STATE OF ILLINOIS

ILLINOIS COMMERCE COMMISSION

COMMONWEALTH EDISON COMPANY	:	
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Petition for Statutory Approval of a Smart Grid Advanced Metering Infrastructure Deployment Plan pursuant to Section 16-108.6 of the Public Utilities Act	: : :	No. 12-0298

COMMONWEALTH EDISON COMPANY'S MODIFIED SMART GRID ADVANCED METERING INFRASTRUCTURE DEPLOYMENT PLAN

Commonwealth Edison Company ("ComEd") hereby submits to the Illinois Commerce Commission ("Commission") its Modified Smart Grid Advanced Metering Infrastructure Deployment Plan (the "Modified Plan") as directed by, and as modified in accordance with, the Commission's June 22, 2012 Order in this Docket. ComEd submits the Modified Plan without waiving its legal rights to seek further review of the issues and arguments raised in ComEd's Verified Application for Rehearing filed July 6, 2012, and the Modified Plan is subject to any relief granted, or further modifications adopted, on rehearing or any subsequent appeal.

Dated: July 13, 2012

Respectfully submitted,

COMMONWEALTH EDISON COMPANY

By: ______________________
One of its attorneys

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Smart Grid Advanced Metering Infrastructure Deployment Plan

Submitted by:
Commonwealth Edison Company

July 13, 2012

Modified pursuant to the Illinois Commerce Commission's June 22, 2012 Order in Ill. C. C. Docket No. 12-0298

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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

[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.

[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. Function and Objectives of the AMI Plan

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. Transform Delivery System Operations

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,

[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

[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.

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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. Overview of Plan Components / Outline of the Plan

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 10-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 10-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).

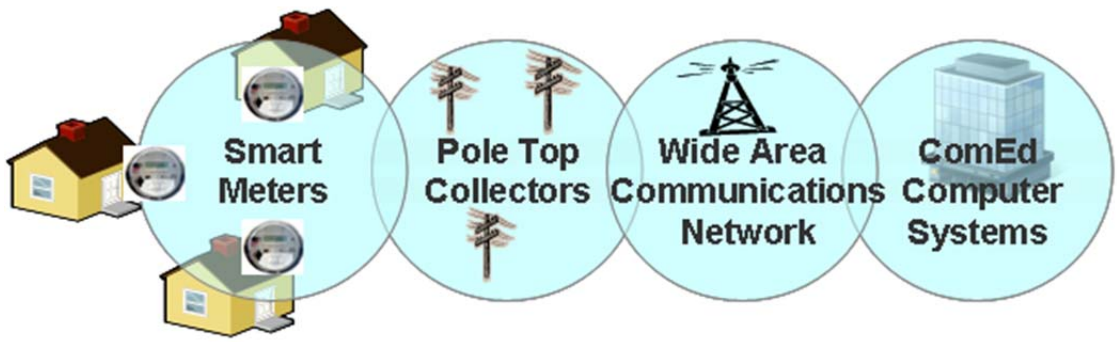

Figure 2 - Meter and Network Deployment Diagram

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 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.

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.

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[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.

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 commence installation of smart meters within 90 days of the Commission's approval of the plan. 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 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 and the peak-time rebate program, the deployment strategy is to install meters in two separate operating centers at any given time beginning in 2013. 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, 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 dual operating center deployment strategy radiating out from the Maywood footprint capitalizes on both prioritization elements. After completing the Maywood operating center, the Glenbard and Chicago South operating centers would be the next deployment areas. The figure below presents the proposed dual deployment order of the 10-year deployment by operating center, maintaining the contiguous deployment sequencing to align with the overall deployment strategy.

Year	**# of Meters Deployed**	**Operating Centers served by Cross Dock #1**	**Operating Centers served by Cross Dock #2**
2012	131,192	Remaining Maywood (Residential), Chicago South (Residential)	N/A
2013	384,854	Remaining Maywood (Commercial), Chicago South	Glenbard
2014	535,794	Chicago South	Glenbard, Mount Prospect
2015	530,355	Chicago South, Crestwood	Mount Prospect, Skokie, Chicago North
2016	459,754	Crestwood, Bolingbrook, University Park	Chicago North
2017	496,795	University Park, Joliet	Chicago North
2018	448,320	Joliet, Aurora	Chicago North
2019	401,319	Aurora, Elgin, Crystal Lake	Chicago North, Libertyville
2020	351,766	Crystal Lake, Rockford	Libertyville, DeKalb
2021	288,851	Rockford, Dixon, Freeport	Streator, DeKalb
TOTAL	**4,029,000**		

**Note: When two or more operating centers are listed in a given year, they will be completed in the order listed.*

Figure 6 - Meter Deployment Rollout[34]

This plan represents the current approach to geographic meter deployment over a 10-year period as specified in the PUA. 220 ILCS 5/16-108.6(c). The timing and prioritization of the

[34] The overall meter count for the deployment is 4,029,000. The 4,157,000 total 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.

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.

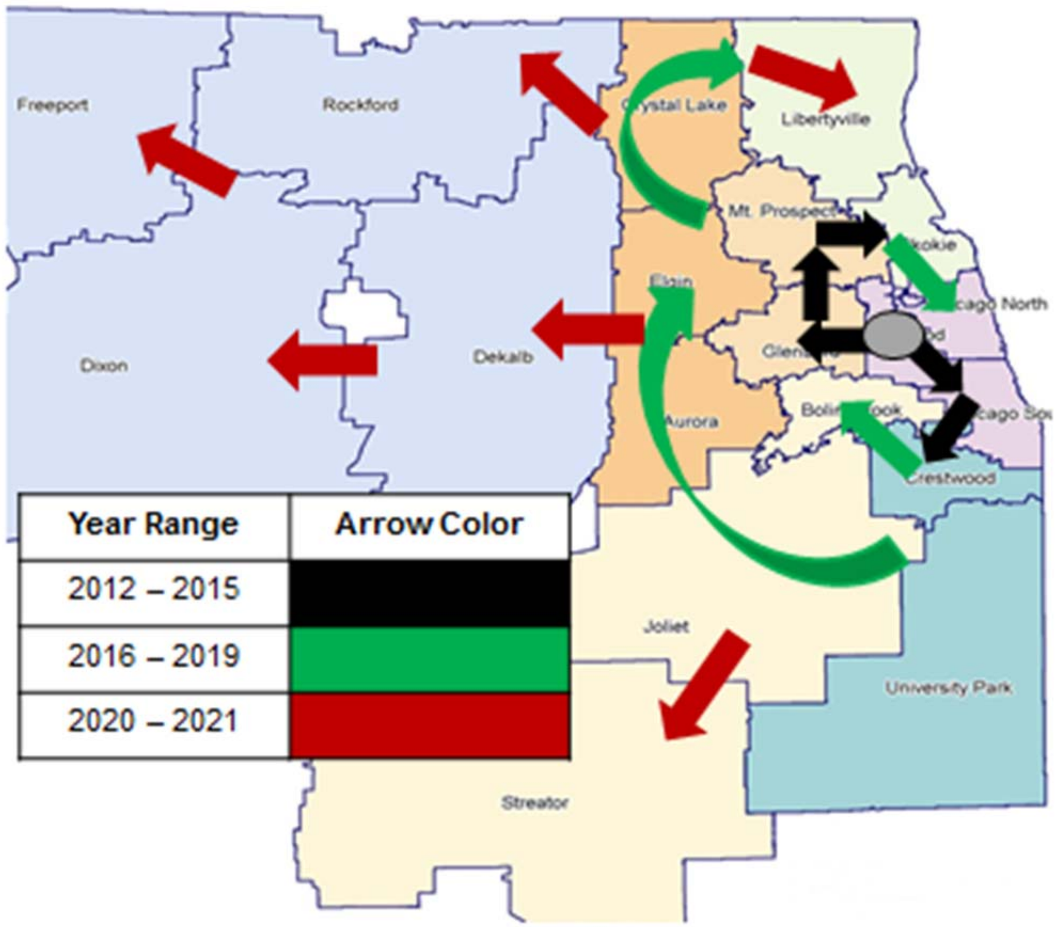

Figure 7 - Geographical Representation of the Meter Deployment Schedule

5. <u>Incorporation of Statutory Operational Requirements</u>

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.

[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.

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.

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 ten-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 10-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.

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. <u>Customer Inquiries</u>

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. <u>Electronic communications</u>

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			- 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				**NOT APPLICABLE TO AMI**	- 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. <u>Opt-in Peak Time Rebate Tariff</u>

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 10-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 net load of each customer.
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 beginning in 2013.

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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 next ten years, 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 next ten years, 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 10-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 next 10 years, 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 10-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.

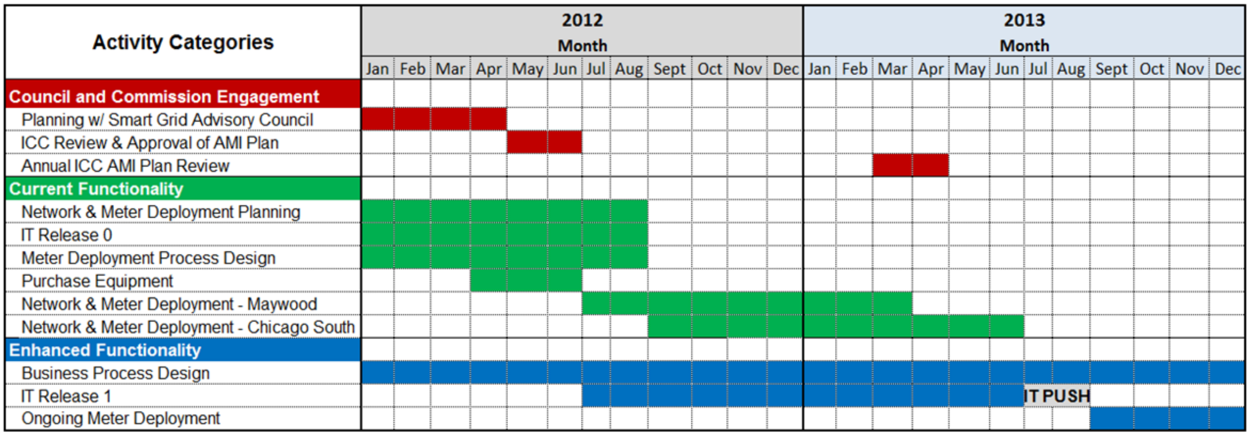

Figure 10 - 2012-2013 Monthly Schedule

Key Observations and Milestones for 2012-2013 include:

- IT Release 0 refers to the IT work to be completed to enhance the AMI Pilot solutions to commence the short-term deployment activities.
- IT Release 1 refers to the long-term solution to be managed by the AMI Business Transformation Project Team.
- A planned 2 month pause in meter installation is scheduled for the summer of 2013 to complete the associated IT work and build-out.

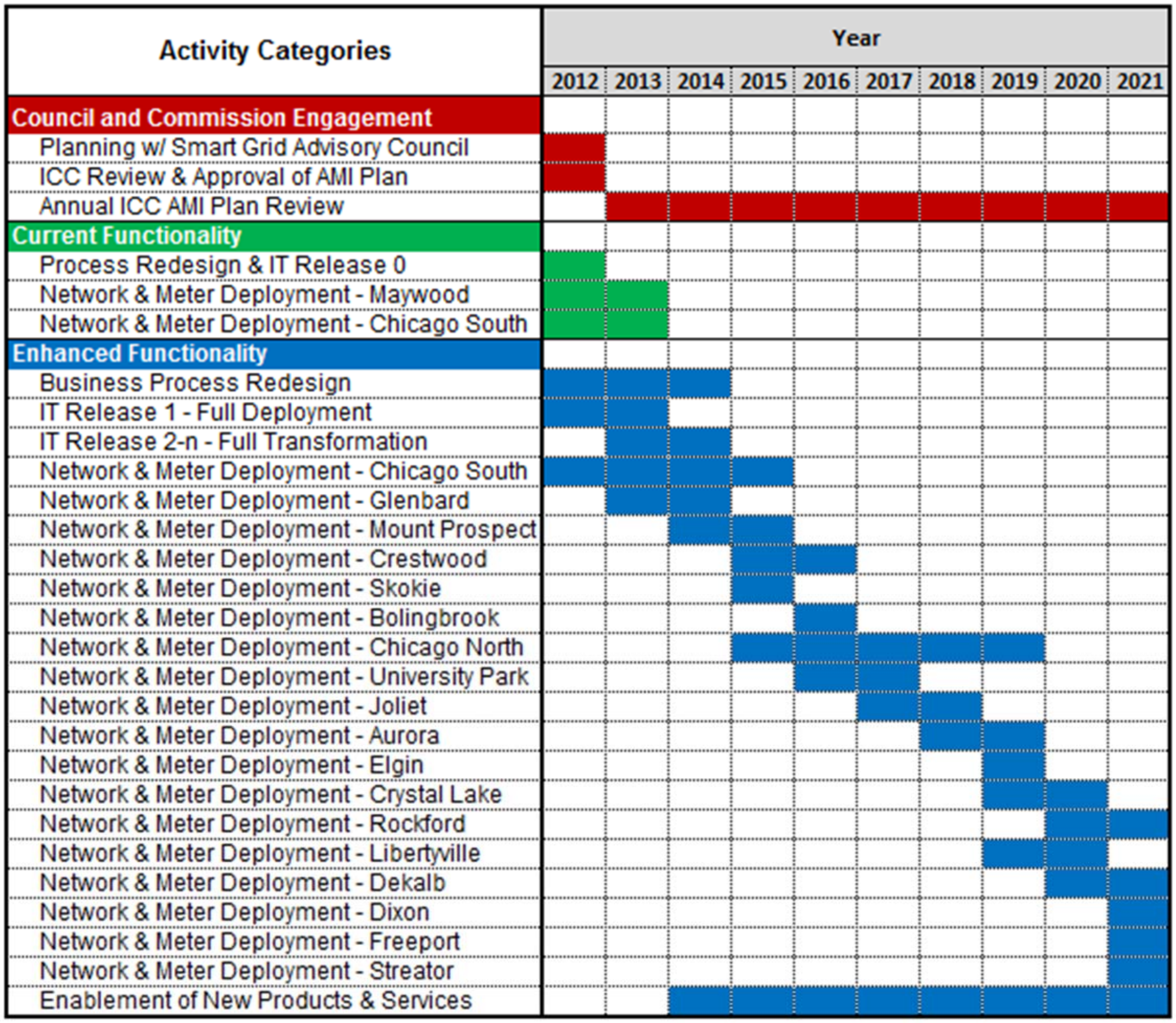

Figure 11 - Overall Deployment Schedule

Key Annual Schedule Observations and Milestones include:

- IT Release 0 refers to the IT work to be completed to enhance the AMI Pilot solutions to commence the short term deployment activities.

- IT Release 1 refers to the long term solution to be managed by the AMI Business Transformation Project Team.

- IT Release 2-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 two 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 overall costs are expected to peak in 2015, followed by a steady decrease throughout the remainder of the deployment period, as depicted in the figures below[37]:

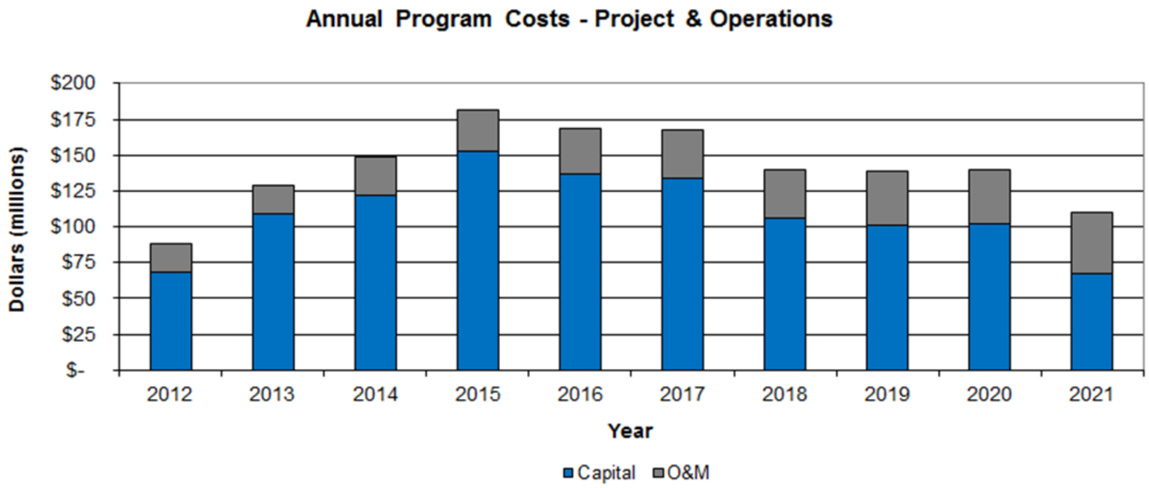

Figure 12 - Annual Program Costs ($ in thousands)

Capital Cost Category	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
AMI	66,195	112,791	119,855	131,114	88,857	93,609	93,301	78,014	71,946	69,259	924,941

Figure 13 - Capital Cost Detail ($ in thousands)

O&M Cost Category	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
AMI	24,029	31,157	32,731	36,954	35,162	37,914	39,658	45,028	44,971	50,524	378,128

[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).

Figure 14 - O&M Cost Detail ($ in thousands)

ComEd estimates that the unrecovered cost of the non-AMI meters is approximately $218 million, as of March 31, 2012. Of this amount, ComEd estimates that the accelerated depreciation resulting from the early retirement of the non-AMI meters over the 10-year AMI meter deployment period will be approximately $105 million. This amount does not include the impact of estimated removal costs, which will be evaluated as part of the next depreciation study that ComEd is planning to conduct in 2013. To the extent that the early retirement of meters impacts future removal cost estimates, those changes will be reflected in new depreciation rates resulting from that study which will be implemented in 2014.

As non-AMI meters are removed, ComEd plans to record monthly the accelerated depreciation costs resulting from the early non-AMI meter retirement as a regulatory asset as the meters are retired, and to amortize each such respective amount over a ten year period beginning with the period in which the respective meters are removed from service. As a result, the regulatory asset is expected to be established gradually over the period 2012 through 2019 as the old meters are removed from service, and will be amortized over the period of 2013 through 2029 (the year in which the cost associated with meters removed from service in 2019 will be fully amortized). 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. <u>Benefits</u>

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.

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 detail 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 Figures 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.

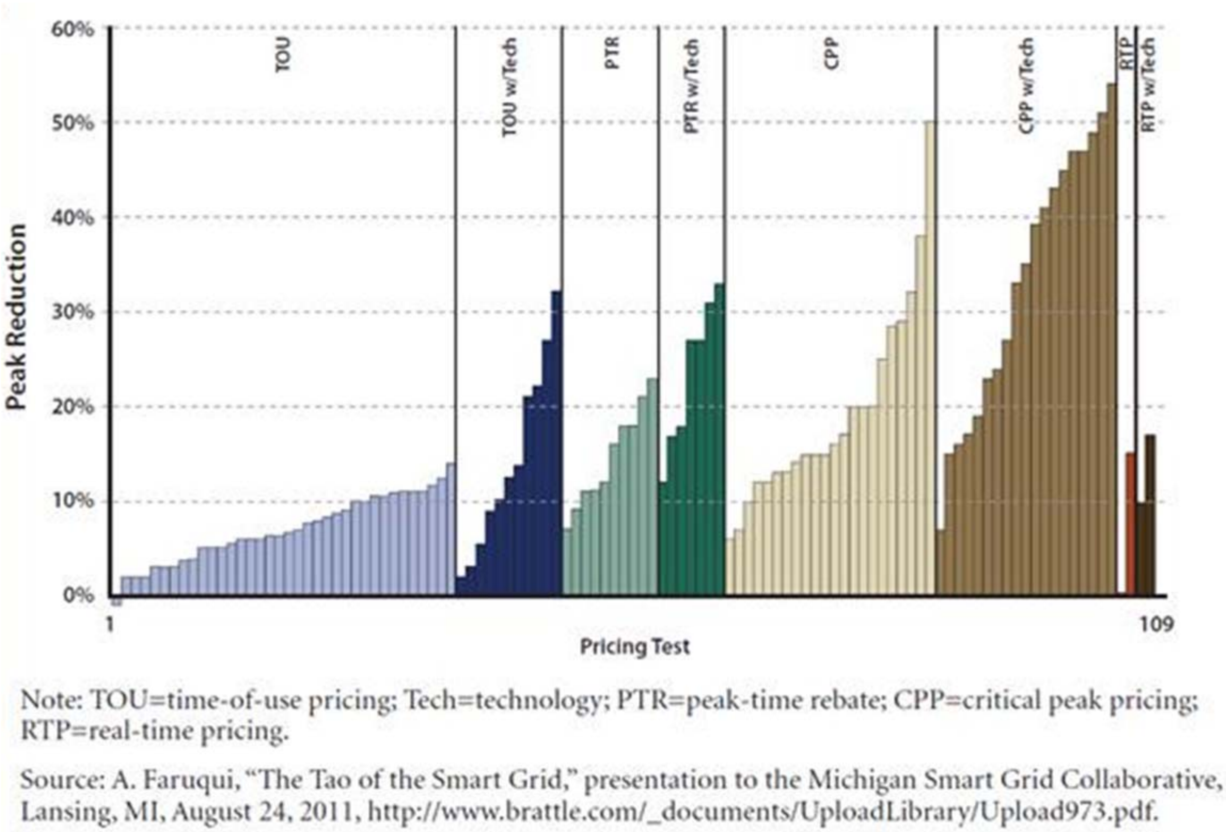

Figure 16 - Peak Load Reduction from Dynamic Pricing Pilot Programs by Rate Design and Technology. Source: MIT study "The Future of the Electric Grid"

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."

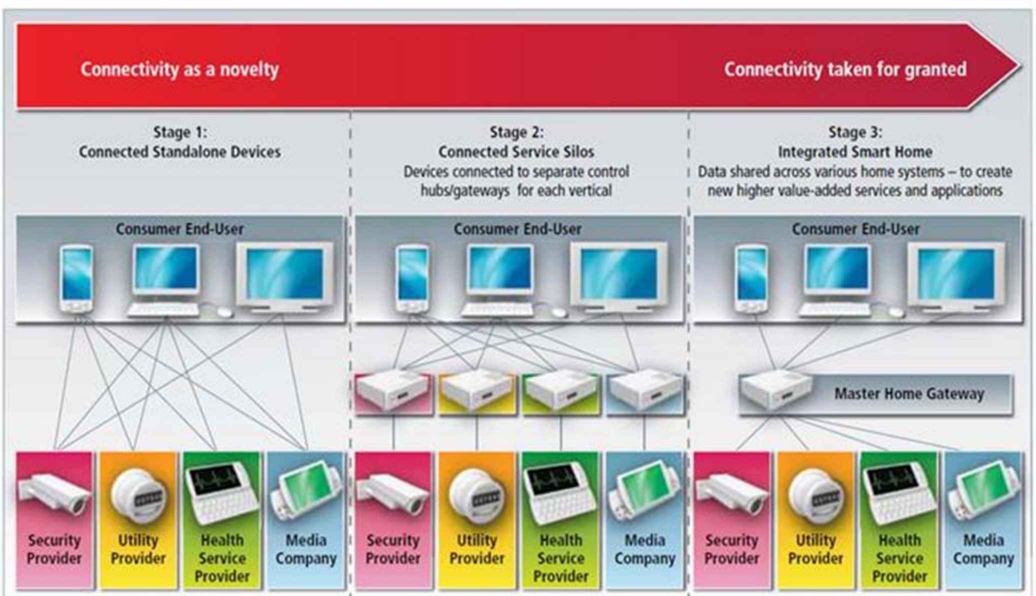

Figure 20 - Smart Home Services Evolution Scenario from GSMA Report "Vision of Smart Home: The Role of Mobile in the Home of the Future"

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 lie 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 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.

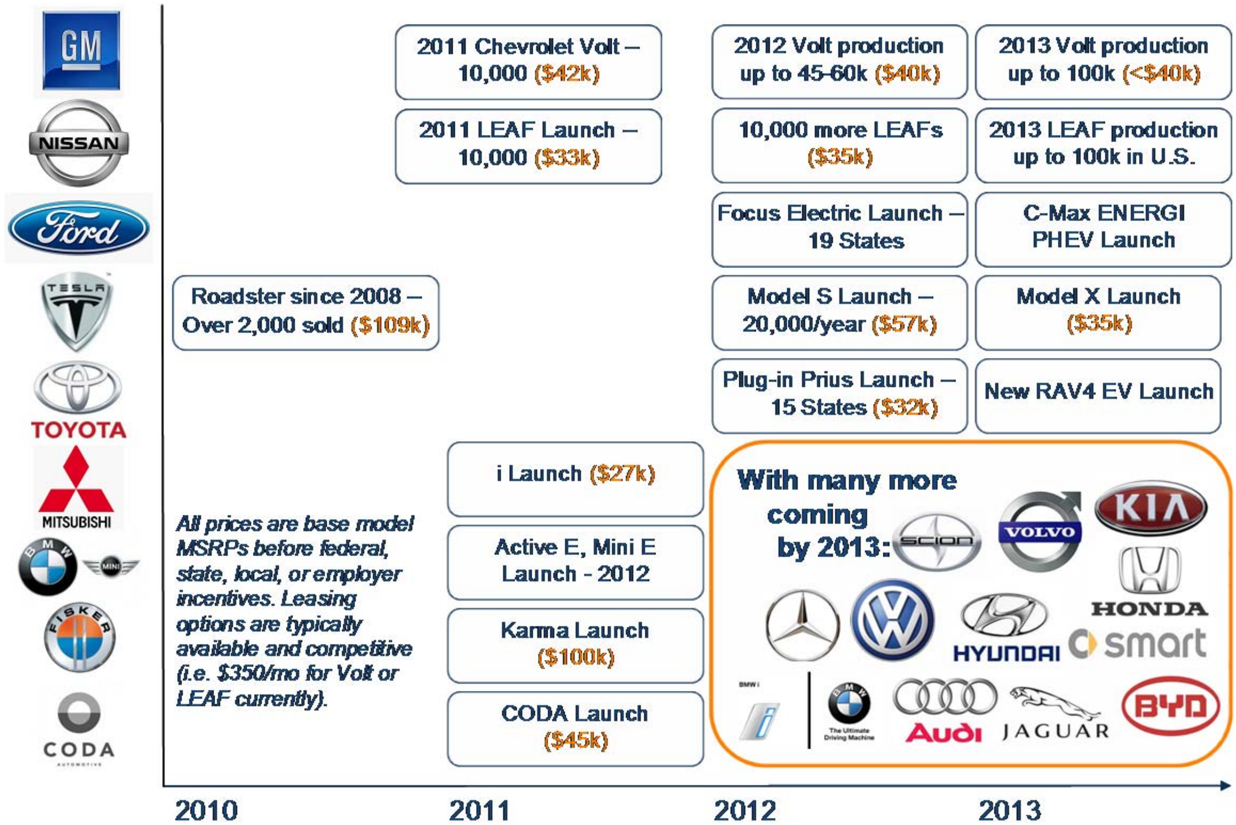

Figure 22 - Anticipated U.S. Commercial Passenger PEV Launches. Source: EEI report titled "The Utility Guide to Plug-In Electric Vehicle Readiness"

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

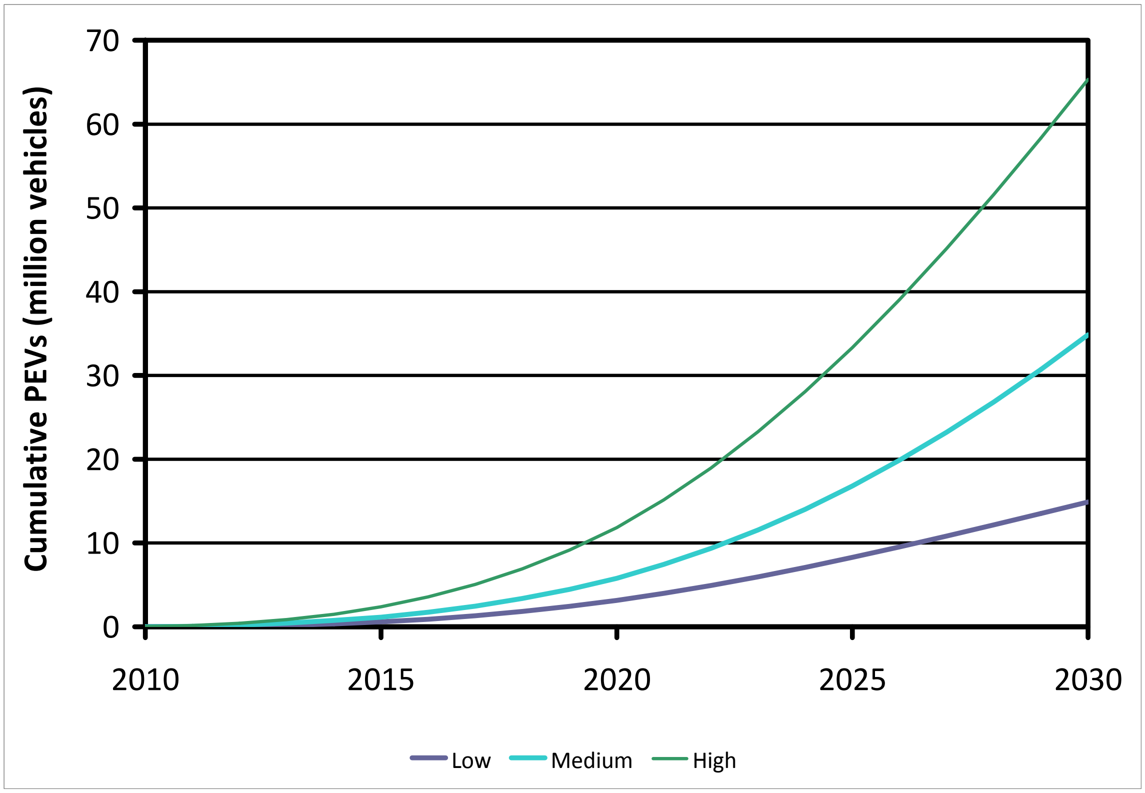

Figure 23 - Projected Electric Vehicles on the Road by 2030. Source: EPRI report titled “Transportation Electrification, A Technology Overview”

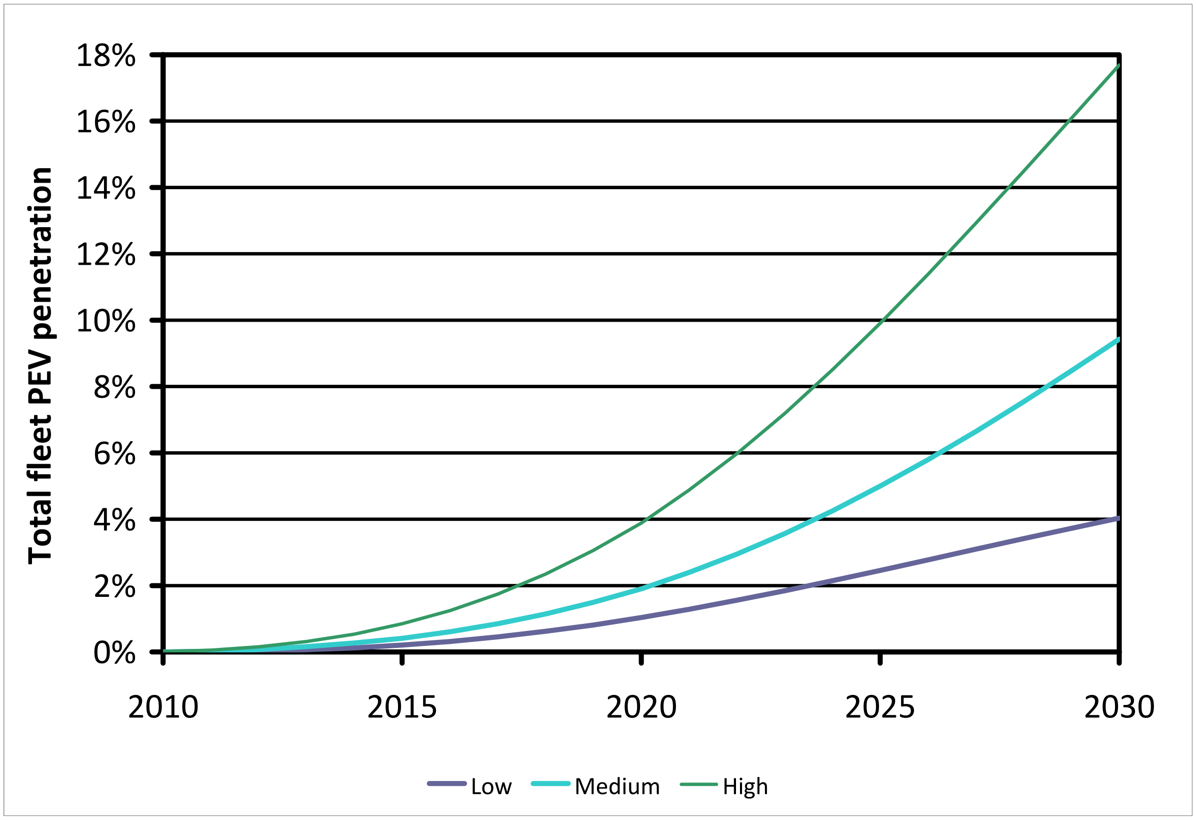

Figure 24 – Penetration of PEVs as a percentage of total U.S. vehicles. Source: EPRI report titled "Transportation Electrification, A Technology Overview"

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]

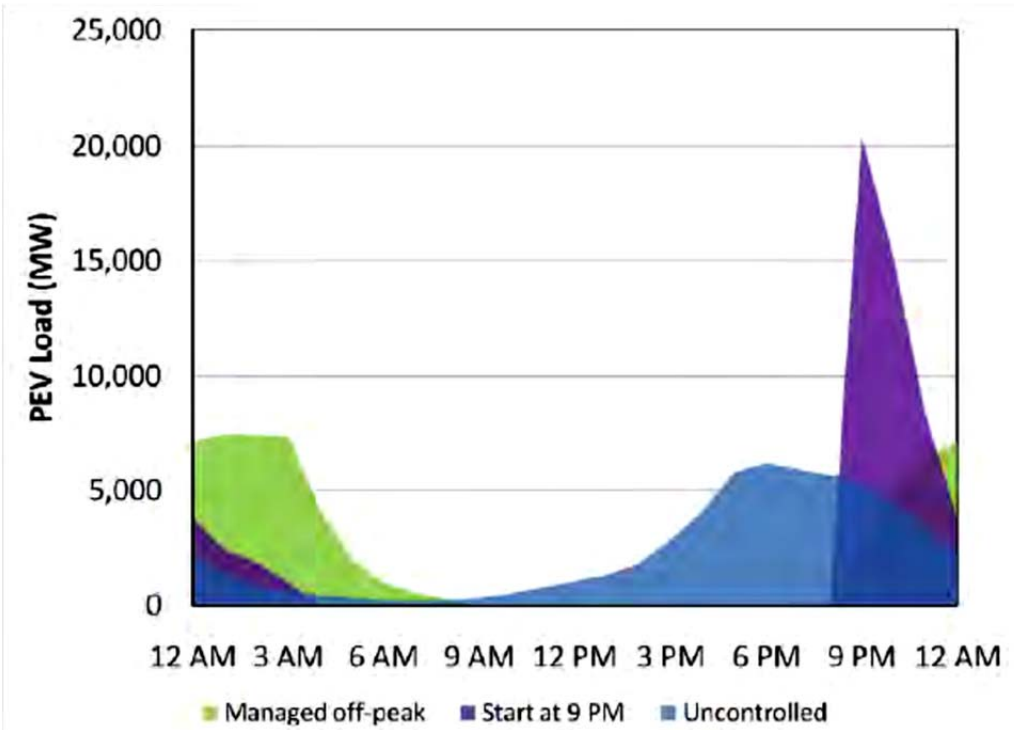

Figure 26 - PEV charging load in 2030, medium adoption scenario. Source: EPRI report titled "Transportation Electrification, A Technology Overview"

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]

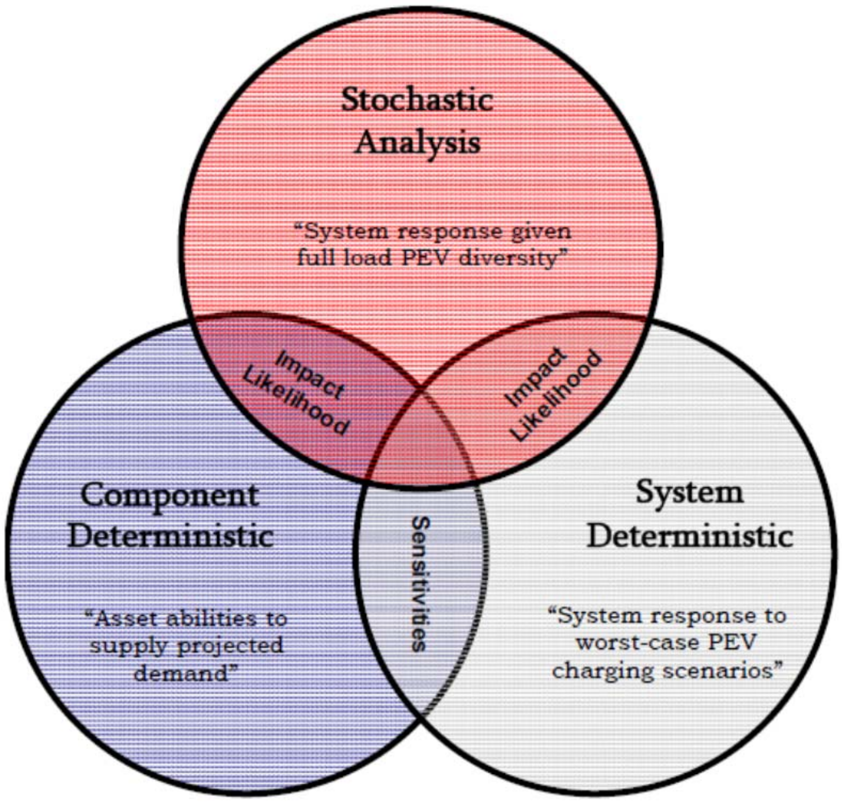

Figure 27 - PEV distribution impact evaluation methodology. Source: EPRI report titled "Transportation Electrification, A Technology Overview"

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 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.

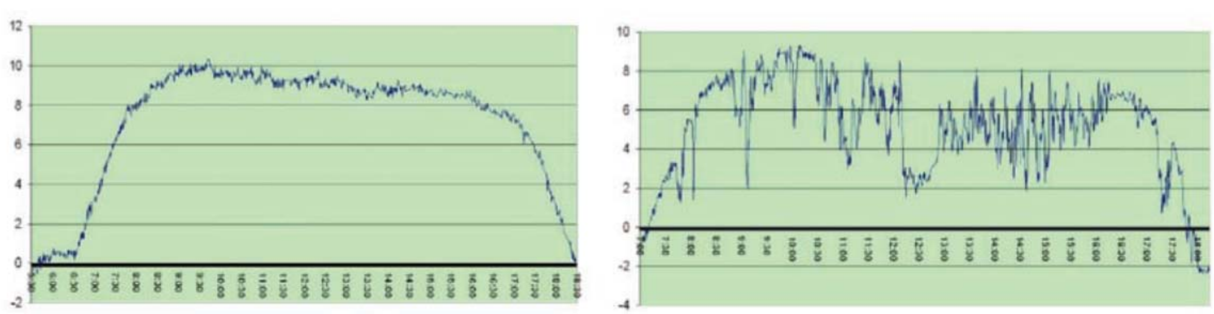

Figure 29 - Nevada Solar Photovoltaic (PV) Plant Output on a Sunny Day (Left) and a Partly Cloudy Day (Right) in 2008. Source: MIT study "The Future of the Electric Grid"

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).

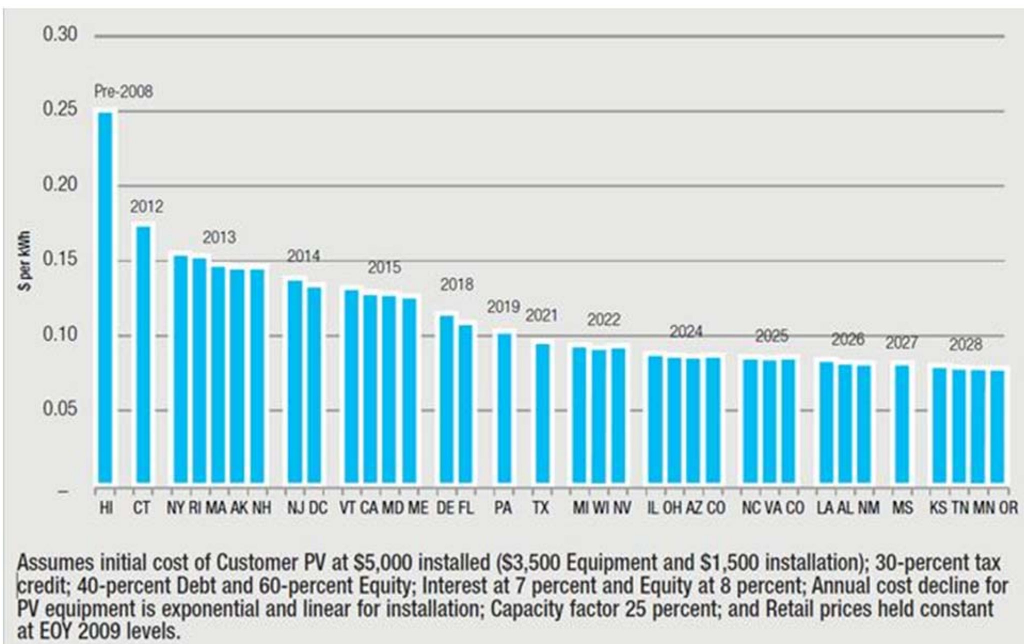

Figure 30 - Grid Parity of Solar PV Forecast by State. Source: Accenture

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.

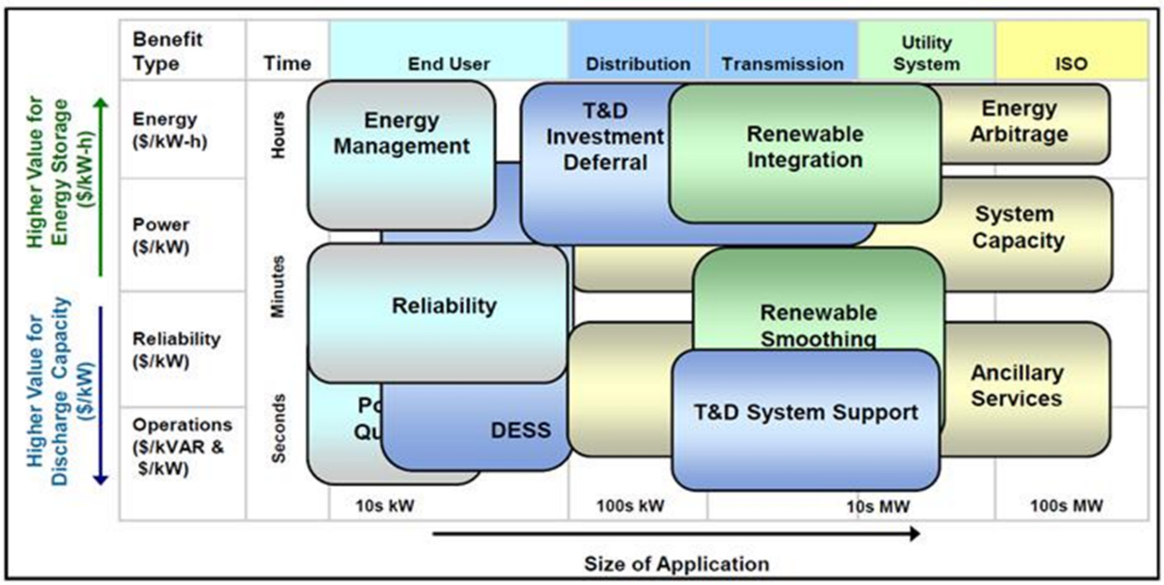

Figure 32 - Energy Storage Benefits Summary. Source: EPRI, "Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits"

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 services 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 22nd, 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. Launched in January, "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. <u>Plan to Enable Existing and Future Smart Grid Technologies and Applications that Deliver Value to Customers</u>

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. <u>ComEd's Process for Enabling Future Smart Grid Applications</u>

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.

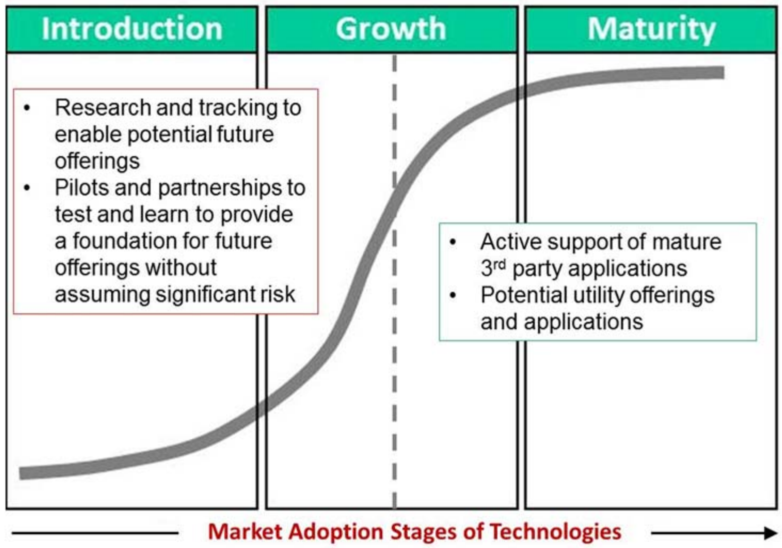

Figure 34 - Maturity Curve for Smart Grid Applications

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'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).

Year	# of Meters Deployed	Operating Centers served by Cross Dock #1	Operating Centers served by Cross Dock #2
2012	131,192	Remaining Maywood (Residential), Chicago South (Residential)	N/A
2013	384,854	Remaining Maywood (Commercial), Chicago South	Glenbard
2014	535,794	Chicago South	Glenbard, Mount Prospect
2015	530,355	Chicago South, Crestwood	Mount Prospect, Skokie, Chicago North
2016	459,754	Crestwood, Bolingbrook, University Park	Chicago North
2017	496,795	University Park, Joliet	Chicago North
2018	448,320	Joliet, Aurora	Chicago North
2019	401,319	Aurora, Elgin, Crystal Lake	Chicago North, Libertyville
2020	351,766	Crystal Lake, Rockford	Libertyville, Dekalb
2021	288,851	Rockford, Dixon, Freeport	Streator, Dekalb
TOTAL	**4,029,000**		

Figure 36).

Year	# of Meters Deployed	Operating Centers served by Cross Dock #1	Operating Centers served by Cross Dock #2
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2020	351,766	Crystal Lake, Rockford	Libertyville, Dekalb
2021	288,851	Rockford, Dixon, Freeport	Streator, Dekalb
TOTAL	**4,029,000**		

Figure 36 - Meter Deployment Rollout

Key AMI Meter Deployment Milestones and Metrics (see Chapter 2 for full list)

- Phase 1 IT release scheduled for end of Q3 2012
- First AMI meter installed Q4 2012
- Approximately 400,000 AMI meters installed each year for ten years (see Figure 6 in Chapter 2 for full roll-out schedule)
- Last non-AMI electro-mechanical meter replaced with AMI meter in 2021
- Phase 2 IT release to support Full Deployment scheduled by end of Q3 2013
- Phase 3-n IT releases to support Full Transformation by end of 2014 (see Figure 11 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 as soon as the PTR tariff is approved by the ICC
- Key milestone: The first PTR event is expected take place in the summer of 2013
- 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 the 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: web portal will be integrated with ComEd.com by the fourth quarter of 2012

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 contacted stakeholders and Staff to attempt to initiate discussions pursuant to the Order regarding the methodology to define and identify "vulnerable" customers. However, in light of the complexities of the issues involved, resolution of the methodology to define and identify "vulnerable" customers was not able to be achieved in the time allowed to file this modified Plan. Therefore, ComEd will continue to engage in discussions with stakeholders and Staff, and will include a proposal for the methodology to define and identify "vulnerable" customers in the first annual report to be submitted on April 1, 2013. ComEd plans ongoing discussions to commence shortly after the filing of its statutorily required peak time rebate program and conclude by December 2012.

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 modified Plan and in its first annual report to be submitted on April 1, 2013. There are significant barriers to tracking vulnerable populations. Based on the testimony of AARP/AG witness Dr. Meghan Sandel, "vulnerable" customers or populations may include: children under the age of 5, seniors, low-income individuals, people who are socially isolated, those with a functional mobility or impaired mobility, pregnant women, those with sleep apnea, those with allergies, those with hypertension, those with diabetes, those with pulmonary disorders, those with asthma, those with learning disabilities and those with lead in their home. ComEd's customer files do not include income, age, or other "vulnerability" indicators described in the testimony of Dr. Sandel, and such "vulnerability" indicators would be considered highly personal and private by customers. Accordingly, in order to compile this personal information, surveys would have to be 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. These and other issues will need to be addressed in ongoing discussions with stakeholders and Staff.

For purposes of this modified Plan, ComEd will initially 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 low income customers that are potentially identifiable through energy assistance programs. For purposes of this modified Plan, "low income customers" will be defined as those customers participating in the Low Income Home Energy Assistance Program (LIHEAP), a deferred payment arrangement (DPA), or the Percentage of Income Payment Program (PIPP). For purposes of this modified 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 25^{th}, 50^{th}, and 75^{th} 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.

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 2012, 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.

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. <u>Objective</u>

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
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)

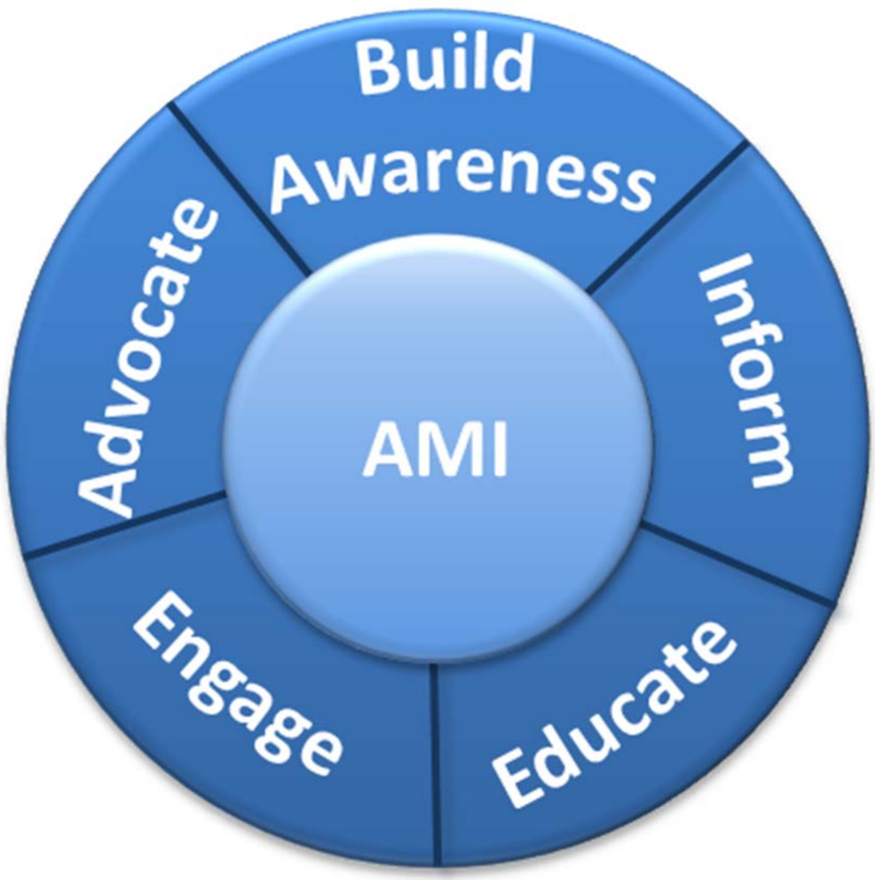
    - Because some customers may not have access to a computer and / or internet access, ComEd is exploring the ability to also facilitate information and data access through personal mobile devices, which may provide less expensive internet access for customers most in need of savings opportunities, by 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>

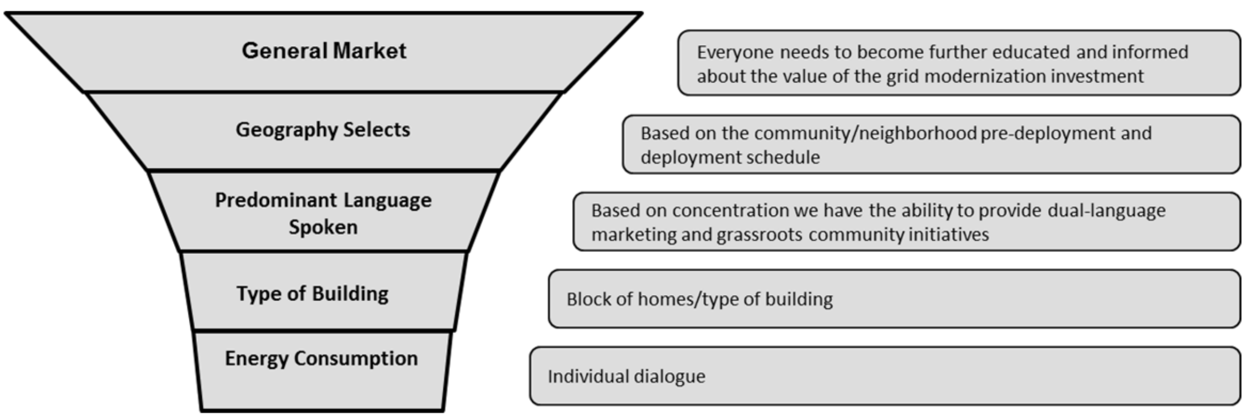
The objective of the customer education and outreach plan will be realized through strategies tied to specific residential and small business audiences. The audiences will be approached based on their current state of understanding, their interest in further education, and their receptivity to engage 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 10-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 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, email

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[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.

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 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 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. <u>Messaging</u>

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 choice 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 2012 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 10-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 immediately 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 in September 2012 with more than four million meters installed over a 10-year period.
  - 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 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.

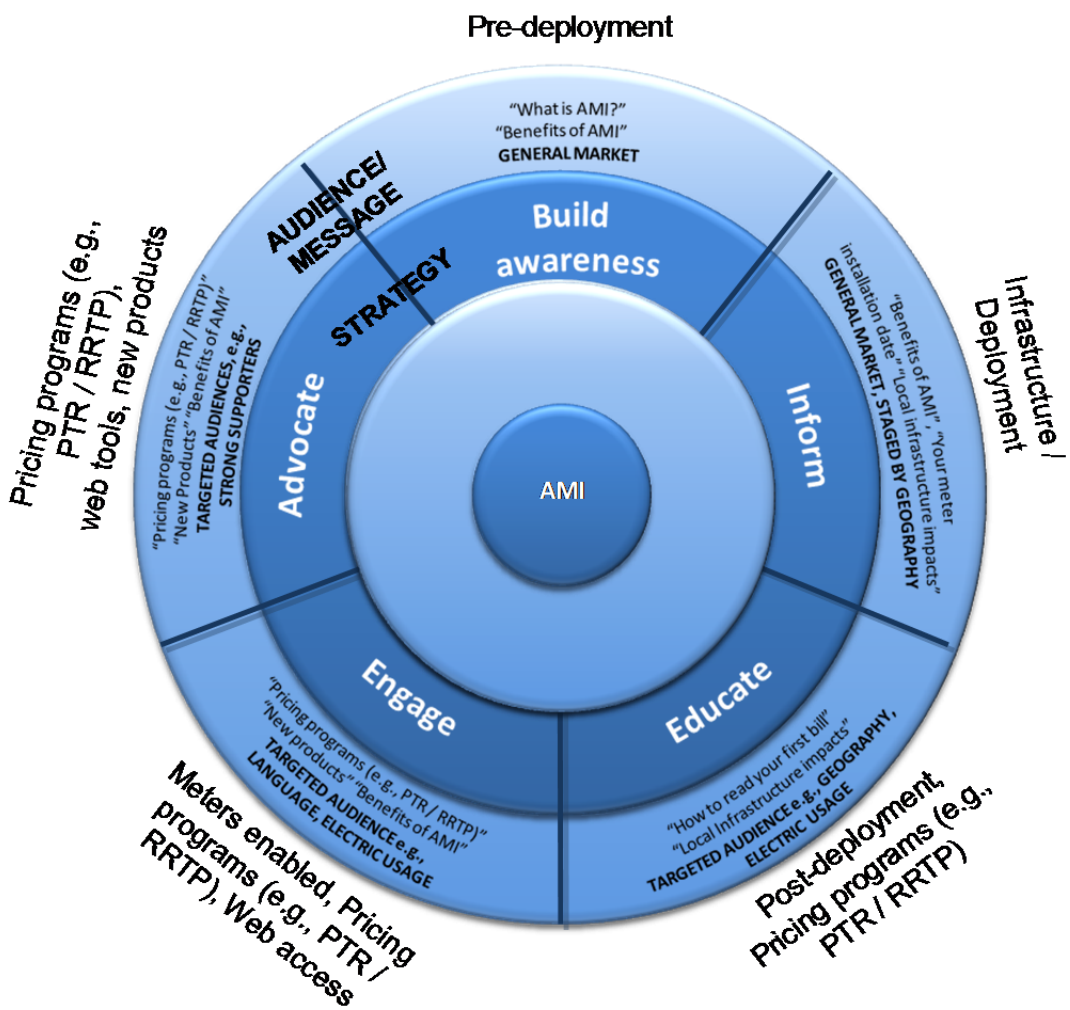
- Compared to analog meters, smart meters provide a wider range of benefits:
  - They reduce utility operating costs (e.g., manual meter reading, manual meter disconnections and reconnections, manual bill creation)
  - They help pinpoint outages and verify power restoration to allow faster outage restoration
  - 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

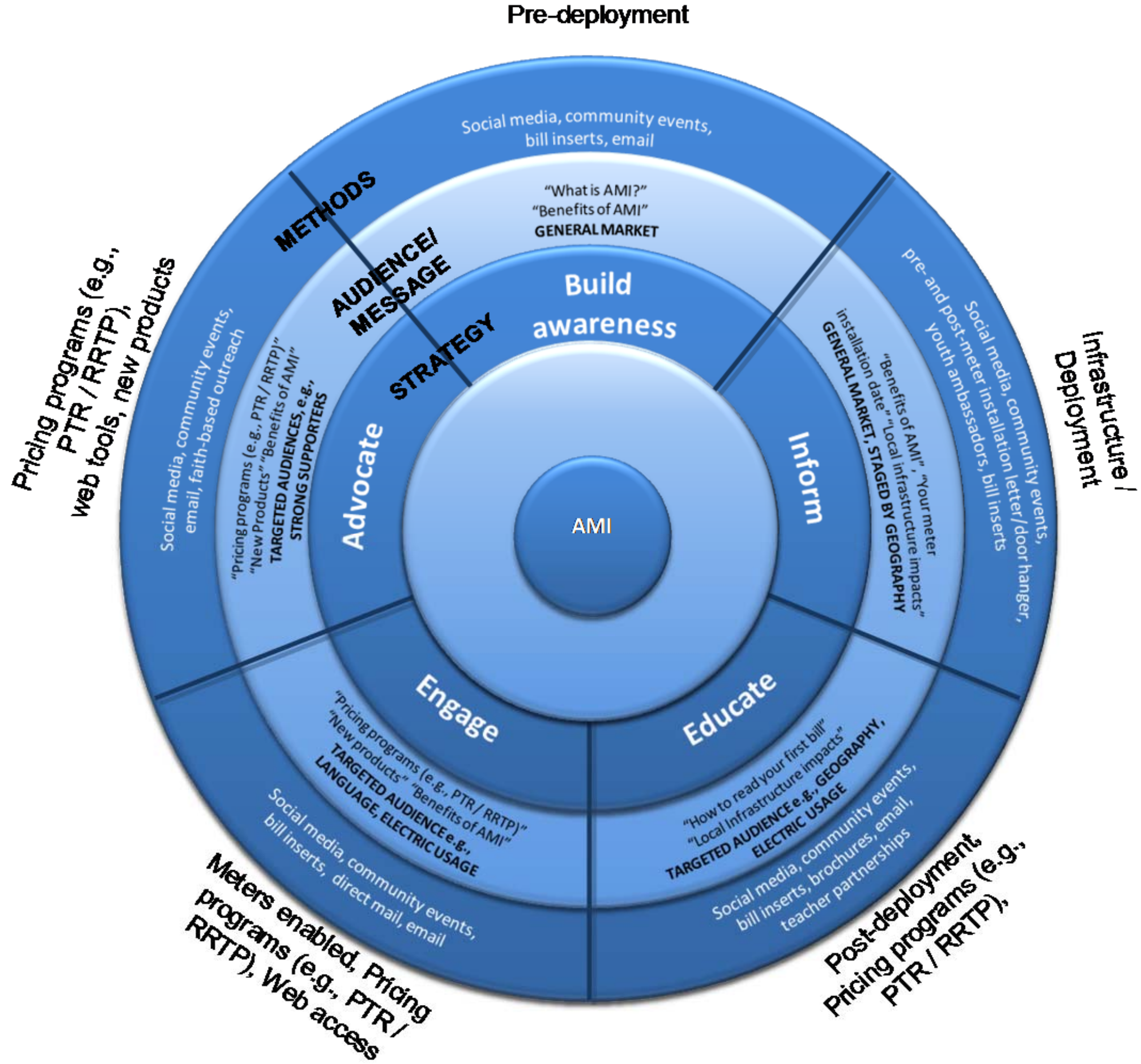
Using key lessons from the Pilot as well as best practices from other utilities, methods have been created to execute each core strategy as shown earlier in the plan. Messaging and audience segmentation will also be incorporated into these customer and small business methods.

ComEd will install advanced meters on homes and businesses throughout its entire service territory on a rolling geographic basis over a 10-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.

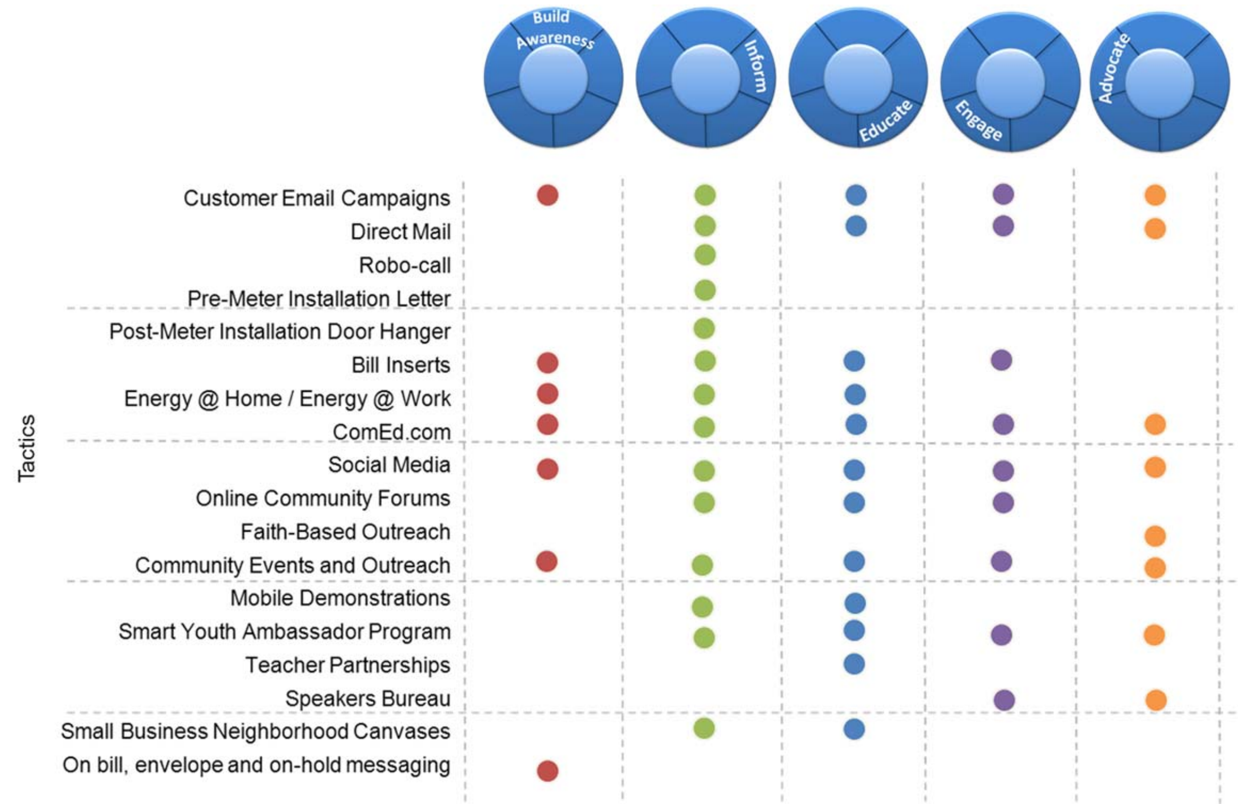
Given this geographic deployment plan, ComEd has the opportunity to tailor its messages about the meter exchange and the benefits of advanced meters, RRTP and PTR program participation to fit the unique characteristics of its customer base within defined geographic boundaries. Because deployment will occur over 10 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 2012 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. <u>Educate</u>

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. <u>Additional Information about Methods</u>

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 is a description of two of the games to be deployed at events and also sit 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-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 2013 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.

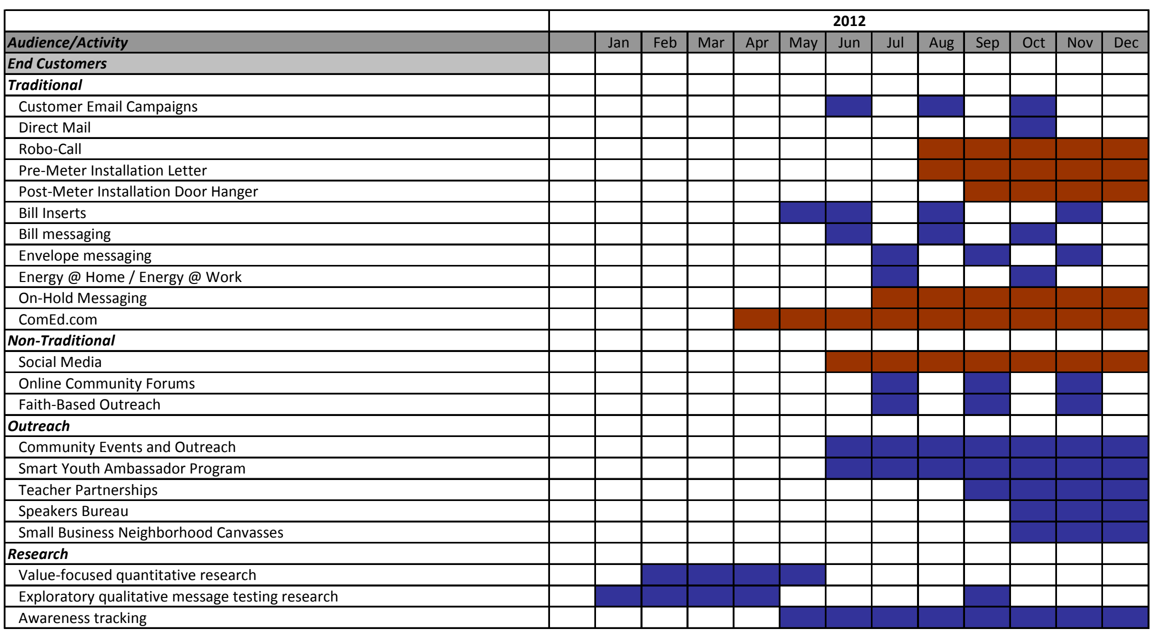


Figure 37 - 2012 End Customer Methods Timeline

	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												
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												
Awareness tracking												

Figure 38 - 2013 Customer Methods Timeline