities to offer to customers this technology, which will provide them with personalized energy reports detailing how and when they use energy in their homes.

Bidgely's HomeBeat platform provides 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.

In September 2016, 45,000 participants were contacted to participate in this program, each of whom were given access to Bidgely's HomeBeat Web & Mobile platform. There are over 1,250 customers who have opted-in to take advantage of this opportunity, and who have enrolled with Bidgely and have access to the service.

As an added customer feature, ComEd is investigating using the SilverLink and SensorIQ applications to send data to Bidgely in near real-time through the smart meter network; if SensorIQ is approved for the Bidgely pilot it will be offered to participants Q1 2018. This feature will provide participants the ability to track their energy use throughout the day and take immediate action if their usage is high. Until now, they would have only been able to review their previous day's usage. The inclusion of Bidgely's HomeBeat Energy Monitor, a Smart Meter Connected Device that allows data to be analyzed by Bidgely in real-time, enables ComEd to offer real-time energy insights, such as high-usage alerts via mobile push notifications within minutes of use.

ComEd is one of the first utilities to offer Bidgely's new suite of HomeBeat products, which 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.

Smart Thermostat Program

ComEd submitted a tariff to the ICC on March 25, 2016 for a program supporting smart thermostats as part of ComEd's Central Air Conditioning ("AC") Cycling Program (i.e., Rider AC). The tariff went into effect on May 9, 2016. ComEd customers in the program can earn up to $40 during the summer (i.e., June 1 through September 30 of each year) by allowing ComEd to adjust the temperature of the customer-owned smart thermostat. Customers in the program can participate using a Nest smart thermostat. As of December 31, 2017, there were 16,491 Nest smart thermostat customers on the program. Nest schedules the demand response events under their "Rush Hour Rewards Program."

The smart thermostat program allows ComEd to leverage smart thermostat products as devices for residential demand response, to enhance customer experience and engagement, and introduces a channel for customers to obtain innovative technologies that help them use less electricity when it is most in demand.

Green Button Connect My Data

In May 2015, ComEd partnered with Schneider Electric to deploy Green Button Connect My Data in northern Illinois. Green Button is an industry initiative stemming from a White House call to action for utilities to voluntarily provide customers with easy access to their energy usage in a

secure and user-friendly electronic format. ComEd is among the first utilities to introduce Green Button Connect My Data, which allows customers to authorize third-party service providers to receive direct access to their energy usage analytics via the Green Button functionality. To help customers maximize energy savings via the Green Button Connect My Data functionality, ComEd offered Energy Insights Online, a free web-based energy analysis service that interfaces with Green Button. Energy Insights Online provided ComEd's commercial customers a more detailed analysis of their building's energy usage. It also enabled third-party vendors, such as Schneider Electric, to provide automated monitoring based commissioning (aMBCx) technology with embedded fault detection and diagnostics ("FDD") analytics that accurately prioritize energy savings opportunities.

The ability to transfer this data more seamlessly to third-party developers will help accelerate technology applications and analytics leveraging smart meter data. ComEd integrated the Green Button Connect functionality for its Commercial & Industrial customers in spring 2015. Elmhurst Hospital is among the first of ComEd's commercial customers to take advantage of ComEd's Energy Insights Online and Green Button Connect My Data. Using the Schneider Electric utility interface, data is pulled from different sources, including three onsite ComEd smart meters, with information Schneider Electric compiles in 5-minute intervals via 13,000 sensor points within the HVAC control system. Working with ComEd and Schneider Electric, Elmhurst Hospital was able to leverage these tools and their smart meters with zero additional investments in hardware or software to reduce the energy costs of their 866,000 square feet facility.

ComEd successfully deployed Green Button Connect for residential customers in two phases. The first phase allowed third-party vendor registrations and was completed in October 2015. The second phase enabled the customer facing portion of Green Button Connect and was completed in December 2015. The customer facing portion was made available to the public on May 23, 2016. ComEd currently has two third-party vendors registered (UtilityAPI and Carbon Cash) and is working with 17 others who are in various stages of enrollment. Lumin, PlotWatt, and WattzOn are currently working with ComEd IT on pre and post production testing and should be up on the ComEd website sometime during the 1st quarter 2018.

IFTTT

In May 2017 ComEd launched its first IoT (Internet of Things) program enhancement through a partnership with IFTTT (If This Then That). IFTTT offers an IoT workflow management tool that connects multiple systems together through an easy to use interface. ComEd launched two separate channels through IFTTT, one for Residential Hourly Pricing program customers to automatically based on custom price signals and one for Peak Time Savings customers to be able to react to Peak Time Savings Hours automatically. Between the Peak Time Savings and Hourly Pricing Channel, more than 1,700 customers were connected and completed nearly 193,000transactions.

V.Smart Grid Collaboration

ComEd recognizes that great innovations come from engaging forward-thinking individuals with a broad diversity of perspectives, experiences, and expertise. That's why ComEd is 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 and events that ComEd has established to seek out and celebrate innovation.

Energy Foundry

In addition to providing an initial funding investment, ComEd continues to support the Energy Foundry in its mission to foster innovative new grid-related and energy-related products and services. 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. Leadership at the Energy Foundry has developed the selection criteria to help entrepreneurs achieve their highest goals and an investment model to accelerate speed to market for promising energy ideas. To date, the Energy Foundry has made thirteen investments and had three successful exits.

Select Investment Activities

- **Advanced Diamond Technologies:** An Argonne National Lab spin-off that developed an innovative method to manufacture a synthetic diamond coating with end use applications including power electronics, industrial components, and power generation.
- **Bractlet:** A software sensor and analytic platform that allows large energy service companies to efficiently and continuously measure the savings of energy efficiency retrofits.
- **Intellihot**: A tank-less water heater that targets the commercial market (i.e., hotels, restaurants). Achieves savings in energy and installation costs, while enhancing reliability. They have a development path that includes combined heat and power.
- **InVekTek**: A Chicago-based company that licensed Georgia Tech motion control technology for industrial drives, improving operational efficiency, increasing useful life, and reducing energy waste.
- **RedWave Energy**: Developing an advanced technology to capture low-grade waste heat from thermal power plant and industrial processes.
- **SiNode**: An early stage advanced materials company developing the next generation of lithium-ion batteries, with a core focus on silicon-graphene anode technology.
- **Tank Utility**: A wireless monitoring solution for residential and industrial heating fuel tanks that allows small and medium sized heating fuel distributors to more efficiently serve customers and optimize deliveries.

- **OpenEE**: Leading data scientists and energy policy experts formed OpenEE to perform cost-effective, near real-time M&V on utility efficiency programs with the long-term goal of acting as a uniform platform for pay for performance utility efficiency programs.

- **Omndian:** An end-to-end residential solar asset management company that leverages a proprietary software platform to provide system monitoring, outsource field service management, performance guarantees and an insurance wrap option from a large 3rd party insurance company.

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. ComEd released a video on CSMART initiatives on the Powering Lives Network in September of this year, which demonstrates state-of-the-art technologies. Some of the initial demos include:

- **AMI Water:** As part of a proof of concept program to leverage the mesh network's capabilities, inter-operability testing of the AMI Water Meter and ComEd's Electric Meter took place at the CSMART lab. The AMI Water meter was tested to

communicate to the electric meter and transmit water usage data to the campus Starfish network and its UtilityIQ management software. Testing on this technology has completed successfully and has moved onto more detailed testing at ComEd's testing facilities.

- **Smart street lights operational testing:** Intelligent and adaptive networked street lights can reduce operating and maintenance and energy costs substantially compared to incumbent streetlighting technology. Streetlight management software helps provide scheduling, remote on/off and dimming features as well as outage detection and 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. ComEd is facilitating the retrofit of a significant number of the IIT campus lights with this technology.
- **Smart Street Light Applications**: The CSMART team has been exploring and developing an application integrating the campus 911 emergency call buttons with the smart streetlights. This application enables brightening of streetlights based on activation of a 911 call button. The key research component is regarding how to control the appropriate streetlights in response to an external information source. Current efforts are building on the successful pilot to implement motion sensing and "on the edge" group control.
- **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.
- **PMU Data Collection and Analytics:** Eight phasor measurement units ("PMUs") are in place at IIT. All eight of these communicate with a phasor data concentrator ("PDC") controller responsible for data collection. Current efforts are focused on integrating PMU data with the OSIsoft Asset Framework Template.
- **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.

- **IIT Single Line-diagram – mapping the IIT Micro-grid**: Utilizing OSIsoft's PI ProcessBook to create a live updating one line diagram that condenses the microgrid data into one easily accessible location for IIT facilities members and for faculty and student research. Stores historical microgrid data at 5-second intervals in condensed and easily searchable form for analysis and adds real-time notifications to microgrid assets to inform facilities and faculty of changing statuses around the campus.
- **OSIsoft Asset Framework ("AF") Template Project:** Creating a Common Interface Model ("CIM") for the campus microgrid including solar, battery storage, Cogeneration, wind, as well as relay and protection. This model will serve as an input to a CIM translator into OSIsoft's hierarchical data management software. The CIM translator has the added benefit of automatically creating PI tags (data points in the PI system) which removes many man-hours of configuration.
- **UFARM Campus Community Garden:** Initiated by the IIT chapter of *Engineers for a Sustainable World,* this facility is a test-bed for the development of urban agricultural technology. Current projects are heavily focused on networked monitoring and intelligent irrigation controls.
- **Microgrid SCADA:** Utilizing Alstom SCADA software and existing Silver Spring Networked devices this tool will be used in parallel with production controls and monitoring to establish control of edge devices (Smart Streetlights initially) and a development environment for microgrid specific SCADA.

- **IIT DC Nanogrid:** Complementing the 200 kW Photovoltaic installation on Keating Hall this project adds a DC bus, micro controller, and 8 hours of battery storage to power building loads (DC) without the losses of an inverter. The first major application is the upgrade of gymnasium lighting to controllable LEDs.

SmartGridExchange™

The mission of the SmartGridExchange™ ("SGE") is to discover, seek out, foster, and execute pilots and innovative products and relationships. This collaborative initiative between ComEd, entrepreneurs, technology start-ups, universities and customers seeks to explore and shape new products, offers and innovative solutions that utilize the intelligence and benefits of the smart grid. 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 customers a convenient portal from which they can learn about new and developing energy products and services.

In addition to the Bidgely Pilot, Smart Thermostats Program, Green Button Connect My Data, IFTTT and other programs detailed in the previous section, some additional

initiatives and demonstrations already underway through the SmartGridExchange™ include the following:

- Through ongoing market scans and ideation sessions, the SmartGridExchange™ has already become the birthplace of multiple new technology demonstrations, and collaborations, including Smart Meter Connected Devices, Bidgely, and Nest Learning Thermostat™.
- ComEd hosted its fourth annual SmartGridExchange™ Forum in downtown Chicago in September 2017 and included speakers such as Lawrence Orsini of LO3 and Illinois Commerce Commission Chairman Brien Sheahan. The forum brings together leading technology and innovation companies 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.

The SmartGridExchange™ initiative has continued to introduce, vet, and advance new ideas and potential pilots while continuing to deploy existing in-market initiatives and programs. The SGE Team has continued biweekly market assessments of industry developments and to identify products and solutions with potential for piloting or collaboration under SGE. New technologies that have been vetted are continuously added to the SGE initiative pipeline to monitor, evaluate, and charter new initiatives and pilots. The SGE team has been meeting with vendors and program managers to explore, discuss, and structure potential pilot program design. The SGE Team is working on securing which projects will be developed and implemented in 2018.

Smart Grid Advanced Metering Annual Implementation Progress Report

Industry & Customer Research: Non-Utility Owned Storage Units

ATTACHMENT 4

ComEd
An Exelon Company

Industry & Customer Research: Non-Utility Owned Energy Storage Units

March 7, 2018

accenture

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EXECUTIVE SUMMARY

The Illinois energy storage market has slowed since the 2015 boom in the frequency regulation market, however it might accelerate as a result of the Illinois Future Energy Jobs Act

Objective

- As part of ComEd's obligation under the Energy Infrastructure Modernization Act, ComEd is required to submit an Annual Implementation Progress Report that includes an overview of the annual energy storage uptake within its utility service territory. This project conducted primary and secondary research on the energy storage industry and specifically activity in Illinois.

Perspective on Overall Energy Storage Market

- In 2017, 2.2 GW of advanced energy storage was commissioned globally compared to 1.0 GW in 2016. The U.S. commissioned 193.1 MW of deployments in 2017 compared to 395.4 MW in 2016.
- The U.S. annual deployments are expected to grow to 2.5 GW by 2022 with major growth in utility, residential, and non-residential storage.
- With a current focus on shorter duration, high power projects, lithium-ion has been the technology of choice for most new deployments. The technologies used may change as the market experiences a "race to the bottom" in cost and a shift from power to energy.

Perspective on Illinois Energy Storage Market

- In 2017, the Illinois Energy Storage Market had relatively little activity; One project was announced and went online, one is under construction, and one recently received approval from the Illinois Commerce Commission. Two projects are active in PJM's interconnection queue.
- Illinois has not been the primary focus of energy storage providers due to the continued low energy prices and demand charges in the local distribution and wholesale (PJM) markets. Storage vendors active in Illinois primarily focus on utility and commercial and industrial storage. Going forward, the storage market may see an uptick as a result of the recent Illinois Future Energy Jobs Act legislation and continued storage cost decreases.
- PJM changed their frequency regulation specifications in January of 2017, prompting energy storage vendors to file a complaint with FERC, who has yet to rule on the filing. The altered specifications have reduced margins by up to 75% for some storage projects.

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RESEARCH APPROACH

The following approach and timeline was used for the energy storage market assessment

Perform Market Assessment 2/5/18 – 2/19/19	Conduct Primary Research 02/13/18 – 02/23/18	Communicate Findings 02/26/18 – 03/2/18
Market & Industry Assessment	**Primary Research & Analysis**	**Review with Key Internal Stakeholders**
Confirm ComEd Objectives ▪ Identify key aspects of Electrical Storage Systems ▪ Gather details on ComEd service territory	**Prepare Primary Research:** ▪ Identify vendors and contacts ▪ Develop primary research approach/ questions	**Stakeholder Buy-In:** ▪ Detailed review of identified findings with key stakeholders
Assess Industry / Market: ▪ Identify key industry trends ▪ Update energy storage technology options ▪ Provide forward-looking projections ▪ Conduct secondary research	**Conduct Primary Research:** ▪ Interview 11 energy storage vendors ▪ Synthesize findings from industry / market scans, secondary customer research, and primary research to identify key elements of storage implementation	**Final Messaging:** ▪ Update the findings in line with comments from key stakeholders ▪ Organize and prepare findings for legal / regulatory compliance

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ENERGY STORAGE APPLICATIONS

Storage applications span the entire electric grid value chain

Value Chain	Category	Use Case	Description
Generation	Grid integration	Renewables integration	Optimize (smooth, firm, time-shift, adjust ramping) the output and reactive power capabilities from renewables generation and mitigate rapid output changes by optimum dispatch strategies
	Grid integration	Generation Investment Optimization	Reduce / defer the need for generation resources, such as additional peaking plants or demand response resources in the system to meet peak demand
	Ancillary Services	Operating reserves	Maintain system balance by providing synchronized and non-synchronized stand-by capacity
	Ancillary Services	Black start	Restart electric supply resources in situations when power systems collapse without pulling electricity from the grid
	Generation Operations	Fuel optimization	Hedge and optimize fuel use by utilizing storage during high fuel price hours, in lieu of high priced fuel sources and / or trading excess fuel
	Generation Operations	Emissions optimization	Reduce or moderate the operations of fossil-fuel generation to reduce emissions and optimize emissions trading
	Generation Operations	Heat rate optimization	Optimize and smooth heat rate ramp up/down of conventional generation to manage load conditions on the system
	Generation Operations	Wear and tear	Reduce loading on conventional generation and cycling - particularly Peaker plants during peak hours and mid-range coal plants during off-peak hours
Transmission & Distribution	Ancillary Services	Frequency regulation	Balance continuously shifting supply and demand within a control area with rapid charges and discharges on a sub-hourly, minute-to-minute basis
	Power Quality & Reliability	Voltage control	Optimize voltage and reactive power in the distribution system to maintain uniform and consistent output with renewables
	Power Quality & Reliability	Substation black start	Restart of substations and increased reliability in situations when power systems collapse
	Power Quality & Reliability	Reliability Improvements	Restore power for a limited amount of time in the event of an outage
	T&D Operations	T&D congestion relief	Relief of congestion points due to collocated energy storage injections reducing peak loads
	T&D Operations	T&D Investment Optimization	Reduce / defer the need for large transmission, substation, or T&D investments due to collocated energy storage systems supporting end user peak demand
	T&D Operations	Wear and tear	Reduce wear and tear on T&D equipment (eg. thermal stressing, frequent tap changer resetting) due to improved voltage and frequency regulation and reduced peak load
	T&D Operations	Line loss reduction	Reduce technical line losses through reduction in longer distance transmission and distribution of electricity due to collocated injection of energy storage
Behind-the-Meter	End-User	Home Management & Back-up Power	Enable retail load shifting and peak-load shaving to reduce time of use charges, and/or participate in Demand Response program, provide back-up power
	End-User	PV & Electric Vehicles	Enable infrastructure, load shifting, improve efficiency & fuel savings, offer protection and control equipment

Source: Global Data, GTM Research, DOE Global Energy, Energy Storage Association, Renewable Energy World, U.S. Energy.Gov

GLOBAL STORAGE TECHNOLOGIES (1/3)

Pumped hydro dominates the energy storage landscape in terms of global capacity

	Mechanical			Thermal	
	Pumped Hydro	**Flywheel**	**Compressed Air**	**Thermal[2]**	**Liquid Air**
Capacity[1]	254.2 GW	0.9 GW	1.2 GW	4.4 GW	5 MW
# of projects[1]	661	41	13	165	1
# of providers	*165	7	7	10	1
Useful Life	20+ years	10-30 years	1-20 years	20+ years	30+ years
Duration	Hours - days	Suited for <30 minutes duration projects	Minutes – hours	Minutes – hours	Hours – months
Power Rating	1 MW – 2+ GW	100 kW – 5+ MW	500 kW – 270+ MW	10 kW – 150+ MW	5 MW – 100+ MW
Applications	Ancillary grid services such as firming capacity, black start, and spinning reserve	Electric supply reserve capacity, resiliency, frequency regulation, voltage support	Electric supply capacity, energy time shift, frequency regulation	Renewable capacity firming, renewables energy tie shift, electric bill management, electric supply capacity	Energy applications – peak shaving, load leveling, etc.
Pros	Matured technology, high power capacity solution	High power density, scalable for short and long duration, high depth of discharge	Low cost, flexible size, matured technology, leverages existing gas turbine technology	Low cost, flexible size/scalable, leverages mature technology	Low technology risk, matured technological components, energy dense
Cons	Dependence on topographical conditions and large land use, relatively low energy density	Relatively low energy capacity, high heat generation, and sensitive to vibrations	Geographic limitation, difficult to modularize for small installations	Some technology is still pre-commercial, difficult to modularize for small installations	Process is only 25-50% efficient

[1]Excludes projects that were canceled, dormant, suspended, de-commissioned, are under rehabilitation & modernization.
[2]Includes chilled water, concrete, heat, ice, and molten salt technologies.
Source: Global Data, GTM Research, DOE Global Energy, AECOM Energy Study, Lazard

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GLOBAL STORAGE TECHNOLOGIES (2/3)

The North American fuel cell market is projected to grow at a CAGR of over 25% until 2025

Electro-Chemical

	Zinc Air	Fuel Cell	Ultra capacitors	Superconducting Magnetic Coil	Hydrogen
Capacity[1]	19.6 MW	261.5 MW	1.2 MW	R&D	29.9 MW
# of projects[1]	6	302	2	NA	16
# of providers	2	28	1	NA	7
Useful life	< 2 years	1-5 years	10-15 years	NA	3-20 years
Duration	Suited for applications of 4 hour discharge	Hours – months	Suited for 2-minutes or less power applications	Seconds	Minutes – hours
Power Rating	.3 MW – 10 MW	<50 MW	1 kW – 10 kW	High Power	25kW – 10 MW
Applications	Energy applications – peak shaving, load leveling, etc.	On-site power, back up	Short recharging periods and many cycles per day (ex: ramp rate control)	Short recharging periods and many cycles per day (ex: ramp rate control)	Renewable capacity firming, renewables energy time shift
Pros	Very high energy density, light compared to sealed batteries lower cost, Non flammable	Response time almost zero, Advantageous for combined heat and power apps, longer operating time compared to batteries, reliable	Very high power density, reliable, low maintenance, long lifetime, wide temperature range, very fast charge/ discharge	Very quick response time, high round-trip efficiency, very high power output, good for power quality control in manufacturing plants	High efficiency, no greenhouse gas emissions
Cons	Better suited for EVs and electronics, impacted by humidity, lower discharge efficiency	Lower efficiency, limited fueling infrastructure, expensive to produce	Low energy density and 10x larger than comparable battery, expensive, not as well known/ established in U.S. for battery applications	Reliability depends on an energy-intensive refrigeration system	Expensive extraction process, flammable, low energy density

[1]Excludes projects that were canceled, dormant, suspended, de-commissioned, are under rehabilitation & modernization

Source: Global Data, GTM Research, DOE Global Energy, Energy Storage Association, Renewable Energy World, Grand View Research, AECOM Energy Study, Lazard, U.S. Energy.Gov

GLOBAL STORAGE TECHNOLOGIES (3/3)

Lithium-ion is the most popular electro-chemical storage technology, accounting for nearly 50% of global electro-chemical capacity.

Electro-Chemical

	Lithium-ion	Sodium Based	Lead-Acid	Flow Batteries	Nickel Based
Capacity[1]	2.1 GW	203.9 MW	74.3 MW	173.1 MW	30.7 MW
# of projects[1]	555	64	65	78	8
# of providers	69	5	27	16	3
Duration	Suited for power and energy applications from 12 minutes to 4 hour discharge	Suited for 2-6 hour discharge applications	Suited for 4 hour discharge duration or longer	Suited for power and electric-centric applications of 4 to 12 hour discharge	Minutes – days
Power Rating	1 kW-10 MW	100 kW – 10 MW	1 kW – 1 MW	1 kW – 100 kW 1 MW – 10 MW (Zinc)	0 – 40 MW
Useful Life	10-20 years	10-20 years	3-20 years	10-25 years	20-25 years
Applications	Frequency regulation, renewables capacity firming, renewables energy time shift, resiliency, microgrid	Electric bill management, electric energy time shift, renewable energy integration	Electric energy time shift, renewable capacity firming, frequency regulation, voltage support	Renewables capacity firming, electric bill management, electric energy time shift, micro-grid capability	Distribution upgrade due to solar, electric supply capacity, renewables capacity firming, frequency regulation
Pros	Multiple chemistries, rapidly decreasing cost, efficient power and energy density	High temp. tech.: mature, high energy capacity, long duration Cold tech.: emerging technology, low cost, potentially safer	Low capital cost, well-established, simple technology, high efficiency (80-90%)	Power and energy independently scalable, no degradation in energy storage	High power and energy densities, efficiency, improved longevity, performs well at low temp
Cons	Safety issues from overheating, requires advanced manufacturing capabilities	High cost, especially low temperature batteries (higher cost, lower efficiency), flammability issues for high temperatures	Limited service life, capacity decrease when high power is discharged, hazardous material, reliability issues	Relatively high system costs, reduced efficiency with rapid charge/discharge	Expensive, toxicity limits Nickel Cadmium to stationary application

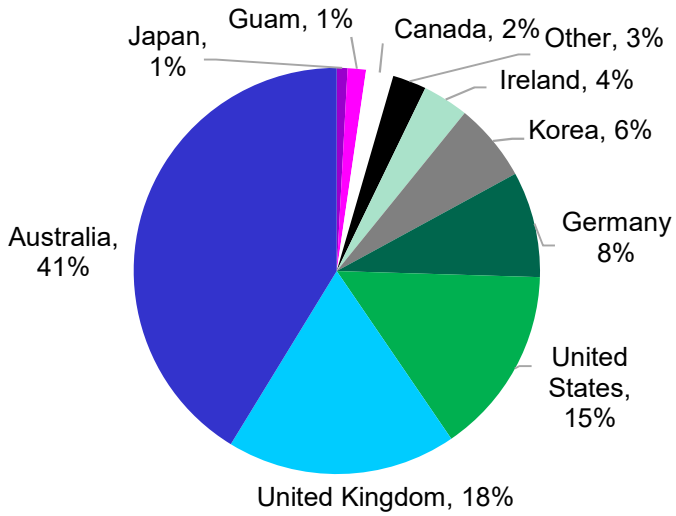
[1]Excludes projects that were canceled, dormant, suspended, de-commissioned, are under rehabilitation & modernization

Source: Global Data, GTM Research, AECOM Energy Study, Lazard, U.S. Energy.Gov

2017 ENERGY STORAGE PROJECT ACTIVITY

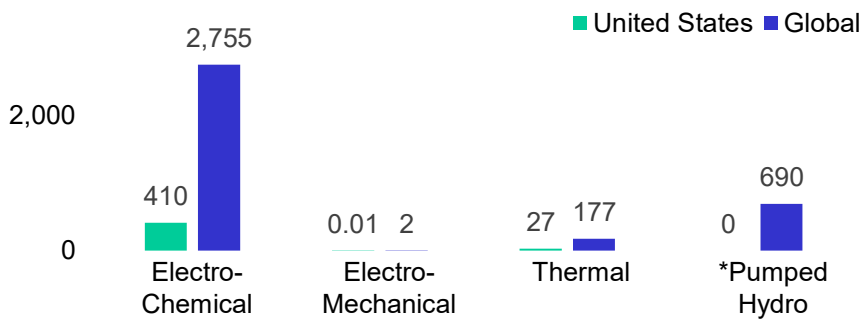
The majority of global and U.S. storage projects announced in 2017 are electro-chemical

Electro-Chemical Projects Announced in 2017 (By Country, by MW)

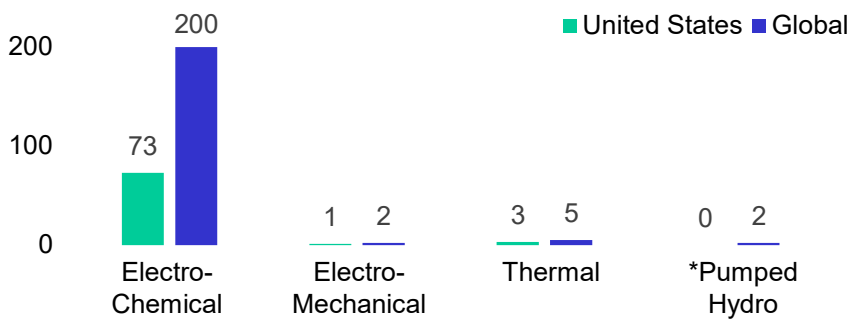


Australia, the UK, and the United States lead in electro-chemical storage development, accounting for **nearly 75%** of electro-chemical storage capacity announced in 2017.

Storage Projects Announced in 2017 (By MW)



Storage Projects Announced in 2017 (By Count)



*Includes Pumped Hydro projects that came online in 2017
Source: DOE energy storage database, Global Data

IN SERVICE U.S. ENERGY STORAGE PROJECTS

While the majority of in service U.S. projects are electro-chemical, pumped hydro accounts for a much larger share of U.S. energy storage capacity.

U.S. Operational Advanced Energy Storage (Total as of Feb. 2018)

Technology	Capacity (GW)	# Of Projects
Electro-Chemical	1.06	544
Thermal	1.10	98
Electro-Mechanical	0.17	23
Total	**2.32**	**665**

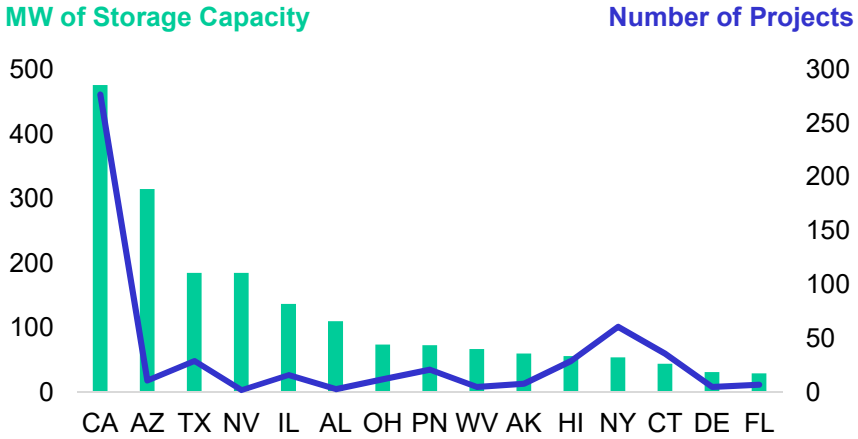
82% of U.S. advanced energy storage projects are **electro-chemical**

U.S. Operational Pumped Hydro Energy Storage (Total as of Feb. 2018)

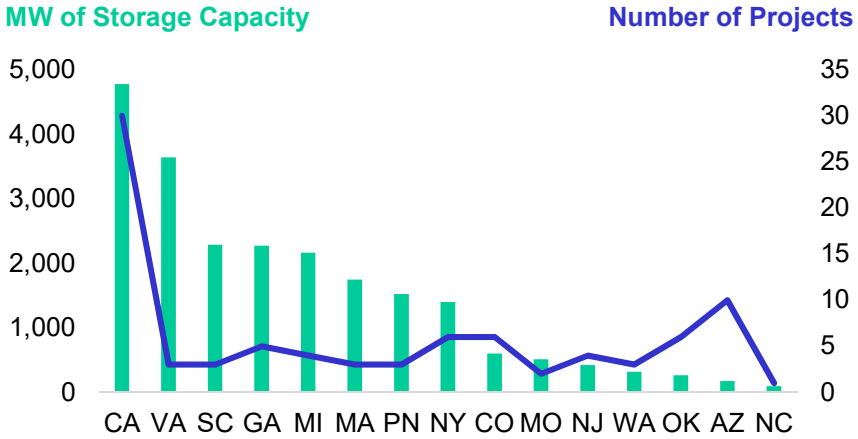
	Capacity (GW)	# Of Projects
Total	**22.2**	**51**

The operational storage capacity of U.S pumped hydro is **nearly 10 times** that of advanced energy storage.

Operational Advanced Energy Storage (as of Feb. 2018)



Operational Pumped Hydro Energy Storage (as of Feb. 2018)



California leads the nation in number of storage projects and storage capacity, largely driven by the high price of energy and regulatory conditions. California claims 42% of advanced energy storage projects and 23% of pumped hydro projects.

Source: Global Data

U.S. ELECTRO-CHEMICAL STORAGE GROWTH

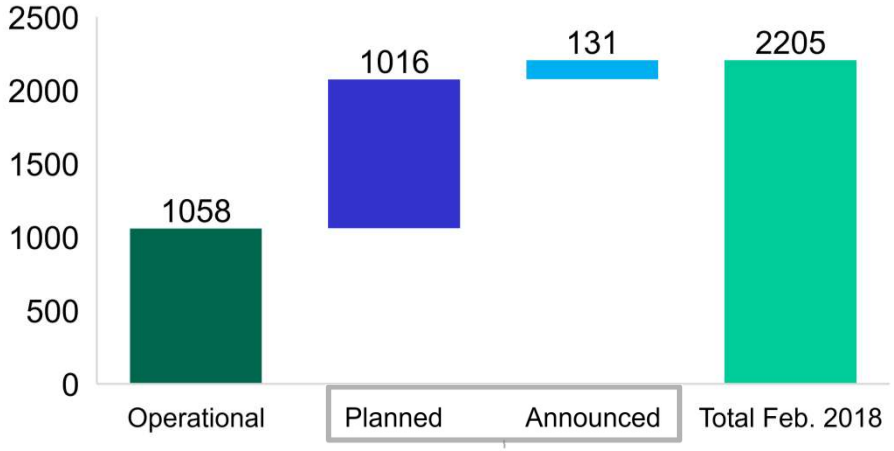
Lithium-ion batteries have contributed most to the growth of advanced energy storage. They will continue to dominate the market, as they make up 51% of planned or announced projects.

Compound Growth of Electro-Chemical Storage Projects Announced by Year

Technology	**5 Year CAGR (2012 – 2017)** Capacity of Projects Announced by Year	**5 Year CAGR (2012 – 2017)** Number of Projects Announced by Year
Lithium-ion Battery	**275%**	**86%**
Flow Battery	25%	15%
Fuel Cell	6%	7%

Planned or Announced Electro-Chemical Storage

Total U.S. Electro-Chemical Storage Capacity (MW) as of Feb. 2018



Of the electro-chemical projects with the status of 'planned' or 'announced', **51% are lithium-ion batteries** and **24% are fuel cells.**

Number of Planned or Announced Li-ion Projects

Rated Power	**Number of Projects**
≤1 MW	65
1-10 MW	33
11-20 MW	8
21-30 MW	2
>30 MW	6

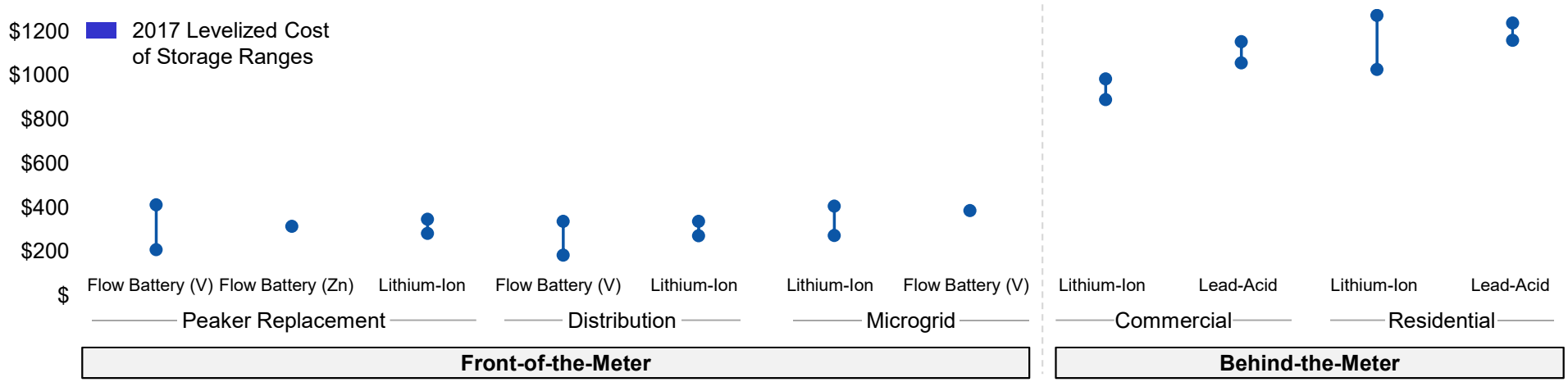
The average size of the planned or announced Li-ion projects is 6.4 MW, and 57% of the projects are ≤1 MW

Source: Global Data

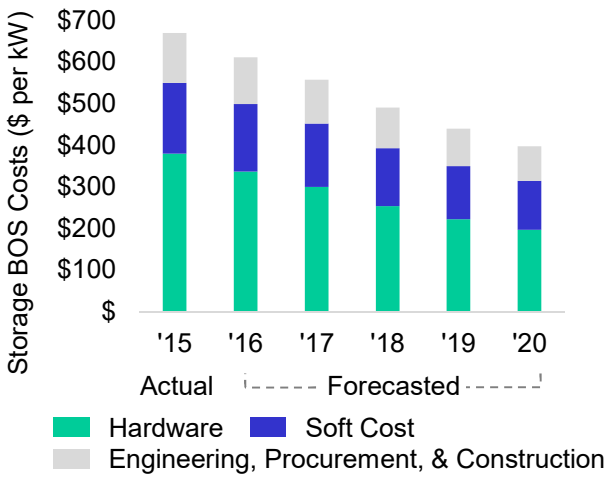
DECREASING STORAGE COSTS

The cost of energy storage continues to decrease across technologies

Levelized Cost of Storage ($/MWh)



Storage Balance of System Costs



Average Capital Cost Outlook

Technology	Avg. 5 Yr Change in Cost	Avg. CAGR
Lithium-Ion	(36%)	(10%)
Flow Battery – Vanadium	(19%)	(5%)
Flow Battery – Zinc Bromide	(28%)	(8%)
Lead-Acid	(8%)	(2%)

Drivers for Cost Reduction

- Economies of scale from production volume increases
- Manufacturing and engineering improvements
- Innovations in materials science
- Market pressure for continued battery cost reduction (especially from electric vehicle manufacturers)

Source: Lazard Nov 2017 Levelized Cost of Storage, Greentech Media

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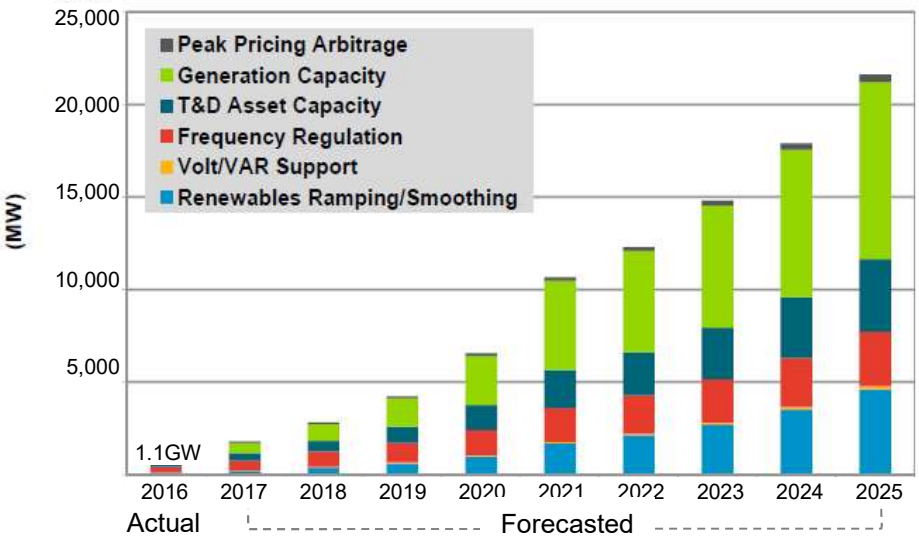
OVERALL ENERGY STORAGE GROWTH

Overall energy storage is projected to grow exponentially in both global and U.S. markets

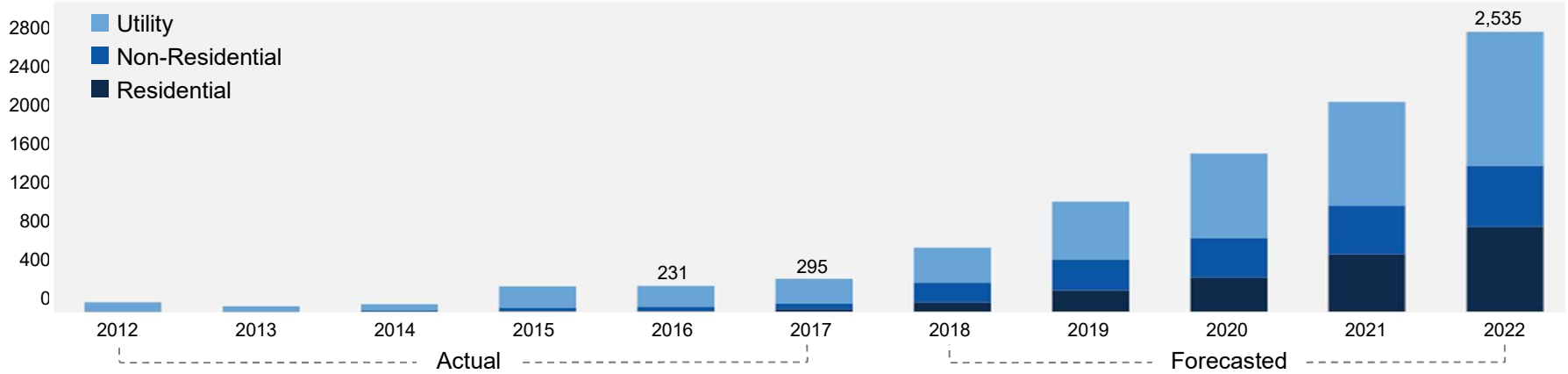
Installed *ESGAS Power Capacity by Application, World Markets 2016-2025



Globally, generation capacity and renewables ramping/smoothing are projected to make up the majority of the future energy storage capacity

In the U.S., energy storage is expected to grow almost tenfold over the next 5 years due to increasing utility demand as well as new demand from residential and C&I customers

U.S. Annual Energy Storage Deployment Forecast, 2012-2022 (MW)



*Energy Storage for the Grid and Ancillary Services
Source: Navigant Research, GTM Research

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FRONT-OF-THE-METER POLICY DEVELOPMENTS

Regulations and incentives passed in 2017 will continue to advance front-of-the-meter storage

Non-Exhaustive

Federal

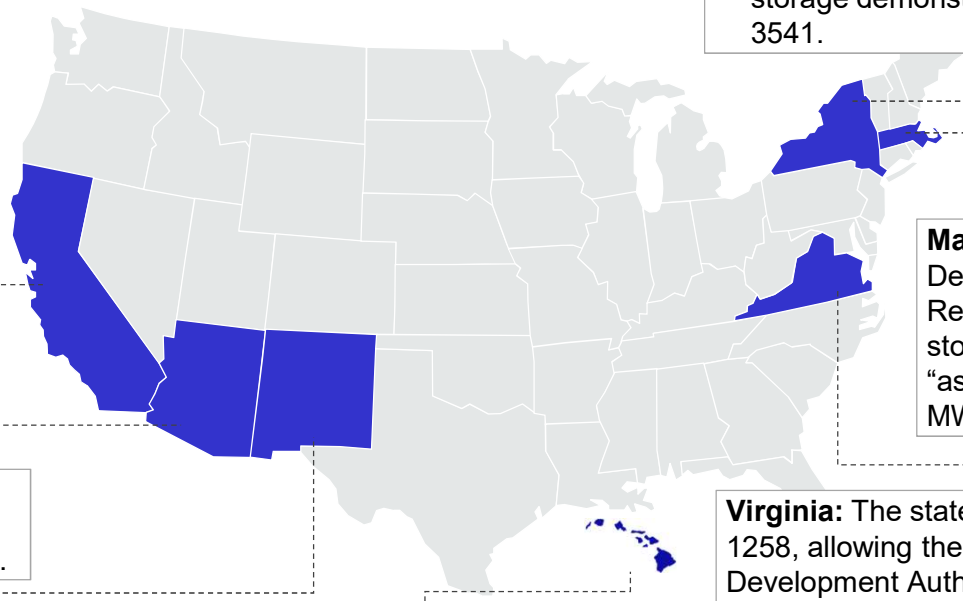
- FERC approved order 841, directing RTOs and ISOs to come up with market rules for energy storage to participate in wholesale energy, capacity and ancillary service markets.
- NARUC released an updated ratemaking manual for distributed energy resources.
- Four bills were introduced in the U.S. Senate in the fall of 2017 that could advance energy storage, including another attempt to secure a tax credit for energy storage and multiple efforts to increase resiliency after the intense 2017 hurricane season.

New York:

- The state legislature passed a bill to establish a storage target in the first quarter of 2018; it also introduced a bill proposing a credit for storage manufacturing facilities.
- NYSERDA offered up to $15.5 for energy storage demonstration projects via PON 3541.

California:

- The State Legislature introduced AB 1405, to establish a clean peak standard for California
- The CPUC announced an additional 500 MW of distributed energy targets for three main IOUs.
- CAISO launched Phase 3 of the Energy Storage and Distributed Energy Resources Initiative.



Massachusetts: The MA Department of Energy Resources released its energy storage target, setting an "aspirational" target of 200 MWh by Jan. 1, 2020

Arizona: APS announced its 2017 Integrated Resource Plan, including more than 500 MW of energy storage.

Virginia: The state legislature passed SB 1258, allowing the state's Solar Energy Development Authority to include energy storage, and HB 1760, allowing utilities to recover costs from energy storage projects.

New Mexico: Public Service Company of NM released an updated integrated resource plan that called for an RFP to procure energy storage before 2022.

Hawaii: The state legislature introduced bills pertaining to energy storage tax credits and infrastructure loans.

Source: GTM Grid Edge Executive Briefings, Q1-Q4 2017; Green Tech Media; Utility Dive

BEHIND-THE-METER POLICY DEVELOPMENTS

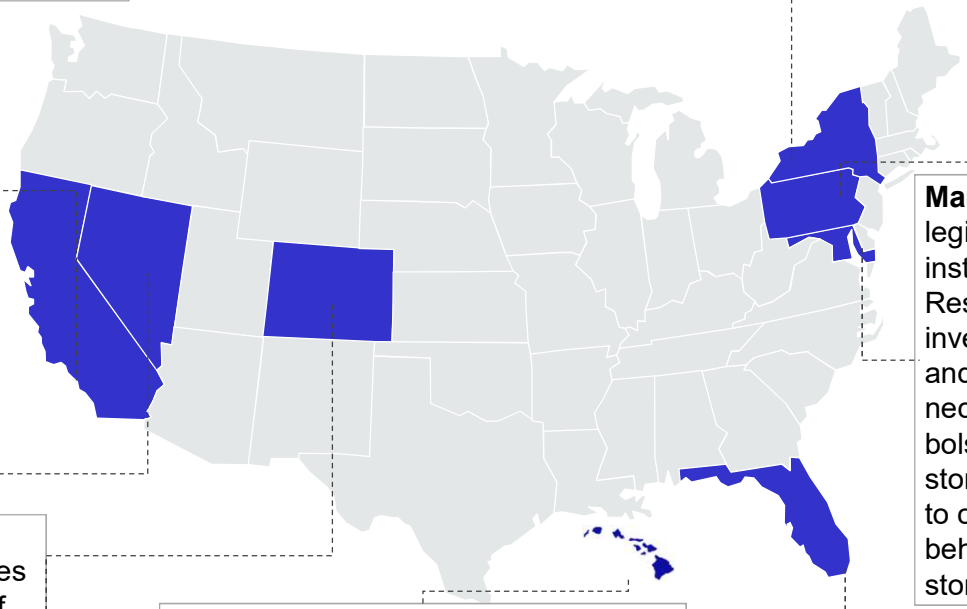
Regulations and incentives passed in 2017 will continue to advance behind-the-meter storage

Non-Exhaustive

California:
- CPUC approved doubling of the Self Generation Incentive Program budget for 2017 through 2019
- The state's governor signed AB 546 into law to streamline storage permitting.
- CPUC directed IOUs to identify and select a project where DERs can be deployed in place of traditional infrastructure.

New York: NY PSC issued an order to allow commercial storage to export to the grid and directed utilities to explore how storage exports impact grid; it also approved expansion of the BQDM program.

Pennsylvania: The state legislature introduced HB 1412 to encourage utilities to investigate storage and allow storage participation in wholesale markets.



Nevada: The governor signed SB 145 and SB 146 into law, establishing a behind-the-meter storage incentive program, and directing utilities to explore distributed resource plans.

Maryland: The State legislature passed bills instructing the Power Plant Research Program to investigate market incentives and regulatory reforms necessary or beneficial to bolster implementation of storage; also considering bill to create a tax credit for behind-the-meter energy storage systems.

Colorado: Senate Bill 17-089 introduced in the legislature proposes to allow installation and utilization of behind-the-meter storage and prevent additional fees to be administered by utilities on customers employing storage.

Hawaii: Hawaii Public Utilities Commission issued new program rules, (Smart Export and CGS+) that encourage rooftop PV and storage through net metering.

Florida: The state legislature passed SB 90 to exempt 80% of storage system value from ad valorem taxation.

Source: GTM Grid Edge Executive Briefings, Q1-Q4 2017; Hawaii Public Utilities Commission

MARKET CHALLENGES

In spite of the optimistic growth projections, the storage market faces regulatory, financial, and technological hurdles.

Energy Storage Regulations are Still in Their Early Stages

- Some states have mandates and incentive programs for energy storage, such as SGIP in California or NYSERDA in New York, but many states are still in the process of forming rules around DERs, NEM, tariffs, and incentives.
- Many state commissions do not allow utilities to fully own storage assets because they can perform as generation assets.
- Operating batteries to simultaneously tap multiple revenue sources can unlock significantly more value than using them for individual applications, however regulatory hurdles to value stacking exist even in California. Clarification of policies regarding aggregation requirements for wholesale market participation, limits on net exports of energy to the grid, and prioritization of dispatch control when a battery is being operated is necessary to unlock additional value.

Inconsistent Rules Addressing Aggregated Distributed Energy Resources

- FERC passed a rule in February 2018 requiring RTOs and ISOs to revise tariffs allowing for energy storage to participate in U.S. wholesale energy markets. The rule will expand the scope of energy storage's participation beyond frequency regulation and into larger ancillary services, however uncertainties remain regarding the participation of DERs in wholesale energy markets because ISOs and RTOs don't have oversight or visibility into the distribution grid.
- FERC will host a technical conference in April to discuss the participation of DERs in wholesale markets.

High Capital Investments With Long Payback Periods

- Despite overall decreases in storage technology costs, energy storage deployment still requires large capital investments that are difficult to overcome for use cases where batteries have narrow value pools. The majority of storage projects utilize lithium-ion technologies because they provide the best economics in most use cases and are quick to deploy.

Technology Maturity

- While energy storage has seen noteworthy advances, R&D and manufacturing processes continue to drive significant improvements to the technology. This progress continues to push costs down and improve areas like efficiency, reliability, safety, capacity, and power across most of the technologies available.

Fluctuations in the Energy Storage Vendor Landscape

- There is a lot of activity amongst energy storage vendors. In January 2018, S&C Electric announced their exit from the storage market despite the company's 2006 entry. In addition Alevo and Aquion filed for bankruptcy in 2017 and legacy energy companies were actively acquiring energy storage startups (ENEL bought Demand Energy, Wartsila bought Greensmith, Aggreko bough Younnicos, AES signed a joint venture with Siemens to merger energy storage groups)

Source: Utility Dive, Greentech Media, Accenture Analysis,

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2 RESEARCH APPROACH

3 PERSPECTIVE ON ENERGY STORAGE MARKET

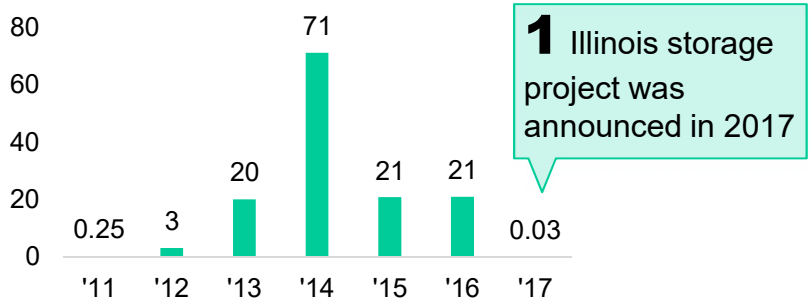
4 PERSPECTIVE ON ILLINOIS MARKET

5 GLOSSARY

ILLINOIS ENERGY STORAGE MARKET SUMMARY

Storage in Illinois boomed in 2014 and 2015 due to the rise in the frequency regulation market, which has since slowed.

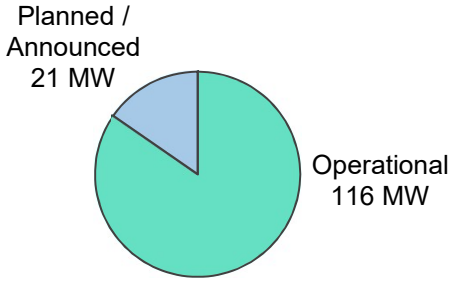
Capacity of Energy Storage Projects Announced by Year (MW)



Illinois 2017 Energy Storage Market Activity

Project Name	Year Announced	2017 Activity
Beecher Community Energy Storage	2017	Came online
Bronzeville Microgrid	2016	Was on hold until ICC approval received
Marengo Project	2016	Under construction
Energy Vault Project	2016	Active in PJM's queue
Itasca BTM Project	2016	Active in PJM's queue

Current Status of all Illinois Advanced Energy Storage Projects (MW)



Illinois is **5th** in the U.S. for total operational storage capacity

Illinois is **11th** in the U.S. for total planned / announced storage capacity

Key Applications of Illinois Energy Storage

Service	Rated Power (MW)
Frequency Regulation	132.55
Electric Bill Management	2.25
Back Up / On-Site Power	0.57
Electric Supply Capacity	0.31
Microgrid Capability	1.00

98% of all Illinois' energy storage projects are **Lithium-Ion**

PJM is the most mature market in the nation for frequency regulation

The concentration of lithium-ion technology makes sense for a frequency regulation heavy market because of the focus on power over energy

Source: Global Data

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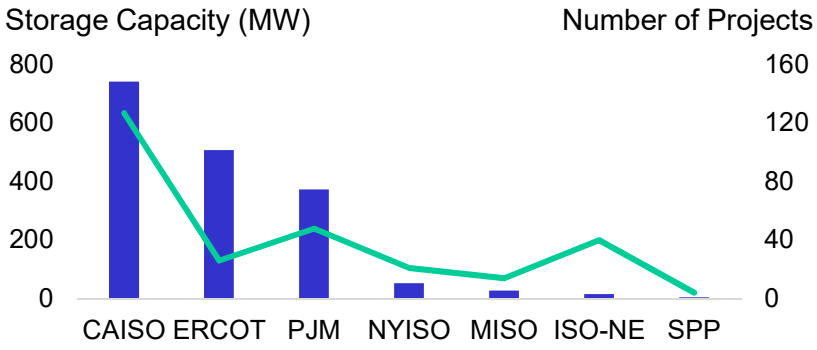
PJM & MISO MARKETS

PJM is the most mature frequency regulation market, though recent changes in specifications create uncertainties. MISO is signaling greater interest in energy storage.

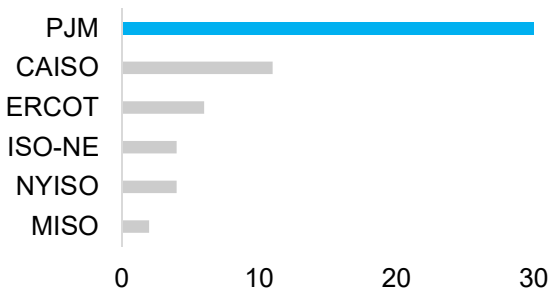
PJM & MISO Market Overview

PJM lags behind CAISO and ERCOT on energy storage overall, though it is the most mature frequency regulation market

All Storage Projects



Number of Frequency Regulation Storage Projects



In April, MISO created a new resource category to allow limited participation of energy storage in wholesale markets. In August, MISO formed an Energy Storage Task Force and determined that creating energy storage market definitions and rules was the single biggest market issue for 2018.

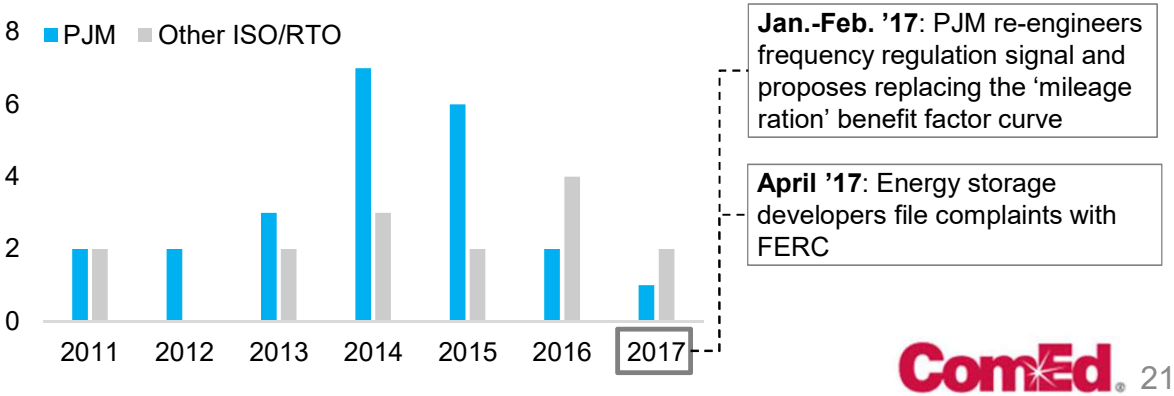
Growth in PJM Slows

PJM changed frequency regulation specifications in January, eliciting storage developers to file a complaint with FERC.

PJM's new rules have lowered revenue for a 20-MW, 5MWh storage system from $623 in 2014 to $86 today.

Storage vendors noted that the frequency regulation market was already saturated, and the rule change makes the market less desirable.

Frequency Regulation Projects Announced



Source: Utility Dive, Global Data, Green Tech Media, RTO Insider

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CHALLENGES TO STORAGE GROWTH IN ILLINOIS

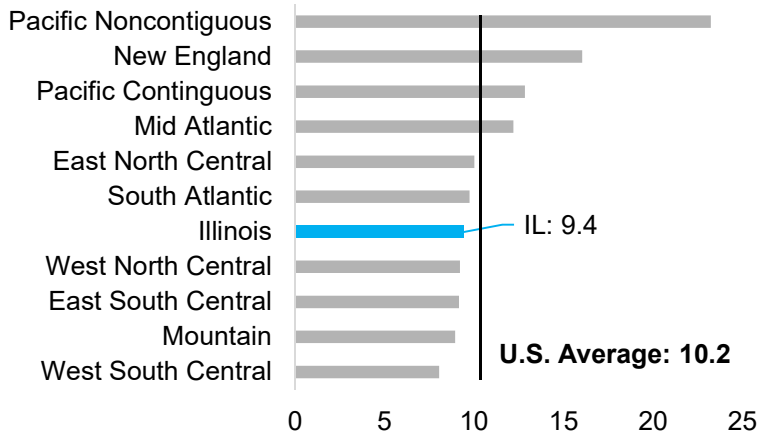
Illinois' low cost of energy and regulatory policies dictate growth in the energy storage market

Low Energy Prices

Illinois energy prices are **7.9% less** than the U.S. average and are significantly lower than the Pacific Noncontiguous (AK, HI) and New England regions.

Illinois ranks **27th** for highest state energy prices.

***Average Electricity Prices for all Sectors (Cents/kWh)**



Illinois has a lower maximum demand charge than states such as New York and California which have large energy storage markets. However, Illinois has higher average demand charges than these states.

Demand Charges by State

State	Maximum charge across all utilities	Average of all utility maximum charges
NY	$51.25	$9.30
CA	$47.08	$11.45
CO	$46.43	$21.68
MA	$41.25	$19.14
AZ	$35.45	$18.82
NE	$30.00	$14.82
IL	**$30.00**	**$16.58**
GA	$28.70	$5.83
NC	$25.65	15.61
VT	$25.39	17.43

Little or No Direct Policy and Incentive Programs

Vendors have noted that energy storage has not been explicitly supported in Illinois and that it is hard to see Illinois as a big market until there are clear regulatory policies. That said, the Future Energy Jobs Act (passed Jan. 2017) has Renewable Portfolio Standards and solar rebates for commercial customers. Depending on the impact the FEJA legislation has on the solar deployment, these policies could eventually have a positive effect on the demand for energy storage as storage can provide incremental benefits to solar by smoothing the fluctuations in generation due to weather and by shifting load.

*Sectors include residential, commercial, industrial, and transportation. Data is an average of prices in Nov. 2016 and Nov. 2017

Source: U.S. Energy Information Administration, National Renewable Energy Laboratory

FUTURE ENERGY JOBS ACT (FEJA)

FEJA, which went into effect in June 2017, contains the following key elements:

Energy Efficiency (EE)

- Allows ComEd to gradually increase EE spending to $400M+ per year, and the investment is included in the rate base
- Sets Cumulative Persisting Annual Savings (CPAS) goals, with ROE incentives/penalties for exceeding or failing to meet those goals
    - Voltage Optimization (VO) energy savings count toward CPAS goals, but VO investment does not earn incentive returns
- Tasks ComEd with creating a low-income EE program of $25M/year
- Exempts large customers (>10MW over 30-minute period) from EE programs
- Increases On-Bill Financing (OBF) to $20M/year

Renewable Portfolio Standard (RPS)

- Requires IPA to procure Renewable Energy Credits (RECs) for 13% of a utility's load in 2017 delivery year, ramping up to 25% by June 1, 2025
- Requires annual procurement of 2 million RECs each from new wind and solar by 2021 delivery year, ramping up to 4 million by 2030
- The Adjustable Block Program allows the IPA to set different prices for RECs from different generation sources and allows the price for each source to drop as adoption for that source increases. Furthermore, it requires that a minimum amount of RECs come from each source.
- Provides resi solar (<10 kW) 15-year REC payment upfront; small C&I (10 kW – 2 MW) receive 15-year REC payment over 5 years

CARE

- Extension of CARE program at $10M/year for five years starting June 1, 2017

Solar for All

- Uses Renewable Energy Resources Fund (RERF) monies to fund low-income residential DG incentives (22.5%), low-income community solar subscription incentives (37.5%), non-profit and public-sector DG incentives (15%), and community solar pilot incentives (25%)
- Utilities shall propose community solar projects up to $20M

Net Metering (NEM) & DG Rebates

- Residential NEM unchanged until 5% cap reached
- $250/kW nameplate capacity rebate available to non-residential NEM customers, including existing NEM customers
- Utilities may capitalize costs of rebates; requires line item on bill
- Utilities may propose new uses for smart inverters, potentially compensating customers for use of smart inverters

Zero Emissions Standards (ZES)

- Zero Emissions Credits (ZECs) are procured from Illinois nuclear power plants
- The ICC will set the rate, not to exceed 1.65% of average resi-rate in '08-'09
- ComEd will collect funds from all customers via new line item on the bill

Job Training

- Requires that ComEd coordinate and fund training for clean energy jobs.
- Allocates $10 million every four years in 2017, 2021, and 2025 – a total of $30 million – for solar pipeline training programs, craft apprenticeships and multicultural training for individuals from diverse and/or underserved backgrounds.

Long-Term Renewable Resources Procurement Plan

- The IPA filed the procurement plan, which lays out how the state will pay for and structure the projects and programs under FEJA, on Dec. 4, 2017.

Source: Accenture Analysis, ComEd, The Illinois Power Agency

ILLINOIS ENERGY STORAGE MARKET ACTIVITY (1/2)

In 2017 ComEd pilots 25kW community energy storage system in Beecher, Illinois

LOCATION

- Beecher, Illinois, an area that experiences an unusually high number of outages. The battery is located near existing ComEd equipment.

TECHNOLOGY

- 25 kW, 25kWh Lithium-ion battery
- PureWave Community Energy Storage System (CES) from S&C Electric Company.

ASSET OWNER

- ComEd

ComEd crews lower the Community Energy Storage unit into the underground vault near customer homes in Beecher, Illinois
Photo: Midwest Energy News

KEY APPLICATIONS

- Distribution energy storage
- Improved power reliability
- ComEd will evaluate the potential of the technology

TIMELINE

- Project deployed in March, 2017
- Pilot will run for 1 year

Source: ComEd, Midwest Energy News

ILLINOIS ENERGY STORAGE MARKET ACTIVITY (2/2)

Updates to the 2016 report include: the ICC recently approved the Bronzeville Microgrid, the Marengo Project is under construction, and the Energy Vault and Itasca projects are active in PJM's queue.

	Bronzeville Microgrid	Marengo Project	Energy Vault Project	Itasca BTM Project
Location	Chicago, Illinois	McHenry, Illinois	Chicago, Illinois	Itasca, Illinois
Technology	• Phase I: 2.5 MW load, solar PV & storage with diesel back-up. • Phase II: 4.5 MW load, clustering demonstration with existing microgrid at the Illinois Institute of Technology	• 20 MW / 10 MWh lithium-ion energy storage is one of the largest, fully commercial storage projects in North America	100 kW, battery type unspecified	• 1 MW, battery type unspecified • Will be paired with a 600 kW solar system.
Asset Stakeholders	ComEd intends to put the generation aspects of the project out to competitive bid for leasing or ownership.	• Financer: Swiss Green Electricity Management Group • Technology provider: Leclanché • Developer: GlidePath Power	The project is being developed by Energy Vault LLC.	• Sun-Mountain Hilltop LLC is developing the battery. • Solberg Manufacturing will own the asset. • Intelligent Generation will manage the battery
Key Applications	• Distribution energy storage • The microgrid will serve ~1,060 residential and C&I customers including 10 community facilities	• Transmission energy storage • The plant will provide frequency regulation to PJM	Unspecified	• Behind-the-Meter energy storage • Renewables integration and back-up power
Cost	• Total Cost: $29.6M. • ComEd was awarded $4M from the DOE Sunshot Initiative, and $1.2M from DOE to work with Argonne National Laboratory to integrate the project with IIT's microgrid	Unspecified	Unspecified	Unspecified
Timeline / Status	• 2016: Project announced • 2017: ComEd seeks funding approval from the ICC • 2018: ICC approves the project, and construction is scheduled to begin	• 2016: Project announced • 2017: Construction began • 2018: Project scheduled to be operational	• June, 2016: Entered PJM's queue • The project is currently in the phase of engineering and procurement	• Aug. 2016: Entered PJM's queue • Project is still active in PJM's queue

Source: Greentech Media, Chicago Tribune, Midwest Energy News, Transmission Hub, Australian Energy Storage Database, Northwest Herald, GlidePath Power, ComEd, S&C Electric Company, T&D World, PJM

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GLOSSARY

The following acronyms are used in this report

Acronym	Definition
APS	Arizona Public Service Electric Company
C&I	Commercial & Industrial
CAGR	Compounded Annual Growth Rate
CAISO	California Independent System Operator
CPUC	California Public Utilities Commission
DERs	Distributed Energy Resources
ERCOT	Electric Reliability Council of Texas
ESGAS	Energy Storage for the Grid and Ancillary Services
FEJA	Future Energy Jobs Act
FERC	Federal Energy Regulatory Commission
GW	Gigawatt
ICC	Illinois Commerce Commission
ISO	Independent System Operator
ISO-NE	Independent System Operator – New England
kW	Kilowatt
MISO	Midcontinent Independent System Operator
MW	Megawatt
NARUC	National Association of Regulatory Utility Commissioners
NEM	Net Metering
NY PSC	New York Public Service Commission
NYISO	New York Independent System Operator
NYSERDA	New York State Energy Research & Development Authority
PJM	Pennsylvania, Jersey, Maryland Power Pool Regional Transmission Organization
PV	Solar Photo Voltaic
RTO	Regional Transmission Organization
SGIP	Self-Generation Incentive Program
SPP	Southwest Power Pool
T&D	Transmission & Distribution

Smart Grid Advanced Metering Annual Implementation Progress Report

HAN Device Interoperability

ATTACHMENT 5

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HAN DEVICE INTEROPERABILITY

This document is up to date as of 2 November 2017

Smart meters outfitted with Silver Spring network interface cards (NICs) support connectivity to the customer's home area network (HAN) through the ZigBee Smart Energy Profile specification. The Silver Spring HAN Test Kit enables utilities and third-party device manufacturers to qualify ZigBee-based HAN devices as compatible with the Silver Spring NICs and Silver Spring firmware.

To date, the following third-party device manufactures have purchased a HAN Test Kit. Please contact these vendors directly to confirm whether they have tested their devices and against what NIC firmware to confirm compatibility on your network.

Table 1. Manufactures that have purchased HAN Test Kits

Manufacturer	Tested by
AlertMe	Manufacturer
Ambient Devices	Manufacturer
Belkin	Manufacturer
Bidgley	Manufacturer
Carrier	Carrier Comfort Choice Touch Zigbee tested by Silver Spring. For other devices, consult with manufacturer
Ceiva Logic	Manufacturer
ClipperCreek	Manufacturer
Comverge	Manufacturer
Cooper Power Systems	Manufacturer
Digi	Manufacturer
EC Infosystems	Manufacturer
Ecobee	Manufacturer
Efergy	Manufacturer
Emerson	Manufacturer

Table 1. Manufactures that have purchased HAN Test Kits *(Continued)*

Manufacturer	Tested by
Energate	Silver Spring
Intercel	Manufacturer
Intwine	Manufacturer
Jetlun	Manufacturer
LG Electronics	Manufacturer
Millenium Electronics	Manufacturer
MJ Innovations	Manufacturer
MMB Research	Manufacturer
OWON Technology	Manufacturer
Phasefale	Manufacturer
Rainforest Automation	Manufacturer
Schneider Electric	Manufacturer
Secure Together	Manufacturer
SolarCity	Manufacturer
Tendril	Manufacturer
ThinkEco	Manufacturer
Whirlpool	Manufacturer

Frequently Asked Questions

Q: What level of testing does Silver Spring perform for devices confirmed to interoperate with the Silver Spring platform?

Silver Spring does not perform testing of these devices to confirm that they are interoperable with the Silver Spring platform. Testing is performed, however, on the platform itself to verify HAN functionality across a range of various HAN devices.

Q: Will Silver Springs be testing any devices directly?

Silver Spring does not focus on directly reselling devices and, therefore, does not take responsibility for specific device interoperability—this is considered the responsibility of the HAN device manufacturers. If customers would like Silver Spring to qualify devices on their behalf, this can be discussed through a possible services engagement.

Q: What level of testing does the manufacturer perform for devices, and how does this level differ from devices Silver Spring tests?

Device manufacturers use the Silver Spring HAN Test Kit to validate basic ZigBee SEP interoperability between HAN devices and the Silver Spring NIC. The HAN Test Kit test procedures focus solely on protocol-level testing.

Q: What is the HAN Test Kit?

The Silver Spring HAN Test Kit is a test tool available to third-party device manufacturers for validating their HAN devices against the Silver Spring NIC. Silver Spring also provides the HAN Test Kit to utilities for lab interoperability testing.

The HAN Test Kit provides the following features:

- A structured environment for running existing tests and writing new ones
- Support for testing HAN devices equipped with ZigBee security test certificates, production certificates, or no certificates
- Sets of tests for provisioning, messaging, demand response/load control (DRLC), pricing, simple metering, and over-the-air (OTA) upgrades
- A console application that can be used for experimentation and test development
- Some simple command-line instructions that allow the tester to create DRLC, message, and price commands, or to obtain a summary of the HAN status tied to a particular meter (for example, radio status, network and link keys, joined devices, and cert type)
- HTML reporting of test results (for suites)

Q: Does Silver Spring validate or "certify" manufacturer's test results?

No, Silver Spring does not validate the results and makes no claims about the level of interoperability of manufacturer-tested device. For these details, please contact the manufacturer directly.

Q: Does Silver Spring provide a warranty that the devices on this list will operate as intended without any issues?

Devices tested by the manufacturer are not covered by a Silver Spring warranty. The primary goal of both forms of device testing is to ensure a baseline level of compatibility and to resolve common issues that might arise in the field. Device testing significantly reduces, but does not eliminate, the possible risk of interoperability or other device issues.

Silver Spring continues to expand its ecosystem of technology partners and encourages suppliers to purchase the HAN Test Kit and participate in the self-certification process.

Contact Silver Spring Networks

For help with any Silver Spring product, contact your project manager or Silver Spring Networks Customer Support.

Telephone	Hours	Email
Toll free within the US and Canada: 1-888-SSN-9876 (1-888-776-9876) Non-toll-free: 1-669-770-4298	5:00 AM - 6:00 PM US Pacific Time	**support@silverspringnet.com**
In Australia: 1300 706 769	9:00 AM - 9:00 PM Australia Eastern Time	**aus-support@silverspringnet.com**
Contact us on the Web: http://www.silverspringnet.com/services/customer-support/		

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ATTACHMENT 6

Type	Count	Reason	Disposition
Formal ICC Complaints Escalated to Customer Experience	0	N/A	N/A
Formal ICC Complaints Handled by Customer Relations	2	2 Meter Fitting Issue	Closed
Informal ICC Complaints Escalated to Customer Experience	40	13 Meter Issue 14 Policy 6 Service Refused 6 Billing 1 Personal Issue	Closed
Informal ICC Complaints handled by Customer Relations	40	28 Billing 6 Meter Issue 2 Rider Discrepency 1 Meter Reader Issue 1 Personal Issue 1 Service Refused 1 Policy	Closed
Other Complaints	186	31 Billing 14 Meter Issue 17 Service Refused 1 Customer Equipment Issue 4 Policy 13 Repair 9 Interference 14 Other 2 UTC/ No Access 81 General Inquiry	185 Closed 1 Cub Complaint Open- Billing
Meter Installation Refusal Requests	2451	904- Health Concerns 774- No Reason 321- Other Reason 282- Multiple Reasons 75- Privacy Concerns 52- Cost Concerns 28- Overheating Concerns 15- Security Concerns	*1672 Closed and are on the refusal list *779 Converted and have or will have a smart meter installed
Total	**2719**		

** Other Complaints Includes both complaints Customer Relations worked on, as well as Complaints that Customer Experience worked, that don't fall under the ICC umbrella