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File #: 2507/142658

August 1, 2013

Rosemary Chiavetta  
Secretary  
Pennsylvania Public Utility Commission  
Commonwealth Keystone Building  
400 North Street, 2nd Floor North  
P.O. Box 3265  
Harrisburg, PA 17105-3265

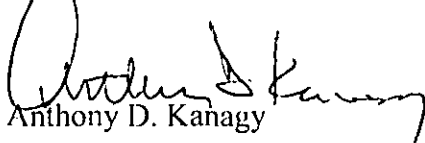
**RE: Petition of PPL Electric Utilities Corporation for Approval to Modify its Smart Meter Technology Procurement and Installation Plan and to Extend its Grace Period**  
**Docket No. M-2009-2123945**

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Dear Secretary Chiavetta:

Enclosed please find PPL Electric Utilities Corporation's 2013 Annual Smart Meter Plan Filing for the above-referenced proceeding. Copies have been provided as indicated on the Certificate of Service.

Respectfully Submitted,



Anthony D. Kanagy

ADK/skr

Enclosure

cc: Certificate of Service  
Paul T. Diskin

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2013 AUG -1 PM 2:19  
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SECRETARY'S BUREAU

Before the  
**PENNSYLVANIA PUBLIC UTILITY COMMISSION**

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PPL Electric Utilities Corporation  
Smart Meter Technology Procurement and Installation Plan

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**2013 ANNUAL SMART METER PLAN FILING**

Docket No. M-2009-2123945

August 1, 2013

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## I. INTRODUCTION

In this filing, PPL Electric Utilities Corporation ("PPL Electric" or the "Company") is submitting its 2013 annual smart meter plan update filing as required by the Pennsylvania Public Utility Commission's ("Commission") Order entered on June 24, 2010. *Petition of PPL Electric Utilities Corporation for Approval of Smart Meter Technology Procurement and Installation Plan*, Docket No. M-2009-2123945 ("June 24 Order").

## II. BACKGROUND

PPL Electric provides electric distribution, transmission and default generation services to approximately 1.4 million customers in a certificated service territory that spans approximately 10,000 square miles in all or portions of 29 counties in eastern and central Pennsylvania. PPL Electric is a "public utility" and "electric distribution company" ("EDC") as those terms are defined under the Public Utility Code, 66 Pa. Code §§ 102 and 2803.

On August 14, 2009, PPL Electric filed its Smart Meter Plan with the Commission pursuant to Act 129 of 2008, P.L. 1592 ("Act 129") and the Commission's Smart Meter Implementation Order. *Smart Meter Procurement and Installation*, Docket No. M-2009-2092655, Order entered June 24, 2009.

As explained in the Company's Smart Meter filing, PPL Electric already has installed an advanced meter infrastructure ("AMI") system in its service territory. Therefore, under its Smart Meter Plan, PPL Electric proposed to study, test, and pilot applications that enhance and expand upon the capabilities of the Company's existing smart meter system, focusing primarily on those capabilities that require a benefit to cost analysis as directed by the Commission Order. In its Smart Meter Plan, PPL Electric also proposed a cost recovery mechanism consistent with the requirements of Act 129 and the Commission's Implementation Order.

On June 24, 2010, the Commission entered its order in the Smart Meter proceeding. In its June 24 Order, the Commission revised certain aspects of the Company's Smart Meter Plan. These included:

- Modifying the Company's proposed cost recovery mechanism and reconciliation period;
- Requiring the Company to file Service Limiting and Pre-Pay Metering Pilot Plans for the Commission's consideration before the Company implemented these functionalities;
- Requiring the Company to continue to identify, test, develop and implement cost-effective means for directly providing metered usage data to customers;

- Requiring the Company to address how its smart meter technology will effectively support the automatic control of a customer's consumption by a customer's chosen third party, in addition to the customer or PPL Electric;
- Requiring the Company to expand its metering capabilities to meet Act 129's requirements;
- Eliminating the Company's proposed Feeder Meter pilot program;
- Requiring the Company to ensure that its pilot programs address the need, ability and cost for sub-hourly metering;
- Requiring the Company to recover smart meter plan costs from Large C&I customers through a fixed customer charge.
- Requiring the Company to allocate non-direct common costs based on the ratio of the number of meters assigned to the class, divided by the number of meters for the entire system.

In its June 24 Order, the Commission also required PPL Electric to file annual smart meter filings with the Commission. Pursuant to the Commission's Order, PPL Electric hereby submits its annual filing. Below, PPL Electric explains the actions that it will take under its Smart Meter Plan in 2013 through 2014. PPL Electric also submits proposed Smart Meter Rider ("SMR") charges to be effective for service rendered on and after January 1, 2014.

### **III. DISCUSSION**

#### **Stakeholder Meetings**

PPL Electric has held several stakeholder meetings this year. The first general stakeholder meeting was held on February 27, 2013 and the second general meeting was held on July 18, 2013. At these meetings, PPL Electric provided a status update on each of its active pilots/evaluations. Representatives from the Office of Consumer Advocate ("OCA"), Pennsylvania Utility Law Project ("PULP"), PP&L Industrial Customer Alliance ("PPLICA"), Reliant Energy, Law Bureau, Bureau of Consumer Services ("BCS"), Bureau of Investigation and Enforcement ("I&E"), Bureau of Audits, Bureau of Technical Utility Services ("TUS"), Office of the Executive Director, and various Commissioner's offices attended one or both of the meetings.

#### **Petition to Modify the Plan and Extend the Grace Period**

On May 4, 2012, the Company filed a Petition requesting approval to modify its Smart Meter Plan and to extend its grace period to give the Company additional time to further test and evaluate the most cost-effective ways to meet the Act 129 requirements. *Petition of PPL Electric Utilities Corporation for Approval to Modify Its Smart Meter*

*Technology Procurement and Installation Plan and to Extend its Grace Period*, Docket No. P-2012-2303075 ("May 2012 Petition"). In the May 2012 Petition, the Company requested Commission approval to implement eight new smart meter programs, which included:

1. VCharge Project
2. Accelerated Supplier Switching Project
3. Real Time Pricing for Mid-Size C&I Customers (100 kW – 500 kW) Project
4. Meter Data Management Data Warehouse and Analytics Project
5. Faster Data Presentment to Customers and Supplier Project
6. Supplier Portal Project
7. Improve Validation/Editing/Estimation Process Project
8. Outage Duration Project

In the May 2012 Petition, the Company also requested a 24-month extension of its Grace Period in order to continue to further test and evaluate the most cost-effective ways to meet the Act 129 requirements. In its Order entered August 2, 2012 at the subject docket, the Commission approved programs 4, 5, 6, 7 and 8 identified above, and denied or held in abeyance programs 1, 2 and 3 identified above in the context of the Smart Meter proceeding, and granted an extension until June 30, 2014 for the Company to file its Final Smart Meter Plan.

### **Smart Meter Plan Actions**

Below, PPL Electric summarizes the actions that it will take under its Smart Meter Plan in 2013 and 2014. The Company notes that these actions, including the timeline for performing these actions, are set forth in additional detail in the following attachments to this updated Plan.

- Attachment 1: Smart Meter Milestone Plan
- Attachment 2: Smart Meter Plan Budget
- Attachment 3: Smart Meter Plan Pilot/Evaluation

For ease of reference, the Company has followed the order of smart meter requirements as set forth on pages 29-30 of the Commission's Smart Meter Implementation Order, and as set forth on pages 17-32 of the Company's original Smart Meter Plan. The Company has also, for the sake of completeness, continued to provide an appendix (Appendix A titled "Responses to Commission Questions Regarding Ability

To Provide 15 Minute or Shorter Interval Data”) and moved into that appendix responses to the Commission's questions that were previously provided in the 2011 Annual Update Filing.

### **1. Bi-directional data communications.**

PPL Electric's currently deployed AMI system is capable of bi-directional communications. Full two-way communication exists today on PPL Electric's power line system and in the wireless-based system used for the Company's customers who are served at higher voltages. The power line system is capable of full communication with each meter communicating daily and hourly usage, momentary voltage losses, potential loss of power, and voltage data upon request from the network.

The Company does not expect to conduct specific pilots in this area, but will perform a pilot using in-home displays with home area networks. The in-home display pilot is discussed below under the requirements for open standards and protocols.

### **2. Recording usage data on at least an hourly basis once per day.**

PPL Electric's currently deployed AMI meters record usage data on at least an hourly basis once per day.

### **3. Providing customers with direct access to and use of price and consumption information.**

PPL Electric provides access to price and consumption information to various groupings of customers and to individual customers through its web-based customer-facing Energy Analyzer and, when requested by the customer, pulse data. The Company also participates in the U.S. Department of Energy's "Green Button" initiative, which allows customers to download their energy usage directly to their computers or smart phone applications from a link on PPL Electric's website. In addition, the Company proposed to pilot two other means of electronic access that included alerts on Price and Usage Information and Faster Data Presentment to Customers & Suppliers. These pilots are discussed below.

#### **A. Messaging – Price and Usage Information**

PPL Electric has completed the pilot to provide notifications to customers for changes to prices and/or consumption and has successfully implemented the solution as a service available to customers.<sup>1</sup> The objective of this pilot was to help customers increase their understanding and awareness of energy usage and pricing; thereby, enabling them to make more informed decisions about their energy usage. Customers have the option to receive three different types of notifications, (1) Price to Compare (“PTC”) Notification, (2) Bill to Date (“BTD”) Notification, and (3) Abnormal Usage (“AU”) Notification. Customers are able to receive the notifications through their choice of email, text message and/or an

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<sup>1</sup> This pilot is marketed under the brand name “myPPLAlerts”.

Interactive Voice Response ("IVR") phone call. Further description of the notifications is as follows:

- a. PTC notifications are sent to enrolled customers each time PPL Electric's PTC changes. The first PTC notifications were sent out in August 2011.
- b. BTB notifications are sent to enrolled customers when they exceed their specified threshold for the month. Each enrolled customer selects a dollar amount that will trigger a notification through his/her preferred communication channel. The first BTB notifications were sent out in November 2011.
- c. AU notifications are sent to enrolled customers when the Company recognizes abnormal usage for three consecutive days. The first AU notifications were sent out in December 2011.

The messaging pilot demonstrated PPL Electric's ability to integrate meter data collected through the AMI system and housed in the Company's Meter Data Management System ("MDM") into an existing third-party messaging system. Calculations are performed on the data in MDM and if the correct customer-established criteria are met, MDM sends a trigger to the messaging system which then sends the alert to the customer via email, text message and/or IVR.

All customers served on rate schedules where a PTC is calculated are eligible for the PTC notifications. All residential customers are eligible for AU notifications. All residential customers (excluding Time of Use ("TOU")) are eligible for the BTB notification. (Customers taking supply from an Electric Generation Supplier are eligible to participate. Because the Company may not have knowledge of the pricing included in a customer's contract with their EGS, the bill-to-date calculation in this instance reflects default service pricing.) PPL Electric initially planned to allow TOU customers to enroll in BTB notifications. However, due to the complexity and high cost of programming this functionality coupled with the small number of customers enrolled in the TOU rate, and the pending proposal to restructure the TOU rates, PPL Electric has delayed the TOU phase of the project and will reevaluate completing that phase after these issues are resolved.

As noted above, the initial phase of the pilot was rolled out at the end of 2011. As of June 17, 2013, participation in each of the notification options was as follows:

Price-To-Compare = 3,730 customers  
Bill-To-Date = 2,836 customers  
Abnormal Usage = 4,029 customers

The total cost of this pilot and implementation was \$203,771 which included (1) the initial evaluation in 2010, (2) the pilot phases spanning from 2011 to 2012, (3) software and licensing, (4) evaluation of pilot results, and (5) reporting of results and implementation plan to the Commission. PPL Electric issued a news release

in February 2012 highlighting "myPPLAlerts". PPL Electric featured the capability to provide "myPPLAlerts" in the March 2012 "Connect" newsletter which is included with customer bills. PPL Electric also mentioned "myPPLAlerts" again in the June 2012 "Connect" newsletter, the October 2012 "Connect" newsletter (as part of National Preparedness Month), and again on the front page of the March 2013 "Connect" newsletter. Additionally, "myPPLAlerts" are advertised through various social media outlets, and are also promoted on PPL Electric Utilities' website ([www.pplelectric.com/alerts](http://www.pplelectric.com/alerts)). It is the Company's intent to continue to educate customers regarding this service through "Connect" and other means both periodically and as events may dictate. Customers can enroll in the program through PPL Electric's website, or they can call PPL Electric's Customer Contact Center and a Customer Service Representative can enroll them for the specific notification(s) they wish to receive. On-going support for the program is part of normal operating costs and no longer included in the smart meter plan.

PPL Electric conducted a post-implementation customer survey in November 2012. The objective of the survey was to better understand the following:

1. Do customers like the messages?
2. Is the information contained in the alerts useful to customers?
3. Are the alerts helping customers change behavior with regard to their electric consumption?

The survey was sent to 2,671 customers who were enrolled in one or more of the notifications, and who provided an email address. A total of 561 customers responded to the survey, for a 21 percent response rate. Customers were only surveyed regarding the PPL Electric Notification(s) for which they were currently enrolled. Overall, the results were positive. Summary of key findings of the survey were:

- Generally, participants in the notification program are more satisfied than the overall PPL Electric residential population regarding PPL Electric's service and its willingness to help them reduce their electricity costs.
- The majority of respondents stated the notifications are useful and would recommend the program to others.
- Nearly all customers said the number of notifications they are receiving from PPL Electric are appropriate.

## **B. Faster Data Presentment to Customers and Suppliers**

The Company currently presents validated customer usage data on its website within 48 hours. In its Order approving PPL Electric's Smart Meter Plan, the Commission stated that providing access to hourly usage data within 48 hours was not considered to be providing customers with direct access to customer usage data. Smart Meter Order, p.



22. Accordingly, this pilot was proposed by PPL Electric in its May 4, 2012 petition and approved to proceed in the Commission's Order entered August 2, 2012.

The objective of this pilot is to present validated customer data for use by customer's and their authorized representatives on the Company's website sooner than 48 hours by modifying the way that the Company processes and validates data within its AMI and back office systems. PPL Electric examined opportunities to accelerate the processing of customer usage data to the customer-facing web portal to help facilitate faster presentment of data.

The project team followed a structured process of discovery and documentation of current processes, examination and exploration of potential acceleration opportunities, identification of risks associated with each opportunity, and analysis and selection of recommended strategies. It is important to recognize that, since its August 2009 Smart Meter Plan Filing and prior to undertaking these additional efforts, PPL Electric had already improved the presentment of approved data for customer viewing to 31 hours following the day of the actual consumption. This makes interval data available by 7:00 a.m. on the morning of the second day following its actual consumption.

In considering the various opportunities, the magnitude of the effort associated with each, the risks associated with each, and the resultant web acceleration of data presentment, the Company has determined that the most prudent approach is one which compresses the current extract/load/validation processes. As a result, the Company has developed a process that accelerates web presentment of validated interval data by approximately 9 hours (to ~9:30 PM on the day following the day of the actual consumption), meeting the expectation to present validated data to customers and their third parties within 24 hours. As this pilot was concluding, the Company also initiated an assessment of the exposure of its meter data management system to technical and functional obsolescence. If that effort were to reveal a need to replace all or significant portions of the meter data management system, then any upgrades to the existing system for the sake of faster data presentment might become obsolete. A final recommendation on this matter will be included in the Company's June 2014 Final Smart Meter Plan. The estimated cost for this pilot is \$105,000.

#### **4. Providing customers direct information on their hourly consumption.**

PPL Electric provides its customers with access to information on hourly consumption from its AMI system. This data is provided on a daily basis to the PPL Electric meter data management system to enable customers to access their individual information on PPL Electric's Energy Analyzer website.

The Company has proposed to implement the following project.

##### **A. Improved Validation / Editing / Estimation ("VEE") Process to Incorporate Outage Data:**

Through the operation and on-going evaluation of its smart meter system, PPL Electric has identified an opportunity to improve the interval data validation

process related to electric outages. During the meter data validation process, there are times when it is difficult for the VEE algorithms to distinguish between a power outage (during which zero consumption would be a valid value) and a lost communication path to the meter (where a zero might be recorded because there was no communication when, in fact, there actually was usage). Such circumstances are currently addressed by comparing the sum of interval usage to the monthly usage and filling missing intervals with the unaccounted for monthly usage in accordance with profiles. Because the Company typically captures between 99.25% and 99.50% of all hourly data, this issue actually affects very few hours and very few customers. Furthermore, very few of those customers are likely being billed hourly rates. However, the increasing numbers of requests by EGSs for interval billing data for customers not equipped with MV-90 meters and an expected increase in Electric Generation Suppliers ("EGS") TOU offers appears to indicate that an increasing number of customers are being billed on hourly rates.

The objective of this project is, therefore, to improve the VEE process by integrating outage data from the Company's Outage Management System ("OMS"). The project is currently evaluating integrating outage data from OMS into the MDM system in order for the VEE process to more accurately estimate missing hourly data without populating data into hours with times of known outages. As a result of additional project scoping and planning undertaken since last year's filing, the estimated project cost has increased from \$103,000 to \$140,000, of which \$128,000 will be spent in 2013.

## **5. Enabling time-of-use rates and real-time price programs.**

PPL Electric's currently deployed AMI is capable of providing hourly data to enable the Company to offer TOU rates and real-time price programs to its customers. The existing meter population already is delivering hourly data for billing purposes at a high success rate for TOU applications.

Regarding real-time pricing programs, PPL Electric's currently deployed AMI is capable of accommodating the capture and retrieval of hourly data in accordance with PJM hourly pricing. Beginning January 1, 2010, these programs were offered to Large C&I customers taking delivery at primary voltage and above. Beginning in January 2011, the Company offered this option to all customers with demands that are greater than 500 kW.

## **6. Supporting the automatic control of the customer's electric consumption.**

### **A. Load Control Evaluation**

PPL Electric completed a pilot to use the capabilities of the AMI system currently deployed to automatically control individual customer's electric consumption. The objectives of this pilot were to demonstrate the capabilities of PPL Electric's

AMI system to directly control a customer's electric consumption, and to demonstrate that electric consumption was reduced during load control periods. In addition, PPL Electric required that customers have the ability to opt-out of any specific load control event. Results were measured through observation of customer hourly consumption interval data. Preparation for this pilot began in 2010 and the pilot was conducted from July 1, 2011 to September 30, 2011. Load control devices were installed on customer air conditioning systems and water heaters. The Company has completed analysis of the results including an analysis of costs and benefits.

PPL Electric's Load Control pilot was available to residential customers who receive electric service from four specific electric distribution circuits in the Lehigh Valley. These feeders were chosen based on consideration of the density of residential customers as well as the peak summer load on each feeder. In addition, eligibility was limited to these circuits in order to segregate the Smart Meter Load Control pilot from PPL Electric's Act 129 Energy Efficiency and Conservation Load Control program. This segregation was deemed appropriate in order to more clearly discern results of the pilot and to avoid confusing customers as to the availability of different programs to them or to their neighbors. Approximately 10,000 customers are served from circuits chosen for the pilot. PPL Electric's target was to enroll 500 customers in the pilot.

PPL Electric began soliciting participants in February, 2011. The first solicitation was a letter mailed directly to all residential customers on the selected electric distribution circuits. Subsequently, email solicitations were sent to the residential customers on the selected circuits. Customers were able to enroll in the pilot either by using a website created specifically for the Load Control pilot, or, alternatively, by calling PPL Electric's Customer Contact Center and having a customer service representative assist in their enrollment. Initially, 212 customers agreed to participate in the pilot; however, by the time the pilot started, there were 177 participants. The leading causes given by customers for the attrition were concerns about comfort, health effects, scheduling difficulties for the installation of equipment, and security.

Customers who chose to participate in the Load Control pilot received \$32 for control of their central air conditioning ("AC") unit, and an additional \$18 if they consented to allow PPL Electric to control their electric water heater ("WH"). Six events were initiated during the summer of 2011. Table 1, below, provides a summary of the objectives of these events. In its Final Report, the Company will provide an analysis of actual load shed during these events.

Table 1 - Load Control Event Summary				
Date	Start Time	Duration	AC Load Target	WH Load Target
7/11/2011	1:00 PM	3 hours	20%	50%
7/12/2011	1:00 PM	3 hours	20%	50%
7/18/2011	2:00 PM	2 hours	20%	50%
7/19/2011	1:00 PM	5 hours	20%	50%
7/20/2011	1:00 PM	6 hours	20%	50%
7/21/2011	12:00 PM	3 hours	50%	100%

PPL Electric's Load Control pilot incurred a total cost of \$467,735. Based on the 177 customers who elected to participate in the pilot, this is a cost of \$2,643 per customer. At full deployment, it is estimated that 15,000 customers would enroll over a three year period at an estimated cost of \$8.2 million dollars (including deployment costs and the participation incentive), or \$547 per customer.

The pilot was a successful demonstration of the capability of PPL Electric's AMI system to control customer load. The data indicates that each load control event was successful and electric usage was reduced during the load control periods. Furthermore, there were no technical issues with the technology and field devices that would indicate that the pilot could not be expanded to a larger population. However, system scalability tests would need to be performed on the meter data management system, master communication system and other back office systems to determine the extent of the expansion and potential impact on the AMI system operations performance.

PPL Electric was, at the time, offering (in conjunction with a third-party Conservation Service Provider) a similar load control program under the Act 129 Energy Efficiency and Conservation ("EE&C") program. This Act 129 program did not make use of PPL Electric's AMI system for communication. It did employ PPL Electric's AMI system to validate the load reduced through the use of hourly interval meter reads and the analysis capabilities of the meter data management system. There were approximately 45,000 customers enrolled in the EE&C load control program and the frequency of events, duration of events, customer payment, and other parameters that define the customer's participation were similar to those of the Smart Meter Load Control pilot. The widespread customer acceptance of the EE&C load control program indicates that an adequate program was in place to meet the needs of the customers, the regulations and PPL Electric. Therefore, there is no need for a competing program. Furthermore, the EE&C load control program is a less expensive program than the AMI (smart meter) load control program. The cost on a per customer basis for the third party EE&C load control program is significantly less expensive than the cost of the AMI load control pilot. Even at full implementation, the projected cost of the AMI load control solution is considerably greater than the third party

EE&C load control program. The higher cost of the AMI load control implementation is due to three main issues as follows:

- Significant IT resources would be required to automate processes in PPL Electric's Customer Information System ("CIS").
- PPL Electric would need to develop and implement a customer support structure to specifically support the AMI load control program.
- Installation of AMI load control is more customized and involved than the EE&C solution and requires access to the home and wiring of the thermostat.

Additionally, the third party EE&C load control program is less complex, both from PPL Electric's perspective and the customer's perspective. The equipment for the EE&C load control program is installed outside the customer's home, minimizing impact on the customer. The EE&C load control program does not require an internet connection in the customer's home. Finally, the EE&C load control program has a well-established, robust customer support structure.

In conclusion, PPL Electric does not recommend the implementation of the AMI load control program as it would add additional cost to PPL Electric's customers and there is already a competitively priced third party solution in place that satisfies the current needs of PPL Electric and its customers.

## **7. Ability to remotely disconnect and reconnect**

### **A. Remote Connect / Disconnect**

PPL Electric is running a pilot to test the remote service disconnect functionality and assess the desirability of incorporating this functionality into the customer-initiated service transfer business process (i.e. move-in/move-out), and to test appropriate customer safeguards. This functionality is supported by PPL Electric's current AMI deployment. Remote disconnection and reconnection can be accomplished through the use of a meter with a service disconnect integrated into either the meter or a disconnect collar installed at the customer's premise. PPL Electric's existing power line communication network supports the communication of signals to cause disconnection and reconnection.

The pilot enables remote "hard" blocking of meters when there is a move-out and no subsequent move-in within a specified time period. When a customer calls to connect service at a location where the service was remotely disconnected customer service representatives instruct customers to turn off their main breaker, and then process the connect through the AMI system to remotely turn on the service. In the fall of 2012 PPL Electric installed 488 meters with an integrated switch in the move-in / move-out process in the Lehigh operating region. This functionality is not employed in the event that there is a termination for non-payment. See the table below for the number of switch actions, number

of premises and number of field trips saved under the pilot through the end of June 2013:

Count of Switch Actions		Count of Premise	Total switch Actions	Field Trips Saved
0		141	0	0
1	(Not counted in field trips Saved)	61	61	0
2	(Only 1 counted in field trip saved)	260	520	260
3	(Only 2 counted in Field Trip Saved)	4	12	8
4	(Only 3 counted in Field Trip Saved)	22	88	66
<b>Totals for On-going Pilot to End of June 2013</b>		<b>488</b>	<b>681</b>	<b>334</b>

In the latter part of 2013 and into 2014, PPL Electric will be evaluating expanding the use of the remote service switch throughout the Company's service territory, and for use in other business processes. As has been done in the past, PPL Electric will meet with key stakeholders to discuss the objectives and any concerns of expanding the use of this technology. The pilot will run through 2014. PPL Electric will submit initial findings and conclusions as part of its Final Smart Meter Technology and Implementation Plan. Total pilot costs are estimated at \$1,670,000 through 2014 and include: (1) establishment of pilot objectives, (2) meter hardware and installation, (3) software and programming, (4) pilot analysis and evaluation of expanding the use of the remote switch technology to other business processes, (5) establishment of an implementation plan, and (6) reporting of results and proposed implementation plan to stakeholders and the Commission.

#### **8. Ability to provide 15-minute or shorter interval data.**

##### **A. Scalability of PLC System and Focus Meters to Support 15 minute Interval Data**

PPL Electric conducted a pilot in 2010 and 2011 to assess the capability to provide 15-minute interval data using power line meters that have the capability to be configured for 15-minute data collection at the residential and Small C&I customer level. The Company currently, when requested by a customer, provides more granular interval data, such as 15-minute intervals, through the installation of a KYZ pulse equipped recorder meter. Because the need for more granular data is most often associated with commercial customers, this pilot focused on customers in the Small Commercial and Industrial class. The Company spent \$44,593 to complete this pilot which included: (1) the remote reconfiguration of 500 installed power line meters from 60-minute to 15-minute collection, (2) a scalability test to determine if PPL Electric's power line system

can read 15-minute data from all Small C&I accounts (180,000 accounts), (3) evaluation of pilot results, (4) development of recommendations including consideration of process changes necessary to accept customers', EGSs', and/or third parties' requests for 15-minute data, and (5) reporting of results and an implementation plan to the Commission. In approving the Company to proceed with this pilot, the Commission, in its June 24, 2009 Order, put forth eight questions for the Company to answer in the course of conducting this pilot. Answers to the Commission's questions as set forth in the June 24 Order can be found in Appendix A.

PPL Electric has concluded that its current approach to 15-minute and shorter interval usage data does not limit the ability of customers to access the benefits that may be available to them in the PJM ancillary services and demand reduction markets. PPL Electric understands that 15-minute interval data may have benefits to EGSs and third parties in designing rates and in their management of demand-reduction programs, but has no information to allow it to quantify those benefits. Finally, the Company has, itself, on certain occasions, used higher resolution data captured from a premise for short periods to investigate customer complaints or power delivery issues, rather than dispatching a technician and leaving expensive equipment at the premise. However, the Company is not aware that its current approach creates a barrier to customers achieving such benefits.

The cost/benefit issue is, therefore, to identify the least costly approach to achieving a fixed set of benefits. The cost of providing KYZ pulses is approximately \$475 per customer while the cost of upgrading the entire small C&I class of customers to 15-minute capability is \$1,753,000 plus \$20,000 per year. Ignoring the annual cost of \$20,000 and comparing only undiscounted first costs, one would have to anticipate about 3,700 customers (i.e., \$1,753,000/\$475) desiring 15-minute data to economically choose a class wide solution over a customer specific solution. There are currently only 307 customers in the small C&I class who have requested and have been provided KYZ pulses. The Company is also aware that, in a significant number of these 307 cases, the pulses are actually used as input to customers' processes or for monitoring curtailments that require information at intervals even shorter than 15 minutes. In those instances, the provision of 15-minute interval data would not substitute for the installation of a pulse recorder. The Company believes that, in consideration of the fact that (1) the number of customers requesting KYZ pulses is unlikely to reach the "breakeven" level of 3,700 customers and (2) the need for KYZ pulse data is driven by specific commercial needs that are different than simply knowing 15-minute usage, its current approach of providing KYZ pulse recorders on request is more appropriate and cost effective than incurring the cost of upgrading all of the meters in the small C&I class.

## **9. On-board meter storage of meter data.**

Residential meters that were deployed as part of PPL Electric's initial AMI deployment in 2002 through 2004 are capable of storing 24 values of hourly interval data. The Company's power line communication system acquires that information every 8 hours on a daily basis. Should communication to the meter fail, there are several opportunities to capture the intervals before they are over-written. PPL Electric's read rate in 2013 through May for hourly data is 99.3%. The Company is upgrading its meter population annually through normal meter purchases (currently about 40,000 meters per year) related to new construction, meter replacements and customer requests. Because the vendor's standard meter has greater storage capability than those deployed initially, the meter population is gradually being upgraded with meters capable of storing, at the meter level, at least 7 days of daily data and up to 30 days of hourly data. The current population of these newer meters is slightly greater than 115,000.

### **A. Ability to Read Historical Data / Process IT**

PPL Electric conducted a pilot to test its ability to acquire any or all of the 30 days of hourly intervals and revalidate them in the meter data management system ("MDMS"). The primary expected benefit of this pilot was to be able to fill daily and hourly data for web presentment, with actual data that otherwise would have been missing or estimated. Planning and evaluation for this pilot began in 2011 and was completed in 2013.

The ability to retrieve missing interval data from the newer meter module proved very reliable as the AMI system was able on average to retrieve 70% of missed hourly data that would otherwise be estimated or empty. However, because the Company's hourly read rate is very high (99.3%), and the existing validation and estimating process provides sound estimates, the potential improvement of historic reads would have very little impact on web presented data. In addition, as this pilot was concluding, the Company also initiated an assessment of the exposure of its meter data management system to technical and functional obsolescence. If that effort were to reveal a need to replace all or significant portions of the meter data management system, then any upgrades to the existing system for the sake of capturing historic data might be rendered useless. Accordingly, the Company believes it is appropriate to defer a commitment to upgrading the existing system without first confirming that those upgrades will have an appropriate useful life. A final recommendation on this matter will be included in the Company's June 2014 Final Smart Meter Plan.

The estimated costs of the pilot have decreased from \$456,000 to \$102,000.



## **10. Open standards and protocols that comply with nationally recognized non-proprietary standards.**

The Company's current AMI deployment can support the open standards and protocols that are recognized nationally. PPL Electric plans to continue incorporating open standards and protocols into the Company's use of smart meter technology. It will accomplish this by monitoring the progress of Smart Grid Standards as guided by the National Institute of Standards and Technology ("NIST") and incorporating those evolving standards into its smart meter and smart grid system.

One example of this is the Company's commitment to undertake the Federal government's "Green Button" initiative to implement standardized presentment of usage data (which replaces the more general "open standards and protocols that comply with nationally recognized non-proprietary standards, such as IEEE 802.15.4"). The Company has implemented the Green Button initiative, and it became operational on July 31, 2012. The costs to implement the Green Button initiative are not included in the *Smart Meter Rider*.

The following pilots have been identified to ensure compliance with open standards and protocols:

### **A. In Home Display / Home Area Network**

At the time the Company initially filed its Smart Meter Plan, the Company planned to explore incorporating IEEE 802.15.4 compliant Zigbee communications into a home area network through a pilot beginning in 2010 and concluding in 2011. Instead, as the result of technology evolutions since that initial filing, the Company plans to incorporate IEEE 802.11 compliant wireless local area network ("WLAN") communications into a home area network pilot. The Company believes that this protocol will be more generally accepted in the future than Zigbee communications. Although PPL Electric does not have specific statistics, it believes many of the Company's customers already have WLAN communications in their home and devices that communicate over WLAN.

Additionally, the Smart Energy Profile ("SEP") version 1.x currently in use today will remain an active standard providing smart energy functionality using the existing hardware available today. However, moving forward with new hardware and new functionality, an IP-based solution using a new SEP 2.0 standard is being developed by a consortium of interested industry groups including the WiFi Alliance. The SEP 2.0 standard is not backward compatible with SEP 1.x and today's older hardware is not likely to be upgradeable to 2.0. Currently, there are no devices that meet this new standard since the final standard has not been approved, however existing IP-based WiFi hardware does reflect the operating characteristics of an IP-based standard. Therefore, the Company will proceed with a pilot utilizing the IP-based platform with the expectation that the new SEP 2.0 standard can be utilized for future deployment.

The objective of the pilot is to provide customers with an in-home display so that they can view their real-time energy usage while they are in their home. In its *Smart Meter Plan* filing in August, 2011, the Company's proposed home area network/In-Home Display pilot was planned to begin in October 2011. As a result of technical issues experienced while testing, the pilot was delayed. The Company worked closely with its AMI vendor to troubleshoot the technical issues and began to deploy the updated Wi-Fi meters in October of 2012 to a small group of approximately 50 participants to confirm that technical issues had been resolved. This group was also surveyed and the feedback showed an overall 80 to 90% favorable response to the ability to view their energy usage in real time. Based on the favorable post survey results from that group and the absence of technical issues, the Company is currently expanding the pilot to approximately 400 customers. The pilot will continue through 2014 at which time the Company will be filing its Final Smart Meter Procurement and Installation Plan. Any future implementation of this technology will be addressed in that plan.

The estimated cost of this pilot is \$546,000 which includes (1) establishment of pilot objectives, (2) providing price and consumption information to the customer, (3) evaluation of bi-directional communications to end-use devices, (4) inviting customers to participate in the pilot, (5) providing the meter and in home display hardware including any equipment installation, (6) software and programming, (7) evaluation of pilot results, and (8) reporting of results to the Commission.

#### **B. AMI System Security Assessment**

PPL Electric is currently conducting a security assessment of its AMI systems. As new technologies are introduced and integrated into the meter, such as Wi-Fi and remote service disconnect switches, additional points of potential access are created and new privacy and security concerns are introduced. PPL Electric has engaged an industry expert to perform a Cyber Security assessment of the PPL Electric AMI system. The project began in May of 2013 with the preliminary assessment to be delivered in August 2013. The approach is to baseline current practices, identify industry standards and trends, identify threats and vulnerabilities, perform a likelihood and impact analysis, and develop a mitigation plan. The estimated cost to conduct this evaluation is \$200,000. No estimate can be provided at this time of the cost of mitigation activities.

#### **11. Ability to upgrade these minimum capabilities as technology advances and becomes economically feasible.**

PPL Electric's smart meter infrastructure possesses the ability to upgrade firmware and communication systems in compliance with new standards and protocols. The Company's plan addresses technology advances discussed below.

## General Obsolescence and Upgrade Issues

PPL Electric continues to conduct technological and economic evaluations on potential applications that can enhance the performance of the existing AMI components, as well as the next generation of smart meter system technologies and Smart Grid integration. These evaluations will consider the obsolescence of the communications infrastructure equipment and meters, and their replacement with new technology that enables PPL Electric to continue to meet the smart meter requirements and identify additional capabilities that may be beneficial to customers. Additionally, the Company will consider new applications that complement the capabilities of the existing system.

In 2011, PPL Electric completed a thorough evaluation of the existing power line smart meter infrastructure and its ability to support enhancements. The evaluation considered PPL Electric's current business requirements, anticipated future business requirements and information on possible functional requirements from the Commission's Retail Market Investigation and other sources. The evaluation was completed and resulted in an AMI technology roadmap that will allow the Company to address obsolescence and plan for upgrades. The Company continues to evaluate the most cost-effective solution to maintain AMI functionality and meet the requirements of Act 129. The full extent of the meter replacement and system enhancement strategy will determine the future costs. The Company has developed the following pilots in support of this objective.

### **A. Next Generation PLC System Enhancement – TWACS 20 Pilot**

While PPL Electric's existing metering infrastructure meets current business requirements, future requirements may soon exceed the ability of bandwidth constrained substations to meet increased data demands. In order to assess the viability of the Company's AMI system to meet these demands, it is necessary to evaluate the bandwidth increases realized by implementing the next generation communication protocol known as TWACS 20. The objective of this pilot is to evaluate the ability of the next generation communication protocol (TWACS 20) to relieve bandwidth constrained substations within the PLC based AMI system.

The expected high level benefits include (1) verify that TWACS 20 will relieve bandwidth constrained substations as expected, (2) demonstrate that there is a proven solution available for extending the useful life of the Company's PLC based AMI system, (3) demonstrate the ability to support future business requirements such as increased ping volume, on board meter storage, and increased requests for voltage and momentary outage information.

The Sumner substation is one of the more densely populated and bandwidth constrained Company substations. For this reason, that substation was chosen for this pilot. The pilot began in October of 2012 with the replacement of approximately 10,500 meters served from the Sumner substation with new digital meters equipped with the next generation communication module. Once the new meters had been installed, the new TWACS 20 communication software was installed in the substation communication equipment in early 2013. PPL Electric

worked closely with the equipment vendor to tune the performance of the system to maximize the potential additional bandwidth. Measurement and testing results have shown that the TWACS 20 software does provide significant additional bandwidth capability. Currently, various tests are being performed to study how the additional bandwidth can be used and what additional meter data can be obtained from the newer generation meters. Metrics have been developed to track bandwidth and system performance for different combinations of communications. A detailed evaluation is being conducted of the findings and future recommendations are being developed. The pilot will run through 2014, when the Company will submit its Final Smart Meter Technology and Implementation Plan. Total pilot costs are estimated at \$1.8 million through 2013 of which \$1.7 million was spent in 2012 primarily for the purchase and installation of the meters. An additional \$250,000 is budgeted in 2014 to complete the analysis. If the pilot is successful a wider deployment may be recommended as part of the Final Smart Meter Technology and Implementation Plan.

#### **B. Telecommunications Substation Modem Evaluation and Replacement**

PPL Electric completed a telecommunications substation modem evaluation in 2010 to determine the optimal method to bring meter data back from substations to the central processing point. The Company retrieves meter data from the meter to the substation through the power line carrier system. Previously, at the substation, the data was compiled and sent back to the Company through leased telephone lines. The evaluation in 2010 determined that this was not optimal method to collect this data from the substations. This method has long term operational concerns and is very costly. The Company determined that bringing the data back from substations through cellular modems or fiber were the best options. At substations with PPL Electric Smart Grid capabilities, the Company will bring the data back through fiber optic cable already located at the substation for the PPL Electric Smart Grid project. At all other substations, the data will be brought back through cellular modems. This project was completed and implemented in 2012. The total cost of this project was \$520,630.

#### **C. PLC Based System Enhancements**

In 2011, the Company evaluated adding or replacing equipment to enhance data capture and accommodate new end-use devices. The Company evaluated the addition of two different pieces of equipment at substations: (1) additional modulation transformer units ("MTU") and (2) new Substation Communications Processor Assembly ("SCPA") G2 boards.

The Company has determined that it is not cost effective to install additional MTU's at substations with only one MTU. Additional MTU's help the Company continue to obtain meter readings during maintenance at the substation. The Company determined it would be more cost effective to build three mobile MTU trailers and two mobile switching trailers that could be installed at the substation

when maintenance needs to be performed and removed once the maintenance is completed. This will allow greater flexibility during maintenance at the substation at a reasonable cost. This work was completed in 2012.

As part of the Substation Communication Equipment, the Company uses SCPA-93 boards. These boards process all commands and data flowing through the substations. They were developed in 1993 and are nearing the point where the technology is obsolete; i.e., no longer capable of being maintained and compatible with newer generation interfacing technology. The SCPA-G2 board is the next generation technology. A technical evaluation of the new SCPA-G2 boards supported piloting this new equipment in 2012 at 60 substations. In its original Smart Meter Plan filing, the Company's plan, if confirmed by the evaluation, was to install this new equipment at 175 substations in 2012 and at 150 substations in 2013. The initial results of the evaluation did not clearly confirm the benefits of moving forward with a full implementation; therefore, a slower implementation schedule was chosen to allow the Company to verify the performance improvements gained from this new equipment and more definitively determine the benefit of further deployment. Further evaluation determined the SCPA-G2 has more processing power, more modern communication protocols, and enables the use of TWACS-20 – the next generation communication protocol. The Company has decided to deploy SCPA-G2 boards at the remaining substations. Deployment is scheduled to be complete in early 2014.

The total cost for the PLC system enhancements is estimated at \$1.3 million.

#### **D. Real Time Path Mapping in PLC System**

The Company is currently evaluating operational improvements to the AMI back office system to make the PLC system more responsive to changes of electrical paths of meters. The project is estimated at \$66,000 and is on-schedule to be implemented in 2013 with on-going evaluation through the end of the year.

#### **E. Momentary Outage Monitoring**

PPL Electric currently captures meter blink data ("blink counts") on each meter once per week. This data is used to resolve customer complaints that may arise regarding power quality and reliability. In 2011, the Company began a pilot program to enhance this capability and become more proactive in understanding emerging power quality issues and addressing them prior to a customer contacting PPL Electric. The blink counts are now being transferred from the metering system, into a data management system which is then extracted out to an internal reporting system and an internal mapping system. Additional analytical reports have been developed in order to analyze the blink count data in a meaningful way to aid in determining the approximate location of any distribution system components that operated to cause the "blinks". The data capture, reporting, and mapping capability has been completed. This pilot is

currently in a data analysis and validation phase in order to understand how to utilize the blink count data, how to enhance the reporting and analytical capabilities, and how to expand the system capability to go beyond weekly capture of blink counts. Preliminary results have shown the ability to aggregate meter blink count data to upstream system devices and then field validate issues along the circuit. In addition, the correlation between high blink counts and abnormal voltage conditions is being analyzed. The Company plans to continue the evaluation through 2013.

The total estimated cost to conduct this pilot is \$117,000 which includes, (1) establishment of evaluation objectives, (2) software and IT programming, (3) evaluation of the results, (4) establishment of recommendations for implementation, (5) reporting results and plans to the Commission and, (6) implementation of pilot into production if results warrant full implementation.

#### **F. Service Limiting / Service Extending**

This functionality is supported by PPL Electric's smart meter infrastructure. Service extending can be accomplished through the use of a meter with a service disconnect and service limiting intelligence at the customer's premise. This functionality limits the current (amps) level to the premise, thereby allowing the customer to continue to maintain essential loads. A service extender can be used to allow a customer to maintain a minimum level of service as an alternative to termination of service due to non-payment of bills. Service extenders may also have been useful in the case of vacation homes or other seasonal loads. The Company recognizes that, while this capability was included in the Commission's June 24, 2010 Order, the PUC has not required EDCs to evaluate this capability. However, the Implementation Order does not preclude further consideration of this functionality.

PPL Electric has completed a high-level pilot evaluation and has reviewed several different methodologies for use of the service extending functionality to address customer needs and make the Company's business processes more efficient. The Company's research indicates that, although this functionality can provide some benefits to customers and the Company, the costs of IT integration, the daily operational changes, and the potential customer misperception are likely to outweigh the benefits.

Therefore, PPL Electric does not recommend moving forward with a pilot evaluation of the service extending functionality at this time. The Company will *continue to monitor the development of the technology and potential application to utility business processes.* Previously estimated costs of \$3.7 million to conduct this program have been removed from the Plan.

PPL Electric incurred \$7,682 of costs to conduct the evaluation and document the recommendation.

## **G. Prepay Metering**

Prepay metering was expected to enable a customer to make energy consumption decisions based on a "pay-as-you-go" approach. PPL Electric recognizes that, while this capability was included in the Commission's June 24, 2010 Order, the Commission has not required EDCs to evaluate this capability in the Implementation Order. However, the Implementation Order does not preclude further consideration of this functionality. In fact, the Commission's regulations at 52 Pa. Code § 56.267 do include a section on the use of pre-pay meters. PPL Electric proposed to work directly with Commission staff and interested parties on the objectives for a pilot to evaluate the benefits of this type of program.

The expected high level benefits are that pre-pay metering would (1) contribute to a reduction in customers' energy consumption, (2) enable customers to learn how to manage their electric energy payments, (3) enhance customer payment options, and (4) reduce the need and associated costs to dispatch personnel to disconnect and reconnect customers' service.

Successful implementation of prepay program, such as the program offered by Arizona's Salt River Project, required consensus and collaboration among all parties. Accordingly, the Company expects to engage in significant pre-work and discussions among stakeholders prior to implementing a prepay metering pilot.

The Company proposed to conduct a 500 customer pilot to begin in 2013 in which PPL Electric would solicit customers to volunteer to participate. PPL Electric identified high-level pilot requirements, and worked with prepay vendors to better understand prepay system capabilities and functionality. Through this evaluation the Company determined there would need to be significant regulatory changes to conduct a prepay pilot.

The time constraints associated with the need to file a Final Smart Meter Plan in June 2014 will not allow sufficient time for the Company and all interested stakeholder to shape a program that will best suit the needs of the customer base. In addition, the Company has determined that the cost to conduct a pilot will be significantly higher than estimated. Accordingly, the Company believes it appropriate to suspend its efforts on this pilot.

The cost to evaluate implementation of a prepay meter pilot was \$97,773 where the working team (1) defined pilot requirements, (2) worked with prepay vendors on options that would align with the Pennsylvania requirements for prepay metering, (3) joined a national Prepay working group to better understand the landscape of prepay in the Utility market.

## **H. Accelerated Supplier Switching (Off-Cycle)**

In its Retail Markets Investigation, the Commission indicated a desire for all customers to be able to switch suppliers more quickly than is permitted under the current switching rules which, in practice, result in a switching delay of between 16 days and 45 days from the date that the EDC is made aware of the request to switch.

In response to this directive, PPL Electric proposed, in its May 2012 Petition, to implement an Accelerated Supplier Switching Pilot Program to evaluate the Company's ability to implement off-cycle switching. This proposal was consistent with comments filed by PPL Electric on December 14, 2011 in response to the Commission's *"Interim Guidelines Regarding Standards for Changing a Customer's Electricity Generation Supplier"* (Docket No. M-2011-2270442). See *"Final Order Investigation of Pennsylvania's Retail Electricity Market: End State of Default Service"* Docket No. I-2011-2237952 (Order entered February 14, 2013). This Final Order directed Commission staff to initiate a rulemaking to review and revise the switching regulations at Pa. Code §§ 57.171 – 179. The rulemaking will explore methods to accelerate the switching timeframes beyond simply shortening the confirmation period. This could include off-cycle switching and other processes made possible with the deployment of advanced metering.

The rulemaking will be initiated by end of 2013 to revise the switching regulations, with the intent of accelerating the switching process. A rulemaking will provide all interested parties with the opportunity to participate and will allow the Commission to make fully informed decisions on the complex issues involved. The use of formal rulemaking should also help clarify any cost-recovery issues.

The Commission will consider whether or not statutory changes are needed to facilitate or clarify the use of advanced meters in the switching process.

At the time of the May 2012 Petition, a project plan with a tentative schedule and cost estimate were developed. Approximately \$19,000 was spent in developing this initial project scope. The Company will further define the project scope, schedule resources to ensure consistency with the final direction from the Retail Markets Investigation. Since the rulemaking will not take place until the fourth quarter of 2013, for scheduling purposes it is assumed that the project will be implemented in 2014. The estimated project cost has increased from its original estimate of \$525,000 to \$687,000.

## **I. MDM Data Warehouse and Analytics**

The Company's MDMS was designed to meet production needs (meter reading schedules, billing requirements, posting of data to the Energy Analyzer website, etc.) and not to provide for significant amounts of ad-hoc querying of meter data



or to provide any complex analytics. In order to meet its current needs, the Company, at times, exceeds the existing data extraction and analysis capabilities of its MDMS, which slows the performance of the system and jeopardizes production activities. As the uses for and demand for interval data grow, this limitation will result in the Company being unable to support these new functionalities and demands.

The industry is adopting data warehouses as the appropriate infrastructure to support the needs of developing advanced analytics for large volumes of meter data and improve operational performance of meter data management systems. The Company proposed to install a data warehouse for meter data beginning in 2012. The first phase of the project involved installing all required software and hardware for the meter data warehouse and providing the Company's business users ad-hoc querying capability. The key benefits of this first phase are to reduce the threat to timely completion of production activities within MDMS and establish an environment for the development of data analytical capabilities. The second phase of the project will involve developing the advanced queries, data analytics, and enabling the development of other applications such as the Supplier Portal project (as described below).

In its Implementation Order, the Commission recognized that a fully functional smart meter infrastructure involves more than just the meter hardware attached to the customer's premises but also involves an entire network. Implementation Order, p. 6. The MDM Data Warehouse and Analytics project will enhance PPL Electric's ability to provide smart meter data to customers and EGSs, and provide an ability to perform enhanced analysis of meter data to better serve the Company's customers.

Since the May filing a project plan with schedules and estimated costs has been developed. The total estimated cost of the project has increased from \$1,475,000 to \$2,006,000 of which \$1,187,475 was spent in 2012 and \$819,000 will be spent in 2013.

#### **J. Supplier Portal Pilot**

In the Commission's Order approving PPL Electric's Smart Meter Plan, the Commission directed PPL Electric to continue to test and develop ways to *provide customer meter data to customers and third parties*. Smart Meter Order, p. 22.

In response to this directive, the Company has proposed to conduct a Pilot Program whereby PPL Electric would allow suppliers to access customer meter data through a secure portal to the Company system. The Company notes that the current EDI transaction process to provide EGSs with interval usage data was conceived prior to the advent of smart meters and did not contemplate more than just the largest customers having interval data. The Company and EGSs are discovering that, as the availability and demand for interval usage data are

increasing, EDI is proving to be a cumbersome and expensive way of transmitting that data.

The project was initiated in 2012, and the first deployment was released to production and suppliers on May 17, 2013. The total cost of the project is estimated to be \$603,000. The project involves creating a secure data environment wherein EGSs, and potentially other third parties, can, with appropriate customer authorization, access usage data directly without need for an EDI request and response. While the data feed to the Portal is currently from the meter data management system, data will, in the future, be supplied through the Data Warehouse and Analytics Project described above.

PPL Electric is also participating in the Electronic Data Exchange Working Group ("EDEWG") WPWG (Web Portal Working Group) Sub Team as the EDC Chair, and is expecting the Sub Team to provide recommendations which will ultimately shape the continued development of the Supplier Portal through 2014.

#### **K. Power Monitoring for Large Power Meters**

PPL Electric is in the process of replacing 300 to 400 of its existing large power MV-90 meters that are of a type and vintage for which parts and service are no longer available. These meters represent a fraction of the total population of about 2,200 large power meters that are processed through the MV-90 system. The replacement of these existing meters with ION meters is being accomplished outside of PPL Electric's Smart Meter Plan. The ION meters are more technologically advanced and have monitoring and data recording functionality that does not exist in the meters being replaced. Furthermore, the additional functionality is accessible outside of the proprietary logic of the MV-90 system, thereby, providing the opportunity to obtain power quality and meter diagnostic information that was not previously available.

During 2013, PPL Electric will acquire and install software that will trend and analyze data from the ION meters for the purpose of identifying metering and service quality issues. The data being captured and analyzed includes energy, demand, voltage, current, harmonic content, sub-cycle sags, and voltage surges. This work is consistent with the Commission's directive that smart meter technology should be capable of being upgraded as technology advances and becomes economically feasible.

The estimated cost of this work is \$55,000 which includes (1) purchase and installation of software and (2) development of a web-based interface for PPL Electric users to access the data and analytical capabilities.

## **L. Smart Meter Data Exchange**

On December 5, 2012, the PUC issued a Final Order at Docket No. M-2009-2092655 (Order entered December 6, 2012) directing EDC's to include in their smart meter plans descriptions of how they will provide certain functionality identified in the Final Order. The four functionalities identified in the Final Order are:

- Utilize smart meter data for Bill Ready and Dual billing.
- Provide at least 12 months of account or meter level Historical Interval Usage ("HIU") data via Electronic Data Interchange ("EDI")
- Participate in an *Electronic Data Exchange Working Group* sub-team to define a solution for providing HIU and billing quality Interval Usage via a web-portal.
- Provide a plan to support meter level HIU data.

PPL Electric's advanced meter infrastructure already provides the first three functionalities. PPL Electric will be providing the fourth of these functionalities in a future release of its Supplier Portal described under item "J" above.

## **M. Evaluation of Next Generation AMI Technologies**

In 2013, PPL Electric initiated an evaluation of next generation AMI technologies to fully assess current and future smart meter functionality. The objective of the evaluation is to gain a deeper understanding of new AMI technologies that exist or will exist in the marketplace. The Company will use this evaluation along with the next generation PLC evaluation, and pilot results, to construct business cases in order to determine the most cost-effective technology path forward that meets Act 129 smart meter requirements, customer needs and business needs. This will serve as the basis for the Final Smart Meter Plan filing in June 2014. The Company has retained consultants to assist in this effort and to assist in the MDMS assessment. The evaluation will consist of the following main topics:

- Technical assessment of mass market and large commercial and industrial metering systems,
- Technical assessment of IT requirements (including MDMS) and *network communications*,
- Business case and recommendations,
- Organizational assessment,
- Recommended solution and implementation plan.

This evaluation is expected to be completed by the end of 2013 with activities continuing into 2014 to prepare the Final Smart Meter Plan filing. Overall costs to perform the evaluation and prepare the filing are estimated at \$1.35 M.

**12. Ability to monitor voltage at each meter and report data in a manner that allows an EDC to react to the information.**

PPL Electric collects voltage information as required for specific engineering review. Industrial and commercial meters also offer more precise voltage, current and relational phase-angle information and the Company uses this information to diagnose meter and service issues. PPL Electric will conduct two pilots to demonstrate this capability as follows:

**A. Wireless Based System Enhancement**

The Company's wireless-based large power meters offer precise voltage, current and relational phase-angle information. The Company has completed a pilot to improve the use of that information for the diagnosis of meter and service issues. This enhancement was implemented in 2011 for the large power meters. The cost of the large power meter information enhancement was \$142,672.

By having more precise service diagnostic information PPL Electric can proactively identify possible equipment damage and better identify abnormal service situations. Quicker, identification and correction of possible issues can help reduce potential revenue losses, billing issues, and increase customer satisfaction.

**B. Voltage Measurement / Collection Reporting in PLC Based System**

PPL Electric is using the power line carrier PLC-based existing smart meter technology and infrastructure to improve the measurement, collection and analysis of voltage information to enhance PPL Electric's distribution system reliability. Currently, the PPL Electric metering system captures voltage data three times a day. The average, minimum, and maximum voltage values are captured and this data is transferred from the metering system into the data management system. The data can then be extracted into an internal reporting system and an internal mapping system. These reports and maps are being used to analyze the PPL Electric distribution system to identify system component problems and to resolve customer issues that may arise. The work scope identified for this pilot has been completed and is being transitioned to production. PPL Electric will continue to validate the data by engaging field personnel and enhance the reporting, mapping and analytical capability of the current system. This effort will continue through 2013.

Many examples of applying the voltage data to resolve issues have been documented since the inception of the pilot. These examples include more effective distribution planning and engineering, identification of problems with equipment installations, and identification of failing equipment. Furthermore, PPL Electric has demonstrated the ability to proactively and reactively identify system component issues to better serve our customers.

The final cost for the PLC-based pilot is \$259,000 which includes (1) determining the feasibility of gathering this new information by performing an impact analysis on the smart meter infrastructure to ensure there are no performance issues, (2) exporting the data collected into a data management system to provide a facility for engineers to access and apply advanced analytics for their business applications, (3) software and IT programming, (4) establishment of implementation plan, and (5) reporting the results and implementation plans to the Commission.

### **13. Ability to remotely reprogram the meter.**

PPL Electric has the ability, with its smart meter infrastructure, to remotely program communication equipment and newer meters in the system. The Company has demonstrated this capability in several applications.

### **14. Ability to communicate outages and restorations.**

The Company's current AMI deployment is integrated with its OMS to permit a more accurate determination of the extent of an outage and provide the ability to restore customers more quickly than would otherwise be possible. As it moves forward with its Smart Meter Plan, PPL Electric is continuing to seek ways to incrementally improve proactive outage detection over the life of the systems. Two pilots are being conducted at this time.

#### **A. Proactive Outage Detection**

In 2011, PPL Electric began a pilot to further enhance use of the existing AMI's capabilities. The objective of the pilot was to determine the system-wide feasibility of using the power line system for the purpose of distribution system health checks and proactive outage detection. The pilot was completed in 2012 at a cost of \$166,268.

The approach was to monitor a load reduction at the feeder level using PPL Electric's Supervisory Control and Data Acquisition system (SCADA) and then through an interface to PPL Electric's Outage Management System (OMS) trigger a ping of the meters on that circuit. Once the software and interfaces were developed, and the systems were configured to transmit the required data, the process was set to run in a test mode using real time SCADA data for a few circuits. During this test phase the system did trigger and create outages in PPL's test OMS, however; there was a minimum of a ten minute delay from the start time of the outage until it was created in test OMS. Invariably during this time customers had already called in to report the outage. Accordingly, the Company does not plan to fully implement this functionality.

#### **B. Outage Duration Pilot**

PPL Electric has identified an opportunity to retrieve additional outage information from meters. Outage duration and the start timestamp are available

in the module register of the Company's new standard residential meters. The Company believes there may be a benefit in retrieving this data from the meter and using it for outage and power quality analysis to improve customer service.

The Company has developed a preliminary scope for the project and plans to deploy changes in fourth quarter 2013 contingent upon the release of vendor software. The estimated cost of the project is \$85,000. The data for this pilot is available from PPL Electric's standard digital meters numbering just over 115,000 installed in the field. In advance of the vendor's release of software, PPL Electric has spent the first half of 2013 developing a process which will allow the Company to retrieve outage duration data directly from the module register.

Also in the first half of 2013, PPL Electric studied what data is available from the meter, and the value that might be gained from the data. The Company has found that the meter tracks sustained outages (greater than 5 minutes) by posting, in the module, the start time of the outage and the duration of the outage *which can be used to derive outage stop time*. PPL Electric has studied outage start and stop times from the Company's Outage Management System, and compared the times against the data retrieved from the meters. Preliminary results confirm the accuracy of the meter data and some positive benefits associated with utilizing duration data to more accurately track customer outages.

#### **15. Ability to support net metering of customer-generators.**

The smart meter infrastructure deployed by PPL Electric supports this capability and is utilized today to acquire all the point of contact and generation quantities.

##### **A. Evaluate Feasibility of Metering Customer-Owned Generation with TNS**

PPL Electric piloted, in 2010 and 2011, the functionality and performance of new bi-directional meters that measure energy flow at the PPL Electric point of contact. The pilot consisted of installing 400 PLC-enabled bi-directional meters at services supporting net-metered facilities. These meters provide net energy usage on an interval basis; measuring both delivered and received energy flowing to and from the Company's grid. All residential customers with installed generation now have a bi-directional meter and a process has been established to ensure that customers who install generation in the future receive a bi-directional meter. In addition, the bi-directional meter is now the Company's standard meter for new installations and meter changes.

Within the pilot, it was determined that minimal changes were required to PPL Electric's MDMS and customer information and billing system to accept delivered and received energy usage. Therefore, the estimated cost to conduct this pilot and implementation is significantly less than previously expected. Total costs in 2010 and 2011 were \$177,207. This included (1) upgrading existing net metering

customers with the new power line meter, (2) meter hardware and installation, (3) software and IT programming to accept and validate energy data, (4) evaluation of pilot results, and (5) development of an implementation plan.

In 2011, the Company explored the best metering options for small three-phase C&I customers that have generation installed. The Company identified preferred metering and has completed installation of meters on all small three-phase C&I accounts with generation installed. Additional costs to install 143 three-phase power line carrier net meters were \$85,088. That work was completed in 2012. This project is fully implemented and processes are in place to ensure net meters are installed at premises with generation installed.

## **16. Smart Meter Rider**

PPL Electric is submitting concurrent with this filing its proposed Smart Meter Rider ("SMR") charges to be effective for service rendered on and after January 1, 2014 in Supplement No. 136 to PPL Electric's Tariff-Electric Pa. P.U.C. No. 201. Consistent with PPL Electric's tariff, the rate calculations included in Supplement No. 136 are based upon an annual budget amount of all costs required for the Company to implement its SMP during the compliance year of January 1, 2014 through December 31, 2014. The rates also include reconciliation of the Company's SMR charges as of the end of the 12-month period ending June 30, 2013. The reconciliation report for the 12 months ending June 30, 2013, also was filed under separate cover. The Company will be filing its *Final Smart Meter Plan* by June 30, 2014 which is during the application period of the 2014 SMR. To the extent that the Company's Final Plan may request Commission approval of additional AMI costs, the Final Plan will propose recovery of those costs, subject to Commission approval, as an adjustment to the SMR.

## **IV. CONCLUSION**

PPL Electric's original Smart Meter Plan filing has evolved in response to the Commission's June 24, 2009 Order, the Commission's August 2, 2012 Order in response to the Company's May, 2012 petition, input from stakeholders, and, also, in response to technology evolutions that have occurred since the Company initially filed its Plan. PPL Electric is continuing to work to ensure its customers are provided all of the smart meter functionality required under Act 129 in a cost-effective manner. The Company will be filing its *Final Smart Meter Plan* by June 30, 2014.

## **APPENDIX A**

### **Ability to Provide 15-minute or Shorter Interval Data**

#### **Answers to Commission's Questions set forth in June 24, 2010 Order**

PPL Electric conducted a pilot in 2010 and 2011 to assess the capability to provide 15-minute interval data on a consistent basis using power line meters that have the capability to be configured for 15-minute data collection at the residential and Small C&I customer level. The Company's findings from the pilot are outlined within the following questions that were set forth in the Commission's June 24 Order:

1. *What are the capability and limitations of proposed smart meters to measure and record sub-hourly usage?*

Currently, the Company provides sub-hourly 15-minute interval data for all its large commercial and industrial ("C&I") customers. Large C&I customers are defined as C&I customers with a demand of greater than 500 kW.

Currently, small C&I customers are generally provided hourly interval data. Small C&I customers are defined as C&I customers with a demand of less than 500 kW and there are approximately 180,000 such small C&I customers. However, as a result of past participation on now-closed rates and other circumstances, approximately 52,000 of these small C&I customers have a meter that can provide 15-minute interval data without further modification. In order to measure and record sub-hourly usage for all small C&I customers through the power line carrier system, the Company would need to upgrade the meters of 128,000 customers to newer electronic meters at an estimated cost of \$17.28 million. Because the demand for sub-hourly data among this class of customers is not great, the Company's practice has been to, upon request of the customer, provide KYZ pulse data which can be integrated into 15 minute intervals, or any other length of interval the customer or third-party acting on behalf of the customer may desire.

Residential customers are also provided with hourly interval data. In order to measure and record sub-hourly usage for all residential customers through the power line carrier system, the Company would need to upgrade the meters of approximately 1.3 million customers to newer electronic meters at an estimated cost of \$175.5 million.

2. *What are the capability and limitations of proposed smart meter communication and data storage systems to transmit and store sub-hourly usage information?*



In order to transmit and store sub-hourly usage for all small C&I customers, the Company would need to strategically upgrade and/or modify the existing AMI system including meters, substation equipment and data storage. The estimated cost of upgrading meters is \$17.28 million as discussed in the response to Question 1, above. The additional substation equipment is estimated to cost \$250,000. The additional data storage costs to store 15-minute interval data for 180,000 small C&I customers on the same basis (accessibility, retention times, etc.) are estimated to be \$20,000 per year.

3. *What are the sub-hourly PJM requirements for participation in ancillary service markets?*

The PJM Interconnection ("PJM") identifies three ancillary services markets on its website (<http://www.pjm.com/markets-and-operations/ancillary-services.aspx>). These are:

- Synchronized Reserve,
- Regulation, and
- Black Start Service.

Each of these services and the associated metering requirements are described below.

**Synchronized Reserve**

Synchronized reserve service supplies electricity if the grid has an unexpected need for more power on short notice. Both generators and loads can participate in the synchronized reserve market. The power output of generating units supplying synchronized reserve can be increased quickly to supply the needed energy to balance supply and demand; demand resources supplying synchronized reserve can reduce their load quickly in order to maintain the balance between supply and demand. Demand resources providing Synchronized Reserve are required to provide metering information at no less than a one minute scan surrounding a synchronized reserve event. Metering information for demand resources is not required to be sent to PJM in real time. Daily uploads at the close of the next business day after the operating day, if an event has occurred, are sufficient. (PJM Manual 11: ***Energy & Ancillary Services Market Operations***; Section 4: Overview of the PJM Synchronized Reserve Market Revision 46; Effective Date: 06/01/2011; pages 63 – 64 and 72)

**Regulation**

Regulation is necessary to provide for the continuous balancing of resources (generation and interchange) with load and for maintaining scheduled Interconnection frequency at 60 cycles per second (60Hz). PJM commits on-line resources whose output (for generators) or consumption (for loads) is raised or lowered as necessary to follow moment-to-moment changes in generation or load. The resources assigned to provide regulation must be capable of responding to the Area Regulation signal immediately, achieve

their bid capability within five minutes and must increase or decrease their outputs at the ramp rates that are specified in the data that is submitted to PJM. Regulation is predominantly achieved using automatic generation control equipment; however, customers ("demand side response resources") can also provide regulation. Resources (either generators or loads) participating in the regulation market will receive from PJM an assigned regulation signal at 10 second intervals and a real-time regulation signal (intended to move the participating resource) at 2 second intervals. Resources (either generators or loads) participating in the regulation market will send to PJM signals that provide the resource's capability to provide regulation and the real-time regulation that the resource is providing. Both of these signals are calculated every 2 seconds and sent at 2 second intervals. Consumption metering must, therefore, be able to meet the 2 second calculation requirement. (PJM Manual 12: **Balancing Operations**; Section 4: Providing Ancillary Services; Revision 22, Effective Date: 05/13/2011; pages 38-42)

#### **Black Start Service**

Black start capability is necessary to restore the PJM transmission system following a blackout. Black Start Service shall enable PJM and Local Control Centers to designate specific generators whose location and capabilities are required to re-energize the transmission system. Black Start Service applies only to generation resources and, therefore, establishes no requirements for consumption metering. (PJM Manual 12: **Balancing Operations**; Section 4: Providing Ancillary Services; Revision 22, Effective Date: 05/13/2011; pages 49)

Although not listed among the ancillary service markets, many retail customers participate in PJM's Demand Response Programs. PJM hosts two different programs – the Emergency Load Response Program and the Economic Load Response Program. In both programs, hourly load data is available within 60 days of the participant's load reduction. (PJM Manual 11: **Energy & Ancillary Services Market Operations**; Section 10: Overview of the Demand Resource Participation; Revision 46, Effective Date: 06/01/2011; pages 103 and 113-117)

4. *What are PPL's incremental smart meter, communication, data storage, and data sharing costs associated with these sub-hourly requirements for ancillary services?*

As noted in the response to Question 3, there are no requirements for sub-hourly data associated with PJM's Black Start Service Market. Also, as noted in the response to Question 3, participation in both the Synchronous Reserve and Regulation Markets require the receipt of a signal, rapid response to that signal, and metering information at intervals of a minute and shorter. It is PPL Electric's understanding that this functionality is typically accomplished

through a communication, metering, and control package that is provided by the service provider the customer engages to facilitate his participation. The Company also understands that the communication, metering, and control package is typically a stand-alone package that performs, by design and intent, independently from the Company's metering equipment, that it may include features that are proprietary in nature, and that it is typically provided under the service contract between the customer and the service provider. Accordingly, PPL Electric incurs no incremental smart meter, communication, data storage, and data sharing costs associated with the participation of customers in the PJM ancillary services markets.

Finally, and also noted in the response to Question 3, participation in PJM's demand response programs, although not among the ancillary services markets, does not require data granularity or communication capability beyond that which is already provided by PPL Electric's AMI. Nevertheless, the Company is aware that at least some curtailment service providers who facilitate the participation of customers in the demand response markets require sub-hourly data for their own purposes. Upon request of a customer, PPL Electric will provide a KYZ pulse equipped recorder meter to customers that require real-time sub-hourly data. The Company is aware that, while in some cases the desire is driven by a need to track real-time energy consumption and demand, in other cases the pulses are used as direct inputs to an energy management system. The incremental cost associated with each such request is \$475. The Company does not directly charge the requesting customer, but, instead, reflects the cost in its base rates.

5. *What are the incremental equipment and installation costs of pulse data recorders used to measure sub-hourly meter data?*

The incremental equipment and installation costs of providing pulse data for the purpose of measuring sub-hourly usage are discussed, above, in the response to Question 4.

6. *Is a pulse data recorder attached to PPL's meter sufficiently accurate for use by PJM in its ancillary markets, or is redundant metering required to meet PJM standards?*

As discussed, above, in response to Question 4, it is PPL Electric's understanding that participation in PJM's ancillary markets requires functionality beyond the simple measurement of usage and, therefore, does not involve PPL Electric's AMI system. PPL Electric's existing AMI system does meet PJM's requirements for participation in its demand response programs. Redundant metering is not required.

7. *What are the additional customer costs associated with (1) transferring pulse meter information from the meter to inside the customer's premise, (2)*

*processing this data into usable format, (3) communicating the data to a third party or PJM?*

PPL Electric is unable to anticipate and estimate all of the different needs of customers and their third-party consultants regarding meter pulse data. As noted in response to Question 4, above, it is PPL Electric's understanding that while in some cases the desire is driven by a need to track real-time energy consumption and demand, in other cases the pulses are used as direct inputs to an energy management system. Each customer's circumstances are different and costs to transfer pulse meter information from the meter to inside the customer's premise can vary significantly depending on the customer's meter location and needs.

PPL Electric's KYZ pulse equipped recorder meter provides a standard KYZ format and a polling format for direct meter data connections that is consistent with PJM protocols. At this point, the data is in a format that is compatible with standard data integration and control protocols. However, customers, and third-parties acting on behalf of consultants, may have various other requirements, depending upon the market in which they are participating and the nature of their participation.

For example, PPL Electric is working with an entity seeking to place thermal storage heating systems into PJM's regulation market. As described above, this market requires direct telemetering of data and PPL Electric's understanding is that the vendor will be accomplishing this with a single control module that operates the heating system in accordance with the signal received from PJM, meters the system's use, and provides necessary data to PJM. In this application, PPL Electric's advanced metering infrastructure will not be used to facilitate participation in the regulation market; however, it will be used to permit the customer to utilize the enhanced control capability to also purchase retail electricity in real-time.

The majority of customers that request KYZ pulses are participating in a PJM demand response program through a curtailment service provider ("CSP"). End-use customers cannot participate in a PJM program on their own unless they register with PJM as a CSP. Many of the CSP's in the market utilize the KYZ pulses to meet their specific needs by connecting the pulses directly to their own computer software. These costs are typically not billed directly to the participating customers, but are instead addressed in their service contract with the CSP.

8. *To the extent a customer requests sub-hourly data, what if any cost recovery charge is appropriate, For example, would it be appropriate to have a customer charge that varies with the level of sub-hourly metering requested, and if so, what would those sub-hourly metering charges be?*

Currently, there is not a customer charge for KYZ pulse data. PPL Electric is not proposing to add a customer charge for this service at this time. However, if the Company is asked to provide sub-hourly data through the current AMI system, a customer charge may be required and full recovery for all incremental costs would be necessary.

# Attachment 1

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## ATTACHMENT 1

PPL Electric Smart Meter Program Milestone Plan					2010				2011				2012				2013				2014			
					1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
<b>6 B(1): Bidirectional data communications capability</b>																								
Note: Demonstration of this functionality will be provided in conjunction with the home area network pilot to be completed in Section 6 C(4).																								
<b>6 B(2): Recording usage data on an hourly basis at least once per day</b>																								
Note: PPL Electric does not anticipate any incremental costs to be expended except for meter replacement under normal conditions such as damage to the meter, defective meters and customer requests.																								
<b>6 B(3): Provide customers with direct access to price and consumption information</b>																								
<b>1. Messaging - Price and Usage Information [1]</b>																								
- Evaluate various channels of customer communications																								
- Implementation																								
<b>2. Faster Data Presentment to Customers &amp; Suppliers</b>																								
Note: Demonstration of this functionality will be provided in conjunction with home area network pilot to be completed in Section 6 C(4).																								
<b>6 B(4): Provide customers with information on their hourly consumption</b>																								
<b>1. Improve VEE Process to Incorporate Outage Data</b>																								
Note: Work with customers, EGSs and third parties to provide hourly consumption that is in clear and understandable formats. Estimated costs to be quantified later during 30 month grace period.																								
<b>6 B(6): Supporting automatic control if the customer's electric consumption</b>																								
<b>1. Load Control Evaluation [2]</b>																								
- Conduct pilot																								
<b>6 C(1): Remote disconnection and reconnection</b>																								
<b>1. Remote Disconnect / Reconnect [3]</b>																								
- Evaluate benefits of remote disconnect/reconnect functionality																								
- Conduct pilot																								
<b>6 C(2): Ability to provide 15 minute or shorter interval data</b>																								
<b>1. Evaluate scalability in PLC based system</b>																								
- Performance evaluation for 800 meters > 500 KW																								
- Potential TNS to MV 90 meter conversion																								
<b>2. Performance evaluation of Focus UMT-r meters</b>																								
- Conduct pilot with 500 meters																								
<b>6 C(3): On-board meter storage of meter data</b>																								
<b>1. Ability to read historical data/process IT [4]</b>																								
- Design/development & pilot with Aclara																								
- Evaluate benefits of historic meter data to update VEE process																								

## ATTACHMENT 1

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# ATTACHMENT 1

PPL Electric Smart Meter Program Milestone Plan	2010				2011				2012				2013				2014			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
<b>6 C(6): Ability to monitor voltage at each meter</b>																				
1. Wireless-based system enhancement																				
2. Voltage measurement/collection/ reporting in PLC-based system																				
-Conduct Pilot																				
- Full scale implementation and evaluation																				
<b>6 C(7): Remote programming capability</b>																				
Note: To be demonstrated in conjunction with work to be completed in Section 6 C(5).																				
<b>6 C(8): Communicate outages and restorations</b>																				
1. Proactive Outage Detection																				
- Assess options to determine how to become more proactive with outage detection																				
- Implement pilot																				
2. Outage Duration																				
<b>6 C(9): Ability to support net metering of customer generators</b>																				
1. Evaluate feasibility Customer Owned Generation with TNS																				
- Conduct pilot with Focus UMT-r meters - 400 meters (existing net metering customers that do not have a Focus UMT-r meter installed)																				
- Implementation																				
<b>Program Management</b>																				

## Legend

Pilot / Assessment

Implementation / Potential implementation / Evaluation

## Footnotes

[1] Implementation of TOU deferred.

[2] Implementation deferred.

[3] Future implementation plans will be submitted as part of the final Smart Meter Plan.

[4] Full scale implementation deferred at this time.

[5] Implementation of SCPA G-2 boards accelerated to end in early 2014.

[6] Pilot is canceled due to costs outweighing benefits of implementing this technology.

[7] There are no costs associated with the Smart Meter Data Exchange

# Attachment 2

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## ATTACHMENT 2

PPL Electric Utilities Smart Meter Program Budget	2010	2011	2012	2013	2014	Total
<b>6 B(1): Bidirectional data communications capability</b>						
Note: Demonstration of this functionality will be provided in conjunction with home area network pilot to be completed in Section 6 C(4).						
<b>6 B(2): Recording usage data on an hourly basis at least once per day</b>						
Note: PPL Electric does not anticipate any incremental costs to be expended except for meter replacement under normal conditions such as damage to the meter, defective meters and customer requests.						
<b>6 B(3): Provide customers with direct access to price and consumption information</b>						
<b>1. Messaging - Price and usage information</b>						
- Evaluate various channels of customer communications	\$18,729					\$18,729
- Pilot		\$175,299	\$9,743			\$185,042
<b>2. Faster Data Presentment to Customers and Suppliers</b>			\$6,235	\$98,734		\$104,969
Note: Demonstration of this functionality will be provided in conjunction with home area network pilot to be completed in Section 6 C(4).						
<b>6 B(4): Provide customers with information on their hourly consumption</b>						
<b>1. Improved VEE process to incorporate outage data</b>			\$11,733	\$127,892		\$139,625
Note: Work with customers, EGSs and 3rd parties to provide hourly consumption that is in clear and understandable formats.						
<b>6 B(6): Supporting automatic control if the customer's electric consumption</b>						
<b>1. Load Control Evaluation</b>						
- Conduct pilot of 500 Customer installations	\$36,851	\$421,795	\$9,089			\$467,735
<b>6 C(1): Remote disconnection and reconnection</b>						
<b>1. Remote Disconnect / Reconnect</b>						
- Conduct pilot		\$50,075	\$706,909	\$93,440	\$820,000	\$1,670,424
<b>6 C(2): Ability to provide 15 minute or shorter interval data</b>						
<b>1. Performance evaluation of Focus UMT-r meters</b>						
- Conduct pilot with 500 meters	\$10,507	\$34,086				\$44,593
<b>6 C(3): On-board meter storage of meter data</b>						
<b>1. Ability to read historical data/process IT</b>						
- Design/development & pilot with Aclara		\$13,824	\$62,717			\$76,541
- MDM capability to upload and re-VEE data				\$25,216		\$25,216
<b>6 C(4): Open standards and protocols</b>						
<b>1. In-Home Display/Home Area Network</b>						
- Evaluate available technologies and requirements	\$16,761					\$16,761
- Conduct Pilot with 500 customers		\$412,630	\$41,748	\$59,774	\$15,000	\$529,152
<b>2. AMI System Security Assessment</b>						
- Assess the current AMI system for security effectiveness				\$200,000		\$200,000
<b>6 C(5): Ability to upgrade these minimum capabilities as technology advances and becomes economically feasible</b>						
<b>1. General Obsolescence and Upgrade Issues</b>						
- Next generation PLC based system evaluation		\$241,628				\$241,628
- Potential next generation PLC based system implementation (TWACS 20 Pilot)			\$1,693,734	\$111,995	\$250,000	\$2,055,729
- Evaluation next generation AMI technologies			\$3,525	\$825,000	\$525,000	\$1,353,525
- Assessment of existing PLC based functionality	\$12,982					\$12,982
- Telecommunications Substation Modem evaluation and replacement	\$333,962	\$180,531	\$6,137			\$520,630

## ATTACHMENT 2

<b>PPL Electric Utilities Smart Meter Program Budget</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>Total</b>
- Real Time Path mapping in PLC based system						
» Evaluate feasibility and potential design			\$17,196			\$17,196
» Implement/evaluate results of proof of concept design						
» Implement full scale			\$12,717	\$36,000		\$48,717
- PLC Based System Enhancements						
a. Consider addition of Modulation Transformer Units(MTU)						
» Evaluate the benefits for additional MTUs		\$11,332				\$11,332
» Implement additional TWACS Trailers			\$280,481	\$4,819		\$285,300
b. Consider deployment of SCPA G2 Boards						
» Evaluate the benefits for new SCPA G2 boards		\$11,332				\$11,332
» Install SCPA G2 boards			\$261,753	\$756,051		\$1,017,804
2. Service Extending						
- Conduct pilot - 500 customers			\$7,682			\$7,682
3. Prepay Metering						
- Conduct pilot - 500 customers			\$87,716	\$10,057		\$97,773
4. Momentary Outage Monitoring						
- Conduct pilot		\$15,725	\$56,049			\$71,774
- Implement recommendations				\$45,725		\$45,725
5. Accelerated Supplier Switching Project (Off-Cycle)			\$18,691	\$50,940	\$636,017	\$705,648
6. MDM Data Warehouse and Analytics			\$1,187,475	\$819,291		\$2,006,766
7. Supplier Portal Pilot			\$17,123	\$344,728	\$241,192	\$603,043
8. Power Monitoring for Large Power Meters				\$54,710		\$54,710
9. Smart Meter Data Exchange [1]						\$0
6 C(6): Ability to monitor voltage at each meter						
1. Wireless-based system enhancement	\$71,027	\$71,645				\$142,672
2. Voltage measurement/collection/ reporting in PLC-based system						
- Pilot	\$4,329	\$123,394				\$127,723
- Full scale implementation and evaluation			\$101,247	\$30,501		\$131,748
6 C(7): Remote programming capability						
Note: To be demonstrated in conjunction with work to be completed in Section 6 C(5).						
6 C(8): Communicate outages and restorations						
1. Proactive Outage Detection						
- Assess options to determine how to become more proactive with outage detection	\$2,630					\$2,630
- Implement pilot		\$127,985				\$127,985
- Implement plan			\$32,617	\$3,036		\$35,653
2. Outage Duration Pilot and Implementation			\$10,733	\$74,638		\$85,371
6 C(9): Ability to support net metering of customer generators						
1. Evaluate feasibility customer owned generation with TNS						
- Conduct pilot with Focus UMT-r meters - 100 meters	\$77,666					\$77,666
- Implementation		\$99,541	\$85,088			\$184,629
Program Management	\$395,846	\$306,810	\$456,444	\$452,000	\$368,416	\$1,979,516
<b>Total</b>	<b>\$981,290</b>	<b>\$2,297,632</b>	<b>\$5,184,582</b>	<b>\$4,224,547</b>	<b>\$2,855,625</b>	<b>\$15,543,676</b>
Footnotes						
[1] There are no costs associated with the Smart Meter Data Exchange						

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## **ATTACHMENT 3**

# **PPL Electric Utilities Corporation Smart Meter Plan Pilot/Evaluation**

**6 B(1)**  
**Bidirectional Data Communications**

<b>Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• Perform evaluations using in-home displays with home area networks in coordination with the pilot referenced in section 6C(4)</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• Estimated cost of this pilot is outlined in Section 6C(4)</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Pilot description is outlined in Section 6C(4)</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Benefits are described in Section 6C(4)</li></ul>

**6 B(2)**

**Recording hourly usage data on at least an hourly basis**

<b>Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• None to be performed, because PPL Electric's existing power line and large power smart meter systems already meet this requirement.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• Not applicable.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Continue to deploy meters for new construction, upon customer request, and to replace damaged and defective meters.</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• The Company's customers already receive the benefits of hourly meter reads.</li></ul>

**6 B(3)**

**Provide customers with direct access to and use of price and consumption information**

<b>Pilot/Evaluation</b>	<b>Price and Usage Information</b> <ul style="list-style-type: none"><li>• An initiative was undertaken to evaluate and pilot various communication mediums. PPL Electric already provides electronic access to price and consumption information today via their website and through EDI transactions. The Company also developed and implemented messaging enhancements that include alerts on price and/or consumption, as well as abnormal usage. The evaluation included tests of communication channels such as near real-time email, phone messages, and text messages to customers.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The project cost was \$203,771.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Evaluation of available technologies in 2010</li><li>• Implement in 2011 and 2012 the following:<ul style="list-style-type: none"><li>○ Messaging alerts to multiple communication channels</li><li>○ Deployment of software and required licensing</li></ul></li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Customers will derive increased understanding and awareness of energy usage, which lead to better energy management.</li></ul>



**6 B(3)**

**Provide customers with direct access to and use of price and consumption information**

<b>Pilot/Evaluation</b>	<b>Faster Data Presentment to Customers and Suppliers</b> <ul style="list-style-type: none"><li>• The objective of this pilot is to present validated customer usage data for use by customer's and their authorized representatives on its website sooner than 48 hours by modifying the way that the Company processes and validates data within its AMI and back office systems.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated project cost is \$105,000.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Develop scope, cost and detailed schedule</li><li>• Evaluating all AMI and back office systems that would require changes</li><li>• Determine net reduction in time to present data</li><li>• Develop new processes and procedures</li><li>• Implement changes</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Energy usage information available to customers would be more current than that which presently is available, allowing customers to make decisions regarding their electricity use and consumption based on more current information.</li><li>• Suppliers may be able to offer new products and billing options to customers.</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• If the pilot is successful, PPL Electric will implement the changes on a broader scale in 2013.</li></ul>

**6 B(4)**

**Provide customers with information on their hourly consumption**

<b>Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• PPL Electric provides its customers with information on hourly consumption from its AMI. This data is provided on a daily basis to the PPL Electric meter data management system that enables customers to access their individual information on the web.</li><li>• The Company also provides hourly consumption through EDI transactions to EGS's and third parties.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• N/A</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• N/A</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• N/A</li></ul>

**6 B(4)**

**Provide customers with information on their hourly consumption**

<b>Pilot/Evaluation</b>	<b>Improved Validation/Editing/Estimation ("VEE") Process to Incorporate Outage Data</b> <ul style="list-style-type: none"><li>• This project's aim is to leverage outage management data to improve the VEE process.</li><li>• The pilot will evaluate integrating outage data from OMS into the MDM system in order for the VEE process to more accurately estimate missing hourly data without populating data into hours of known outages.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated project cost is \$140,000.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Develop a scope, cost and detailed schedule</li><li>• Analyze missing intervals and compare to current VEE process</li><li>• Evaluate the most cost-effective way to integrate outage data into the meter data validation process</li><li>• Implement changes into VEE process, if proven to be beneficial</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Customers would no longer see data appear on PPL Electric's online energy analyzer tool during the hours they are without service.</li><li>• The Company's internal algorithms will more accurately profile interval data by avoiding intervals that occurred during a known outage.</li><li>• Customers will see more accurate data within PPL Electric's online energy analyzer tool.</li><li>• Billing that relies on hourly usage will be more accurate.</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• If the pilot is successful, PPL Electric would implement on a broader scale and look for additional opportunities to review and refine the data.</li></ul>

**6 B(5)**  
**Enabling TOU and RTP Programs**

<b>Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• In 2010, conduct a performance evaluation with the Company's AMI to determine the feasibility of collecting and delivering 15-minute data at a high success rate for RTP billing for large power customers greater than 500 KW in demand. This evaluation will be conducted in coordination with Evaluation #1 discussed in Section 6C (2). Due to billing system limitations for real-time pricing, PPL Electric determined that it was most cost effective to read the accounts with greater than 500 kW demand with the large power meter wireless system. This amounted to 320 accounts and was completed in 2010 outside of the Plan.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• N/A</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• N/A</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• N/A</li></ul>

**6 B(6)**

**Supporting the automatic control of the customer's electric consumption**

<b>Pilot/Evaluation</b>	<b>Load Control</b> <ul style="list-style-type: none"><li>• PPL Electric conducted a pilot to further extend the benefits of the currently deployed AMI system to demonstrate how it meets this minimum requirement. This was accomplished by installing load control devices on air conditioning systems and water heaters. Pilot planning began in 2010 and the pilot was completed in 2011.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The project cost is \$467,735</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Establish pilot objectives</li><li>• Invite customers to participant in pilot (177 customers participated)</li><li>• Purchase and install load control devices</li><li>• Develop/implement required software and IT programming changes and licensing</li><li>• Evaluate pilot results</li><li>• Results and proposed implementation plan presented to the Commission in this filing</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Allows customer to take advantage of TOU rate options</li><li>• Enables customers to shed load during periods of peak pricing</li><li>• Provides capability for PPL Electric to shed load during emergency load reduction events called by PJM to maintain system reliability</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• The future costs have been reduced by \$8.2 M from 2013 to 2015 because the Company is not proposing to implement this pilot.</li></ul>

**6 C(1)**

**Ability to remotely disconnect and reconnect**

<b>Pilot/Evaluation</b>	<b>Remote Disconnect/Reconnect</b> <ul style="list-style-type: none"><li>• PPL Electric conducted an evaluation in 2011 to determine the costs and benefits of remote disconnect/reconnect functionality within their service territory.</li><li>• A 500 meter pilot will be conducted in 2012 and 2013 that enables "hard" blocking and successive remote connections of all accounts in the pilot, excluding terminations for non-payment, and payment driven reconnections.</li><li>• Pilot evaluation will continue through June of 2014</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated project cost is \$1,670,000</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Establish pilot objectives</li><li>• Identify locations for pilot meter installs</li><li>• Purchase of meter hardware and installation</li><li>• Develop/implement required software and IT programming changes and licensing</li><li>• Evaluate pilot results</li><li>• Establish potential implementation plan</li><li>• Report results and proposed implementation plan to the Commission</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Contributes to the reduction in consumption on inactive meters</li><li>• Eliminates need to dispatch personnel to disconnect and reconnect</li><li>• Provides ability to comply with Commission regulations in normal connect/disconnect situations</li><li>• Automates the process for completing connects and disconnects</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• Future implementation plans will be submitted as part of the final plan submitted in 2014.</li></ul>

**6 C(2)****Ability to provide 15-minute or shorter interval data**

<b>Pilot/Evaluation</b>	<b>15 Minute Interval Data</b> <ul style="list-style-type: none"><li>• A pilot was conducted 2010 and 2011 to determine the feasibility of providing 15-minute interval data in the power line smart meter infrastructure using installed meters that have the capability to be configured for 15-minute data collection at the small commercial customer level. In addition, a scalability test was completed to determine if PPL Electric's power line system can handle reading 15-minute data from all small commercial accounts without significant investment into the power line system.</li><li>• Based on the pilot, a cost benefit analysis was completed to determine the economic viability of implementing 15-minute interval data to all small commercial customers through the Company's power line carrier system.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The project cost was \$44,593.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Remote reconfiguration of installed smart meters from 60 minute interval data to 15-minute interval data collection</li><li>• Scalability test</li><li>• Evaluate pilot results</li><li>• Cost Benefit Analysis</li><li>• Development of recommendations</li><li>• Report results and an implementation plan to the Commission.</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Determine the most cost-effective method for providing customers with interval data to meet the needs of customers, third-party aggregators and EGS's.</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• The Company proposed to maintain its current process of providing customers with 15-minute interval data upon request through KYZ pulses.</li></ul>

**6 C(3)**

**On board meter storage of meter data**

<b>Pilot/Evaluation</b>	<b>On-board meter storage</b> <ul style="list-style-type: none"><li>• A pilot was run to test the ability to acquire any or all of the 30 days of hourly intervals and revalidate it in the meter data management system (MDMS). Pilot planning began in 2011 and the pilot concluded in 2013.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The cost to conduct this pilot was \$101,757.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Implement software application changes and upgrades to the AMI systems</li><li>• Implement changes to business process for validation, editing and estimation of billing and presentation data</li><li>• Develop/implement required Company software and IT programming changes</li><li>• Evaluate pilot results</li><li>• Development of a potential implementation plan</li><li>• Report results and proposed implementation plan to the Commission.</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Tests the operation and performance of the meters' extended memory capabilities</li><li>• Demonstrates the ability to support the on-board storage capability</li><li>• Provides the ability to acquire lost data for more accurate billing information and data presentment</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• None planned, except for deploying normally purchased new meters to meet this requirement going forward in the smart meter plan. This plan will provide smart meters for new construction, customer requests, and replacement of damaged and defective meters.</li></ul>



**6 C(4)**

**Open standards and protocols that comply with nationally recognized non-proprietary standards**

<b>Pilot/Evaluation</b>	<b>In-Home Display/Home Area Network</b> <ul style="list-style-type: none"><li>• Conduct a home area network pilot trial beginning in 2012 and concluding in 2013 to develop the appropriate technology that meets customer requirements and expectations. The pilot will incorporate IEEE 802.11 compliant wireless local area network (WLAN) communications.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated project cost is \$546,000.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Establish pilot objectives</li><li>• Provide price and consumption information to the customer to aid in making energy efficient buying decisions</li><li>• Evaluate bidirectional communications to the end-use devices</li><li>• Invite customers to participate in the pilot</li><li>• Provide the meter and home display hardware including any equipment installation</li><li>• Develop/implement any required software and IT programming changes</li><li>• Evaluate pilot results</li><li>• Development of a potential implementation plan</li><li>• Report results and proposed implementation plan to the Commission</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Contributes to the reduction of energy consumption through "conservation smart" automated home controls</li><li>• Provides the basic hardware foundation for special rate initiatives such as critical peak pricing</li><li>• Enables the customer to understand and control their energy consumption.</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• Future implementation plans will be submitted as part of the final plan submitted in 2014.</li></ul>

**6 C(4)**

**Open standards and protocols that comply with nationally recognized non-proprietary standards**

<b>Pilot/Evaluation</b>	<b>AMI System Security Assessment</b> <ul style="list-style-type: none"><li>• PPL Electric proposes to conduct a security assessment of its AMI systems and processes that began in May of 2013 and will conclude at the end of 2013.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated project cost is \$200,000.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Establish pilot objectives</li><li>• Conduct pilot</li><li>• Evaluate pilot results</li><li>• Development of a potential implementation plan</li><li>• Report results and proposed implementation plan to the Commission</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Understand security risks and vulnerabilities for the current AMI system as well as any new AMI features being offered such as remote service disconnect and in home display.</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• Findings from the evaluation will be incorporated into future implementation plans.</li></ul>

**6 C(5)**

**Ability to upgrade these minimum capabilities as technology advances and becomes economically feasible**

<b>Pilot/Evaluation</b>	<b>General Obsolescence and Upgrade Issues</b> <b>Projects include:</b> <ol style="list-style-type: none"><li>1. Next generation PLC based system evaluation</li><li>2. TWACS 20 Pilot</li><li>3. Telecommunications Substation Modem evaluation and replacement</li><li>4. Real Time Path mapping in PLC based system</li><li>5. PLC Based System Enhancements</li><li>6. Evaluation of Next Generation AMI Technologies</li><li>7. Power Monitoring for Large Power Meters</li></ol> <ul style="list-style-type: none"><li>• PPL Electric will conduct technological and economic evaluations that can enhance the performance of the existing AMI components as well as on next generation smart meter system technologies and Smart Grid integration. These evaluations will consider obsolescence of the communications infrastructure equipment and meters, replacement with new technology that enable PPL Electric to extend the minimum requirements and support the additional capabilities.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated cost of all projects listed above is \$5,631,000.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Evaluate the existing power line smart meter infrastructure in 2011 that extend the minimum requirements and support the additional capabilities, as well as the proposed enhancements</li><li>• Evaluate Smart Grid Integration over the period from 2011 to 2014 that extend the communication infrastructure's capability to backhaul AMI/Smart Grid data more effectively</li><li>• Consider additional or new smart meter infrastructure equipment to enhance data capture and accommodate new end use devices</li><li>• Continually evaluate the next generation of AMI technologies for applicability at PPL Electric.</li><li>• Periodically report results and potential implementation plans to the Commission.</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Effectively manage obsolescence of existing smart meter infrastructure</li><li>• Positions PPL Electric for additional capabilities including Smart Grid related applications and operations</li><li>• Improves efficiency in backhauling advanced meter data.</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• Implementation would occur simultaneously as each technology is researched and replaced.</li></ul>

**6 C(5)**

**Ability to upgrade these minimum capabilities as technology advances and becomes economically feasible**

<b>Pilot/Evaluation</b>	<b>Service Limiting/Service Extending</b> <ul style="list-style-type: none"><li>• PPL Electric originally intended to conduct a pilot to deploy this enhanced capability at 500 customer accounts from 2013 through 2014. Pilot planning began in 2012. However, as explained in this filing, PPL does not recommend moving forward with a pilot evaluation of the service extending functionality. PPL will continue to monitor the development of the technology and potential application to utility business processes.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The cost to conduct this evaluation was \$7,682.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• N/A</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• N/A</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• N/A</li></ul>

**6 C(5)**

**Ability to upgrade these minimum capabilities as technology advances and becomes economically feasible**

<b>Pilot/Evaluation</b>	<b>Pre-pay Metering</b> <ul style="list-style-type: none"><li>• PPL intends to conduct a pilot from 2013 through 2015 that will be offered to 500 residential customers. PPL will solicit a select customer base for the pilot, which will exclude low income customers as defined in 52 Pa. Code Section 56.17. Through the planning and pilot implementation, the Company will assure that public policy issues reflected in the Commission's regulations are addressed.</li><li>• Pilot planning will begin in 2012.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The project cost was \$97,773.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Establish pilot objectives</li><li>• Invite 500 customer to participate in pilot</li><li>• Purchase and installation of meter hardware with an integrated disconnect and in-home display</li><li>• Develop/implement required software and IT programming changes</li><li>• Evaluate pilot results</li><li>• Development of recommendations for implementation</li><li>• Periodically report results and a proposed implementation plan.</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Contributes to reduction in the customer's energy consumption</li><li>• Enables customers to effectively learn how to manage their electric energy payments</li><li>• Enhances customer payment options</li><li>• Reduces the need to dispatch personnel to disconnect and reconnect because the customer possesses the control to disconnect/reconnect safely when payment credits expire/recharged.</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• The Company and all interested stakeholder should work in combination with each other to shape a program that will best suit the needs of customers. In addition, the Company has determined that the cost to conduct a pilot will be significantly higher than estimated. Accordingly, the Company believes it appropriate to suspend its efforts on this pilot.</li></ul>

**6 C(5)**

**Ability to upgrade these minimum capabilities as technology advances and becomes economically feasible**

<b>Pilot/Evaluation</b>	<b>Momentary Outage Monitoring</b> <ul style="list-style-type: none"><li>• PPL Electric is conducting a pilot in 2012 through 2013 to further refine the use of momentary interruption (blink count) information to determine how blink information can be provided proactively. This would be accomplished through the aggregation of blink count data in a meaningful way to aid in determining the approximate location of the device that operated.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated project cost is \$117,000</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Develop and enhance business processes that actively review customer blink information</li><li>• Determine the most likely location of a momentary operation</li><li>• Ascertain how the customer blink information can be incorporated into PPL Electric's outage management system to refine PPL Electric's outage detection analysis and post outage restoration</li><li>• Assure that automation of the processes is implemented for ease of application of the information for all business users.</li><li>• Develop/implement required software and IT programming changes</li><li>• Evaluate the results</li><li>• Development of recommendations for potential implementation</li><li>• Report results and implementation plan to the Commission</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• <i>Enables proactive messaging to Company engineers when the blink counts reach a specific threshold limit</i></li><li>• <i>Alerts the engineer that an issue may be occurring at the customer location or the feeder servicing that customer or group of customers</i></li><li>• <i>Enables engineers to take action to begin their investigation and contact the customer(s) to query if they are experiencing any issues as well as informing them that PPL Electric is working on it</i></li><li>• <i>Identifies and resolves device issues which have frequent momentary operations</i></li><li>• <i>Improves satisfaction of customers who experienced significant numbers of momentary interruptions.</i></li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• Implementation would occur simultaneously as this capability is developed and enhanced.</li></ul>

**6 C(5)**

**Ability to upgrade these minimum capabilities as technology advances and becomes economically feasible**

<b>Pilot/Evaluation</b>	<b>Accelerated Supplier Switching</b> <ul style="list-style-type: none"><li>• This project will enable customers to switch suppliers more quickly than the current supplier switching rules and will be implemented in accordance with the guidance from the Retail Market Investigation.</li><li>• The Final Order Investigation of Pennsylvania's Retail Electricity Market: End State of Default Service" Docket No. I-2011-2237952 (Order entered February 14, 2013) directed Commission Staff to initiate a rulemaking to review and revise the switching regulations at 52 Pa. Code §§ 57.171 – 179. The rulemaking will explore methods to accelerate switching timeframes including off-cycle switching.</li><li>• The rulemaking will be initiated by end of 2013 to revise the switching regulations, with the intent of accelerating the switching process. A rulemaking will provide all interested parties with the opportunity to participate and will allow the Commission to make fully informed decisions on the complex issues involved. The use of formal rulemaking should also help clarify any cost-recovery issues.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated project cost is \$706,000.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Develop scope, costs and detailed schedule</li><li>• Work with key stakeholders and Retail Market Investigation</li><li>• Evaluate all impacted systems</li><li>• Develop new procedures and processes</li><li>• Develop training and documentation for customer service</li><li>• Implement in accordance with final guidance from Retail Market Investigation</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Improve customer satisfaction and development of retail markets by allowing off-cycle switching (limited to one off-cycle switch per month).</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• Rulemaking will take place 4<sup>th</sup> quarter 2013, with expected implementation 2014.</li></ul>

**6 C(5)**

**Ability to upgrade these minimum capabilities as technology advances and becomes economically feasible**

<b>Pilot/Evaluation</b>	<b>Supplier Portal Pilot</b> <ul style="list-style-type: none"><li>• This project is to pilot and evaluate an alternative method of providing large amounts of energy usage and interval data to suppliers through a secure portal.</li><li>• The project involves creating a secure data environment wherein EGSs, and potentially other third parties, can, with appropriate customer authorization, access usage data directly without need for an EDI request and response. It is likely that such data environment would be built using the functionality provided by the Data Warehouse and Analytics Project.</li><li>• PPL is also participating in the EDEWG WPWG (Web Portal Working Group) Sub Team as the EDC Chair, and is expecting the Sub Team to provide recommendations which will ultimately steer the continued development of the Supplier Portal through 2014.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated project cost is \$603,000.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Develop scope, costs and detailed schedule</li><li>• Work with key stakeholders to develop standards</li><li>• Develop processes and procedures</li><li>• Create a secure data environment, wherein EGSs, and potentially other third parties, can access usage data directly without the need for an EDI request and response</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Direct access to customer meter data in a more timely manner</li><li>• Secure data environment</li><li>• More efficient than the current EDI system</li><li>• Less expensive than the current EDI system</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• The first deployment released to production and suppliers 5/17/13.</li><li>• If successful, PPL Electric potentially would implement on a broader scale and look for additional opportunities and entities that could utilize the data and the secure portal.<ul style="list-style-type: none"><li>◦ We anticipate a second deployment to be released to production and suppliers 4<sup>th</sup> quarter 2013 and a third release in the 2<sup>nd</sup> quarter of 2014.</li></ul></li></ul>



**6 C(5)**

**Ability to upgrade these minimum capabilities as technology advances and becomes economically feasible**

<b>Pilot/Evaluation</b>	<b>MDM Data Warehouse and Analytics</b> <ul style="list-style-type: none"><li>• This project is to copy customer and meter data into a data warehouse (i.e., non-production) environment to improve PPL Electric's analytical capability to support suppliers and customers.</li><li>• The Company proposes to install a data warehouse for meter data beginning in 2012.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated project cost is \$2,007,000.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• The Company would take a phased approach to the project.</li><li>• 2012 - Phase 1 - Install all required software and hardware for the meter data warehouse.</li><li>• 2013 - Phase 2 - Develop an advanced data analytics for meter data.</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Ad-hoc querying capability</li><li>• Improve MDMS operational performance</li><li>• Enhance PPL Electric's ability to provide smart meter data to customers and EGSs.</li><li>• Improve ability to perform better analysis of meter data to better serve customers</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• Implementation would occur simultaneously with the two phases of this project.</li></ul>

6 C(6)

Ability to monitor voltage at each meter and report data in a manner that allows an EDC to react to the information

<b>Pilot/Evaluation</b>	<p><b>Projects include:</b></p> <ol style="list-style-type: none"> <li><b>1. Site Scan Enhancement in wireless-based system</b></li> <li><b>2. Voltage Monitoring in PLC-based system</b></li> </ol> <ul style="list-style-type: none"> <li>In 2010, PPL Electric began implementing an enhancement that applies more precise voltage, current and relational phase angle information from the Company's large power meters for diagnosing meter and service issues. This enhancement was implemented in 2011 for the large power meters.</li> <li>A pilot was conducted from 2011 through June of 2013 to further the measurement, collection and analysis of voltage information to enhance PPL Electric's distribution system reliability using the power line AMI system. The work scope identified for this pilot has been completed and is being transitioned to production.</li> </ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"> <li>Large power meter information enhancement - \$142,672</li> <li>PLC based pilot - \$259,000</li> </ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"> <li>Determine the feasibility of gathering this new information by performing an impact analysis on the AMI to ensure there are no performance issues</li> <li>Export the data collected into a meter data management system which provides a facility for engineers to access and apply the data in business applications</li> <li>Develop/implement required software and IT programming changes</li> <li>Establish and report results and implementation plan to the Commission.</li> </ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"> <li>Application of voltage profiling information at a customer, transformer and circuit level will provide information on the health of an entire circuit</li> <li>Use of this information will alert PPL Electric to customer voltage problems, thereby increasing customer satisfaction by correcting voltage issues on a proactive basis</li> <li>Applications of voltage, current and relational phase angles information will proactively aid identification of defective metering equipment to avoid revenue loss</li> <li>Will provide pertinent information to a smart grid strategy that will enable PPL Electric to reduce voltage when needed to maintain distribution system reliability</li> <li>Will provide a framework for an accurate operational model, which will provide faster customer restoration, and more efficient system utilization.</li> </ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"> <li>Implementation of the PLC-based and wireless-based pilots would occur simultaneously as the capability is developed and enhanced.</li> </ul>

**6 C(7)**

**Ability to remotely reprogram the meter**

<b>Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• PPL Electric will be evaluating ways to continue refining the power line smart meter infrastructure's remote programming capabilities. These evaluations are associated with the work described in Section 6C(5).</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The costs to complete these evaluations are included in Section 6C(5).</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Demonstrate enhanced ability to reprogram meters</li><li>• Upgrade the system's equipment firmware to improve performance</li><li>• Consider potential equipment hardware upgrades to accommodate enhanced functionality.</li><li>• Reporting results and implementation plans to the Commission.</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Benefits are similar to that described in Section 6C(5).</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• Embedded in that described in Section 6C(5).</li></ul>

**6 C(8)****Ability to communicate outages and restorations**

<b>Pilot/Evaluation</b>	<b>Proactive Outage Detection</b> <ul style="list-style-type: none"><li>• PPL Electric will define roadmaps and conduct a pilot to <i>further enhance use of the existing AMI's capabilities in 2012.</i></li><li>• The objective of the pilot will be to determine the system-wide feasibility of using the power line system for proactive meter outage detection for the purpose of distribution system health checks and active outage detection.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The project cost was \$166,268.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Establish pilot objectives</li><li>• Demonstrate improvement in the accuracy of existing pings through the investigation and mediation of performance issues</li><li>• Integrate SCADA data to proactively "ping" customers' meters to assess service status</li><li>• Optimize "ping" services to more actively assess outage conditions and dispatch personnel where required</li><li>• Reporting results and implementation plan to the Commission.</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Implements proactive pinging of customers' meters to determine their outage status will help reduce outage times for customers, specifically for smaller outages, or outages where a customer would not normally report that they are out of service</li><li>• Ability to know outage types and locations will more quickly allow PPL Electric to report that information to customers who do call in</li><li>• Will provide a framework for more quickly performing proactive outage notification feature in the future for customers to elect that option.</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• Implementation would occur simultaneously as the capability is developed and enhanced.</li></ul>

**6 C(8)**

**Ability to communicate outages and restorations**

<b>Pilot/Evaluation</b>	<b>Outage Duration</b> <ul style="list-style-type: none"><li>• PPL will conduct a pilot beginning in 2012 to further enhance the use of outage information.</li><li>• The objective of the pilot will be to determine the system-wide feasibility of using the power line system for retrieving meter outage duration and start time stamp information for the purpose of meter data validation, power quality analysis, and outage management.</li></ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"><li>• The estimated project cost is \$85,000.</li></ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"><li>• Establish pilot objectives, cost and detailed schedule</li><li>• Demonstrate ability to retrieve outage duration information from meters</li><li>• Develop analysis tools</li><li>• Determine how to use the information in the meter data validation and outage management processes.</li></ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"><li>• Improved power quality analysis and customer service</li><li>• Improved VEE process</li><li>• Retrieve sustained outage information from meter module for validation and fine-tuning of outage data</li></ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"><li>• If the pilot is successful, PPL Electric will implement on a broader scale and look for additional opportunities to use the data.</li></ul>

## 6 C(9)

### Ability to support net metering of customer generators

<b>Pilot/Evaluation</b>	<b>Customer-Owned Generation</b> <ul style="list-style-type: none"> <li>PPL Electric piloted, in 2010 and 2011, the functionality and performance of the new bi-directional meters in its infrastructure that measure energy flow at the PPL Electric point of contact. The pilot will consist of using 400 bi-directional meters in the power line smart meter system that will provide net energy usage on an interval basis measuring delivered and received energy flowing to the PPL Electric grid. The pilot customers will be existing net metering customers with older vintage meters.</li> </ul>
<b>Estimated Cost of Pilot/Evaluation</b>	<ul style="list-style-type: none"> <li>The actual cost of the pilot and implementation was \$262,295.</li> </ul>
<b>Pilot/Evaluation Plan</b>	<ul style="list-style-type: none"> <li>Identify approximately 400 existing net metering customers and replace their meter to the new standard power line meter</li> <li>Meter hardware and installation</li> <li>Develop/implement required software and IT programming changes for the AMI and MDMS</li> <li>Evaluate pilot results</li> <li>Establish an implementation plan</li> <li>Report results and implementation plan to the Commission.</li> </ul>
<b>High Level Benefits</b>	<ul style="list-style-type: none"> <li>Supports the functional operation and performance capabilities of the power line smart meter infrastructure and bi-directional meters</li> <li>Meets the intent of the Commission's Net Metering tariffs</li> <li>Provides a feasible and economical meter solution to monitor AEPS renewable energy requirements through measurement of the generation output of applicable generation sources.</li> </ul>
<b>Potential Implementation</b>	<ul style="list-style-type: none"> <li>Implementation was completed and fully supports net metering for customers with installed generation. This includes a process to ensure correct metering is installed following notification of customer's intention to install generation. Within the pilot, it was determined that minimal changes were required to the Company's MDMS, customer information and billing systems.</li> </ul>

## CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing has been served upon the following persons, in the manner indicated, in accordance with the requirements of § 1.54 (relating to service by a participant).

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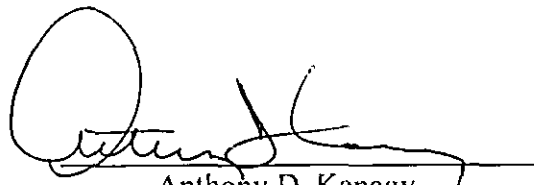
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Date: August 1, 2013



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